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WELCOME MESSAGE FROM CONFERENCE GENERAL CHAIR

Welcome to IEEE ITSC 2008, as well as IEEE/INFORMS SOLI 2008 and IEEE/ASME MESA 2008, and Beijing, China - the capital of the Central Kingdom. We hope that you have a technically rewarding experience as well as some memorable experiences in this ancient and exciting city, right after the success of the Beijing Summer Olympics and the first Chinese Spacewalk Mission. We believe that we have an extraordinary technical program thanks to the Program Committee chaired by Professor William Scherer (University of Virginia, USA) and co-chaired by Drs. Matthew Barth (University of California, Riverside, USA), Urbano Nunes (University of Coimbra, Portugal), and Lefei Li (Tsinghua University, China), and five plenary and banquet speakers:

- Dr. Chelsea White III, H. Milton and Carolyn J. Stewart Chair, Schneider National Chair in Transportation and Logistics, Dean, H. Milton Stewart School of Industrial and Systems Engineering, Georgia Institute of Technology, USA;
- Dr. Xiao Ming Liu, Director of the Beijing Transportation Council and Professor of the Beijing University of Technology, Beijing, China;
- Dr. Shoubo Xu, Academician, Chinese Academy of Engineering, Beijing Jiaotong University, China
- Dr. Bahram Ravani, Department of Mechanical and Aeronautical Engineering, University of California – Davis, USA;
- Dr. Markos Papageorgiou, Director of Dynamic Systems & Simulation Laboratory, Technical University of Crete, University Campus, Greece.

We would like to thank the following key organizing committee members: Special Session Chair, Mark Hickman (University of Arizona, USA), Finance Chair, Yanqing Gao (University of Arizona, USA), Publication Chair, Guanpi Lai (University of Arizona, USA), Publicity Chair, Harry Cheng (University of California, Davis, USA), Exhibition Chair, Steve Watkins (Missouri University of Science and Technology, USA), and Registration Chair, Nan Zhang (Chinese Academy of Sciences, China). The entire IEEE ITSC/SOLI/MESA 2008 team who helps put the conference together deserves our sincere gratitude. Our special thanks go to many volunteers and staffs for the long hours and hard work they have generously given to IEEE ITSC/SOLI/MESA 2008. Finally, we would like to thank all the session organizers/chairs, authors, speakers, and participants of this conference for taking part in and contributing to IEEE ITSC/SOLI/MESA 2008.

Make friends at the Friendship Hotel and Have a great time in Beijing, China!

CONFERENCE GENERAL CHAIR



Fei-Yue Wang
Chinese Academy of Sciences
University of Arizona
Email: feiyue@ieee.org

WELCOME MESSAGE FROM THE PROGRAM CHAIR AND CO-CHAIRS

As one of the premier ITS conferences, the IEEE ITSC 2008 covers a wide range of ITS topics, including basic ITS research, new technology, a variety of ITS applications, and ITS societal/environmental impacts. It is clear that intelligent transportation systems research continues to march forward at a great pace across the world. This year we had a total of 353 submitted papers—after the IEEE standard review process, a total of 203 papers were accepted for presentation and publication in the proceedings. The topics this year (based on paper keywords) include items such as: Imaging (43), Traffic Control (39), Simulation and Modeling (38), Travel Information and Guidance (27), Navigation (19), Collision Avoidance (16), Advanced Safety Systems (13), and Travel Behavior under ITS (10), among others.

This conference is truly international, with papers submitted from 34 different countries. The majority of papers came from China this year (127), followed by the United States (47), France(26), Germany(15), Taiwan(15), Japan(12), and Spain(12).

We have organized the technical program by research topics in 50 parallel sessions. The sessions are organized in "tracks" with similar topics presented in the same rooms each day. In addition, we have a special workshop session on Artificial Transportation Systems and Simulation, to be held on Sunday October 12th.

The program review was carried out using the standard IEEE procedures with participation from the ITSC 2008 International Program Committee (IPC) acting as "associate editors". Each of these editors was in charge of assembling a team of reviewers, then providing a summary report for each paper. The program committee used these reports to select papers for inclusion in the proceedings. We would like to express our deep gratitude to the reviewers and the associated editors for all of their efforts.

It is our hope that your participating in ITSC 2008 is a rewarding experience and that you get a chance to meet other colleagues working in the exciting area of ITS!

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Trends and Research Directions in Supply Chain & Logistics Engineering

Prof. Chelsea (Chip) C. White III

H. Milton and Carolyn J. Stewart Chair
Schneider National Chair in Transportation and Logistics
H. Milton Stewart School of Industrial and Systems Engineering
Georgia Institute of Technology

Monday October 13, 2008

9:30-10:10 Ballroom (JuYingTing), Friendship Palace

Abstract We look at current forces affecting supply chain design and global logistics, including fuel and labor costs; mode shifts; improvements in efficiency within each mode; currency dynamics; risk; labor shortages, laws, and wages in China; international freight transport network congestion; capacity reduction; product & package design to reduce weight and cube; and information technology applications. We then focus on interesting research directions linked to the next level of supply chain control productivity - controlling supply chains in real-time, based on real-time data - and discuss the value of information and how to extract this value effectively.

Biography Professor White is a Chaired Professor in Transportation and Logistics in the School of ISyE, Georgia Tech. His research interests include stochastic optimization and the integration of formal reasoning techniques and concepts in artificial intelligence for problem solving with application to transportation, health care, military decision making, and strategic planning. He is editor-in-chief of the ITS Journal and editor of the IEEE Transactions on Systems, Man and Cybernetics, Part A. He is past president of the IEEE Systems, Man, and Cybernetics (SMC) Society, President-elect of the ITS Michigan Board of Directors, a member of the ITS World Congress Board of Directors, and a member of the ITS America Coordinating Council. He is a Fellow of the IEEE, director of the ITS Research Center, Co-Director of the Sloan Trucking Project, and Director of the EECS ITS Laboratory.



To Set up A Sustainable Transportation Systems for Beijing 2008 Olympic Games

Dr. Xiaoming Liu

Director of the Beijing Municipal Committee of Communications

Beijing Municipal Committee of Transport

Monday October 13, 2008

10:10-10:50 Ballroom (JuYingTing), Friendship Palace

Abstract As an Olympic city, Beijing has had to face many challenges, such as transportation, environment, security etc. The transport challenge to Beijing to bid, prepare for and host the games, our trails and triumphs are presented. The address also describes the direction that the Beijing transport is now moving toward, a sustainable transportation system.

Biography Dr. Liu is the secretary and director of the Leading Party Group of Beijing Municipal Committee of Communications, is responsible for general works of Beijing Municipal Committee of Communications. He also takes charge of the Personnel Department, the Financial Department and the Research Room and contacts with Beijing Transportation Research Center.

Dr. Liu is also a professor of Beijing University of Technology.



The Theory of Commodity Material Flow

Academician Shoubo Xu

Beijing Jiaotong University

Monday October 13, 2008

10:50-11:30 Ballroom (JuYingTing), Friendship Palace

Abstract Author makes for the first time according to the basic theory of technological economics — theory of six forces on essential factors of production & living, hierarchical theory on production factors and theory of material flow to produce the theory of material flow based on the 6 essential factors commodity such as labor, capital, physical, nature, freight, time.

This paper makes the commodity movement rule in the development of social economy for the first time, commodity movement includes the movement of physical object of commodity and the capital movement of commodity and the information movement of commodity. The movement of physical object of commodity forms commodity physical flow and the information movement of commodity forms commodity information flow, and the capital movement of commodity forms commodity capital flow. According to the Theory of Material Flow regardless of commodity physical object, commodity capital and commodity information, is material, commodity physical flow, capital flow and information flow must obey entire commercial movement rule. The theory of commodity material flow includes Commodity Physical Flow Theory, Commodity Capital Flow Theory and Commodity Information Flow Theory.



Biography Academician Shoubo Xu was born in 1931 at Shaoxing, Zhejiang Province, China. He is the founding father of the discipline called Technological Economics (TE), Energy Technological Economics (ETE)/Comprehensive Energy Engineering (CEE), and the theory of Material Flow Technological Economics (MFTE)/Comprehensive Material Flow Engineering (CMFE). Dr. Xu obtained his BS in power engineering from the Nanjing Institute of Technology in 1955. He then graduated from the Energy Institute of the Academy of Sciences of USSR in

1960 and was awarded a doctor degree in technological science. Currently he is a professor and PhD advisor at Beijing Jiaotong University.

Dr. Xu served as the Chairman of the First Council of the China Society of Technological Economics Research, the first Director of the Institute of Technological Economics of the Chinese Academy of Social Science, the first Chairman of the Department of Technological Economics of the Graduate School of the Chinese Academy of Social Sciences, the President of the Institute of Technological Economics of the State Commission of Planning, PRC. Dr. Xu was also the first Standing Chairman of the China Society of Material Flow Research, the first Chairman of the Special Committee on Material Flow Technological Economics of the China Society of Material Circulation. He has served as an advisor for the State Commission of Energy PRC. He was also a senior advisor of the Ministry of Energy PRC, Director of the Research Bureau of Energy Office of the State Council PRC, a standing Chairman for the First Council of Beijing Energy Society, a standing Chairman of the First Council of the China Research Society of Energy Bases, the first Director of the Energy Technological Economics/Comprehensive Energy Research Department of the Chinese Academy of Sciences.

In 2001, he was elected as an academician of the Chinese Academy of Engineering.

Mechatronics Design and Implementation of Driver Assistance Technologies For Intelligent Transportation Systems

Prof. Bahram Ravani

Department of mechanical and Aeronautical Engineering

University of California – Davis

Monday October 13, 2008

11:30-12:10 Ballroom (JuYingTing), Friendship Palace

Abstract The mechatronics design, testing, and implementation of various technologies for driver assisted guidance and control of vehicles in Intelligent Transportation Systems (ITS) is presented. Driver assisted guidance and control in ITS include applications such as lane keeping, intelligent cruise control, and obstacle identification and avoidance. These driver assistance functions require development of mechatronics sensing, human machine interface, and other related technologies. The designs of several mechatronics systems developed for this purpose are discussed. These include:

1. An all-digital magnetic sensing system that would provide reliable sensing of vehicle position from roadway imbedded magnets for lane keeping.
2. A robotic system for installation of the magnets on the roadway.
3. A human-machine interface for driver assistance.
4. An all-accelerometer INS (Inertial navigation System) for dead reckoning of vehicle positions for GPS (Global Position System) based lane keeping.
5. A laser based sensing system for intelligent cruise control.

In applications that require obstacle identification and avoidance, the concept of an innovative radar sensing system is presented.

Experimental data and video from actual implementation of these systems for driver assistance in hazardous snow and ice removal operations in highway maintenance on California highways is also presented. In addition, the theoretical basis used in modeling the human-in-the-loop steering dynamics of vehicles during snow and ice removal operations for the design and simulation of the mechatronics systems developed is discussed.

Biography Bahram Ravani is a Professor of Mechanical Engineering at the University of California - Davis and a Co-Director of the Advanced Highway maintenance and Construction Technology Research Center – A Collaborative research Center between the California Department of Transportation and the University. He has been a faculty member at UC-Davis since 1987. He was the Interim Chair of Electrical and Computer Engineering Department from 2005-2008 and the Chair of Mechanical and Aeronautical Engineering Department from 1996 to 2001. His areas of current research include Robotics and Mechatronics, Mechanical Design and Manufacturing, Intelligent Transportation Systems and Highway Safety, and Dynamics and Biomechanics. He was a past member of the management committee of the ASME/IEEE Transactions on Mechatronics and a former editor for Design for the same Transaction Journal. He was also a former editor in chief of ASME Transactions Journal of Mechanical Design. He is a Fellow of ASME and a past recipient of several achievement awards including the Machine Design Award of ASME.



Dr. Ravani received his BS degree Magna Cum Laude from Louisiana State University, Baton Rouge, LA in 1976; the MS degree from Columbia University in New York in 1978 and the Ph.D. degree from Stanford University, Stanford, CA, in 1982, all in Mechanical Engineering. He was a tenured faculty at the University of Wisconsin-Madison before moving to UC-Davis.

Optimal Mainstream Traffic Flow Control of Large Scale Motorway Networks

Prof. Markos Papageorgiou

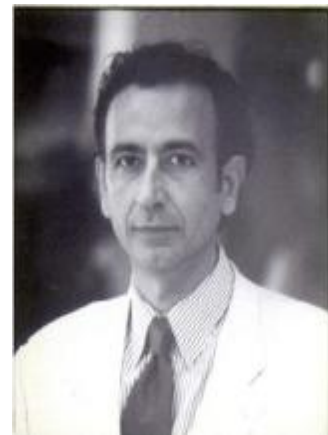
Dynamic Systems & Simulation Laboratory,
TECHNICAL UNIVERSITY OF CRETE, University Campus

Tuesday October 14, 2008

19:00-19:30 Ballroom (JuYingTing), Friendship Palace

Abstract The continuously increasing daily traffic congestions on motorway networks around the world call for innovative control measures that would drastically improve the current traffic conditions. Mainstream traffic flow control (MTFC) is proposed as a novel and efficient motorway traffic management tool, and its possible implementation and principal impact on traffic flow efficiency is analysed. Variable speed limits, suitably operated and enforced, are considered as one (out of several possible) way(s) for MTFC realisation, either as a stand-alone measure or in combination with ramp metering. A computationally efficient software tool for optimal integrated motorway network traffic control including MTFC is applied to a large-scale motorway ring-road. It is demonstrated via several investigated control scenarios that traffic flow can be substantially improved via MTFC with or without integration with coordinated ramp metering actions.

Biography Markos Papageorgiou was born in Thessaloniki, Greece, in 1953. He received the Diplom-Ingenieur and Doktor-Ingenieur (honors) degrees in Electrical Engineering from the Technical University of Munich, Germany, in 1976 and 1981, respectively. From 1976 to 1982 he was a Research and Teaching Assistant at the Control Engineering Chair, Technical University of Munich. He was a Free Associate with Dorsch Consult, Munich (1982-1988), and with Institute National de Recherche sur les Transports et leur Sécurité (INRETS), Arcueil, France (1986-1988). From 1988 to 1994 he was a Professor of Automation at the Technical University of Munich. Since 1994 he has been a Professor at the Technical University of Crete, Chania, Greece. He was a Visiting Professor at the Politecnico di Milano, Italy (1982), at the Ecole Nationale des Ponts et Chaussées, Paris (1985-1987), and at MIT, Cambridge (1997, 2000); and a Visiting Scholar at the University of Minnesota (1991, 1993), University of Southern California (1993) and the University of California, Berkeley (1993, 1997, 2000).



Workshop on Artificial Transportation Systems and Simulation

15:00-16:50, Sunday October 12, 2008

Conference Room No.1, Friendship Palace

Rosaldo Rossetti
Workshop Chair

University of Porto, Portugal

Ronghui Liu
Workshop Co-Chair

University of Leeds, UK

Henry Liu
Workshop Co-Chair

University of Minnesota, USA

The aim of ATSS Workshop series is to foster the discussion on issues concerning the development of Artificial Transportation Systems and Simulation as a means to devise, test and validate ITS-based technologies. With the ability to integrate different transportation models and solutions in a virtual environment, ATSS serve as an aid to support decisions made by engineers and practitioners in a controlled and safe manner. They also provide a natural ground where new approaches can be experimented while avoiding natural drawbacks of dealing directly with real critical domains.

On the basis of theories and methodologies borrowed from a wide spectrum of disciplines, such as the Social Sciences, Distributed Computing, Multi-agent Systems and many others, important issues to address in the development of Artificial Transportation Systems would include (but are not limited to):

- Agent-based modelling and simulation
- Real agent architectures;
- Hardware and software-in-the-loop simulation;
- Agent-human interactions;
- Environment modelling and interaction protocols;
- Learning and adaptation;
- Collaboration, cooperation, competition, coalitions in traffic and transportation models;
- Social and emergent behaviour in MAS-T (multi-agent systems applied to traffic and transport);
- Large scale simulation of agent-based microscopic traffic models;
- Calibration and validation of agent-based models for traffic and transportation.

CONFERENCE VENUE

Beijing Friendship Hotel

Address: No. 1 Zhongguancun South St. Beijing 100873, P.R. China

Beijing Friendship Hotel is located at the southwestern corner of Sitong Bridge, North Third Ring Road. It is adjacent to Peking University, Chinese People's University, Beijing Institute of Technology, Shuang An Market, Modern Plaza and Golden Resources Shopping Mall. The hotel can be easily reached by several public buses and the on-going Beijing No.4 Subway.



The Distance to:

- Capital Airport----- 34Km
About 45 minutes in good traffic. The shuttle bus from the hotel to the airport is another option.
- Beijing West Railway Station----10Km
It takes about 40 minutes in good traffic.
- Tian`anmen Square---18Km
About 30 minutes in good traffic.

Beijing Friendship Hotel is one of the largest garden-style hotels in Asia. Located in the heart of ZhongGuanCun Hi-Tech Zone, the Friendship Hotel neighbors many world famous tourist sites and universities such as Tsinghua and Peking Universities, and the Summer Palace. It covers a total area of 335,000 square meters of land in the capital city, of which 200,000 square meters are landscaped in the traditional Chinese garden style. The Friendship Hotel of Beijing represents classic Chinese architectural elegance and presents most pleasurable views. There are more than 1,800 guestrooms, apartments and office rooms, 26 restaurants and banquet halls of different styles and capable of catering for 2,600 guests at the same time, In addition 38 conference rooms and function halls of

different sizes are capable of hosting national and international conferences ranging from 10 to 1,000 attendees. The comprehensive business services and recreational facilities in the Friendship Hotel of Beijing will make your business trip a very pleasant and successful one.

CONFERENCE REGISTRATION & INFORMATION

The registration desk is located at Friendship Palace will be open on the following dates and times:

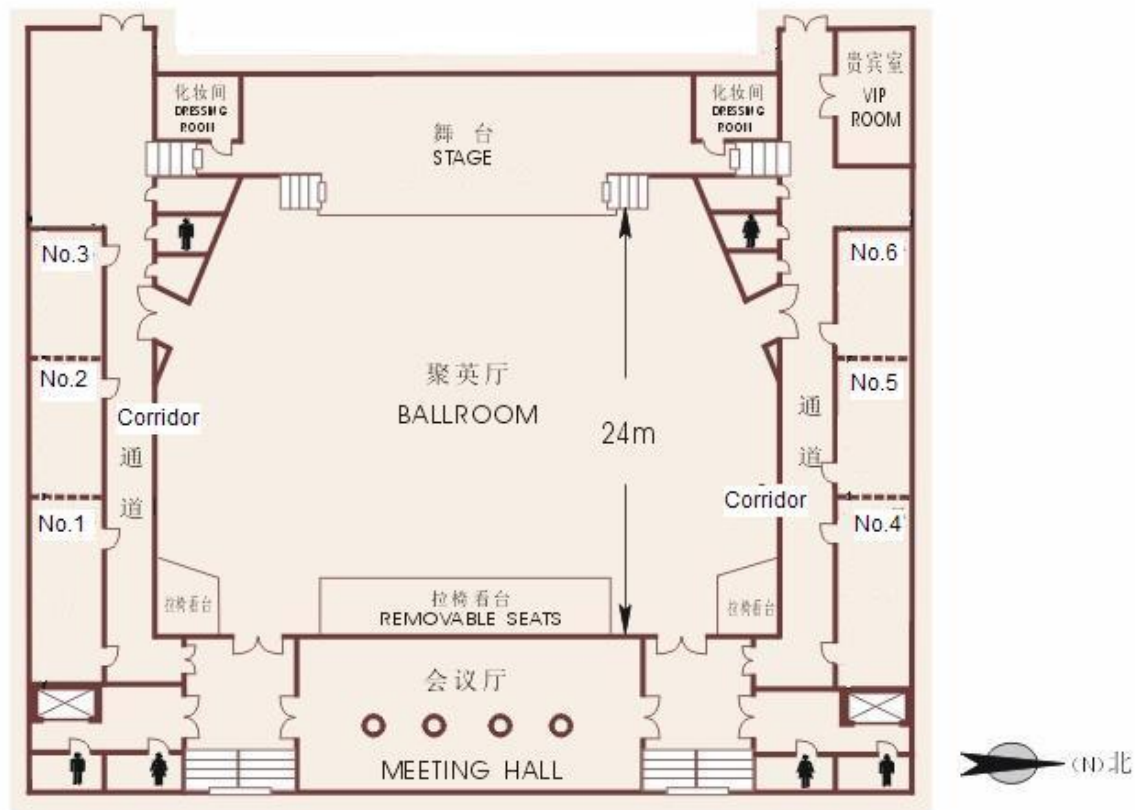
Sunday	12th	October	8:30—17:00
Monday	13th	October	8:00—17:00
Tuesday	14th	October	8:30—17:00
Wednesday	15th	October	8:30—12:00

CONFERENCE PROCEEDINGS

Each registered participant will receive one copy of the CD-ROM proceedings along with this Conference Program.

OPENING CEREMONY

The opening ceremony will take place at 8:50, 13th October, at the Ballroom (JuYingTing), Friendship Palace, Beijing Friendship Hotel.



WELCOME RECEPTION

Monday, 13th October 2008, 18:00-22:00

The welcome reception will be held at JuFuYuan Restaurant, Friendship Palace, Beijing Friendship Hotel. The event is free to all Full registered delegates; vouchers will be included in your conference package.

CONFERENCE BANQUET

Tuesday, 14th October 2008, 18:00-22:00

The ITSC'08 Banquet will take place at the Ballroom (JuYingTing), Friendship Palace, Beijing Friendship Hotel, please make sure you arrive in time. Vouchers will be included in your conference package. "2007 IEEE/ITS Award" and "2008 IEEE ITSS Best Dissertation" will also be announced at banquet.

MORNING AND AFTERNOON BREAKS

Six tea/coffee breaks will be offered to all registered attendees during the conference period.

LUNCH BREAKS

The lunch will be from 12:00-13:30 each conference day at JuFuYuan Restaurant, Friendship Palace.

Session Chairs should better review the conference program before their session in order to know the information about their session better. To ensure smooth running of the conference, Session Chairs are kindly asked to strictly respect the schedule.

All rooms will be equipped with a computer, a video projector and a screen. Presentations must be down loaded to the computer before the session starts. Authors have been asked to meet Session Chairs at the session room a few minutes before the beginning of the session and to provide with their presentations (in MS PowerPoint or PDF).

The length of oral presentation is restricted to 22 minutes, including questions. The authors are strongly advised to keep their oral presentation within 15 minutes and to leave 7 minutes for discussion with the audience and change of speaker. Session Chairs are kindly asked to closely monitor the timing against the schedule.

IEEE ITSC 2008 – INSTRUCTIONS FOR PRESENTERS OF PAPERS

Each paper is allocated a 22 minute presentation slot. Please limit your presentations to 15 minutes to allow sufficient time for Q&A and laptop turnover.

Each room is equipped with an LCD projector. It is expected that presenters will bring their own laptop computers.

If you plan to bring only a USB memory stick, it is your responsibility to find a compatible computer for presentation. Conference prepares a number of laptop computers available at the conference site.

IEEE ITSC 2008 – TOURS

Tour Date: Thursday October 16, 2008

8:00-16:00

Travel Agency: Guokang Travel Agency Date: Oct. 16

To reserve the Tours, please stop by Travel Agency desk, which will be set up near registration desk during the conference.

Tour #1 Great Wall Tour: The Great Wall & The Ming Tomb

Price: 300RMB/Person (including tour guild, bus, lunch, ticket)

Tour Routing:

Hotel Lobby pick-up -> The Jade Factory -> The Great Wall -> Lunch -> The Ming Tomb -> The silk Factory, The Tea House or Chinese Herbs Center -> Hotel drop-off

Detailed instruction:

The Great Wall

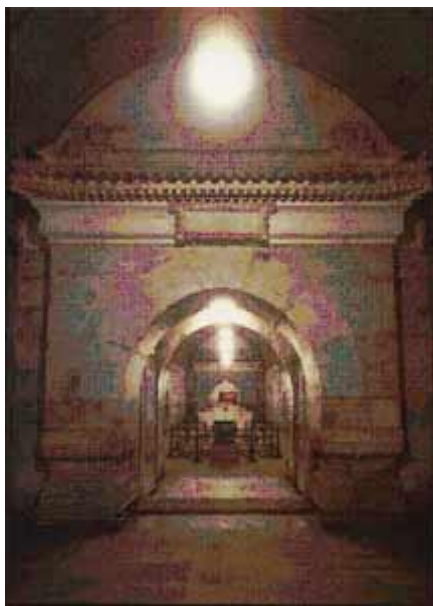


The Great Wall, like the Pyramids of Egypt, the Taj Mahal in India and the Hanging Garden of Babylon, is one of the great wonders of the world. Starting out in the east on the banks of the Yalu River in Liaoning Province, the Wall stretches westwards for 12,700 kilometers to Jiayuguan in the Gobi desert, thus known as the Ten Thousand Li Wall in China. The Wall climbs up and down, twists and turns along the ridges of the Yanshan and Yinshan Mountain Chains through five provinces--Liaoning, Hebei, Shanxi, Shaanxi, and

Gansu--and two autonomous regions--Ningxia and Inner Mongolia, binding the northern China together.

Historical records trace the construction of the origin of the Wall to defensive fortification back to the year 656 B.C. during the reign of King Cheng of the States of Chu. Its construction continued throughout the Warring States period in the fifth Century B.C. when ducal states Yan, Zhao, Wei,

and Qin were frequently plundered by the nomadic peoples living north of the Yinshan and Yanshan mountain ranges. Walls, then, were built separately by these ducal states to ward off such harassments. Later in 221 B.C., when Qin conquered the other states and unified China, Emperor Qinshihuang ordered the connection of these individual walls and further extensions to form the basis of the present great wall. As a matter of fact, a separate outer wall was constructed north of the Yinshan range in the Han Dynasty (206 BC--1644 BC.), which went to ruin through years of neglect. In the many intervening centuries, succeeding dynasties rebuilt parts of the Wall. The most extensive reinforcements and renovations were carried out in the Ming Dynasty (1368--1644) when altogether 18 lengthy stretches were reinforced with bricks and rocks. It is mostly the Ming Dynasty Wall that visitors see today.



The Ming Tomb

Standing in the Spirit Way at the Ming Tombs looking back towards the entry gate. The Ming Dynasty Tombs (Chinese: 明朝十三陵; pinyin: Míng cháo shí sān líng; lit. Thirteen Tombs of the Ming Dynasty) are located some 50 kilometers due North of Beijing at an especially selected site. The site was chosen by the third Ming Dynasty emperor Yongle (1402 - 1424), who moved the Capital City of China from Nanjing to the present location of Beijing. He is credited with envisioning the layout of the ancient city of Beijing as well as a number of landmarks and monuments located therein. After the construction of the Imperial Palace (the Forbidden City) in 1420, the Yongle Emperor selected his burial site and creating his own mausoleum.

From the Yongle Emperor onwards, 13 Ming Dynasty Emperors were buried in this area. The tombs of the first two Ming Emperors are located near Nanjing (the capital city during their reigns). Emperor Jingtai was also not buried here as the Emperor Tianshun had denied Jingtai an imperial burial but was instead buried west of Beijing. The last Emperor Chongzhen who hung himself in April, 1644 was the last to be buried here, named Si Ling by the Qing emperor but on a much smaller scale than his predecessors.

During the Ming dynasty, the tombs were off limits to commoners but in 1644 Li Zicheng's army ransacked and set many of the tombs on fire before advancing and capturing Beijing in April of that year.

Tour #2 Classic Beijing: The Forbidden City & The Temple of Heaven & The Summer Palace

Price: 300RMB/Person (including tour guild, bus, lunch, ticket)

Tour Routing:

Hotel Lobby pick-up -> The Forbidden City -> The Temple of Heaven -> Lunch -> Pearl Market -> The Summer Palace -> The Silk Factory -> Hotel drop-off

Detailed instructions:

Forbidden City (Gu Gong)

Home to two dynasties, the Ming and the Qing, the Forbidden City is the granddaddy of preserved ancient buildings in China. It was built during the Ming Dynasty, under the reign of Yong Le, and required the effort of a million laborers. Most of the buildings have been rebuilt or restored as the originals were destroyed during the tumultuous events of recent Chinese history.



The palace is massive with a lot of ground to cover. It is probably best to go with a tour group so that you do not miss anything, but an audiotope tour is also available. You will see various grand temples and halls but the main highlights are the Three Great Halls, and the Hall of Supreme Harmony. The latter hall was traditionally the most important structure used for imperial ceremonies such as the Emperor's birthday. Purchase maps at the front gate with admission.

The Temple of Heaven



About 2km southeast of the Forbidden City towers Tian Tan, or the Temple of Heaven, where dynastic rulers in China used to worship the heaven. The temple plus subsidiary buildings and a surrounding garden covers an area five times the size of the Forbidden City. As Chinese emperors called themselves Tianzi, or the son of heaven, they had to cede supremacy to the heaven in terms of abiding.

Chinese emperors had many other gods to worship apart from the god of heaven, including the gods of earth, water and war. They also worshipped their ancestors. As a result, religious activities were an important part of their busy work schedule. Temples of various kinds are scattered in Beijing. The best-known are the Temple of Heaven in the south, the Temple of Earth in the north, the Temple of Sun in the east, and the Temple of the Moon in the west. The Temple of Heaven is the grandest of them all.

Summer Palace (Yi He Yuan)

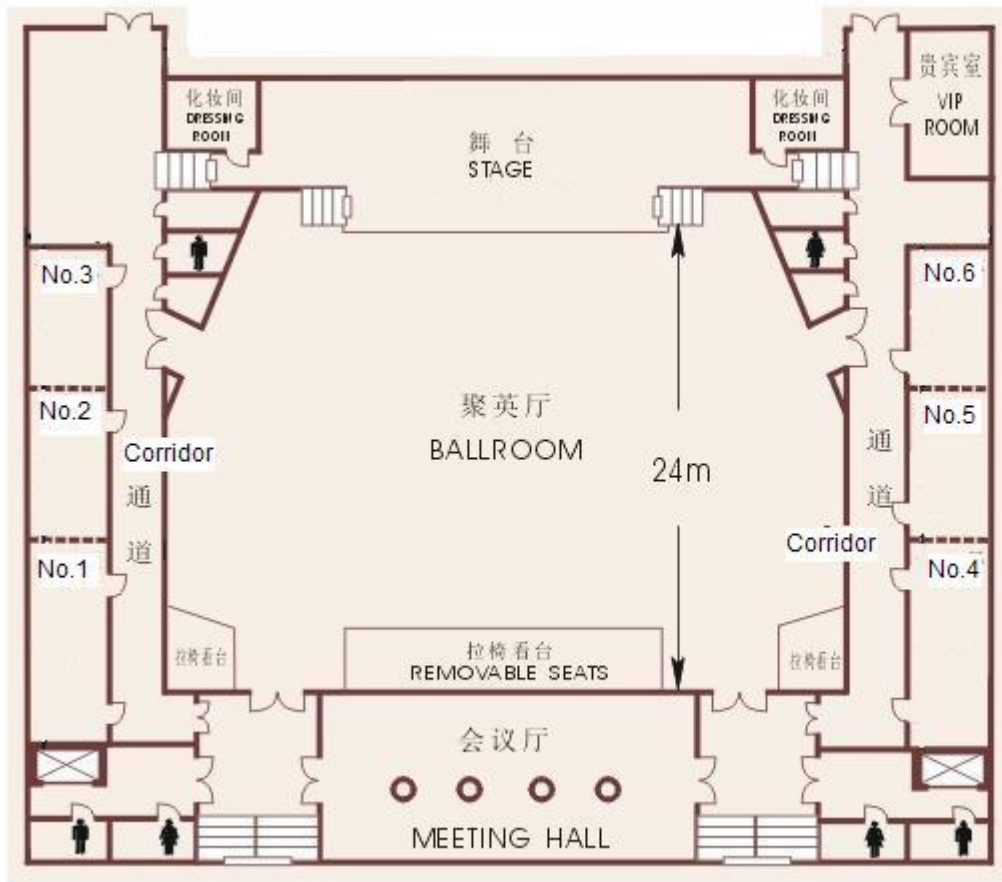


front gate with admission.

Built during the Qing Dynasty, the Summer Palace comprises a large park with beautiful imperial architecture. Used as a summer residence by the imperial family, the estate boasts rolling hills, a lake (Kun Ming Lake) and gardens. Like the Forbidden City, there is much to see at the Summer Palace, and you can easily wile away an entire day exploring the grounds. Major sites to visit include the Precious Clouds Pavilion and the Buddhist Temple of the Sea of Wisdom. Do not miss the 17-arch bridge and the Hall of Benevolence and Longevity. Purchase maps at the

BEIJING FRIENDSHIP HOTEL FLOOR PLAN





IEEE ITSC 2008 PROGRAM AT A GLANCE

ITSC 2008 Technical Program Sunday October 12, 2008

Track T1

15:00-16:50 SuDT1

Conference Room No.1

Artificial Transportation Systems and Simulation

Workshop Chairs: Rosaldo Rossetti, University of Porto, Portugal, Ronghui Liu, University of Leeds, UK, Henry Liu, University of Minnesota, USA

Registration/Help Desk – Conference Foyer Desk
Friendship Palace

Sunday October 12, 2008
8:30-17:00

Monday October 13, 2008
08:00-17:00

Tuesday 14, October 14, 2008
08:30-17:00

Wednesday October 15, 2008
08:30-12:00

ITSC 2008 Technical Program Monday October 13, 2008

Track T1	Track T2	Track T3	Track T4	Track T5
08:50-09:30 Ballroom (JuYingTing), Friendship Palace Opening Ceremony				
09:30-10:10 MoPL1 Ballroom (JuYingTing), Friendship Palace Keynote I: Trends and Research Directions in Supply Chain & Logistics Engineering, Prof. Chelsea C. White III, Georgia Institute of Technology				
10:10-10:50 MoPL2 Ballroom (JuYingTing), Friendship Palace Keynote II: To Set up A Sustainable Transportation Systems for Beijing 2008 Olympic Games, Dr. Xiaoming Liu, Beijing Municipal Committee of Transport				
10:50-11:30 MoPL3 Ballroom (JuYingTing), Friendship Palace Keynote III: The Theory of Commodity Material Flow, Academician Shoubo Xu, Beijing Jiaotong University				
11:30-12:10 MoPL4 Ballroom (JuYingTing), Friendship Palace Keynote IV: Mechatronics Design and Implementation of Driver Assistance Technologies For Intelligent Transportation Systems, Prof. Bahram Ravani, University of California – Davis				
12:10-12:30 The entrance of Friendship Palace Taking Photos				
12:30-13:30 JuFuYuan Restaurant, Friendship Palace Lunch				
13:30-14:58 MoCT1 Conference Room No.1 ITS Architecture and Standards	13:30-14:58 MoCT2 Conference Room No.2 Vision: In-Vehicle 1	13:30-14:58 MoCT3 Conference Room No.3 Travel Time Prediction 1	13:30-14:58 MoCT4 Conference Room No.4 Optimization and Control: Theory and Modeling 1	13:30-14:58 MoCT5 Conference Room No.5 Data Mining and Analysis 1
15:00-15:30 Corridor outside Conference Room No.1-5 & Meeting Hall, Friendship Palace Coffee break				
15:30-16:58 MoDT1 Conference Room No.1 Traffic Surveillance	15:30-16:58 MoDT2 Conference Room No.2 Vision: In-Vehicle 2	15:30-16:58 MoDT3 Conference Room No.3 Travel Time Prediction 2	15:30-16:58 MoDT4 Conference Room No.4 Optimization and Control: Theory and Modeling 2	15:30-16:58 MoDT5 Conference Room No.5 Data Mining and Analysis 2
18:00-22:00 JuFuYuan Restaurant, Friendship Palace Welcome Reception				

ITSC 2008 Technical Program Tuesday October 14, 2008

Track T1	Track T2	Track T3	Track T4	Track T5	
<p align="center">08:30-09:58 TuAT1</p> <p align="center">Conference Room No.1</p> <p align="center">Simulation and Modeling 1</p>	<p align="center">08:30-09:58 TuAT2</p> <p align="center">Conference Room No.2</p> <p align="center">Vision: Surveillance 1</p>	<p align="center">08:30-09:58 TuAT3</p> <p align="center">Conference Room No.3</p> <p align="center">Topics in ITS 1</p>	<p align="center">08:30-09:58 TuAT4</p> <p align="center">Conference Room No.4</p> <p align="center">Traffic Control: Miscellaneous</p>	<p align="center">08:30-09:58 TuAT5</p> <p align="center">Conference Room No.5</p> <p align="center">ITS Communications</p>	
<p>10:00-10:30 Corridor outside Conference Room No.1-5 & Meeting Hall, Friendship Palace Coffee break</p>					
<p align="center">10:30-11:58 TuBT1</p> <p align="center">Conference Room No.1</p> <p align="center">Simulation and Modeling 2</p>	<p align="center">10:30-11:58 TuBT2</p> <p align="center">Conference Room No.2</p> <p align="center">Vision: Surveillance 2</p>	<p align="center">10:30-11:58 TuBT3</p> <p align="center">Conference Room No.3</p> <p align="center">Incident Management</p>	<p align="center">10:30-11:58 TuBT4</p> <p align="center">Conference Room No.4</p> <p align="center">Navigation, Guidance and Control 1</p>	<p align="center">10:30-11:58 TuBT5</p> <p align="center">Conference Room No.5</p> <p align="center">Electronic Payment Services</p>	
<p>12:00-13:30 JuFuYuan Restaurant, Friendship Palace Lunch break</p>					
<p align="center">13:30-14:58 TuCT1</p> <p align="center">Conference Room No.1</p> <p align="center">Simulation and Modeling 3</p>	<p align="center">13:30-14:58 TuCT2</p> <p align="center">Conference Room No.2</p> <p align="center">Vision: Surveillance 3</p>	<p align="center">13:30-14:58 TuCT3</p> <p align="center">Conference Room No.3</p> <p align="center">Traveler Services Information</p>	<p align="center">13:30-14:58 TuCT4</p> <p align="center">Conference Room No.4</p> <p align="center">Navigation, Guidance and Control 2</p>	<p align="center">13:30-14:58 TuCT5</p> <p align="center">Conference Room No.5</p> <p align="center">Man-Machine Interface and Behavior</p>	
<p>15:00-15:30 Corridor outside Conference Room No.1-5 & Meeting Hall, Friendship Palace Coffee break</p>					
<p align="center">15:30-16:58 TuDT1</p> <p align="center">Conference Room No.1</p> <p align="center">Simulation and Modeling 4</p>	<p align="center">15:30-16:58 TuDT2</p> <p align="center">Conference Room No.2</p> <p align="center">Vision: Surveillance 4</p>	<p align="center">15:30-16:58 TuDT3</p> <p align="center">Conference Room No.3</p> <p align="center">Rail ITS</p>	<p align="center">15:30-16:58 TuDT4</p> <p align="center">Conference Room No.4</p> <p align="center">Navigation, Guidance and Control 3</p>	<p align="center">15:30-16:58 TuDT5</p> <p align="center">Conference Room No.5</p> <p align="center">Public Transportation Management</p>	
<p>18:00-22:00 Ballroom (JuYingTing), Friendship Palace Banquet Conference Banquet: Banquet Talk by Prof. Markos Papageorgiou, Optimal Mainstream Traffic Flow Control of Large Scale Motorway Networks 2007 IEEE ITS Award Announcement & 2008 IEEE ITSS Best Dissertation Announcement</p>					

ITSC 2008 Technical Program Wednesday October 15, 2008

Track T1	Track T2	Track T3	Track T4	Track T5	
<p>08:30-09:58 WeAT1</p> <p>Conference Room No.1</p> <p>Statistical Modeling</p>	<p>08:30-09:58 WeAT2</p> <p>Conference Room No.2</p> <p>Imaging and Image Analysis</p>	<p>08:30-09:58 WeAT3</p> <p>Conference Room No.3</p> <p>Cooperative Systems</p>	<p>08:30-09:58 WeAT4</p> <p>Conference Room No.4</p> <p>Traffic Control: Dynamic Speeds</p>	<p>08:30-09:58 WeAT5</p> <p>Conference Room No.5</p> <p>Vehicle Location Systems 1</p>	
<p align="center">10:00-10:30 Corridor outside Conference Room No.1-5 & Meeting Hall, Friendship Palace Coffee break</p>					
<p>10:30-11:58 WeBT1</p> <p>Conference Room No.1</p> <p>Traffic Theory for ITS 1</p>	<p>10:30-11:58 WeBT2</p> <p>Conference Room No.2</p> <p>Multi-Sensor Fusion 1</p>	<p>10:30-11:58 WeBT3</p> <p>Conference Room No.3</p> <p>Advanced Safety Systems</p>	<p>10:30-11:58 WeBT4</p> <p>Conference Room No.4</p> <p>Traffic Control: Video</p>	<p>10:30-11:58 WeBT5</p> <p>Conference Room No.5</p> <p>Vehicle Location Systems 2</p>	
<p align="center">12:00-13:30 JuFuYuan Restaurant, Friendship Palace Lunch break</p>					
<p>13:30-14:58 WeCT1</p> <p>Conference Room No.1</p> <p>Traffic Theory for ITS 2</p>	<p>13:30-14:58 WeCT2</p> <p>Conference Room No.2</p> <p>Multi-Sensor Fusion 2</p>	<p>13:30-14:58 WeCT3</p> <p>Conference Room No.3</p> <p>Collision Detection/Avoidance</p>	<p>13:30-14:58 WeCT4</p> <p>Conference Room No.4</p> <p>Traffic Control: Signalization 1</p>	<p>13:30-14:58 WeCT5</p> <p>Conference Room No.5</p> <p>Vehicle Location Systems 3</p>	
<p align="center">15:00-15:30 Corridor outside Conference Room No.1-5 & Meeting Hall, Friendship Palace Coffee break</p>					
<p>15:30-16:58 WeDT1</p> <p>Conference Room No.1</p> <p>Driver Assistance Services</p>	<p>15:30-16:58 WeDT2</p> <p>Conference Room No.2</p> <p>Multi-Sensor Fusion 3</p>	<p>15:30-16:58 WeDT3</p> <p>Conference Room No.3</p> <p>Vision: Driver Assistance</p>	<p>15:30-16:58 WeDT4</p> <p>Conference Room No.4</p> <p>Topics in ITS 2</p>	<p>15:30-16:58 WeDT5</p> <p>Conference Room No.5</p> <p>Travel Information and Guidance</p>	

IEEE ITSC 2008 TECHNICAL PROGRAM

Sunday, October 12, 2008

SuDT1	Conference Room No.1
ATSS Workshop (Special Session)	
15:00-15:22	SuDT1.1
<i>Towards Reservation-Based Intersection Coordination: An Economic Approach</i> , pp. 1-6.	
Vasirani, Matteo	Univ. Rey Juan Carlos
Ossowski, Sascha	Univ. Rey Juan Carlos
15:22-15:44	SuDT1.2
<i>Event-Driven Architecture for Decision Support in Traffic Management Systems</i> , pp. 7-13.	
Dunkel, Juergen	Hannover Univ. of Applied Sciences and Arts
Fernandez, Alberto	Univ. Rey Juan Carlos
Ortiz, Rubén	Univ. Rey Juan Carlos
Ossowski, Sascha	Univ. Rey Juan Carlos
15:44-16:06	SuDT1.3
<i>Towards an Artificial Traffic Control System</i> , pp. 14-19.	
Rossetti, Rosaldo	LIACC - Univ. of Porto
Ferreira, Paulo	Artificial Intelligence and Computer Science Lab.
Braga, Rodrigo	Artificial Intelligence and Computer Science Lab.
Oliveira, Eugénio	Faculty of Engineering, Univ. of Porto
16:06-16:28	SuDT1.4
<i>An Investigation on ATS from the Perspective of Complex Systems</i> , pp. 20-24.	
Li, Jinyuan	Tsinghua Univ. China
Tang, Shuming	Inst. of Automation, Chinese Acad. of Sciences
Wang, Fei-Yue	Univ. of Arizona

Monday, October 13, 2008

MoCT1	Conference Room No.1
ITS Architecture and Standards (Regular Session)	
13:30-13:52	MoCT1.1
<i>Infomobility Provision through MBMS/UMTS in Realistic Scenarios</i> , pp. 25-30.	
Bazzi, Alessandro	Univ. of Bologna
Masini, Barbara Mavi	Univ. of Bologna
Conti, Andrea	Univ. of Ferrara
Andrisano, Oreste	Univ. of Bologna
13:52-14:14	MoCT1.2
<i>Software Architecture Design on Large-Scale Network Traffic Signal Controllers System</i> , pp. 31-36.	
Qi, Zhaoge	Zhejiang Univ.
Shi, Wei	Zhejiang Univ.
Wu, Zhaohui	Zhejiang Univ.
14:14-14:36	MoCT1.3
<i>A Concept for Ubiquitous Transportation Systems and Related Development Methodology</i> , pp. 37-42.	
Lee, Eunyoung	Ajou Univ.
Ryu, Kiyool	Ajou Univ.
Paik, Insup	Ajou Univ.
14:36-14:58	MoCT1.4
<i>The Concept of an Open Platform for Traffic and Traveler Information Services</i> , pp. 43-48.	
Li, Yanying	ERTICO - ITS Europe
Andrade, Mariana	ERTICO - ITS Europe
Bliervaque, Vincent	ERTICO - ITS Europe

MoCT2	Conference Room No.2
Vision: In-Vehicle 1 (Regular Session)	
13:30-13:52	MoCT2.1
<i>Vision-Based Real-Time Lane Marking Detection and Tracking</i> , pp. 49-54.	
Liu, Wei	Northeastern Univ. Shenyang, China
Zhang, Hongliang	Univ. Northeastern Univ.
Duan, Bobo	Neusoft Park
Yuan, Huai	Northeastern Univ. Shenyang, China
Zhao, Hong	China
13:52-14:14	MoCT2.2
<i>Detection, Tracking and Recognition of Traffic Signs from Video Input</i> , pp. 55-60.	
Ruta, Andrzej	Brunel Univ.
Li, Yongmin	Brunel Univ.
Liu, Xiaohui	Brunel Univ.
14:14-14:36	MoCT2.3
<i>Vehicle Tracking by Non-Drifting Mean-Shift Using Projective Kalman Filter</i> , pp. 61-66.	
Bouttefroy, Philippe Loic Marie	Univ. of Wollongong
Bouzerdoum, Abdesselam	Univ. of Wollongong
Beghdadi, Azeddine	Univ. Paris 13
Phung, Son Lam	Univ. of Wollongong
14:36-14:58	MoCT2.4
<i>Curb Detection Based on a Multi-Frame Persistence Map for Urban Driving Scenarios</i> , pp. 67-72.	
Oniga, Florin Ioan	Tech. Univ. of Cluj Napoca
Nedevschi, Sergiu	Tech. Univ. of Cluj-Napoca
Meinecke, Marc-Michael	Volkswagen AG

MoCT3	Conference Room No.3
Travel Time Prediction 1 (Regular Session)	
13:30-13:52	MoCT3.1
<i>Neural Network Committee to Predict Travel Times: Comparison of Bayesian Evidence Approach to the Use of a Validation Set</i> , pp. 73-78.	
van Hinsbergen, Chris Philip	Delft Univ. of Tech.
Ijsbrand	Delft Univ. of Tech.
van Lint, Hans	Delft Univ. of Tech.
Van Zuylen, H.J.	Delft Univ. of Tech.
13:52-14:14	MoCT3.2
<i>The Effects of Traffic Accidents on Travel Time Reliability</i> , pp. 79-84.	
Tu, Huizhao	Delft Univ. of Tech.
van Lint, Hans	Delft Univ. of Tech.
van Zuylen, H.J.	Delft Univ. of Tech.
14:14-14:36	MoCT3.3
<i>Variation Based Online Travel Time Prediction Using Clustered Neural Networks</i> , pp. 85-90.	
Yu, Jie	Univ. of Maryland
Chang, Gang-Len	UMD
Ho, H.W.	Univ. of Maryland
Liu, Yue	Univ. of Maryland at Coll. Park
14:36-14:58	MoCT3.4
<i>A Reliable Hybrid Prediction Model for Real-Time Travel Time Prediction with Widely Spaced Detectors</i> , pp. 91-96.	
Zou, Nan	Univ. of Maryland
Wang, Jianwei	Univ. of Maryland
Chang, Gang-Len	UMD

MoCT4	Conference Room No.4
Optimization and Control: Theory and Modeling 1 (Regular Session)	
13:30-13:52	MoCT4.1
<i>AFT2: An Automated Maintenance and Calibration Tool for Traffic Management & Control Systems</i> , pp. 97-104.	
Kosmatopoulos, Elias	Tech. Univ. of Crete
Papageorgiou, Markos	Tech. Univ. of Crete
Wang, Yibing	Monash Univ.

13:52-14:14 MoCT4.2
Optimal Parameter Settings for Adaptive Traffic-Actuated Signal Control, pp. 105-110.
 Zheng, Xing Univ. of California, Irvine
 Chu, Lianyu Univ. of California, Berkeley

14:14-14:36 MoCT4.3
Offline Offset Models for Coordinated Signal Control, pp. 111-115.
 Ma, Ying-Ying Tongji Univ.
 Yang, Xiaoguang Tongji Univ.
 Zhong, Zhangjian Tongji Univ.

14:36-14:58 MoCT4.4
Optimization of Traffic Flows in Congested Metropolitan Areas, pp. 116-121.
 Giglio, Davide Univ. of Genova
 Riccardo, Minciardi Univ. of Genova

MoCT5 Conference Room No.5
Data Mining and Analysis 1 (Regular Session)

13:30-13:52 MoCT5.1
Data Mining Based Research on Urban Tide Traffic Problem, pp. 122-127.
 Gong, Xiaoyan Inst. of Automation, Chinese Acad. of Sciences
 Lu, Yu Shandong Communications Bureau

13:52-14:14 MoCT5.2
Analysis and Optimization of Statistical Data in Beijing for Traffic Information Services, pp. 128-133.
 Li, Man Hitachi (China) R&D Corp.
 Wang, Wenjia Hitachi (China) Res. & Development Corp.

14:14-14:36 MoCT5.3
Short-Term Traffic Flow Forecasting Using Macroscopic Urban Traffic Network Model, pp. 134-138.
 Lin, Shu Shanghai Jiao Tong Univ.
 Xi, Yugeng Shanghai Jiao Tong Univ.
 Yang, Yanfei Shanghai Jiao Tong Univ.

14:36-14:58 MoCT5.4
Estimation of Vehicle Usage Rate Based on Capture-Recapture Model with License Plate Recognition Data, pp. 139-144.
 Chen, Xiqun Tsinghua Univ.
 Yang, Xinmiao Tsinghua Univ.
 Shi, Qixin Tsinghua Univ.

MoDT1 Conference Room No.1
Traffic Surveillance (Regular Session)

15:30-15:52 MoDT1.1
Vehicle Classification Algorithm Based on Binary Proximity Magnetic Sensors and Neural Network, pp. 145-150.
 Zhang, Wei Dalian Univ. of Tech.
 Tan, Guozhen Dalian Univ. of Tech.
 Ding, Nan Dalian Univ. of Tech.
 Shang, Yao Dalian Univ. of Tech.
 Lin, Mingwen Dalian Univ. of Tech.

15:52-16:14 MoDT1.2
A New Approach for In-Vehicle Camera Obstacle Detection by Ground Movement Compensation, pp. 151-156.
 Yang, Changhui Sanyo Electric Co., Ltd.
 Hongo, Hitoshi SANYO
 Tanimoto, Shinichi SANYO Electric Co., Ltd.

16:14-16:36 MoDT1.3
Obtaining Dense Road Speed Estimates from Sparse GPS Measurements, pp. 157-162.
 Phan, Andrew McGill Univ.
 Ferrie, Frank P McGill Univ.

16:36-16:58 MoDT1.4
Airborne Moving Vehicle Detection for Urban Traffic Surveillance, pp. 163-167.
 Lin, RenJun Univ. of Science and Tech. of

Cao, XianBin Univ. of Science and Tech. of China
 Xu, Yanwu Univ. of Science and Tech. of China
 Wei, ChuangXian Univ. of Science and Tech. of China
 Qiao, Hong Chinese Acad. of Sciences

MoDT2 Conference Room No.2
Vision: In-Vehicle 2 (Regular Session)

15:30-15:52 MoDT2.1
3D Traffic Sign Tracking Using a Particle Filter, pp. 168-173.
 Meuter, Mirko Delphi Electronics & Safety
 Kummert, Anton Univ. of Wuppertal
 Müller-Schneiders, Stefan Delphi Corp.

15:52-16:14 MoDT2.2
Evaluation of Road Marking Feature Extraction, pp. 174-181.
 Veit, Thomas Inrets
 Tarel, Jean-Philippe LCPC
 Nicole, Philippe LCPC
 Charbonnier, Pierre LRPC

16:14-16:36 MoDT2.3
Stereovision-Based 3D Lane Detection System: A Model Driven Approach, pp. 182-188.
 Benmansour, Nabil LCPC
 Labayrade, Raphael Univ.
 Aubert, Didier INRETS/LCPC
 Glaser, Sébastien LCPC

16:36-16:58 MoDT2.4
Real-Time Road Traffic Classification Using On-Board Bus Video Camera, pp. 189-196.
 Parisot, Christophe Multitel asbl
 Meessen, Jerome Multitel asbl
 Carincotte, Cyril Multitel asbl
 Desurmont, Xavier Multitel asbl

MoDT3 Conference Room No.3
Travel Time Prediction 2 (Regular Session)

15:30-15:52 MoDT3.1
Traffic Estimation and Prediction Based on Real Time Floating Car Data, pp. 197-203.
 de Fabritiis, Corrado Octo Telematics srl
 Ragona, Roberto Enea
 Valenti, Gaetano Enea

15:52-16:14 MoDT3.2
A New Online Travel Time Estimation Approach Using Distorted Automatic Vehicle Identification Data, pp. 204-209.
 Ma, Xiaoliang Royal Inst. of Tech.
 Koutsopoulos, Haris N. Royal Inst. of Tech.

16:14-16:36 MoDT3.3
A Novel Loglinear Model for Freeway Travel Time Prediction, pp. 210-215.
 Huang, Lili Univ. of California, Riverside
 Barth, Matthew Univ. of California-Riverside

16:36-16:58 MoDT3.4
Design and Initial Implementation of an Inductive Signature-Based Real-Time Traffic Performance Measurement System, pp. 216-221.
 Tok, Yeow Chern Andre Univ. of California, Irvine
 Jeng, Shin-Ting Univ. of California Irvine
 Liu, Hang Univ. of California, Irvine
 Ritchie, Stephen Univ. of California, Irvine

MoDT4 Conference Room No.4
Optimization and Control: Theory and Modeling 2 (Regular Session)

15:30-15:52 MoDT4.1
Studies of Emergency Evacuation Strategies Based on Kinematic Wave Models of Network Vehicular Traffic, pp. 222-227.
 Qiu, Kai-Fu University of Science and Tech. of

Jin, Wen-Long	China Univ. of California
15:52-16:14	MoDT4.2
<i>A Multiple SVR Approach with Time Lags for Traffic Flow Prediction</i> , pp. 228-233.	
Wu, Tianshu	Beijing Univ.
Xie, Kunqing	Peking Univ.
Song, Guojie	PKU
Hu, Cheng	Peking Univ.
16:14-16:36	MoDT4.3
<i>A New Methodology for Processing Time Varying Traffic Data in Multiple States</i> , pp. 234-239.	
Zhu, Weihua	Univ. of California-Riverside
Boriboonsomsin, Kanok	Univ. of California-Riverside
Barth, Matthew	Univ. of California-Riverside
16:36-16:58	MoDT4.4
<i>Test Results and Validation of the FeedMAP Framework with ADAS Applications</i> , pp. 240-246.	
Thomas, Bernd	NAVIGON AG
Loewenau, Jan	BMW Res. and Tech.
Durekovic, Sinisa	NAVTEQ
Landwehr, Michael	PTV AG
Flament, Maxime	ERTICO - ITS Europe
Li, Yanying	ERTICO - ITS Europe

MoDT5	Conference Room No.5
Data Mining and Analysis 2 (Regular Session)	

15:30-15:52	MoDT5.1
<i>Automatic Mining of Vehicle Behaviors with an Unknown Number of Categories</i> , pp. 247-252.	
Liu, Ying	Tsinghua Univ.
Zhang, Hao	Tsinghua Univ.
Meng, Huadong	Tsinghua Univ.
Wang, Xiqin	Tsinghua Univ.
15:52-16:14	MoDT5.2
<i>Hybrid Process Neural Network Based on Spatio-Temporal Similarities for Short-Term Traffic Flow Prediction</i> , pp. 253-258.	
Hu, Cheng	Peking Univ.
Xie, Kunqing	Peking Univ.
Song, Guojie	PKU
Wu, Tianshu	Beijing Univ.
16:14-16:36	MoDT5.3
<i>Linking Freeway and Arterial Data – Data Archiving Testing in Supporting Coordinated Freeway and Arterial Operations</i> , pp. 259-264.	
Yang, Qingyan	Iteris Inc.
Wei, Heng	Univ. of Cincinnati
Gu, Jiuchun	Ludong Univ.
16:36-16:58	MoDT5.4
<i>Nonlinear Analysis of Individual Vehicle Behavior in Car Following</i> , pp. 265-268.	
Wang, Lanjun	Tsinghua Univ.
Zhang, Hao	Tsinghua Univ.
Meng, Huadong	Tsinghua Univ.
Wang, Xiqin	Tsinghua Univ.

Tuesday, October 14, 2008

TuAT1	Conference Room No.1
Simulation and Modeling 1 (Regular Session)	

08:30-08:52	TuAT1.1
<i>An Urban Intersection Model Based on Multi-Commodity Kinematic Wave Theories</i> , pp. 269-274.	
Chen, Liang	Univ. of Science and Tech. of China
Jin, Wen-Long	Univ. of California
Hu, Jianping	Tsinghua
Zhang, Yi	Tsinghua Univ.
08:52-09:14	TuAT1.2

<i>Fuzzy Logic Based Cyclists' Path Planning Behavioral Model in Mixed Traffic Flow</i> , pp. 275-280.	
Huang, Ling	South China Univ. of Tech.
Wu, Jianping	Univ. of Southampton
09:14-09:36	TuAT1.3
<i>Simulation Study of Mixed Traffic in China--A Practice in Beijing</i> , pp. 281-285.	
Guo, Min	Beijing Traffic Management Bureau
Du, Yiman	Univ. of Southampton
Wu, Jianping	Univ. of Southampton
Song, Yan	Company
09:36-09:58	TuAT1.4
<i>Adaptive Dynamic Programming for Multi-Intersections Traffic Signal Intelligent Control</i> , pp. 286-291.	
Li, Tao	Inst. of Automation, Chinese Acad. of Sciences
Zhao, Dongbin	Inst. of Automation, Chinese Acad. of Sciences
Yi, Jianqiang	Inst. of Automation, Chinese Acad. of Sciences

TuAT2	Conference Room No.2
Vision: Surveillance 1 (Regular Session)	

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Toral-Marín, Sergio	Univ. of Seville
Barrero, Federico	Univ. of Seville
Vargas, Manuel	Univ. of Seville
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Huang, Hua	Xi'an Jiaotong Univ.
Zhao, Qian	Xi'an Jiaotong Univ.
Jia, Yulan	Xi'an Jiaotong Univ.
Tang, Shuming	Inst. of Automation, Chinese Acad. of Sciences
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Thi, Tuan Hue	National ICT Australia (NICTA)
Lu, Sijun	National ICT Australia (NICTA)
Zhang, Jian	National ICT Australia (NICTA)
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Ludwig, Oswaldo	ISR-Inst. of Systems and Robotics-UC
Nunes, Urbano	Inst. for Systems and Robotics

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Chen, Zhuo	Univ. of Hong Kong
Ngai, Chi Kit	Univ. of Hong Kong
Yung, Nelson H. C.	Univ. of Hong Kong
08:52-09:14	TuAT3.2
<i>Representing and Tracking of Dynamics Objects Using Oriented Bounding Box and Extended Kalman Filter.</i> , pp. 322-328.	
Kmiotek, Pawel	Univ. of Tech. of Belfort-Montbéliard - France
Ruichek, Yassine	Univ. of Tech. of Belfort-Montbéliard - France
09:14-09:36	TuAT3.3
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Zhu, Zhigao	SouthEast Univ.

Li, Tiezhu SouthEast Univ.
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Using 3D Road Geometry to Optimize Heavy Truck Fuel Efficiency,
 pp. 334-339.
 Huang, Wei Auburn Univ.
 Bevly, David Auburn Univ.
 Schnick, Steve Intermap Tech. Corp.
 Li, Xiaopeng Intermap Tech.

TuAT4 Conference Room No.4
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*An Innovation-Based Approach to Timely and Robust Automatic
 Highway Incident Detection*, pp. 340-345.

Schober, Martin Univ. Stuttgart
 Wehlan, Herbert Univ. Stuttgart
 Meier, Jürgen NAVIGON AG

08:52-09:14 TuAT4.2
*Performance Assessment of Highway Tunnel Surveillance and
 Control System by Fault Tree Analysis*, pp. 346-350.

Zhu, Liwei Key Lab. of Road Safety Tech.
 Ministry of Communica
 Zhang, Zhiyong Key Lab. of Road Safety Tech.
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 Bao, Zuojun Key Lab. of Road Safety Tech.
 Ministry of Communicat

09:14-09:36 TuAT4.3
*Coordinated Control of Mutiple Ramp Metering Based on DHP (» ;)
 Controller*, pp. 351-356.

Bai, Xuerui Inst. of Automation, Chinese Acad.
 of Sciences
 Zhao, Dongbin Inst. of Automation, Chinese Acad.
 of Sciences
 Yi, Jianqiang Inst. of Automation, Chinese Acad.
 of Sciences
 Xu, Jing Inst. of Automation, Chinese Acad.
 of Sciences

09:36-09:58 TuAT4.4
*Scheduling Aircraft Landing Based on Clonal Selection Algorithm and
 Receding Horizon Control*, pp. 357-362.

Jia, XiaoLan Univ. of Science and Tech. of
 China
 Cao, XianBin Univ. of Science and Tech. of
 China
 Guo, YuanPing Univ. of Science and Tech. of
 China
 Qiao, Hong Chinese Acad. of Sciences
 Zhang, Jun Beihang Univ.

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*An NTCIP-Based Semantic ITS Middleware for Emergency Vehicle
 Preemption*, pp. 363-368.

Yang, Chen-Wei Feng Chia Univ.
 Dow, Chyi-Ren Feng Chia Univ.
 Chen, Kuong-Ho Feng Chia Univ.
 Chiang, Wei-Chun Feng Chia Univ.
 Lin, Da-Jie Feng Chia Univ.

08:52-09:14 TuAT5.2
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Yang, Lin Nankai Univ.
 Guo, Jinhua Univ. of Michigan
 Wu, Ying Nankai Univ.

09:14-09:36 TuAT5.3
*Design of Autonomous Decentralized Mobility System:
 Implementation for ITS Services Using DSRC*, pp. 375-382.

Shimura, Akitoshi Hitachi, Ltd.
 Hiraiwa, Masashi Hitachi, Ltd.
 Sugano, Shigeki Waseda Univ.

09:36-09:58 TuAT5.4
*HarpiaGrid: A Reliable Grid-Based Routing Protocol for Vehicular Ad
 Hoc Networks*, pp. 383-388.
 Chen, Kuong-Ho Feng Chia Univ.
 Dow, Chyi-Ren Feng Chia Univ.
 Lee, Yi-Shiou Feng Chia Univ.

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*Second Life Prototyping of Augmented Automobile Navigation
 Assistance*, pp. 389-394.

Chu, Kar-Hai Univ. of Hawaii at Manoa
 Joseph, Samuel R. H. Univ. of Hawaii at Manoa

10:52-11:14 TuBT1.2
*Large-Scale Field Testing of a Real-Time Freeway Network Traffic
 State Estimator in South Italy*, pp. 395-401.

Wang, Yibing Monash Univ.
 Coppola, Pierluigi "Tor Vergata" Univ. of Rome
 Tzimitsi, Athina Tech. Univ. of Crete
 Messmer, Albert Consulting Engineer
 Papagergiou, Markos Tech. Univ. of Crete
 Nuzzolo, Agostino Univ. of Rome "Tor Vergata"

11:14-11:36 TuBT1.3
*Agent-Based Coordination Model for Designing Transportation
 Applications*, pp. 402-407.

Badeig, Fabien French National Inst. for Transport
 and Safety Res. (INR
 Balbo, Flavien Univ. Paris-Dauphine
 Scemama, Gérard French National Inst. for Transport
 and Safety Res. (INR
 Zargayouna, Mahdi French National Inst. for Transport
 and Safety Res. (INR

11:36-11:58 TuBT1.4
*Usage of Its in the In-Vehicle Signing System with RFID Tags and
 Vehicle Routing and Road Traffic Simulation*, pp. 408-413.

Zoghi, Hasan Islamic Azad Univ. Karaj Branch
 Siamardi, Kianoush Islamic Azad Univ. Karaj Branch
 Tolouei, Morteza Islamic Azad Univ. Karaj Branch
 Araghi, Pegah Islamic Azad Univ. Karaj Branch

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10:30-10:52 TuBT2.1
*On Integration of Features and Classifiers for Robust Vehicle
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Oliveira, Luciano Inst. of Systems and Robotics -
 Univ. of Coimbra
 Nunes, Urbano Inst. for Systems and Robotics

10:52-11:14 TuBT2.2
*Understanding Metro Station Usage Using Closed Circuit TeleVision
 Cameras Analysis*, pp. 420-427.

Carincotte, Cyril Multitel asbl
 Hick, Michel Multitel asbl
 Naturel, Xavier IDIAP Res. Inst.
 Yao, Jian IDIAP Res. Inst.
 Odobez, Jean-Marc IDIAP Res. Inst.
 Bastide, Arnaud ACIC nv/sa
 Corbucci, Bruno ATAC Spa

11:14-11:36 TuBT2.3
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 428-433.

Zhao, Huijing Peking Univ.
 Cui, Jinshi Peking Univ.
 Zha, Hongbin Peking Univ.
 Katabira, Kyoichiro Univ. of Tokyo
 Shao, Xiaowei Univ. of Tokyo
 Shibasaki, Ryosuke Univ. of Tokyo

11:36-11:58 TuBT2.4
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440.

Bansal, Mayank	Sarnoff Corp.
Das, Aveek	Sarnoff Corp.
Kreutzer, Greg	Sarnoff Corp.
Eledath, Jayan	Sarnoff Corp.
Kumar, Rakesh	Sarnoff Corp.
Sawhney, Harpreet	Sarnoff Corp.

with *Several Low-Cost Technologies*, pp. 490-494.

Jaume, Segura Garcia	Univ. of Valencia
Jordán Aldasoro, Juan G.	Univ. of Valencia
Miguel A., Jaén	Univ. of Valencia
Francisco R., Soriano	Univ. of Valencia

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10:30-10:52 TuBT3.1

Traffic Impact Assessment of Incident Management Strategies, pp. 441-446.

Dia, Hussein	-
Gondwe, William	Government agency
Panwai, Sakda	The Univ. of Queensland

10:52-11:14 TuBT3.2

Enhancing Automatic Incident Detection Techniques through Vehicle to Infrastructure Communication, pp. 447-452.

Abuelela, Mahmoud	old dominion Univ.
Olariu, Stephan	Old Dominion Univ.
Yan, Gongjun	Old Dominion Univ.

11:14-11:36 TuBT3.3

Empirical Analysis and Modeling of Freeway Incident Duration, pp. 453-457.

Kim, Woon	Univ. of Maryland, Coll. Park
Natarajan, Suhasini	Univ. of Maryland, Coll. Park
Chang, Gang-Len	UMD

11:36-11:58 TuBT3.4

Synthesis of Emergency Evacuation Communication System for Disaster Detection and Information Dissemination, pp. 458-463.

Zeng, Qing-An	Univ. of Cincinnati
Wei, Heng	Univ. of Cincinnati

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10:30-10:52 TuBT4.1

Application of RF Tags in Highway Reference Markers, pp. 464-469.

Cai, Yu	Univ. OF HOUSTON
Liu, Richard C.	Univ. OF HOUSTON

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Wang, Yang	Univ. of Portsmouth
Beullens, Patrick	Univ. of Portsmouth
Liu, Honghai	Univ. of Portsmouth
Brown, David	Univ. of Portsmouth
Thornton, Tim	Smartcom Software
Proud, Richard	ComSine Limited

11:14-11:36 TuBT4.3

The Mobile Spatial DBMS for the Partial Map Air Update in the Navigation, pp. 476-481.

Kyoung Wook, Min	Electronics and Telecommunications Res. Insititute
Kyoung Hwan, An	Electronics and Telecommunications Res. Insititute
Ju Wan, Kim	Electronics and Telecommunications Res. Insititute
Sung Il, Jin	Chungnam National Univ.

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Macek, Kristijan	Swiss Federal Inst. of Tech. Zurich
Vasquez, Dizan	ETHZ
Fraichard, Thierry	Inria Grenoble Rhône-Alpes
Siegiwart, Roland	ETH Zurich

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Feng, Shaojun	Imperial Coll. London
Ochieng, Washington	Imperial Coll. London
North, Robin	Imperial Coll. London

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Automatic Vehicle Detection and Classification, pp. 501-505.

Ferreira, Pedro M. C.	ISEL
Marques, Gonçalo	ISEL
Jorge, Pedro	ISEL
Abrantes, Arnaldo	ISEL
Amador, António	Brisa

11:36-11:58 TuBT5.4

A Comparative Study of Parking and Congestion Charge Policies Based on Transport Mode Choice Estimation, pp. 506-510.

Feng, Suwei	Shanghai Univ. of Finance and Ec.
Ye, Jingjing	Shanghai Univ. of Finance and Ec.

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An Asymmetric Intelligent Model for Public Transportation Networks, pp. 511-516.

Ehsanfar, Abbas	Sharif Univ. of Tech.
Farzinfard, Sina	Sharif Univ. of Tech.
Isaai, Mohammad Taghi	SHARIF Univ. OF Tech.

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Multi-Agent Platform for Solving the Dynamic Vehicle Routing Problem, pp. 517-522.

Barbucha, Dariusz	Gdynia Maritime Univ.
Jedrzejowicz, Piotr	Gdynia Maritime Univ.

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High Order Sliding Mode Observer to Estimate Vertical Forces: Experimental Results, pp. 523-527.

Imine, Hocine	Lab. Central des Ponts et Chaussées
Madani, Tarek, Tarek	Versailles Univ.
Srairi Salim, Salim	LCPC

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EVAQ: A New Analytical Model for Voluntary and Mandatory Evacuation Strategies on Time-Varying Networks, pp. 528-533.

Pel, Adam	Delft Univ. of Tech.
Bliemer, Michiel	Delft Univ. of Tech.
Hoogendoorn, Serge	Delft Univ. of Tech.

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Real-Time Vehicle Classification Using a Smart Embedded Device with a 'Silicon Retina' Optical Sensor, pp. 534-538.

Litzenberger, Martin	Austrian Res. Centers GmbH - ARC
Donath, Nikolaus	Austrian Res. Centers GmbH - ARC
Gritsch, Gerhard	Austrian Res. Centers GmbH - ARC
Kohn, Bernhard	Austrian Res. Centers GmbH - ARC

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Bardet, Francois	Univ. Blaise-Pascal
Chateau Thierry, Chateau	Univ. of Clermont-Ferrand

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Li, Zhi-peng
Sun, Yun
Liu, Fuqiang
Shi, Wenhuan

Tongji Univ.
Tongji Univ.
Tongji Univ.
Shanghai Jiao Tong Univ.

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Sheng, Hao
Li, Chao
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Xiong, Zhang

Beihang Univ.
Beihang Univ.
Beihang Univ.
Beihang Univ.

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Shafahi, Yousef
Nourbakhsh, Seyed
Mohammad
Seyedabrishami, Seyedehsan

Sharif Univ. of Tech.
Sharif Univ.
Sharif Univ. of Tech.
Sharif Univ. of Tech.

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Fang, Fang Clara
Univ. of Hartford

14:14-14:36 TuCT3.3

SmartParking: A Secure and Intelligent Parking System Using NOTICE, pp. 569-574.

Yan, Gongjun
Olariu, Stephan
Weigle, Michele C.
Abuelela, Mahmoud

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old dominion Univ.

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Zhou, Shaolin
Shi, Wei
Tang, Zhi
Wu, Jian
Wu, Zhaohui

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Zhejiang Univ.
Zhejiang Univ.
Zhejiang Univ.
Zhejiang Univ.

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Zhu, Weihua
Boriboonsomsin, Kanok
Barth, Matthew

Univ. of California-Riverside
Univ. of California-Riverside
Univ. of California-Riverside

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Ye, Qian
Chen, Ling
Chen, Gencai

Zhejiang Univ.
Zhejiang Univ.
Zhejiang Univ.

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Lu, Hsueh-Chan
Lin, Chia-Ching
Tseng, Shin-Mu

National Cheng-Kung Univ.
National Cheng-Kung Univ.
National Cheng Kung Univ.

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Li, Qingquan
Zeng, Zhe

Wuhan Univ.
Wuhan Univ.

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Jiang, Li
Li, Yongjuan
Liu, Xueyuan

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Chinese Acad. of sciences
Chinese Acad. of sciences

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Zheng, Pengjun
Univ. of Southampton

14:14-14:36 TuCT5.3

Description and Tests of a Multisensorial Driving Interface for Vehicle Teleoperation, pp. 616-621.

Ortiz, Jesús
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Tecnologia

Italian Inst. of Tech.

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Tecnologia

Univ. of Zaragoza

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Liu, Jianmei
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Management School, TianjinUnive

Tianjin Univ.

Ma, Shoufeng

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Wang, Fa
Tsinghua Univ.

Ji, Yan
Tsinghua Univ.

Li, Li
Tsinghua Univ.

Hu, Jianming
Tsinghua Univ.

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Cheng, Sihan
Univ.

Yao, Danya
Univ.

Zhang, Yi
Tsinghua Univ.

Su, Yuelong
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Xu, Wenda
Tsinghua Univ.

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Liu, Yue
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Chang, Gang-Len
UMD

Yu, Jie
Univ. of Maryland

Hou, Yuanquan
Univ. of Maryland at Coll. Park

Rahwanji, Saed
Maryland State Highway

Administration

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Hu, Ta-Yin
National Cheng Kung Univ.

Chen, Li-Wen
National Cheng Kung Univ.

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Viti, Francesco
Delft Univ. of Tech. / Katholieke

Univ.

Delft Univ. of Tech.

Delft Univ. of Tech.

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van Arem, Bart Univ. of Twente
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Michalke, Thomas Darmstadt Univ. of Tech.
 Kastner, Robert TU Darmstadt
 Fritsch, Jannik Honda Res. Inst. Europe GmbH
 Goerick, Christian Honda Res. Inst. Europe GmbH

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Katabira, Kyoichiro Univ. of Tokyo
 Zhao, Huijing Peking Univ.
 Shibasaki, Ryosuke Univ. of Tokyo

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Kramm, Sebastien INSA Rouen
 Miche, Pierre ROUEN Univ.
 Benshair, Abdelaziz INSA de Rouen

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Yuan, Jianxin Delft Univ. of Tech.
 Hansen, Ingo A. Delft Univ.

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Maryam, Jandaghian Railway Company of I.R. of Iran
 Setayeshi, Saeed Amirkabir Univ.
 Keymanesh, Mahmoud-Reza Railway Company of I.R. of Iran ,
 Iran Univ. of Science & T
 Amirkabir Univ.
 Arabalibeik, Hosein

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Hu, Shou-Ren National Cheng Kung Univ.
 Wu, Kai-Han National Cheng Kung Univ.

16:36-16:58 TuDT3.4
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Gao, Rui Wuhan Univ.
 Meng, Xiaolin The Univ. of Nottingham
 Geng, Jianghui The Univ. of Nottingham
 Yu, Hai-sui The Univ. of Nottingham
 Xu, Lihua Wuhan Univ.

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Zhang, Hao Shanghai Inst. of Microsystem and
 Information Tech. Ch
 Yu, Wen Shanghai Inst. of Microsystem and
 Information Tech. Ch
 Sun, Xiaowei Shanghai Inst. of Microsystem and
 Information Tech. Ch

15:52-16:14 TuDT4.2
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Wille, Joern Marten Tech. Univ. Braunschweig
 Form, Thomas Tech. Univ. Braunschweig

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711-716.
 Betaille, David LCPC
 Toledo-Moreo, Rafael Univ. of Murcia
 Jean, Laneurit LASMEA

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Wang, Bo Beijing Inst. of Tech.
 Miao, Lingjuan Beijing Inst. of Tech.
 Wang, Shunting Beijing Inst. of Tech.
 Shen, Jun Beijing Inst. of Tech.

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Chen, Kuong-Ho Feng Chia Univ.
 Dow, Chyi-Ren Feng Chia Univ.
 Guan, Sheng-Jie Feng Chia Univ.

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Li, Feng JiLin Univ.
 Wang, Dian-Hai Jilin Univ.
 Wang, Jian Jilin Univ.
 Jin, Sheng Jilin Univ.

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An, Jian Tongji Univ.
16:36-16:58 TuDT5.4
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Seer, Stefan arsenal Res.
 Bauer, Dietmar arsenal Res.
 Brändle, Norbert arsenal Res.
 Ray, Markus arsenal Res.

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Geroliminis, Nikolas Univ. of Minnesota
 Kuwahara, Masao Univ. of Tokyo

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Hsu, Chih-Ming National Taiwan Univ.
 Lian, Feng-Li National Taiwan Univ.

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Hensel, Stefan Univ. of Karlsruhe
 Hasberg, Carsten Univ. of Karlsruhe

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Kim, Wonchul Hiroshima Univ.
 Zhang, Junyi Hiroshima Univ.
 Fujiwara, Akimasa Hiroshima Univ.
 Chikaraishi, Makoto Hiroshima Univ.

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Pan, Shengdong National Univ. of Defense Tech.
An, Xiangjing National Univ. of Defense Tech.

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Li, Yaqian INSA de Rouen
Toulminet, Gwenaëlle INRIA Paris - Rocquencourt
Bensrhair, Abdelaziz INSA de Rouen

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Vargas, Manuel Univ. of Seville
Torral-Marín, Sergio Univ. of Seville
Barrero, Federico Univ. of Seville
Milla, Jose Manuel Univ. of Seville

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Legrand, Capucine PSA Peugeot citroen
Fremont, Vincent Univ. de Tech. de Compiègne
Large, Frederic PSA Peugeot Citroen

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Blum, Jeremy Pennsylvania State Univ.
Neiswender, Andrew Pennsylvania State Univ.
Eskandarian, Azim George Washington State Univ. Virginia

08:52-09:14 WeAT3.2
Cooperative Path Prediction in Vehicular Environments, pp. 803-808.

Lytrivis, Panagiotis Inst. of Comm. & Comp. Syst.
Thomaidis, Georgios Inst. of Comm. and Comp. Syst.
Amditis, Angelos Inst. of Communications and Computer Systems

09:14-09:36 WeAT3.3
Comparative Synthesis of the 3 Main European Projects Dealing with Cooperative Systems (CVIS, SAFESPOT and COOPERS) and Description of COOPERS Demonstration Site 4, pp. 809-814.

Toulminet, Gwenaëlle INRIA Paris - Rocquencourt
Boussuge, Jacques ASFA
Laurgeau, Claude Mines ParisTech

09:36-09:58 WeAT3.4
Novel Index for Objective Evaluation of Road Detection Algorithms, pp. 815-820.

Alvarez, José M. Univ. Autònoma de Barcelona
López, Antonio Univ. Autònoma de Barcelona

WeAT4 Conference Room No.4
Traffic Control: Dynamic Speeds (Regular Session)

08:30-08:52 WeAT4.1
Dynamic Speed Limits and On-Ramp Metering for IVHS Using Model Predictive Control, pp. 821-826.

Baskar, Lakshmi Dhevi Delft Univ. of Tech.
De Schutter, Bart Delft Univ. of Tech.
Hellendoorn, Hans Delft Univ. of Tech.

08:52-09:14 WeAT4.2
SPECIALIST: A Dynamic Speed Limit Control Algorithm Based on Shock Wave Theory, pp. 827-832.

Hegyi, Andreas Delft Univ. of Tech.
Hoogendoorn, Serge Delft Univ. of Tech.
Schreuder, Marco Dutch Ministry of Transport, Public Works and Water Management

Stoelhorst, Henk Dutch Ministry of Transport, Public Works and Water Management
Viti, Francesco Delft Univ. of Tech. / Katholieke

09:14-09:36 WeAT4.3
Safety Impacts of Variable Speed Limits – a Simulation Study, pp. 833-837.

Piao, Jinan Univ. of Southampton
McDonald, Mike Univ. of Southampton

09:36-09:58 WeAT4.4
Flatness Based Control of Traffic Flow for Coordination of Ramp Metering and Variable Speed Limits, pp. 838-843.

Kamel, Boumediene Univ. of Artois, France
Benasser, Amar Univ. d'Artois - IUT de Béthune
Jolly, Daniel Univ. d'Artois - Faculté des Sciences Appliquées

WeAT5 Conference Room No.5
Vehicle Location Systems 1 (Regular Session)

08:30-08:52 WeAT5.1
A GPS/GIS Integrated System for Urban Traffic Flow Analysis, pp. 844-849.

Shi, Wenhuan Shanghai Jiao Tong Univ.
Kong, Qing-Jie Shanghai Jiao Tong Univ.
Liu, Yuncai Shanghai Jiao Tong Univ.

08:52-09:14 WeAT5.2
An Estimation-Based Automatic Vehicle Location System for Public Transport Vehicles, pp. 850-856.

Morenz, Tino Trinity Coll. Dublin
Meier, René Trinity Coll. Dublin

09:14-09:36 WeAT5.3
Improved Filtering-Smoothing Algorithm for GPS Positioning, pp. 857-861.

Cao, Yi Shanghai Jiao Tong Univ.
Mao, Xuchu Shanghai Jiao Tong Univ.

09:36-09:58 WeAT5.4
A Statistical Approach to Map Matching Using Road Network Geometry, Topology and Vehicular Motion Constraints, pp. 862-867.

Pink, Oliver Univ. of Karlsruhe
Hummel, Britta Univ. of Karlsruhe

WeBT1 Conference Room No.1
Traffic Theory for ITS 1 (Regular Session)

10:30-10:52 WeBT1.1
Phase Transition of Urban Freeway Traffic Flow, pp. 868-874.

Guan, Wei Beijing Jiaotong Univ. Beijing P.R.C
He, Shuyan Beijing Jiaotong Univ.

10:52-11:14 WeBT1.2
Real Urban Traffic Flow Chaotic Phase Space Study, pp. 875-879.

Zhang, Lidong shandong computer science center
Wang, Yinglong shandong computer science center

Sun, Zhanquan Shandong Computer Science Center
Pan, Jing Shan Shandong Computer Science Center

11:14-11:36 WeBT1.3
Empirical Investigation on Phase Diagram at Urban Freeway with On-Ramp, pp. 880-887.

He, Shuyan Beijing Jiaotong Univ.
Guan, Wei Beijing Jiaotong Univ. Beijing P.R.C

11:36-11:58 WeBT1.4
System Optimization Model for Traffic Network with ATIS, pp. 888-893.

Si, Bingfeng Beijing Jiaotong Univ.

WeBT2 Conference Room No.2
Multi-Sensor Fusion 1 (Regular Session)

10:30-10:52 WeBT2.1

Sensor Fusion on an Embedded System for Traffic Data Analysis - ETRADA-V System, pp. 894-899.

Litzenberger, Martin	Austrian Res. Centers GmbH - ARC
Glasl, Holger	ARC Seibersdorf Res. GmbH
Kohn, Bernhard	Austrian Res. Centers GmbH - ARC
Schalko, Bernhard	ASFİNAG Mautservice GMBH
Fernandez Dominguez, Gustavo	ARC Seibersdorf Res. GmbH

10:52-11:14 WeBT2.2
Improvement of the Proprioceptive-Sensors Based EKF and IMM Localization, pp. 900-905.

Ndjeng Ndjeng, Alexandre	LCPD
Gruyer, Dominique	INRETS/LCPD
Glaser, Sébastien	LCPD

11:14-11:36 WeBT2.3
Multi-Sensor Fusion Method Using Bayesian Network for Precise Multi-Vehicle Localization, pp. 906-911.

Smaili, Cherif	MAIA Team
E. El Najjar, Maan	MAIA Team
Charpillet, François	MAIA Team

11:36-11:58 WeBT2.4
Research on Fuzzy Adaptive H_∞; Robust Filter for Integrated Navigation System, pp. 912-916.

Liu, Jiang	Beijing Jiaotong Univ.
Wang, Jian	Beijing Jiaotong Univ.
Cai, Bogen	Beijing Jiaotong Univ. Beijing

WeBT3 Conference Room No.3
Advanced Safety Systems (Regular Session)

10:30-10:52 WeBT3.1
Driver-Independent Assessment of Arousal States from Video Sequences Based on the Classification of Eyeblick Patterns, pp. 917-924.

Nopsuwanchai, Roongroj	Asahi Kasei Corp.
Noguchi, Yoshihiro	Asahi Kasei Corp.
Ohsuga, Mieko	Osaka Inst. of Tech.
Kamakura, Yoshiyuki	Osaka Inst. of Tech.
Inoue, Yumiko	Osaka Inst. of Tech.

10:52-11:14 WeBT3.2
Driving Force Control Method to Perform Slip Control in Cooperation with the Front and Rear Wheels for Front-And-Rear Wheel-Independent-Drive-Type EVs (FRID EVs), pp. 925-930.

Mutoh, Nobuyoshi	Graduate School, Tokyo Metropolitan Univ.
Tadahito, Saitoh	Graduate School, Tokyo Metropolitan Univ.
Yusuke, Sasaki	Graduate School, Tokyo Metropolitan Univ.

11:14-11:36 WeBT3.3
Towards a Driver Model: Preliminary Study of Lane Change Behavior, pp. 931-937.

Dogan, Ueruen	Ruhr-Univ. Bochum
Edelbrunner, Hannes	NISYS
Iossifidis, Ioannis	Ruhr-Univ. Bochum

11:36-11:58 WeBT3.4
Design a Support Vector Machine-Based Intelligent System for Vehicle Driving Safety Warning, pp. 938-943.

Lin, Che-Chung	Intelligent Mobility Tech. Div. Mechanical and Systems
Lin, Chi-Wei	Intelligent Mobility Tech. Div. Mechanical and Systems R
Huang, Dau-Chen	Intelligent Mobility Tech. Div. Mechanical and Systems
Chen, Yung-Hsin	Asia Univ. (also Industrial Tech. and Res.)

WeBT4 Conference Room No.4
Traffic Control: Video (Regular Session)

10:30-10:52 WeBT4.1
Automatic Daytime Road Trajectory Control and Monitoring System, pp. 944-949.

Fernández Alcantarilla, Pablo	Univ. of Alcalá
Sotelo Vázquez, Miguel Ángel	Univ. of Alcalá
Bergasa, Luis M.	Univ. of Alcalá

10:52-11:14 WeBT4.2
Video Based Traffic Congestion Prediction on an Embedded System, pp. 950-955.

Glasl, Holger	ARC Seibersdorf Res. GmbH
Schreiber, David	Smart Systems Div. Austrian Res. Centers GmbH(ARC)
Viertl, Nikolaus	ARC Seibersdorf Res. GmbH
Veigl, Stephan	ARC Seibersdorf Res. GmbH
Fernandez Dominguez, Gustavo	ARC Seibersdorf Res. GmbH

11:14-11:36 WeBT4.3
Real-Time License Plate Localization Based on a New Scale and Rotation Invariant Texture Descriptor, pp. 956-961.

Nguyen, Chu-Duc	Ec. Centrale of Lyon
Ardabilian, Mohsen	Ec. Centrale de Lyon
Chen, Liming	Ec. Centrale de Lyon

WeBT5 Conference Room No.5
Vehicle Location Systems 2 (Regular Session)

10:30-10:52 WeBT5.1
Development of Satellite Based Positioning and Navigation Facilities for Precise ITS Applications, pp. 962-967.

Meng, Xiaolin	The Univ. of Nottingham
Yang, Lei	The Univ. of Nottingham, Univ. Park
Aponte, Jose	The Univ. of Nottingham, Univ. Park
Hill, Chris	The Univ. of Nottingham, Univ. Park
Moore, Terry	The Univ. of Nottingham, Univ. Park
Dodson, Alan	The Univ. of Nottingham, Univ. Park

10:52-11:14 WeBT5.2
Adaptive Traffic Lane Detection Based on Normalized Power Accumulation, pp. 968-973.

Zhang, Hao	Shanghai Inst. of Microsystem and Information Tech. Ch
Yu, Wen	Shanghai Inst. of Microsystem and Information Tech. Ch
Sun, Xiaowei	Shanghai Inst. of Microsystem and Information Tech. Ch

11:14-11:36 WeBT5.3
Hybridized GPS/DR Positioning System with Unknown Initial Heading for Land Vehicles, pp. 974-979.

Dumitrache, Alexandru	Tech. Univ. of Bucharest
Zamora-Izquierdo, Miguel A.	Univ. of Murcia
Toledo-Moreo, Rafael	Univ. of Murcia
Gomez-Skarmeta, Antonio, F.	Univ. of Murcia

11:36-11:58 WeBT5.4
Beacon Placement for Indoor Localization Using Bluetooth, pp. 980-985.

Chawathe, Sudarshan	Univ. of Maine
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WeCT1 Conference Room No.1
Traffic Theory for ITS 2 (Regular Session)

13:30-13:52 WeCT1.1
A Dynamic Model for Acceleration Behaviour Description in Congested Traffic, pp. 986-991.

Celikoglu, Hilmi Berk	Tech. Univ. of Istanbul
Dell'Orco, Mauro	Tech. Univ. of Bari

13:52-14:14 WeCT1.2
Characteristics of Mixed Traffic with Different Acceleration Vehicles on Single-Lane, pp. 992-997.

Zhang, Fa
Zhao, Qiao-Xia
Li, Jinling

Xi'an JiaoTong Univ.
Air Force Engineering Univ.
Xi'an JiaoTong Univ.

14:14-14:36 WeCT1.3
A Novel Approach to Forecast Weakly Regular Traffic Status, pp. 998-1002.

Zhang, Yang
Liu, Yuncai

Shanghai Jiao Tong Univ.
Shanghai Jiao Tong Univ.

14:36-14:58 WeCT1.4
Gradient Projection Algorithm Using Curry's Steplength for Traffic Assignment, pp. 1003-1008.

Li, Zichuan
Chang, Gang-Len
Natarajan, Suhasini

Univ. of Maryland, Coll. Park
UMD
Univ. of Maryland, Coll. Park

WeCT2 Conference Room No.2
Multi-Sensor Fusion 2 (Regular Session)

13:30-13:52 WeCT2.1
Integrating Spline Curves in Road Constraint Object Tracking, pp. 1009-1014.

Hasberg, Carsten
Hensel, Stefan

Univ. of Karlsruhe
Univ. of Karlsruhe

13:52-14:14 WeCT2.2
Low-Power Vehicle Speed Estimation Model and Algorithm Based on WSN, pp. 1015-1020.

Ding, Nan
Tan, Guozhen
Lin, Mingwen
Shang, Yao
Ma, Honglian

Dalian Univ. of Tech.
Dalian Univ. of Tech.
Dalian Univ. of Tech.
Dalian Univ. of Tech.
Dalian Univ. of Tech.

14:14-14:36 WeCT2.3
A UKF-NN Framework for System Identification of Small Unmanned Aerial Vehicles, pp. 1021-1026.

Kallapur, Abhijit
Samal, Mahendra
Puttige, Vishwas Ramadas
Anavatti, Sreenatha
Garratt, Matthew

UNSW @ADFA
UNSW @ADFA
UNSW @ADFA
Univ. of New South Wales
UNSW @ADFA

14:36-14:58 WeCT2.4
A Hierarchical Bus Rapid Transit System Based on Wireless Sensor Networks, pp. 1027-1031.

Huang, Wu-Ling
Tang, Shuming
Li, Zhenjiang
Zhu, Fenghua
Ai, Yunfeng

Inst. of Automation Chinese Acad. of Sciences
Inst. of Automation, Chinese Acad. of Sciences
Inst. of automation Chinese Acad. sciences
Key Lab. of Complex Systems and Intelligence Science, Inst. Coll. of Computing and Communication Engineering

WeCT3 Conference Room No.3
Collision Detection/Avoidance (Regular Session)

13:30-13:52 WeCT3.1
Contrast-Invariant Obstacle Detection System Using Color Stereo Vision, pp. 1032-1037.

Cabani, Iyadh
Toulminet, Gwenaëlle
Bensrhair, Abdelaziz

INSA de Rouen
INRIA Paris - Rocquencourt
INSA de Rouen

13:52-14:14 WeCT3.2
Evaluation and Improvement of Required Deceleration Algorithm in Frontal Collision Warning Systems, pp. 1038-1042.

Li, Chaoyi
Meng, Huadong
Zhang, Hao
Wang, Xiqin

Tsinghua Univ.
Tsinghua Univ.
Tsinghua Univ.
Tsinghua Univ.

14:14-14:36 WeCT3.3
Collision Probability Assessment for Speed Control, pp. 1043-1048.

Lambert, Alain
IEF Univ. d'Orsay

Gruyer, Dominique
Saint Pierre, Guillaume
Ndjeng Ndjeng, Alexandre

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INRETS/LCPC
LCPC

14:36-14:58 WeCT3.4
Enhanced Control of Steering System for Vehicle Evasive Maneuvers, pp. 1049-1054.

Eskandarian, Azim
Soubakhsh, Damoon

George Washington Univ. Virginia
The George Washington Univ.

WeCT4 Conference Room No.4
Traffic Control: Signalization 1 (Regular Session)

13:30-13:52 WeCT4.1
Wide-Area Traffic Signal Control Using Predicted Traffic Based on Real-Time Information, pp. 1055-1060.

Muraki, Yuji
Kanoh, Hitoshi

Univ. of Tsukuba
Univ. of Tsukuba

13:52-14:14 WeCT4.2
SMART-SIGNAL: Systematic Monitoring of Arterial Road Traffic Signals, pp. 1061-1066.

Liu, Henry X.
Ma, Wenteng
Hu, Heng
Wu, Xinkai
Yu, Guizhen

Univ. of Minnesota
Univ. of Minnesota
Univ. of Minnesota
Univ. of Minnesota
Beihang Univ.

14:14-14:36 WeCT4.3
Interactive Signal Control for Over-Saturated Arterial Intersections Using Fuzzy Logic, pp. 1067-1072.

Tian, Ye
Li, Zhiheng
Song, Jingyan
Xiao, Deyun
Zhou, Dabing

Tsinghua Univ.
Tsinghua Univ.
Tsinghua Univ.
Tsinghua Univ.
Tsinghua Univ.

14:36-14:58 WeCT4.4
Design and Evaluation of an Adaptive Bus Signal Priority System Base on Wireless Sensor Network, pp. 1073-1077.

Ma, Wanjing
Yang, Xiaoguang

Tongji Univ.
Tongji Univ.

WeCT5 Conference Room No.5
Vehicle Location Systems 3 (Regular Session)

13:30-13:52 WeCT5.1
Comparison of EKF and PEKF in a SLAM Context, pp. 1078-1083.

Chanier, Francois
Checchin, Paul

Univ. Blaise Pascal LASMEA
Univ. Blaise Pascal - Clermont-Ferrand - FRANCE
Blaise Pascal Univ.
Univ. of clermont-ferrand

13:52-14:14 WeCT5.2
A Precise Road Network Modeling and Map Matching for Vehicle Navigation, pp. 1084-1089.

Wang, Chenhao
Hu, Zhencheng
Uchimura, Keiichi

kumamoto Univ.
Kumamoto Univ.
Kumamoto Univ.

14:14-14:36 WeCT5.3
Level of Service Reliability in Route Guidance System, pp. 1090-1094.

Kuang, Aiwu
Huang, Zhongxiang
Wang, Renying
Long, Kejun

Changsha Univ. of Science & Tech.
Changsha Univ. of Science & Tech.
Changsha Univ. of Science and Tech.
changsha Univ. of science & Tech.

14:36-14:58 WeCT5.4
Dynamic Management of Intelligent Urban Vehicles, pp. 1095-1100.

Melki, Asma
Ec. centrale de Lille

WeDT1 Conference Room No.1
Driver Assistance Services (Regular Session)

15:30-15:52 WeDT1.1
Stability of String of Adaptive Cruise Control Vehicles with Parasitic Delays and Lags, pp. 1101-1106.

Xiao, Lingyun Texas A&M Univ. Coll. Station
 Darbha, Swaroop Texas A&M Univ. Coll. Station
 Gao, Feng Beihang Univ.

15:52-16:14 WeDT1.2
Improving Safety through Online Driver Workload Assessment, pp. 1107-1112.

Younsi, Karine LAMIH Univ. de Valenciennes et du Hainaut Cambrésis
 Girard, Jean-Marc LAMIH Univ. de Valenciennes et du Hainaut Cambrésis
 Popieul, Jean-Christophe Univ. de Valenciennes
 Loslever, Pierre Univ. de Valenciennes
 Simon, Philippe Univ. de Valenciennes

16:14-16:36 WeDT1.3
Error Correcting Scheme for Road-To-Vehicle Visible Light Communication Using LED Array, pp. 1113-1117.

Mase, Shohei Nagoya Univ.
 Arai, Shintaro Nagoya Univ.
 Yamazato, Takaya Nagoya Univ.
 Yendo, Tomohiro Nagoya Univ.
 Fujii, Toshiaki Nagoya Univ.
 Tanimoto, Masayuki Nagoya Univ.
 Yoshikatsu, Kimura TOYOTA CENTRAL R&D Lab.

16:36-16:58 WeDT1.4
Dangerous Prediction by Case-Based Approach on Expressways, pp. 1118-1123.

Wu, Po-Yen National Taiwan Normal Univ.
 Fang, Chiung-Yao National Taiwan Normal Univ.
 Chen, Sei-Wang National Taiwan Normal Univ.

WeDT2 Conference Room No.2
Multi-Sensor Fusion 3 (Regular Session)

15:30-15:52 WeDT2.1
Low Cost Sensors Ego Localization with IMM Approach for Unusual Maneuvers, pp. 1124-1129.

Ndjeng Ndjeng, Alexandre LCPC
 Gruyer, Dominique INRETS/LCPC
 Glaser, Sébastien LCPC

15:52-16:14 WeDT2.2
Kernel and Feature Selection for Visible and Infrared Based Obstacle Recognition, pp. 1130-1135.

Apatean, Anca Ioana Tech. Univ. of Cluj Napoca
 Rogozan, Alexandrina LITIS
 Bensrhair, Abdelaziz INSA de Rouen

16:14-16:36 WeDT2.3
Hybrid Localization Approach of a Bi-Steerable Mobile Robot Based on Grids Matching and Extended Kalman Filter, pp. 1136-1141.

Bouraine, Sara advanced Tech. developpement center
 Djekoune, A. Oualid Advanced Tech. Development Center.
 Azouaoui, Ouahiba Centre de Développement des Tech. Avancées (CDTA)

16:36-16:58 WeDT2.4
Spatio-Temporal RANSAC for Robust Estimation of Ground Plane in Video Range Images for Automotive Applications, pp. 1142-1148.

Mufti, Faisal Australian National Univ.
 Mahony, Robert Australian National Univ.
 Heinzmann, Jochen Seeing Machines

WeDT3 Conference Room No.3
Vision: Driver Assistance (Regular Session)

15:30-15:52 WeDT3.1
Analysing Driver's Attention Level Using Computer Vision, pp. 1149-1154.

Bergasa, Luis M. Univ. of Alcala
 Buenaposada, Jose Miguel Univ. Rey Juan Carlos

Nuevo, Jesus Univ. of Alcala
 Jiménez, Pedro Univ. of Alcala
 Baumela, Luis Univ. Pol. de Madrid

15:52-16:14 WeDT3.2
Pedestrian Detection Using Boosted HOG Features, pp. 1155-1160.

Wang, Zhen-rui Xi'an Jiaotong Univ.
 Jia, Yulan Xi'an Jiaotong Univ.
 Huang, Hua Xi'an Jiaotong Univ.
 Tang, Shuming Inst. of Automation, Chinese Acad. of Sciences

16:14-16:36 WeDT3.3
Driver's Head Detection Model in Color Image for Driver's Status Monitoring, pp. 1161-1166.

Won, Woong Jae Dagegu-Gyeongbuk Inst. of S&T
 Son, Joonwoo Daegu Gyeongbuk Inst. of Science & Tech.

16:36-16:58 WeDT3.4
Pedestrian Detection for a Near Infrared Imaging System, pp. 1167-1172.

Soga, Mineki Toyota Central R&D Lab. Inc.
 Hiratsuka, Shigeyoshi Toyota Central R&D Lab. Inc.
 Fukamachi, Hideo Toyota Motot Corp.
 Ninomiya, Yoshiki Toyota Central R&D Lab. Inc.

WeDT4 Conference Room No.4
Topics in ITS 2 (Regular Session)

15:30-15:52 WeDT4.1
Experimental Research of Real-Time Floating Car System in Beijing, pp. 1173-1176.

Zhu, Liyun Beijing Transportation Res. Center
 Sun, Jianping Beijing Transportation Res. Center
 Wen, Huimin Beijing Transportation Res. Center
 Chen, Feng Beijing Transportation Res. Center
 Gao, Yong Beijing Transportation Res. Center

15:52-16:14 WeDT4.2
Model-Based Estimation of Driver Intentions Using Particle Filtering, pp. 1177-1182.

Lidström, Kristoffer Halmstad Univ.
 Larsson, Tony Halmstad Univ.

16:14-16:36 WeDT4.3
Analysis on Urban Traffic Network States Evolution Based on Grid Clustering and Wavelet De-Noising, pp. 1183-1188.

Zhang, Zuo Tsinghua Univ.
 Zhang, Pingxin Tsinghua Univ.
 Yin, Yaomin Tsinghua Univ.
 Hou, Lin Tsinghua Univ.

16:36-16:58 WeDT4.4
Continuous Driver Intention Recognition with Hidden Markov Models, pp. 1189-1194.

Berndt, Holger Univ. of Ulm
 Emmert, Jörg Ulm Univ.
 Dietmayer, Klaus Christian Univ. of Ulm
 Jürgen

WeDT5 Conference Room No.5
Travel Information and Guidance (Regular Session)

15:30-15:52 WeDT5.1
An On-Road Wireless Sensor Network Approach for Urban Traffic State Monitoring, pp. 1195-1200.

Shuai, Meng School of EECS, Peking Univ.
 Xie, Kunqing Peking Univ.
 Ma, Xiujun School of Ec. Peking Univ.
 Song, Guojie PKU

15:52-16:14 WeDT5.2
Hierarchical Software Architectures and Vehicular Path Prediction for Cooperative Driving Applications, pp. 1201-1206.

Caveney, Derek Toyota Tech. Center

16:14-16:36 WeDT5.3
Analysis of Vehicle Lane Changes for Determining Fastest Paths in the V2V2I ITS Architecture, pp. 1207-1212.

Miller, Jeffrey Univ. of Alaska, Anchorage
16:36-16:58 WeDT5.4
Infrastructureless Inter-Vehicular Real-Time Route Guidance, pp.
1213-1219.
Hawas, Yaser UAE Univ.
Napeñas, Marc Joseph UAE Univ.

IEEE ITSC 2008 BOOK OF ABSTRACTS
Sunday, October 12, 2008

SuDT1 **Conference Room No.1**
ATSS Workshop (Special Session)

15:00-15:22 SuDT1.1
Towards Reservation-Based Intersection Coordination: An Economic Approach, pp. 1-6
 Vasirani, Matteo Univ. Rey Juan Carlos
 Ossowski, Sascha Univ. Rey Juan Carlos

Understanding and controlling a complex system like traffic is not a trivial task. To this aim, many market-based methods have been applied to the design and the management of such system, by defining the rules of the game and trying to enforce a desired global outcome. We model traffic as a computational economy, where drivers trade with the intelligent infrastructure in a virtual marketplace, buying time and space to cross intersections when commuting through the city. We show how such mechanism influences the drivers' behaviour, producing benefits for both the drivers (i.e. lower average travel times) and the road network (i.e. less congestions).

15:22-15:44 SuDT1.2
Event-Driven Architecture for Decision Support in Traffic Management Systems, pp. 7-13
 Dunkel, Juergen Hannover Univ. of Applied Sciences and Arts
 Fernandez, Alberto Univ. Rey Juan Carlos
 Ortiz, Rubén Univ. Rey Juan Carlos
 Ossowski, Sascha Univ. Rey Juan Carlos

Decision support systems for traffic management systems have to cope with a high volume of events continuously generated by sensors. Conventional software architectures do not explicitly target the efficient processing of continuous event streams. Recently, event-driven architectures (EDA) have been proposed as a new paradigm for event-based applications. In this paper we propose a reference architecture for event-driven traffic management systems, which enables the analysis and processing of complex event streams in real-time and is therefore well-suited for decision support in sensor-based traffic control systems. We will illustrate our approach in the domain of road traffic management. In particular, we will report on the redesign of an intelligent transportation management system (ITMS) prototype for the high-capacity road network in Bilbao, Spain.

15:44-16:06 SuDT1.3
Towards an Artificial Traffic Control System, pp. 14-19
 Rossetti, Rosaldo LIACC - Univ. of Porto
 Ferreira, Paulo Artificial Intelligence and Computer Science Lab.
 Braga, Rodrigo Artificial Intelligence and Computer Science Lab.
 Oliveira, Eugénio Faculty of Engineering, Univ. of Porto

This work reports on the use of the concept of Artificial Transportation Systems to implement a framework to allow the specification and test of new generation intelligent traffic control systems. A JADE implementation of a real agent application is linked to a virtual traffic domain to test control behaviour of traffic semaphores. Mixing reality and virtual environments is expected to foster the development of new generation of urban transport solutions. First experiments were carried out, which demonstrated the feasibility of the approach.

16:06-16:28 SuDT1.4
An Investigation on ATS from the Perspective of Complex Systems, pp. 20-24
 Li, Jinyuan Tsinghua Univ. China
 Tang, Shuming Inst. of Automation, Chinese Acad. of Sciences
 Wang, Fei-Yue Univ. of Arizona

Artificial transportation systems (ATS) has been related to the study of complex systems and traffic simulation since its birth. Its relationship with complex systems and its connections, as well as differences from traditional traffic simulation systems pose an

interesting problem. In this paper, according to two hypotheses about complex systems, we inferred three principles: synthesis, experimentation, and constant experimentation. We explored ATS from the perspective of complex systems, along with a diagram depicting the relationship between ATS-related concepts and methods. We then used the reasoning behind deploying agent-based modeling to explain why the principle of simple objects and relationships can be effective in ATS. We examined these principles from a complex adaptive systems perspective. Finally, essential differences between ATS and traditional traffic simulation systems are reported.

Monday, October 13, 2008

MoCT1 **Conference Room No.1**
ITS Architecture and Standards (Regular Session)

13:30-13:52 MoCT1.1
Infomobility Provision through MBMS/UMTS in Realistic Scenarios, pp. 25-30
 Bazzi, Alessandro Univ. of Bologna
 Masini, Barbara Mavi Univ. of Bologna
 Conti, Andrea Univ. of Ferrara
 Andrisano, Oreste Univ. of Bologna

New wireless communication technologies enable new services for infomobility. In this work we explore the feasibility of infomobility applications through multimedia broadcast multicast service (MBMS), a new feature added to the universal mobile telecommunication system (UMTS). We assume to transmit, through MBMS channels, real time traffic information to all vehicles under coverage; such information will be exploited by on board smart navigation systems to update the best route to the destination. Activating this service, part of the base station (BS) power is wasted by MBMS, thus reducing resources available for typical UMTS traffic. In this paper, performance is investigated through simulations, adopting a complete simulation platform that we carefully developed taking into account, by means of an integrated approach, all network protocol layers and realistic road traffic with mobility models. Numerical results are provided by considering as reference scenario the medium-size Italian city of Bologna.

13:52-14:14 MoCT1.2
Software Architecture Design on Large-Scale Network Traffic Signal Controllers System, pp. 31-36
 Qi, Zhaoge Zhejiang Univ.
 Shi, Wei Zhejiang Univ.
 Wu, Zhaohui Zhejiang Univ.

Based on a multilayer Service Oriented Architecture (SOA), one software architecture on large-scale network Traffic Signal Controllers (TSC) system was designed for expedient and effective traffic management. This architecture was achieved by I/O Completion Port (IOCP) mechanism and Web Service technology. IOCP mechanism was adopted not only between the centre control platform and the outfield device, but also between the Server and the Client of centre control platform. IOCP mechanism managed the communications with numerous TSC and numerous Client programs respectively. Web Service technology was applied in the modular centre control platform. Web Service technology encapsulated the relevant information gained during the communication of IOCP mechanism into services, and facilitated the effective integration of the system resource. Moreover, the relationship among the layers of the multilayer SOA was also improved. At last, the implementation of the IOCP mechanism and the Web Service technology in this architecture was introduced in detail. This architecture has been applied in SUPCON Intellific software and the application result is very satisfied.

14:14-14:36 MoCT1.3
A Concept for Ubiquitous Transportation Systems and Related Development Methodology, pp. 37-42
 Lee, Eunyoung Ajou Univ.
 Ryu, Kiyool Ajou Univ.
 Paik, Insup Ajou Univ.

The purpose of this study is primarily to clarify the concept for ubiquitous transportation systems (UTS) based on ubiquitous computing. Additionally, the key conceptual terminologies related to the ubiquitous computing are reinterpreted for the transportation domain. The 8 key properties are proposed as the necessary and sufficient conditions for the ubiquitous transportation system, which can be represented by "4A" & "4T" "4A" stands for Anytime, Anywhere, Anything, and Anybody, and "4T" stands for Transparency, Together, Transcendence, and Trustworthy. And the architecture-based methodology for UTS is also proposed through comparative analysis of systems development methodologies. Finally, the differences between the existing ITS and UTS are explained.

14:36-14:58 MoCT1.4
The Concept of an Open Platform for Traffic and Traveler Information Services, pp. 43-48

Li, Yanying	ERTICO - ITS Europe
Andrade, Mariana	ERTICO - ITS Europe
Blervaque, Vincent	ERTICO - ITS Europe

Most existing traffic data collection and information services have been developed based on specific requirements of their own sectors without taking into account inter-sector cooperation potentials, resulting in a fractioned environment. Although there are a number of platforms available on the market, the current platforms lack open interfaces, which can allow other service providers to access their information. Therefore, any service provider has to collect their own data and develop their own data analysis models, resulting in less efficiency to deliver the service and often unsatisfactory quality. This paper proposes a concept for development of an open platform for traffic management and traveller information services for metropolitan areas. The overview for the open platform is described with some examples of applications and services. Expected improvements and benefits from application of the open platform are also presented.

MoCT2 **Conference Room No.2**
Vision: In-Vehicle 1 (Regular Session)

13:30-13:52 MoCT2.1
Vision-Based Real-Time Lane Marking Detection and Tracking, pp. 49-54

Liu, Wei	Northeastern Univ. Shenyang , China
Zhang, Hongliang	Univ. Northeastern Univ.
Duan, Bobo	Northeastern Univ.
Yuan, Huai	Neusoft Park
Zhao, Hong	Northeastern Univ. Shenyang , China

Detection and tracking of lane marking is essential for driving safety and intelligent vehicle. In this paper, an algorithm is presented which allows detection and tracking of multiple lane markings. Edge points cue is used to detect the lane marking and a road orientation estimation method is used to delete the edge lines which are impossible attribute to lane markings. In order to select the candidate lane marking, a Confidence Measures method is proposed. And then a finite-state machine decides whether or not a lane marking is really detected by fusion multi-frame detection results. Specifically, a particle filter is used to predict the future values of the lane marking model parameters, based on past observations. With particle filtering and Confidence Measures method, lane markings on various road scenes are detected and tracked. Experimental in different conditions, including illumination, weather and road, demonstrates its effectiveness and robustness. The algorithm runs in real-time at rates of about 30 Hz.

13:52-14:14 MoCT2.2
Detection, Tracking and Recognition of Traffic Signs from Video Input, pp. 55-60

Ruta, Andrzej	Brunel Univ.
Li, Yongmin	Brunel Univ.
Liu, Xiaohui	Brunel Univ.

In this paper a comprehensive approach to the recognition of traffic signs from video input is proposed. A trained attentive classifier

cascade is used to scan the scene in order to quickly establish regions of interest (ROI). Sign candidates within ROIs are captured by detecting the instances of equiangular polygons using a Hough Transform-style shape detector. To ensure a stable tracking of the likely traffic signs, especially in cluttered background, we propose a Pixel Relevance Model, where the pixel relevance is defined as a confidence measure for a pixel being part of a sign's contour. The relevance of the hypothesized contour pixels is updated dynamically within a small search region maintained by a Kalman Filter, which ensures faster computation. Gradient magnitude is used as an observable evidence for this update process. In the classification stage, a temporally integrated template matching technique based on the class-specific discriminative local region representation of an image is adopted. We have evaluated the proposed approach on a large database of 135 traffic signs and numerous real traffic video sequences. A recognition accuracy of over 93% in near real-time has been achieved.

14:14-14:36 MoCT2.3
Vehicle Tracking by Non-Drifting Mean-Shift Using Projective Kalman Filter, pp. 61-66

Bouttefroy, Philippe Loic Marie	Univ. of Wollongong
Bouzerdoum, Abdesselam	Univ. of Wollongong
Beghdadi, Azeddine	Univ. Paris 13
Phung, Son Lam	Univ. of Wollongong

Robust vehicle tracking is essential in traffic monitoring because it is the groundwork to high level tasks such as traffic control and event detection. This paper describes a new technique to track vehicles through mean-shift using a projective Kalman filter. The shortcomings of the mean-shift tracker, namely the selection of the bandwidth and the initialization of the tracker, are addressed with a fine estimation of the vehicle scale and kinematic model. Indeed, the projective Kalman filter integrates the non-linear projection of the vehicle trajectory in its observation function resulting in an accurate localization of the vehicle in the image. The proposed technique is compared to the standard Kalman filter implementation on traffic video sequences. Results show that the performances of the standard technique decrease with the number of frames per second whilst the performances of the projective Kalman filter remain constant.

14:36-14:58 MoCT2.4
Curb Detection Based on a Multi-Frame Persistence Map for Urban Driving Scenarios, pp. 67-72

Oniga, Florin Ioan	Tech. Univ. of Cluj Napoca
Nedeveschi, Sergiu	Tech. Univ. of Cluj-Napoca
Meinecke, Marc-Michael	Volkswagen AG

An approach for the detection of straight and curved curbs (border of relevant traffic isles, sidewalks, etc) is presented, in the context of urban driving assistance systems. A rectangular elevation map is built from 3D dense stereo data. Edge detection is applied to the elevation map in order to highlight height variations. We propose a method to reduce significantly the 3D noise from dense stereo, using a multi-frame persistence map: temporal filtering is performed for edge points, based on the ego car motion, and only persistent points are validated. The Hough accumulator for lines is built with the persistent edge points. A scheme for extracting straight curbs (as curb segments) and curved curbs (as chains of curb segments) is proposed. Each curb segment is refined using a RANSAC approach to fit optimally the 3D data of the curb. The algorithm was evaluated in an urban scenario. It works in real-time and provides robust detection of curbs.

MoCT3 **Conference Room No.3**
Travel Time Prediction 1 (Regular Session)

13:30-13:52 MoCT3.1
Neural Network Committee to Predict Travel Times: Comparison of Bayesian Evidence Approach to the Use of a Validation Set, pp. 73-78

van Hinsbergen, Chris Philip	Delft Univ. of Tech.
IJsbrand	
van Lint, Hans	Delft Univ. of Tech.
Van Zuylen, H.J.	Delft Univ. of Tech.

Short-term forecasting of travel time is one of the central topics in

current ITS research and practice. The most widely applied travel time forecasting approach is the neural network. Usually many candidate neural networks are trained and the network performing best on an independent validation dataset is selected. However, the training data then needs to be divided in two, leading to less well trained networks. Using Bayesian inference theory, a selection criterion called the 'evidence' can be derived for each network without the need for a validation set. This results in higher prediction accuracy as more data can be used for training. Moreover, a committee of neural networks can be constructed using the evidence. A case of forecasting travel times on the A12 motorway in the Netherlands shows that the committee approach indeed leads to improved travel time forecasting accuracy, and that the evidence should be preferred over the validation set approach when constructing the committee.

13:52-14:14 MoCT3.2
The Effects of Traffic Accidents on Travel Time Reliability, pp. 79-84
 Tu, Huizhao Delft Univ. of Tech.
 van Lint, Hans Delft Univ. of Tech.
 van Zuylen, H.J. Delft Univ. of Tech.

Traffic accident is one of the main causes of the increasing congestion in traffic networks. Due to the fact that traffic accidents reduce the capacity of a freeway and that their effect and duration are rather unpredictable at the moment they occur, it is expected that they contribute for great proportion to less reliable travel times. In this paper we present an empirical travel time reliability analysis on a basis of a large dataset of registered traffic accident data and empirical traffic flow data. The preliminary results show that travel time accidents result in both higher travel time variability and higher probability of traffic breakdown on freeways and thereby higher travel time unreliability.

14:14-14:36 MoCT3.3
Variation Based Online Travel Time Prediction Using Clustered Neural Networks, pp. 85-90
 Yu, Jie Univ. of Maryland
 Chang, Gang-Len UMD
 Ho, H.W. Univ. of Maryland
 Liu, Yue Univ. of Maryland at Coll. Park

This paper proposes a variation-based online travel time prediction approach using clustered Neural Networks with traffic vectors extracted from raw detector data as the input variables. Different from previous studies, the proposed approach decomposes the corridor travel time into two parts: 1) the base term, which is predicted by a fuzzy membership-value-weighted average of the clustered historical data to reflect the primary traffic pattern in the corridor; and 2) the variation term, which is predicted through the calibrated cluster-based artificial neural network model to capture the actual traffic fluctuation. To evaluate the effectiveness of the proposed approach, this paper has conducted intensive numerical experiments with simulated data from the microscopic simulator CORSIM. Experimental results under various traffic volume levels have revealed the potentials for the proposed method to be applied in online corridor travel time prediction.

14:36-14:58 MoCT3.4
A Reliable Hybrid Prediction Model for Real-Time Travel Time Prediction with Widely Spaced Detectors, pp. 91-96
 Zou, Nan Univ. of Maryland
 Wang, Jianwei Univ. of Maryland
 Chang, Gang-Len UMD

This paper presents a travel time prediction model that employs a small number of traffic detectors to perform real-time prediction under recurrent traffic conditions. The proposed model that consists of mainly a multi-topology Neural Network model and a supplemental component of an enhanced k-Nearest Neighbor model is capable of using various types of available information and contending with the potential detection errors and missing data. The evaluation results from field data have indicated that the developed hybrid model is capable of generating reliable prediction of travel times under various types of traffic conditions, and offers the potential for its application in a large freeway network.

MoCT4 **Conference Room No.4**
Optimization and Control: Theory and Modeling 1 (Regular Session)

13:30-13:52 MoCT4.1
AFT2: An Automated Maintenance and Calibration Tool for Traffic Management & Control Systems, pp. 97-104
 Kosmatopoulos, Elias Tech. Univ. of Crete
 Papageorgiou, Markos Tech. Univ. of Crete
 Wang, Yibing Monash Univ.

Currently, a tremendous amount of human effort and time is spent for maintenance and calibration of operations of Transport Management & Control Systems (TMCSs). TMCS maintenance and calibration is usually performed by experienced personnel in the lack of an automated and systematic approach with no guarantee that the overall maintenance procedure will end-up successfully. Severe congestion, delay and safety problems may occur during manually-based maintenance and calibration activities, which usually take from several months to few years until completed. AFT2 is aiming at replacing the manually-based TMCS maintenance and calibration by a fully-automated procedure applicable to general TMCSs. The approach of AFT2 is based on a recently introduced Adaptive Optimization (AO) methodology which was proven – using rigorous mathematical arguments – to provide with safe and reliable, efficient and rapid maintenance and calibration of general TMCSs. The objective of the present paper is to demonstrate AFT2 efficiency through its application – in simulation – to three different complex, large-scale road TMCSs.

13:52-14:14 MoCT4.2
Optimal Parameter Settings for Adaptive Traffic-Actuated Signal Control, pp. 105-110
 Zheng, Xing Univ. of California, Irvine
 Chu, Lianyu Univ. of California, Berkeley

This paper proposes a real-time adaptive signal control model that decides optimal signal control parameters commonly found in modern actuated controllers, aiming to exploit the adaptive functionality of traffic-actuated control and to improve the performance of traffic-actuated signal system. These control parameters are optimized cycle by cycle to satisfy the real-time vehicle demands that are estimated based on signal timing information. The proposed control model is applied and tested on a network consisting of thirty-eight actuated signals through microscopic simulation. Simulation results show that, traffic-actuated signal control that uses the optimized parameters is able to improve the performance of the study network, especially under off-peak traffic conditions.

14:14-14:36 MoCT4.3
Offline Offset Models for Coordinated Signal Control, pp. 111-115
 Ma, Ying-Ying Tongji Univ.
 Yang, Xiaoguang Tongji Univ.
 Zhong, Zhangjian Tongji Univ.

The offset calculation is an important part in urban traffic coordinate control. Two offset calculation models have been set up considering the relationship between the arriving and departing of vehicles in this paper. And the objective of them is to minimize the delay of vehicles. Model 1 is based on the assumption that the vehicles arriving and departing follows uniform distribution. And another model which is called Model 2 in this paper considered the dispersion of vehicle platoon. Software of MATLAB is used to calculate the offset models under different conditions such as different distance between intersections and volumes. And then microscopic simulations are used to analyze the benefit of offset calculation models. The results of simulation show that both the two models can improve traffic efficiency greatly. And Model 1 is more convenient and practical.

14:36-14:58 MoCT4.4
Optimization of Traffic Flows in Congested Metropolitan Areas, pp. 116-121
 Giglio, Davide Univ. of Genova
 Riccardo, Minciardi Univ. of Genova

A control methodology, whose objective is the optimal distribution of vehicle flows to alternate paths when the main path to reach a certain destination is congested, is proposed in this paper. The control is

actuated by means of variable message signs (VMSs) which are located in some (suburban) links of the traffic network. The displayed messages (control variables) "induce" drivers to follow alternate paths, with the consequence of decongesting links in the main path. The optimization of traffic flows is accomplished over a network model which explicitly considers queues in the links, in order to take into account congestion phenomena which usually characterize urban traffic networks (spillbacks, bottlenecks, etc.). The optimization problem, which is described in the paper, is constrained by the discrete-time state equations of the network model, which provide the dynamics of the number of vehicles (both running and queued) in the links.

MoCT5 Conference Room No.5
Data Mining and Analysis 1 (Regular Session)

13:30-13:52 MoCT5.1
Data Mining Based Research on Urban Tide Traffic Problem, pp. 122-127

Gong, Xiaoyan Inst. of Automation, Chinese Acad. of Sciences
 Lu, Yu Shandong Communications Bureau

Nowadays in some cities, because of inappropriate of layouts of living areas and working areas, every morning, millions of vehicles flood into working areas from living areas, while every evening those vehicles back to living areas, which forms so-called Traffic Tide Phenomenon (TTP) in which vehicles are congested in one direction while the opposite direction is relatively free, especially in some main roads. So in this paper, based on Shanghai Outlines Cross-River Tunnel (SOCRT) project, a Data Mining based Traffic Direction Control Algorithm (DMTDCA) is proposed to adjust the traffic direction of Direction-Changeable Lanes (DCLs) in the tunnel automatically and timely according to analysis results of current traffic flow and short-term forecasted traffic flow of two tunnel entrances in order to make full use of all lanes. Field tests and user reports show efficiency of DMTDCA by 30% increase of average traffic capability, 10% increase of rush hour traffic capability and 40% decrease of average queue length.

13:52-14:14 MoCT5.2
Analysis and Optimization of Statistical Data in Beijing for Traffic Information Services, pp. 128-133

Li, Man Hitachi (China) R&D Corp.
 Wang, Wenjia Hitachi (China) Res. & Development Corp.

In recent years, requirements for high quality traffic information services increase rapidly. Statistical data based on history traffic data can be used as a helpful compensation for real time data to improve the quality of information services. Therefore the methods of analyzing and optimizing statistical data for different cities become very important. This paper introduces some ideas for making the statistical traffic data more accurate and proposes new evaluation model to make the experimental results more understandable and reasonable. Then based on two months history data of probe car system, the paper gives analytical results of statistical data in Beijing.

14:14-14:36 MoCT5.3
Short-Term Traffic Flow Forecasting Using Macroscopic Urban Traffic Network Model, pp. 134-138

Lin, Shu Shanghai Jiao Tong Univ.
 Xi, Yugeng Shanghai Jiao Tong Univ.
 Yang, Yanfei Shanghai Jiao Tong Univ.

Traffic flow forecasting provides important information for both traffic control and traffic guidance. It should be both quick and accurate. A short-term traffic flow forecasting method is given based on the macroscopic urban traffic network model. The model is established to describe the substantial mechanism of traffic flow movement and the topology of the entire urban traffic network. It can simulate the traffic movement in the urban traffic network, and forecast the traffic flow states in the near future accurately. Also, the method has a good real-time feature due to the macroscopic model. In the simulation experiment, microscopic model CORSIM is used as the practical traffic system, and the proposed method is used to forecast the traffic

flow of it. The simulation results show that the method has a good forecasting effectiveness.

14:36-14:58 MoCT5.4
Estimation of Vehicle Usage Rate Based on Capture-Recapture Model with License Plate Recognition Data, pp. 139-144

Chen, Xiqun Tsinghua Univ.
 Yang, Xinmiao Tsinghua Univ.
 Shi, Qixin Tsinghua Univ.

This paper presents a modified model derived from the capture-recapture model that is widely used in biostatistics but seldom applied in transportation to estimate the daily utilized vehicles on streets. A vehicle usage rate estimation algorithm that utilizes a simulative capture-recapture procedure is designed for evaluating traffic situation using license plate recognition (LPR) data. Parameter sensitivity is also analyzed before using real data collected by the LPR systems and the results demonstrate that the model is of high accuracy (average relative error is less than 1%) This paper extends the methodology and algorithm using capture-recapture model to evaluate the running vehicle number on the whole road network by the data collected from LRP systems covering main roads within the fifth ring road in Beijing. The application is helpful for urban transportation managers to understand the recent traffic condition of the whole city, make decisions in time and constitute policies to reduce traffic congestion.

MoDT1 Conference Room No.1
Traffic Surveillance (Regular Session)

15:30-15:52 MoDT1.1
Vehicle Classification Algorithm Based on Binary Proximity Magnetic Sensors and Neural Network, pp. 145-150

Zhang, Wei Dalian Univ. of Tech.
 Tan, Guozhen Dalian Univ. of Tech.
 Ding, Nan Dalian Univ. of Tech.
 Shang, Yao Dalian Univ. of Tech.
 Lin, Mingwen Dalian Univ. of Tech.

To improve the classification accuracy, a new algorithm is developed with binary proximity magnetic sensors and back propagation neural networks. In this scheme, we use the low cost and high sensitive magnetic sensors that detect the magnetic field distortion when vehicle pass by it and estimate vehicle length with the geometrical characteristics of binary proximity networks, and finally classify vehicles via neural networks. The inputs to the neural networks are the vehicle length, velocity and the sequence of features vector set, and the output is predefined vehicle category. Simulation and on-road experiment obtains the high recognition rate of 93.61%. It verified that this scheme enhances the vehicle classification with high accuracy and solid robustness.

15:52-16:14 MoDT1.2
A New Approach for In-Vehicle Camera Obstacle Detection by Ground Movement Compensation, pp. 151-156

Yang, Changhui Sanyo Electric Co.,Ltd.
 Hongo, Hitoshi SANYO
 Tanimoto, Shinichi SANYO Electric Co., Ltd.

The purpose of this paper is to propose a new approach to detecting obstacles using a single camera mounted on a vehicle when the vehicle is backing or turning round at an intersection at a low speed. Using restrictions among feature point locations and their optical flows in geometrically converted top-view images, ground-movement information can be estimated. Our approach compensates for the ground movement between consecutive top-view images using the estimated ground-movement information and computes the difference image between the compensated previous top-view image and the current top-view image. Finally, a new angle_histogram-based algorithm is processed to extract obstacle regions using the difference image. The actual in-vehicle experimental results show that our proposed approach has tolerance for various changing illumination conditions and different road textures.

16:14-16:36 MoDT1.3
Obtaining Dense Road Speed Estimates from Sparse GPS Measurements, pp. 157-162

Phan, Andrew
Ferrie, Frank P

McGill Univ.
McGill Univ.

Nicolle, Philippe
Charbonnier, Pierre

LCPC
LRPC

A major challenge for traffic management systems is the inference of traffic flow in regions of the network for which there is little data. In this paper, GPS-based vehicle locator data from a fleet of 40-60 roving ambulances are used to estimate traffic congestion along a network of 20,000 streets in the city of Ottawa, Canada. Essentially, the road network is represented as a directed graph and a belief propagation algorithm is used to interpolate measurements from the fleet. The system incorporates a number of novel features. It makes no distinctions between freeways and surface streets, incorporates both historical and live sensor data, handles user inputs such as road closures and manual speed overrides, and is computationally efficient - providing updates every 5 to 6 minutes on commodity hardware. Experimental results are presented which address the key issue of validating the performance and reliability of the system.

16:36-16:58 MoDT1.4
Airborne Moving Vehicle Detection for Urban Traffic Surveillance, pp. 163-167

Lin, RenJun	Univ. of Science and Tech. of China
Cao, XianBin	Univ. of Science and Tech. of China
Xu, Yanwu	Univ. of Science and Tech. of China
Wei, ChuangXian	Univ. of Science and Tech. of China
Qiao, Hong	Chinese Acad. of Sciences

At present, moving vehicle detection on airborne platform has been an important technology for urban traffic surveillance. In such a situation, most commonly used methods (e.g. image subtraction) could hardly work well because of some additional difficulties such as slow movement of vehicles and jam. This paper proposed a new moving vehicle detection method named MVD-RD for airborne urban traffic surveillance. First, the non-road regions are extracted using road detection technique. Secondly, the non-road regions with no vehicles are removed according to their size. As a result of this two-stage regions shrinkage, the detection area reduces a lot. Finally, to the reduced area, image subtraction is used to get all moving regions and then moving vehicles can be accurately filtered in a simple way. The experimental results show that, compared with traditional image subtraction methods used in airborne moving vehicle detection, the proposed MVD-RD method achieves much better performance in detection rate, false alarm rate, and detection speed.

MoDT2 **Conference Room No.2**
Vision: In-Vehicle 2 (Regular Session)

15:30-15:52 MoDT2.1
3D Traffic Sign Tracking Using a Particle Filter, pp. 168-173
Meuter, Mirko Delphi Electronics & Safety
Kummert, Anton Univ. of Wuppertal
Müller-Schneiders, Stefan Delphi Corp.

In recent years, there was much activity in the development of camera based active safety systems to aid and to support the driver of a car. One application for such a system is the detection and classification of traffic signs. An important aspect of such a system is the tracking of traffic signs. We present a novel algorithm to track traffic signs in 3D using a single monochrome camera. The algorithm allows to use the constraint that the observed movement on the image plane is entirely caused by the host car movement, which is partially known from internal sensors. The usage of the sensor information improves the tracking process and allows a robust rejection of false positive detections. We also present a way to incorporate a shape cue directly from the image plane into the tracking process. First tests show good results in practice and indicate, that this kind of tracking makes a very valuable addition to a traffic sign detection system.

15:52-16:14 MoDT2.2
Evaluation of Road Marking Feature Extraction, pp. 174-181
Veit, Thomas Inrets
Tarel, Jean-Philippe LCPC

This paper proposes a systematic approach to evaluate algorithms for extracting road marking features from images. This specific topic is seldom addressed in the literature while many road marking detection algorithms have been proposed. Most of them can be decomposed into three steps: extracting road marking features, estimating a geometrical marking model, tracking the parameters of the geometrical model along an image sequence. The present work focuses on the first step, i.e. feature extraction. A reference database containing over 100 images of natural road scenes was built with corresponding manually labeled ground truth images. This database enables to evaluate and compare extractors in a systematic way. Different road marking feature extraction algorithm representing different classes of techniques are evaluated: thresholding, gradient analysis, and convolution. As a result of this analysis, recommendations are given on which extractor to choose according to a specific application.

16:14-16:36 MoDT2.3
Stereovision-Based 3D Lane Detection System: A Model Driven Approach, pp. 182-188
Benmansour, Nabil LCPC
Labayrade, Raphael Univ.
Aubert, Didier INRETS/LCPC
Glaser, Sébastien LCPC

A new stereovision-based method for the road lane detection and 3D geometry estimation is presented in this paper. The proposed approach is based on a recognition algorithm driven by a statistical model of the 3D road lane, projected in both stereoscopic images. First, the model is initialized thanks to a training stage. The model is then updated iteratively, from successively extracted image features. After each iteration, the detection of the next features, in any of the two images of the stereoscopic pair, is driven by the features already detected. The parameters of the road lane, such as width, horizontal and vertical curvature, roll, pitch, and yaw angles, are estimated. The variance of each parameter is also estimated, and is minimized through the estimation process. Unlike previous proposed approaches, no disparity map is required: the matching of the image features is directly obtained as a result of the model update. Thus, computing time is low. Experiments from computer-generated and real images are carried out to assess the efficiency and accuracy of the method.

Index Terms — road lane detection, stereovision, statistical model, model driven matching.

16:36-16:58 MoDT2.4
Real-Time Road Traffic Classification Using On-Board Bus Video Camera, pp. 189-196
Parisot, Christophe Multitel asbl
Meessen, Jerome Multitel asbl
Carincotte, Cyril Multitel asbl
Desurmont, Xavier Multitel asbl

On-board video analysis has attracted a lot of interest over the two last decades, mainly for safety improvement (through e.g. obstacles detection or drivers assistance).

In this context, our study aims at providing a video-based real-time understanding of the urban road traffic. Considering a video camera fixed on the front of a public bus, we propose a cost-effective approach to estimate the speed of the vehicles on the adjacent lanes when the bus operates on its reserved lane.

We propose to work on 1-D segments drawn in the image space, aligned with the road lanes. The relative speed of the vehicles is computed by detecting and tracking features along each of these segments, while the absolute speed of vehicles is estimated from the relative one thanks to odometer and/or GPS data. Using pre-defined speed thresholds, the traffic can be classified in real-time into different categories such as "fluid", "congestion"...

As demonstrated in the evaluation stage, the proposed solution offers both good performances and low computing complexity, and is also

compatible with cheap video cameras, which allows its adoption by city traffic management authorities.

MoDT3 Conference Room No.3
Travel Time Prediction 2 (Regular Session)

15:30-15:52 MoDT3.1

Traffic Estimation and Prediction Based on Real Time Floating Car Data, pp. 197-203
 de Fabritiis, Corrado Octo Telematics srl
 Ragona, Roberto Enea
 Valenti, Gaetano Enea

The knowledge of the actual current state of the road traffic and its short-term evolution for the entire road network is a basic component of ATIS (Advanced Traveler Information Systems) and ATMS (Advanced Traffic Management System) applications. In this view the use of real-time Floating-Car Data (FCD), based on traces of GPS positions, is emerging as a reliable and cost-effective way to gather accurate travel times/speeds in a road network and to improve short-term predictions of travel conditions. The purpose of this paper is to present a large-scale working application of FCD-system, developed and operated by OCTOTelematics, delivering real-time traffic speed information throughout the Italian motorway network and along some important arterial streets located in major Italian metropolitan areas. Traffic speed estimates are deduced at an interval of 3 minutes from GPS traces transmitted in real-time from a large (and still growing) fleet of private cars (about 600.000) equipped with a specific device covering a range of insurance-related applications. This paper also proposes two algorithms, respectively based on Artificial Neural Networks and Pattern-Matching, designed to on-line perform short-term (15 to 30 minutes) predictions of link travel speeds by using current and near-past link average speeds estimated by the OCTOTelematics FCD system. The Rome ring road (GRA-Grande Raccordo Anulare) was used for testing the feasibility of the two algorithms. Testing results s

15:52-16:14 MoDT3.2

A New Online Travel Time Estimation Approach Using Distorted Automatic Vehicle Identification Data, pp. 204-209
 Ma, Xiaoliang Royal Inst. of Tech.
 Koutsopoulos, Haris N. Royal Inst. of Tech.

Online travel time estimation is an important procedure for real-time traffic information systems (RTIS). In this paper, we describe a preliminary travel time data collection and estimation platform developed for RTIS application based on automated vehicle identification technique deployed in the Stockholm city area. The platform is composed of a client-side travel time analysis program and a database server. To obtain accurate real-time link travel times for traffic state prediction and RTIS applications, an automated filtering algorithm is developed and evaluated using travel time data collected in the Stockholm city network. The proposed algorithm shows high performance and is more robust than existing online travel time estimation algorithms. The estimated travel time information provides a solid basis for advanced traffic information system applications.

16:14-16:36 MoDT3.3

A Novel Loglinear Model for Freeway Travel Time Prediction, pp. 210-215
 Huang, Lili Univ. of California, Riverside
 Barth, Matthew Univ. of California-Riverside

As traffic congestion continues to grow worldwide, freeway travel time prediction is becoming increasingly important. During the past decade, numerous research projects have been carried out in travel time estimation. A variety of algorithms and techniques have been developed, primarily for predicting short-term travel time (less than 30 minutes ahead). However, these travel time prediction methods cannot be applied for long-term travel planning. In this paper, a loglinear travel time prediction model is proposed to estimate the travel time that begins at a long-term future moment of departure. Instantaneous and historical traffic data from loop sensors on difference freeways are collected and analyzed. Coefficients in the model are obtained using these training data. By using the proposed loglinear algorithm, the travel time for each segment of the freeways

is predicted. The travel time prediction is performed in real-time based on the travel time of each segment. This model is scalable to freeway networks with arbitrary travel routes. It is unique in that it considers various traffic patterns during different days in one week. It is also simple, stable, and computationally efficiency, with low storage cost requirements. Real world data are used to evaluate the proposed loglinear predictor. The performance of our model is compared with the results of the commonly used predictors.

16:36-16:58 MoDT3.4

Design and Initial Implementation of an Inductive Signature-Based Real-Time Traffic Performance Measurement System, pp. 216-221
 Tok, Yeow Chern Andre Univ. of California, Irvine
 Jeng, Shin-Ting Univ. of California Irvine
 Liu, Hang Univ. of California, Irvine
 Ritchie, Stephen Univ. of California, Irvine

The need for accurate, comprehensive and timely traffic surveillance information is critical to ensure optimal traffic operations and management for advanced traffic management systems (ATMS). This paper describes an on-going study that involves the design and implementation of the section-based freeway Real-Time Traffic Performance Measurement System (RTPMS)—an advanced surveillance system based on inductive vehicle signature technologies. Unlike traffic performance measurement systems that depend on point measures, RTPMS provides section-based travel time measures via matching of inductive vehicle signatures obtained at two adjacent detector station locations. Hence, the performance measures account for traffic conditions spanning an entire section, not just at a local detector station. In addition, each re-identified vehicle is also classified in RTPMS, yielding detailed section-based performance measures of different vehicle classes. This gives the ability to obtain more accurate travel statistics and vehicle exposure rates, such as those of commercial vehicles.

MoDT4 Conference Room No.4
Optimization and Control: Theory and Modeling 2 (Regular Session)

15:30-15:52 MoDT4.1

Studies of Emergency Evacuation Strategies Based on Kinematic Wave Models of Network Vehicular Traffic, pp. 222-227
 Qiu, Kai-Fu University of Science and Tech. of China
 Jin, Wen-Long Univ. of California

How to efficiently control traffic during emergency evacuation is an important research issue. An emergency evacuation strategy, one of the main control strategies, aims to identify the best routing strategy so as to fully utilize the available capacity of a transportation network. In this study, we model the evacuation traffic with a kinematic wave model of network vehicular traffic. We present two evacuation route guidance strategies: one is to maximize the total number of vehicles evacuated from the origin zone during a period of time, and the other is a myopic strategy based on local traffic supplies of downstream links at an intersection. The first strategy is an offline strategy and can be solved by a genetic algorithm, while the second one can be solved online. The performances of the proposed methods are tested with a simple road network.

15:52-16:14 MoDT4.2

A Multiple SVR Approach with Time Lags for Traffic Flow Prediction, pp. 228-233
 Wu, Tianshu Beijing Univ.
 Xie, Kunqing Peking Univ.
 Song, Guojie PKU
 Hu, Cheng Peking Univ.

A multiple support vector regression (SVR) model with time lags was proposed for short term traffic flow prediction. Time lags between current traffic flow and upstream traffic flow were estimated in order to make better use of spatial-temporal correlation between the upstream and the downstream. The time lags could help identify the upstream flow series most similar to that of the current road and to be used as the model input. A global SVR model with a time lag was constructed and we found it performed not so well during some time intervals where the traffic flow was dramatically fluctuant. Local SVR

models with time lags were constructed especially for those intervals and improved the performance. Combining both of the global and the local models, the multiple model was applied to 5-minute freeway data observed by loop detectors in the project Freeway Performance Measurement System (PeMS) of California. Comparisons with several other methods showed that the multiple SVR model with time lags was a promising and effective approach for traffic flow prediction.

16:14-16:36 MoDT4.3
A New Methodology for Processing Time Varying Traffic Data in Multiple States, pp. 234-239
 Zhu, Weihua Univ. of California-Riverside
 Boriboonsomsin, Kanok Univ. of California-Riverside
 Barth, Matthew Univ. of California-Riverside

Freeway management systems are becoming increasingly important, serving as a core of many intelligent transportation system (ITS) applications. Advancement in various areas of traffic monitoring system technology has provided planners and engineers with rich sets of traffic data, both macroscopically and microscopically, that can be used to achieve even better freeway management. In this paper, we propose a new methodology specifically designed to process traffic data that vary in time according to their state. This methodology consists of two algorithms, i.e. a scale space smoothing algorithm and a time segmentation algorithm, which can be used either separately or sequentially to process the data. The scale space algorithm smoothes time series traffic data to eliminate the embedded random effect while preserving the sharp transition state of the data. The time series segmentation algorithm divides the time series data into different "semantically" meaningful segments belonging to different states. This paper also discusses potential applications of this methodology to a variety of ITS implementations. Several experiments have been conducted on selected applications and their results verify the effectiveness of the proposed methodology.

16:36-16:58 MoDT4.4
Test Results and Validation of the FeedMAP Framework with ADAS Applications, pp. 240-246
 Thomas, Bernd NAVIGON AG
 Loewenau, Jan BMW Res. and Tech.
 Durekovic, Sinisa NAVTEQ
 Landwehr, Michael PTV AG
 Flament, Maxime ERTICO - ITS Europe
 Li, Yanying ERTICO - ITS Europe

Up-to-date map data is a must for current and future navigation and Advanced Driver Assistance System (ADAS) applications. Today, digital maps are normally stored on DVDs or hard disks, with periodic updates only available on replacement disks. However, new mechanisms for updating maps have been investigated and some of them already reached the market. As the real world is changing every day, detecting changes to the road network quickly and at a low cost is a challenge. Although mapmakers continuously survey the European road network for changes, map information is not always up-to-date or accurate. This paper presents the test and validation results and two example applications from the FeedMAP project and how they can be used for increasing driving safety by integrating map deviation detection and incremental update technology into ADAS applications using the ADAS Horizon concept.

MoDT5 Conference Room No.5
Data Mining and Analysis 2 (Regular Session)

15:30-15:52 MoDT5.1
Automatic Mining of Vehicle Behaviors with an Unknown Number of Categories, pp. 247-252
 Liu, Ying Tsinghua Univ.
 Zhang, Hao Tsinghua Univ.
 Meng, Huadong Tsinghua Univ.
 Wang, Xiqin Tsinghua Univ.

Automatic mining of vehicle behaviors from raw data collected by multiple sensors provides meaningful qualitative descriptions of the vehicle status. These qualitative behavior descriptions can be used in scenario parsing and have further applications in vehicle surveillance

and frontal collision warning systems. In current approaches, the number of behavior categories is supposed to be known, or need to be manually explored every time the training data is changed. In this paper, the authors use Hidden Markov Model to symbolize the vehicle behaviors and adopt the cross-validated likelihood with penalty for complexity to select the number of hidden states. Appropriate number of behavior categories is selected automatically, and those behaviors are decided at the same time. Real data experiments demonstrate the effectiveness of this approach.

15:52-16:14 MoDT5.2
Hybrid Process Neural Network Based on Spatio-Temporal Similarities for Short-Term Traffic Flow Prediction, pp. 253-258
 Hu, Cheng Peking Univ.
 Xie, Kunqing Peking Univ.
 Song, Guojie PKU
 Wu, Tianshu Beijing Univ.

Spatio-temporal similarities, one of the characteristics to describe the relativity of traffic phenomenon, can be utilized to predict short-term traffic flow. These similarities not always appear at spatial adjacent road links because of complexity of road network. In this paper, we adopt Cross-Correlation Function to depict similarities between different traffic flow series according to the observed flow data. The process characteristic generalizes the evolution rules of traffic flow which are essentials need to be tackled by a prediction model. After choosing the most correlative road links and their time delay instead of the upstream or downstream ones, a Hybrid Process Neural Network is constructed to predict short-term traffic flow, which uses various scales to catch traffic features such as daily-periodicity, weekly-periodicity and spatiotemporal process, since a simple model is not good enough to depict all these rules. Application of the proposed method is demonstrated, and the experimental results show that our method outperforms other compared methods.

16:14-16:36 MoDT5.3
Linking Freeway and Arterial Data – Data Archiving Testing in Supporting Coordinated Freeway and Arterial Operations, pp. 259-264
 Yang, Qingyan Iteris Inc.
 Wei, Heng Univ. of Cincinnati
 Gu, Jiuchun Ludong Univ.

Overall traffic delays are increasing in most of the US surface transportation systems. The Coordinated Freeway and Arterial (CFA) Operations is a new initiative that is trying to integrate freeway and arterial operations via data sharing. This paper presents part of the development from the Great Lakes Intelligent Transportation System I-75 Integrated Corridor (GLITS I-75) project, which is as pilot project of CFA intending to evaluate the feasibility of managing traffic in a multi-jurisdictional freeway and arterial corridor under varying traffic conditions and traffic diversion scenarios. The paper focused on testing the integrated freeway and arterial data archiving system in investigating their potential capability in supporting CFA scenarios. First, the concept of the GLITS I-75 Project is summarized. Second, ITS data archiving technologies were tested at the Road Commission for Oakland County's Traffic Operation Center (RCOC TOC). Finally, in particularly, the potential linkage of archived freeway and arterial data was discussed to show how its potential benefits of the CFA operations.

16:36-16:58 MoDT5.4
Nonlinear Analysis of Individual Vehicle Behavior in Car Following, pp. 265-268
 Wang, Lanjun Tsinghua Univ.
 Zhang, Hao Tsinghua Univ.
 Meng, Huadong Tsinghua Univ.
 Wang, Xiqin Tsinghua Univ.

It is well known that traffic systems are highly nonlinear. Previous research has shown the existence of the chaotic behavior in traffic flow data. However, the corresponding result in individual vehicle behavior has not been investigated. In this paper, we use tools of nonlinear time series analysis to explore the chaotic characteristic from data of individual vehicle behavior in car following. The maximal Lyapunov exponent and correlation dimension of these data are calculated numerically and compared with the results of traffic

Tuesday, October 14, 2008

**TuAT1 Conference Room No.1
Simulation and Modeling 1 (Regular Session)**

08:30-08:52 TuAT1.1
An Urban Intersection Model Based on Multi-Commodity Kinematic Wave Theories, pp. 269-274
Chen, Liang Univ. of Science and Tech. of China
Jin, Wen-Long Univ. of California
Hu, Jianming Tsinghua
Zhang, Yi Tsinghua Univ.

Traffic flow models of an urban intersection can be used to evaluate its performance and offer a base for traffic control strategies, road network design, and so on. The complex conflicts among traffic streams at an urban intersection, including zero conflict, merging conflict, diverging conflict and crossing conflict, have not been synthetically modeled by existing models. In this paper, we consider a four-leg urban intersection as a grid of 2x2 links (2x2 grid) and present a multi-commodity kinematic wave (MCKW) traffic flow model, in which all four conflicts are modeled. In this model, we use a fair merging rule and both strictly First-In-First-Out (FIFO) and non-strictly FIFO diverging rules. Moreover the model is used to simulate conflicts at a signalized urban intersection, where there are no crossing conflicts. As a result, the recurrence of gridlock occurred at un-signalized case is prevented.

08:52-09:14 TuAT1.2
Fuzzy Logic Based Cyclists' Path Planning Behavioral Model in Mixed Traffic Flow, pp. 275-280
Huang, Ling South China Univ. of Tech.
Wu, Jianping Univ. of Southampton

Bicycle is a man-powered, relatively low speed agile and vulnerable traffic mode. The paper presented a fuzzy logic based behavioural model to describe cyclist path planning behaviours at unsignalized intersections in mixed traffic flow situations (with many conflicts among motorcars, non-motor vehicles and pedestrians). Field data were collected for fuzzy logic modelling and for model calibration and validation, and the simulation results are promising. The model could be used in mixed traffic flow simulation and path planning models for Personal Mobility Vehicles (PMVs).

09:14-09:36 TuAT1.3
Simulation Study of Mixed Traffic in China--A Practice in Beijing, pp. 281-285
Guo, Min Beijing Traffic Management Bureau
Du, Yiman Univ. of Southampton
Wu, Jianping Univ. of Southampton
Song, Yan Company

Traffic congestion on urban roads is forcing city authorities to look at innovative transportation solutions. Traffic simulation and other advanced technologies have been used to provide solutions for maximizing the capacity of urban transportation networks and to evaluate and optimize traffic management and signal settings. The authors have investigated about 10 urban signalized intersections to evaluate the adopted traffic organization and signal settings in Beijing. One of these intersections was taken as example to illustrate how to assess the effectiveness of ameliorative measures using the microscopic simulation model.

09:36-09:58 TuAT1.4
Adaptive Dynamic Programming for Multi-Intersections Traffic Signal Intelligent Control, pp. 286-291
Li, Tao Inst. of Automation, Chinese Acad. of Sciences
Zhao, Dongbin Inst. of Automation, Chinese Acad. of Sciences
Yi, Jianqiang Inst. of Automation, Chinese Acad.

This paper aims at developing near optimal traffic signal control for multi-intersections in city. As a new optimization technique, adaptive dynamic programming (ADP) combines concepts of reinforcement learning and dynamic programming. ADP could learn continually from experience to achieve a near optimal control policy under varying conditions. However, without the cooperation among adjacent intersections, the near optimal control for each individual intersection can not guarantee a larger traffic area composing several intersections to be near optimal. This paper presents a new signal control method based on a model-free action-dependent ADP (ADHDP). This method can be used for cooperative control of multiple intersections. In every intersection, an ADHDP signal controller is adopted to adjust signal time according to an integrated unity parameter. The unity parameter is designed to consider not only the control performance in local intersection but also those in the neighbor intersections. Thus the designed controllers could achieve a set of near optimal control police for multi-intersections in a long run. Simulation results show that the trained controller achieves shorter average vehicular delay.

**TuAT2 Conference Room No.2
Vision: Surveillance 1 (Regular Session)**

08:30-08:52 TuAT2.1
Development of an Embedded Vision Based Vehicle Detection System Using an ARM Video Processor, pp. 292-297
Torral-Marín, Sergio Univ. of Seville
Barrero, Federico Univ. of Seville
Vargas, Manuel Univ. of Seville

Abstract—Current Intelligent Transportation Systems tends to be integrated in smart environments where sensors are provided with processing and communication capabilities. This is the case of the vehicle detection system proposed in this paper. The ARM-based video processor not only deals with the video processing algorithms, but also takes advantage of the networking capabilities using an embedded operating system. Consequently, the final prototype implements the vehicle detection system as the main functionality, but offers additional features like remote detection area configuration, video delivery, remote software updating, etc. Results will show all the system capabilities as well as satisfactory vehicle detection rates.

08:52-09:14 TuAT2.2
A 2DLDA Based Algorithm for Real Time Vehicle Type Recognition, pp. 298-303
Huang, Hua Xi'an Jiaotong Univ.
Zhao, Qian Xi'an Jiaotong Univ.
Jia, Yulan Xi'an Jiaotong Univ.
Tang, Shuming Inst. of Automation, Chinese Acad. of Sciences

Vehicle type recognition generally refers to identifying the make and model of vehicles through collected images or information. This paper presents a Two-Dimensional Linear Discriminant Analysis (2DLDA) based algorithm for real time vehicle type recognition. The algorithm is initiated by extracting a region of interest (ROI) relative to the located license plate, then robust features obtained by performing 2DLDA on the gradients of ROI are used for recognition. Experimental results show that the algorithm can achieve high recognition accuracy (94.7%) and that it is not sensitive to variations of vehicle colors and light conditions. The computational complexity is low and the algorithm can be implanted in real time.

09:14-09:36 TuAT2.3
Self-Calibration of Traffic Surveillance Camera Using Motion Tracking, pp. 304-309
Thi, Tuan Hue National ICT Australia (NICTA)
Lu, Sijun National ICT Australia (NICTA)
Zhang, Jian National ICT Australia (NICTA)

A statistical and computer vision approach using tracked moving vehicle shapes for auto-calibrating traffic surveillance cameras is presented. Vanishing point of the traffic direction is picked up from Linear Regression of all tracked vehicle points. Preliminary straightening model is then built to help collect statistics of the typical

vehicle class traveling in each particular scene. Analysis on this class eventually helps to compute the complete calibration parameters. Results obtained from the validation step against traditional methods in different traffic locations demonstrate its desirable accuracy with much more flexibility and reliability.

09:36-09:58 TuAT2.4
Improving the Generalization Properties of Neural Networks: An Application to Vehicle Detection, pp. 310-315
 Ludwig, Oswaldo ISR-Inst. of Systems and Robotics-UC
 Nunes, Urbano Inst. for Systems and Robotics

In this paper a Multilayer Feedforward Neural Network based approach for vehicle detection is proposed. The main idea is to use such network to perform both feature extraction and classification. This simplicity enables real time applications. In order to achieve such capabilities, the network is trained by a new algorithm, proposed in this paper, named Minimization of Inter-Class Interference (MCI). Such algorithm aims to create a hidden space (i.e. feature space) where the patterns have a desirable statistical distribution. Regarding the neural architecture, the linear output layer is replaced by the Mahalanobis kernel, in order to improve generalization. Experiments are performed by means of a dataset that includes two standard datasets from Caltech car rear. Finally, disturbed images are used, in order to evaluate the robustness of the neural-network based vehicle detection. The proposed method reveals low miss rate, low false alarm rate and high area under ROC curve. In Matlab environment, the algorithm spends only 3.280e-4 seconds per image. These facts encourage this research line.

TuAT3 Conference Room No.3
Topics in ITS 1 (Regular Session)

08:30-08:52 TuAT3.1
Pedestrian Behavior Prediction Based on Motion Patterns for Vehicle-To-Pedestrian Collision Avoidance, pp. 316-321
 Chen, Zhuo Univ. of Hong Kong
 Ngai, Chi Kit Univ. of Hong Kong
 Yung, Nelson H. C. Univ. of Hong Kong

This paper proposes a prediction method for vehicle-to-pedestrian collision avoidance, which learns and then predicts pedestrian behaviors as their motion instances are being observed. During learning, known trajectories are clustered to form Motion Patterns (MP), which become knowledge a priori to a multi-level prediction model that predicts long-term or short-term pedestrian behaviors. Simulation results show that it works well in a complex structured environment and the prediction is consistent with actual behaviors.

08:52-09:14 TuAT3.2
Representing and Tracking of Dynamics Objects Using Oriented Bounding Box and Extended Kalman Filter., pp. 322-328
 Kmiotek, Pawel Univ. of Tech. of Belfort-Montbeliard - France
 Ruichek, Yassine Univ. of Tech. of Belfort-Montbeliard - France

Representing and tracking of dynamics objects is one of the main parts of autonomous navigation in urban areas. In the framework of the development of a multiple objects tracking system using multisensor fusion, this paper presents an oriented bounding box (OBB) representation with uncertainty computation as well as a model for object tracking. The uncertainty computation method, which takes into account Laser Range Finder sensor uncertainty and object's relative position, is evaluated. The influence of this uncertainty on the accuracy of the estimation is shown. The tracking model, based on the Extended Kalman Filter is tested and evaluated using the OBB object's representation.

09:14-09:36 TuAT3.3
Environmental Traffic Capacity and Traffic Structure Optimization on Urban Road, pp. 329-333
 Zhu, Zhigao SouthEast Univ.
 Li, Tiezhu SouthEast Univ.

By integrating environmental traffic capacity (ETC) with traffic structure optimization (TSO) on urban road, influencing factors of

ETC were analyzed, and the concept of TSO was introduced. Based on functional relationship between emission factors and vehicular speed, and the regression model of vehicular speed and traffic volume, a relation between traffic volume and traffic pollutants diffusion concentration was set up. A multi-objective optimization model, whose objectives were the maximum of traffic volume and traffic efficiency, was developed and its main constraints were the traffic capacity and the control concentration of pollutants in air quality standard, and then its solving algorithm was designed. The practical example study shows that there are different ETC values according to different environment air quality evaluation factors and the reasonable traffic structure is not only beneficial to improving road traffic efficiency, and also favorable to protecting environment air quality.

09:36-09:58 TuAT3.4
Using 3D Road Geometry to Optimize Heavy Truck Fuel Efficiency, pp. 334-339
 Huang, Wei Auburn Univ.
 Bevly, David Auburn Univ.
 Schnick, Steve Intermap Tech. Corp.
 Li, Xiaopeng Intermap Tech.

This paper investigates the benefit of using a 3D road geometry based optimal powertrain control system in reducing the fuel consumption of heavy trucks. The optimal control system, with a constrained nonlinear programming algorithm as the optimizer, is designed to predict the optimal throttle, gear shifting and velocity trajectory, based on the road geometry to minimize the fuel consumption and travel time. Computer simulations of a Class 8 truck model are conducted with Intermap 3D road geometry. Simulation results show that the optimal control system is able to reduce the fuel consumption with equal travel time, when compared to the defined baseline. Additionally, sensitivity analyses are conducted to investigate how the change of the terrain and the errors in the road map affect the gain of fuel economy and system behavior.

TuAT4 Conference Room No.4
Traffic Control: Miscellaneous (Regular Session)

08:30-08:52 TuAT4.1
An Innovation-Based Approach to Timely and Robust Automatic Highway Incident Detection, pp. 340-345
 Schober, Martin Univ. Stuttgart
 Wehlan, Herbert Univ. Stuttgart
 Meier, Jürgen NAVIGON AG

Timely and accurate detection of traffic incidents is of crucial importance for highway management and warning systems. These tasks are normally carried out by algorithms of traffic state estimation (SE) combined with automatic incident detection (AID) on the basis of local measurements (e.g. inductive loop data, radar data, etc.). It is evident that faults and inaccuracies in the process of measuring traffic data affect the quality of SE and AID significantly. Especially faults in measuring the traffic volume occur frequently. They cause false alarms or they hinder these systems to detect dangerous incidents.

In this article we apply methods of technical fault diagnosis to design an AID. Therein, a vector-based innovation of an Extended Kalman Filter (EKF) is used for distinguishing traffic incidents from flawed data and from other disturbances on traffic flow. Also it is used for timely detection of traffic incidents. For reasons of a robust application in real-world scenarios with flawed data, some modifications are discussed and their positive effects on the innovation-based approach are presented.

08:52-09:14 TuAT4.2
Performance Assessment of Highway Tunnel Surveillance and Control System by Fault Tree Analysis, pp. 346-350
 Zhu, Liwei Key Lab. of Road Safety Tech. Ministry of Communica
 Zhang, Zhiyong Key Lab. of Road Safety Tech. Ministry of Communicat
 Bao, Zuojun Key Lab. of Road Safety Tech. Ministry of Communicat

As the typical application of Intelligent Transportation System (ITS), Highway Tunnel Surveillance and Control System (HTSCS) is the critical system to improving the transportation safety and efficiency of highway tunnel. In this paper, a HTSCS performance assessment model which employs failure rate (probability of top events) as the performance index based on Fault Tree Analysis (FTA) method is presented. Based on this, the performance assessment procedure, the cause and probability of HTSCS failures are provided, and subsequently some advice on the improvement of HTSCS performance is given. The presented model can also be applied in the maintenance of HTSCS, which can provide feasible program for the location of system faults, and thus reduce the workload of fault diagnosis, improve the maintenance efficiency of HTSCS.

09:14-09:36 TuAT4.3
Coordinated Control of Multiple Ramp Metering Based on DHP (»;) Controller, pp. 351-356

Bai, Xuerui	Inst. of Automation, Chinese Acad. of Sciences
Zhao, Dongbin	Inst. of Automation, Chinese Acad. of Sciences
Yi, Jianqiang	Inst. of Automation, Chinese Acad. of Sciences
Xu, Jing	Inst. of Automation, Chinese Acad. of Sciences

we presented a novel control method in previous studies, which is action-dependent heuristic dynamic programming based on eligibility traces (ADHDP (»:)). Although ADHDP (»:) has good performance in local ramp metering control, it can't efficiently deal with the problems of multiple ramp metering control. Then in this article, a new method which is called dual heuristic programming based on eligibility traces (DHP (»:)) is presented. The new method DHP (»:) is composed of DHP and eligibility traces. DHP has efficiently solved the problem of coordinate ramp metering control, and eligibility traces can accelerate the learning rate of DHP. DHP (»:) is an approximate optimal ramp metering method. Simulation studies on a hypothetical freeway are reported, whereby the results are compared with those obtained by applying ALINEA as a stand-alone strategy. It is shown that the proposed control scheme is efficient.

09:36-09:58 TuAT4.4
Scheduling Aircraft Landing Based on Clonal Selection Algorithm and Receding Horizon Control, pp. 357-362

Jia, XiaoLan	Univ. of Science and Tech. of China
Cao, XianBin	Univ. of Science and Tech. of China
Guo, YuanPing	Univ. of Science and Tech. of China
Qiao, Hong	Chinese Acad. of Sciences
Zhang, Jun	Beihang Univ.

The task of Aircraft Landing Scheduling (ALS) is to give a landing sequence and landing times for a given set of aircrafts where many constraints must be satisfied. ALS is an NP-hard problem with large-scale and multi-constraint characteristics, thus it is hard to find optimal solution efficiently. In this paper, a hybrid algorithm of Clonal Selection Algorithm (CSA) and Receding Horizon Control (RHC) was proposed for ALS problem. In details, constrained CSA based on infeasibility degree (IFD) schedules aircrafts in current receding horizon, and then RHC repeats that optimization procedure using excellent gene segment spread (EGSS) until all aircrafts have landed. Comparative experiments show that the CSA-RHC hybrid algorithm is able to obtain an optimal landing sequence and landing times rapidly and effectively.

TuAT5 **Conference Room No.5**
ITS Communications (Regular Session)

08:30-08:52 TuAT5.1
An NTCIP-Based Semantic ITS Middleware for Emergency Vehicle Preemption, pp. 363-368

Yang, Chen-Wei	Feng Chia Univ.
Dow, Chyi-Ren	Feng Chia Univ.
Chen, Kuong-Ho	Feng Chia Univ.

Chiang, Wei-Chun
 Lin, Da-Jie

Feng Chia Univ.
 Feng Chia Univ.

To achieve automation in ITS (Intelligent Transportation System) environments, integrations for existing traffic management systems as well as various vehicle-centered systems need to be done without modification. This is in particular essential for an automated emergency vehicle preemption system, where traffic signal preemption should be more accurate, smooth, and secure. Current researches for ITS middleware do not give much thought on interoperability and performance, thus they cannot support such automation framework. This paper proposes Bevor, a semantic-based ITS middleware for emergency vehicle preemption based on NTCIP (U. S. National Transportation Communications for ITS Protocol). By utilizing NTCIP protocols in Communication Layer, Bevor achieves communication and data interoperability across most devices and equipments; the deployment of NTCIP STMF also significantly improved the effectiveness of transmission. The Service Layer of Bevor is designed with the Web 3.0 framework and XML exchange, enabling easy access to semantic data as well as operations such as event detection, policy matching, etc. A prototype system was implemented, and the experimental results show that Bevor offers a great interoperability, more flexible automation control, semantic reuse, and improved performance.

08:52-09:14 TuAT5.2
Channel Adaptive One Hop Broadcasting for VANETs, pp. 369-374

Yang, Lin	Nankai Univ.
Guo, Jinhua	Univ. of Michigan
Wu, Ying	Nankai Univ.

One hop broadcasting is the predominate form of network traffic in VANETs. Exchanging status information by broadcasting among the vehicles enhances vehicular active safety. Since there is no MAC layer broadcasting recovery for 802.11 based VANETs, efforts should be made towards more robust and effective transmission of such safety-related information. In this paper, a channel adaptive broadcasting method is proposed. It relies solely on channel condition information available at each vehicle by employing standard supported sequence number mechanisms. The proposed method is fully compatible with 802.11 and introduces no communication overhead. Simulation studies show that it outperforms standard broadcasting in term of reception rate and channel utilization.

09:14-09:36 TuAT5.3
Design of Autonomous Decentralized Mobility System: Implementation for ITS Services Using DSRC, pp. 375-382

Shimura, Akitoshi	Hitachi, Ltd.
Hiraiwa, Masashi	Hitachi, Ltd.
Sugano, Shigeki	Waseda Univ.

A group management model was previously proposed in which several base stations (BSs) autonomously judge whether to create a group in order to provide cruise-assist services, such as accident-reporting, and multimedia services, such as maps and music, for a moving vehicle by using multiple Dedicated Short Range Communication (DSRC) BSs flexibly and quickly. In this paper, an Autonomous Decentralized Mobility System Architecture to implement this model within an actual system is discussed. In this architecture, each BS autonomously judges whether to create a group for information provision. Each BS that participates in a group shares content regarding the vehicle and the service progress and provides information for the vehicle based on the urgency and the properties of the information. This paper also describes an evaluation of this architecture applied to test the actual system effectiveness.

09:36-09:58 TuAT5.4
HarpiaGrid: A Reliable Grid-Based Routing Protocol for Vehicular Ad Hoc Networks, pp. 383-388

Chen, Kuong-Ho	Feng Chia Univ.
Dow, Chyi-Ren	Feng Chia Univ.
Lee, Yi-Shiou	Feng Chia Univ.

Vehicular Ad Hoc Network (VANET) is a research field attracting growing attentions. Current routing protocols in VANET usually use geographic information to forward data packets to destination. Since geographic routing is stateless, during routing forwarding, route

recovery processes would be continuously initiated if any topology hole exists, resulting serious performance degradation. In addition, if vehicle density is low in the network, there might not be vehicles available to deliver the packet. This paper proposes HarpiaGrid, a reliable grid-based routing protocol for VANETs. The protocol utilizes in-car navigators to produce geographically logical routing paths, effectively trades route discovery network overhead with insignificant computation time. In addition, by taking advantage of the information provided by gridded geographic data, transmissions are made more efficient. Moreover, in the route maintenance, a fault-tolerance procedure is designed to avoid dead paths. Simulations were conducted, and the results demonstrated that the proposed scheme is indeed more efficient and reliable than other protocols.

TuBT1 Conference Room No.1
Simulation and Modeling 2 (Regular Session)

10:30-10:52 TuBT1.1

Second Life Prototyping of Augmented Automobile Navigation Assistance, pp. 389-394

Chu, Kar-Hai Univ. of Hawaii at Manoa
 Joseph, Samuel R. H. Univ. of Hawaii at Manoa

The automobile industry has produced many cars with new features over the past decade. However, the interaction between the driver and the car has not changed significantly. The information being delivered – both in quantity and method – from the car to the driver has not seen the same improvements as there have been “under the hood.” This paper proposes immersing the driver inside an additional layer of traffic and navigation data, and presenting that data to the driver by embedding display systems into the automobile windows and mirrors. Furthermore, we present a new technique for testing prototypes of such systems; an alternative to custom simulators or cars retrofitted with elaborate testing components. Our method of using the online virtual world Second Life to conduct driving simulations has the advantages of faster development time, lower costs, and simpler setups than many of the alternatives.

10:52-11:14 TuBT1.2

Large-Scale Field Testing of a Real-Time Freeway Network Traffic State Estimator in South Italy, pp. 395-401

Wang, Yibing Monash Univ.
 Coppola, Pierluigi "Tor Vergata" Univ. of Rome
 Tzimitsi, Athina Tech. Univ. of Crete
 Messmer, Albert Consulting Engineer
 Papagergiou, Markos Tech. Univ. of Crete
 Nuzzolo, Agostino Univ. of Rome "Tor Vergata"

This paper addresses a large-scale field test of a real-time freeway network traffic state estimator that was recently developed. The related network traffic flow modeling and state estimator design are first outlined. The test of the estimator for the A3 freeway of 100 km between Naples and Salerno in south Italy is then reported in some detail. The obtained results are deemed quite satisfactory and promising for further future implementations of this traffic state estimation tool.

11:14-11:36 TuBT1.3

Agent-Based Coordination Model for Designing Transportation Applications, pp. 402-407

Badeig, Fabien French National Inst. for Transport and Safety Res. (INR)
 Balbo, Flavien Univ. Paris-Dauphine
 Scemama, Gérard French National Inst. for Transport and Safety Res. (INR)
 Zargayouna, Mahdi French National Inst. for Transport and Safety Res. (INR)

This paper presents an environment-centered approach to design multi-agent solutions to transportation problems. Based on the Property-based Coordination Principle (PbC), the objective of our approach is to solve three recurrent issues in the design of these solutions: the knowledge problem, the space-time dimension and the dynamics of the real environment. To demonstrate the benefits of our approach, two completely different applications, a demand-responsive transportation system and a simulator for crisis management, both based on this principle are presented. For each of

them, we show how these recurrent issues have been solved.

11:36-11:58 TuBT1.4

Usage of Its in the In-Vehicle Signing System with RFID Tags and Vehicle Routing and Road Traffic Simulation, pp. 408-413

Zoghi, Hasan Islamic Azad Univ. Karaj Branch
 Siamardi, Kianoush Islamic Azad Univ. Karaj Branch
 Tolouei, Morteza Islamic Azad Univ. Karaj Branch
 Araghi, Porgeh Islamic Azad Univ. Karaj Branch

Abstract— Vehicle drivers are requested to collect dynamic visual information on such matters as other vehicles and traffic signals, and static visual information including traffic signs, and to maneuver the vehicle accordingly. However, traffic signs and other static visual information are more likely to be overlooked than dynamic visual information during maneuver. In this study, an in-vehicle signing system was built and assessed that uses general-purpose RFID tags as digital traffic signs, and a field test was conducted using tags installed on a road to verify whether the system worked effectively or not. A laboratory test was also carried out using a video of vehicle travel to have subjects experience maneuver. Then, it was found that providing visual and vocal information in the vehicle was effective. And In-vehicle navigation permits people to find their way while driving. Combining these applications with road traffic data may result in diminishing traveling time. In this paper we deal with the problem of vehicle routing on today's congested roads. The result of this study is a web application that provides the user with two possibilities.

TuBT2 Conference Room No.2
Vision: Surveillance 2 (Regular Session)

10:30-10:52 TuBT2.1

On Integration of Features and Classifiers for Robust Vehicle Detection, pp. 414-419

Oliveira, Luciano Inst. of Systems and Robotics - Univ. of Coimbra
 Nunes, Urbano Inst. for Systems and Robotics

Some researches have demonstrated that a single recognition system is not usually able to deal with the diversity of environment situations in images. In this paper, with the aim of finding a robust method to compensate single classifier inability under certain circumstances, an extensive study on how to combine features and classifiers is performed. Two ways of integrating features and classifiers are proposed: concatenated vector and ensemble architecture. These two methods are composed by Histogram of Oriented Gradients and Local Receptive Fields as feature extractors, and a Multi Layer Perceptron and Support Vector Machines as classifiers. A thorough analysis with respect to the robustness of the proposed methods over artificial illumination changing has been experimentally carried out at a front and rear vehicle recognition task. Results have demonstrated that the ensemble architecture with a heuristic Majority Voting presented the best performance (other four classification fusion methods based on majority voting and fuzzy integral were also evaluated). The ensemble classifier obtained an average hit rate of 92.4% and less than 1% of false alarm rate under multiple datasets and environment conditions.

10:52-11:14 TuBT2.2

Understanding Metro Station Usage Using Closed Circuit TeleVision Cameras Analysis, pp. 420-427

Carincotte, Cyril Multitel asbl
 Hick, Michel Multitel asbl
 Naturel, Xavier IDIAP Res. Inst.
 Yao, Jian IDIAP Res. Inst.
 Odobez, Jean-Marc IDIAP Res. Inst.
 Bastide, Arnaud ACIC nv/sa
 Corbucci, Bruno ATAC Spa

In this paper, we propose to show how video data available in standard CCTV transportation systems can represent a useful source of information for transportation infrastructure management, optimization and planning if adequately analyzed (e.g. to facilitate equipment usage understanding, to ease diagnostic and planning for system managers). More precisely, we present two algorithms allowing to estimate the number of people in a camera view and to measure the platform time-occupancy by trains. A statistical analysis

of the results of each algorithm provide interesting insights regarding station usage. It is also shown that combining information from the algorithms in different views provide a finer understanding of the station usage. An end-user point of view confirms the interest of the proposed analysis.

11:14-11:36 TuBT2.3
Monitoring an Intersection Using a Network of Laser Scanners, pp. 428-433

Zhao, Huijing	Peking Univ.
Cui, Jinshi	Peking Univ.
Zha, Hongbin	Peking Univ.
Katabira, Kyoichiro	Univ. of Tokyo
Shao, Xiaowei	Univ. of Tokyo
Shibasaki, Ryosuke	Univ. of Tokyo

In this research, a novel system for monitoring an intersection using a network of single-row laser range scanners (subsequently abbreviated as "laser scanner") is proposed. Laser scanners are set on the road side to profile an intersection horizontally from different viewpoints. This is done so that cross sections of the intersection are captured at a high scanning rate (e.g., 37Hz) and to contain the contour points of the moving objects entering the intersection. Different laser scanners' data are integrated into a common spatial-temporal coordinate system and processed. Thus, the moving objects inside the intersection are detected and tracked to estimate their state parameters, such as: location, speed, and direction at each time instance. An experiment was conducted in central Beijing, where six laser scanners were used to cover a three-way intersection. A digital copy of the dynamic intersection was measured, and, through data processing, a large quantity of physical dimension traffic data was obtained.

11:36-11:58 TuBT2.4
Vision-Based Perception for Autonomous Urban Navigation, pp. 434-440

Bansal, Mayank	Sarnoff Corp.
Das, Aveek	Sarnoff Corp.
Kreutzer, Greg	Sarnoff Corp.
Eledath, Jayan	Sarnoff Corp.
Kumar, Rakesh	Sarnoff Corp.
Sawhney, Harpreet	Sarnoff Corp.

We describe a low-cost vision-based sensing and positioning system that enables intelligent vehicles of the future to autonomously drive in an urban environment with traffic. The system was built by integrating Sarnoff's algorithms for driver awareness and vehicle safety with commercial off-the-shelf hardware on a robot vehicle. We implemented a modular and parallelized software architecture that allowed us to achieve an overall sensor update rate of 12 Hz with multiple high resolution HD cameras without sacrificing robustness and in-field performance. The system was field tested on the Team Autonomous Solutions vehicle, one of the top twenty teams in the 2007 DARPA Urban Challenge competition. In addition to enabling autonomy, our low-cost perception system has an intermediate advantage of providing driver awareness for convenience functions such as adaptive cruise control, lane departure sensing and forward and side-collision warning.

TuBT3	Conference Room No.3
Incident Management (Regular Session)	

10:30-10:52 TuBT3.1
Traffic Impact Assessment of Incident Management Strategies, pp. 441-446

Dia, Hussein	-
Gondwe, William	Government agency
Panwai, Sakda	The Univ. of Queensland

This paper presents results from a simulation study which aimed to quantify the impacts of incident management strategies. The evaluation was based on the development of a large-scale micro-simulation model covering an area approximately 122 square kilometres, including 43 kilometres of motorway and about 85 kilometres of surface roads on the Gold Coast, Australia. The study examined the effectiveness of selected incident management strategies including ramp metering, VMS information dissemination

combined with route diversions, and variable speed limit systems. The provision of VMS information on the motorway and dynamic adjustment of signal timings on the diversion route resulted in equilibrium conditions and balanced distribution of traffic on both the normal and diversion routes when the optimal diversion rate was 30 percent. This resulted in the reduction of delays by 8.8 percent, decrease in number of stops by 22 percent, and decrease in travel times by 3.3 percent. An important finding was that these benefits are only realised when the two incident management responses (VMS route diversion and dynamic traffic signal plans on surface roads) are implemented at the same time. Combined, their impact was such that they resulted in restoration of traffic conditions to the pre-incident situation.

10:52-11:14 TuBT3.2
Enhancing Automatic Incident Detection Techniques through Vehicle to Infrastructure Communication, pp. 447-452

Abuelela, Mahmoud	old dominion Univ.
Olariu, Stephan	Old Dominion Univ.
Yan, Gongjun	Old Dominion Univ.

One of the fundamental requirements of a traffic management system is the ability to determine when an incident has occurred so that proper responses can be initiated. Automatic incident detection (AID) has been considered a method for quickly detecting potential incidents on the road. Although Vehicular Ad hoc Networks (VANETs) started mainly for safety applications, surprisingly a very few work have been done in VANETs for Automatic Incident Detection while most of the research went for developing routing protocols and privacy techniques.

In this paper, we introduce a novel incident detection technique for non dense traffic flow by taking advantage of communication between cars and some roadside infrastructure installed on the road every mile or so. The proposed technique can provide a great enhancement to the existing AID techniques specially under sparse traffic where most of them fail to detect non blocking incidents.

11:14-11:36 TuBT3.3
Empirical Analysis and Modeling of Freeway Incident Duration, pp. 453-457

Kim, Woon	Univ. of Maryland, Coll. Park
Natarajan, Suhasini	Univ. of Maryland, Coll. Park
Chang, Gang-Len	UMD

This paper presents a methodology for developing a model to identify the variables influencing incident duration to estimate and predict incident duration in the state of Maryland. The incident information from years 2003 to 2005 from the Maryland State Highway (MDSHA) database was used for model development, and year 2006 for model validation. Classification Trees (CT) were employed for a preliminary analysis to understand the influence of the variables associated with an incident. Based on the findings from CT, this study constructed the Rule-Based Tree Model (RBTM) to develop the primary prediction model. The overall confidence for the estimated model was over 80% with several remarkable findings regarding the association between the identified factors and incident duration. Although the estimated results from RBTM were quite acceptable, in cases where RBTM did not provide incident duration within a desirable short range, a discrete choice model was developed as a supplemental model. It is deduced that supplemental models along with better quality database are required to improve the prediction accuracy of the duration of a detected incident.

11:36-11:58 TuBT3.4
Synthesis of Emergency Evacuation Communication System for Disaster Detection and Information Dissemination, pp. 458-463

Zeng, Qing-An	Univ. of Cincinnati
Wei, Heng	Univ. of Cincinnati

Since conditions in an emergency situation are altogether different from normal circumstances, it's possible to render the regular communication mechanisms completely unavailable in facilitating evacuation operations. The break-down of normal communication networks requires alternative modes of communication between the emergency control center and first responders. In this paper, a novel communication system for evacuation operation and three scenarios

to efficiently reach out to evacuees in the case of emergencies are presented.

TuBT4 Conference Room No.4
Navigation, Guidance and Control 1 (Regular Session)

10:30-10:52 TuBT4.1
Application of RF Tags in Highway Reference Markers, pp. 464-469
 Cai, Yu Univ. OF HOUSTON
 Liu, Richard C. Univ. OF HOUSTON

In this paper, a high speed (up to 96km/h) vehicle-mounted long range passive radio frequency identification (RFID) system is proposed and developed to locate highway reference markers by collecting and analyzing the global positioning system (GPS) and distance measurement instrument (DMI) data simultaneously. The system consists of two parts: hardware and software. The hardware includes an RFID reader, high-gain reader antenna and passive tag. The software includes a data display interface and a three-threads data collecting system that can get GPS, DMI and RFID data simultaneously. The read range of this system can reach up to 12m and locating resolution can be less than 5m. The life span of the whole system can be up to ten years. A new type of meander dipole tag is designed and each of the RFID tag's cost is less than 2 dollars. The field test also confirmed that the system is reliable and robust in practical highway application.

10:52-11:14 TuBT4.2
A Practical Intelligent Navigation System Based on Travel Speed Prediction, pp. 470-475
 Wang, Yang Univ. of Portsmouth
 Beullens, Patrick Univ. of Portsmouth
 Liu, Honghai Univ. of Portsmouth
 Brown, David Univ. of Portsmouth
 Thornton, Tim Smartcom Software
 Proud, Richard ComSine Limited

This paper presents a novel intelligent navigation system capable of delivering route optimisation and guidance based on travel speed reports supplied by on the road users. The approach integrates fuzzy speed prediction models with a dynamic route optimisation engine to generate routes minimising total expected travel time using predictions on future traffic conditions across a wide road network.

11:14-11:36 TuBT4.3
The Mobile Spatial DBMS for the Partial Map Air Update in the Navigation, pp. 476-481
 Kyoung Wook, Min Electronics and Telecommunications Res. Insititute
 Kyoung Hwan, An Electronics and Telecommunications Res. Insititute
 Ju Wan, Kim Electronics and Telecommunications Res. Insititute
 Sung Il, Jin Chungnam National Univ.

The service handling the map data in the mobile device including navigation, LBS, Telematics, and etc., becomes various. The size of map data which is stored and managed in the mobile device is growing and reaches in several Giga bytes. The conventional navigation system has used the read-only PSF (physical storage format) in order to enhance the performance of system by maximum in the mobile device which has limited resources. So though a little part of the map data is changed the whole data must be updated. In general, it takes several ten minutes to write the 2 Giga bytes map data to a flash memory of mobile device. Therefore, we have developed the mobile spatial DBMS to solve the problem which is that the partial map data couldn't be updated in the conventional navigation system. And we suggest the policy to guarantee the performance of the navigation system which is implemented using the spatial mobile DBMS and verify this by experiment. With our research results, it is possible to update the map data in real time via wireless telecommunication service (CDMA, Wibro and so on) in a mobile navigation system and we expect that the manipulating of the map data and various services in mobile device can be implemented in easy.

11:36-11:58 TuBT4.4

Safe Vehicle Navigation in Dynamic Urban Scenarios, pp. 482-489
 Macek, Kristijan Swiss Federal Inst. of Tech. Zurich
 Vasquez, Dizan ETHZ
 Fraichard, Thierry Inria Grenoble Rhône-Alpes
 Siegwart, Roland ETH Zurich

This paper describes the deliberative part of a navigation architecture designed for safe vehicle navigation in dynamic urban environments. It comprises two key modules working together in a hierarchical fashion: (a) the Route Planner whose purpose is to compute a valid itinerary towards the a given goal. An itinerary comprises a geometric path augmented with additional information based on the structure of the environment considered and traffic regulations, and (b) the Partial Motion Planner whose purpose is to ensure the proper following of the itinerary while dealing with the moving objects present in the environment (eg other vehicles, pedestrians). In the architecture proposed, a special attention is paid to the motion safety issue, ie the ability to avoid collisions. Different safety levels are explored and their operational conditions are explicitly spelled out (something which is usually not done).

TuBT5 Conference Room No.5
Electronic Payment Services (Regular Session)

10:30-10:52 TuBT5.1
Implementation of the ERI Standard and Evaluation of Applications with Several Low-Cost Technologies, pp. 490-494
 Jaume, Segura Garcia Univ. of Valencia
 Jordán Aldasoro, Juan G. Univ. of Valencia
 Miguel A., Jaén Univ. of Valencia
 Francisco R., Soriano Univ. of Valencia

The Electronic Registration and Identification (ERI) systems allow carrying out a remote, secure and univocal identification of a vehicle through electronic devices. This paper presents the implementation of the ERI standard (ISO 24534 & 24535) in an API to develop applications. The implementation took into account the different components of the system to build the architecture of the identification system. Several applications have been developed in order to test this API with several low-cost technologies (Wifi, Bluetooth and RFID).

10:52-11:14 TuBT5.2
Quantitative Measures for GPS Based Road User Charging, pp. 495-500
 Feng, Shaojun Imperial Coll. London
 Ochieng, Washington Imperial Coll. London
 North, Robin Imperial Coll. London

The objective of this paper is to derive quantitative measures for Road User Charging (RUC). Instead of using complicated sensors to measure pollutant emissions and driver behavior, this paper uses Location, Velocity, Acceleration and Time (LVAT) determined by most widely used GPS receivers together with supporting information to derive indirect quantitative indicators for emissions and driver behavior. Test results show that most of the factors relevant to RUC are highly correlated to LVAT. This should enable the implementation and operation of a simple and cost effective variable RUC scheme based on LVAT data derived from GPS measurements.

11:14-11:36 TuBT5.3
Automatic Vehicle Detection and Classification, pp. 501-505
 Ferreira, Pedro M. C. ISEL
 Marques, Gonçalo ISEL
 Jorge, Pedro ISEL
 Abrantes, Arnaldo ISEL
 Amador, António Brisa

This paper presents a proposal for an automatic vehicle detection and classification (AVDC) system. The proposed AVDC should classify vehicles accordingly to the Portuguese legislation (vehicle height over the first axel and number of axels), and should also support profile based classification. The AVDC should also fulfill the needs of the Portuguese motorway operator, Brisa. For the classification based on the profile we propose the use of Eigenprofiles, atechnique based on Principal Components Analysis. The system should also support multi-lane free flow for future

integration in this kind of environments.

11:36-11:58 TuBT5.4
A Comparative Study of Parking and Congestion Charge Policies Based on Transport Mode Choice Estimation, pp. 506-510
 Feng, Suwei Shanghai Univ. of Finance and Ec.
 Ye, Jingjing Shanghai Univ. of Finance and Ec.

With more steps striding towards the practice of market tools like parking charge and congestion charge policies, much attention has been paid to the pricing and policy performance. Based on the survey with willingness-to-pay measures to commuters in Shanghai, some estimation of binary Logit model has been carried out to reveal the common and special factors acting on mode choice. Two Scenarios 'without' and 'with' charge policies are designed to reveal the difference between all informants and commuters with car-ownership, and further to find out special explaining variables to different policies. The analysis shows that the transfer of congestion charge from car users to their units is one of the hardest obstacles to mode change when implementing the congestion charge policy in China's cities.

TuCT1 Conference Room No.1
Simulation and Modeling 3 (Regular Session)

13:30-13:52 TuCT1.1
An Asymmetric Intelligent Model for Public Transportation Networks, pp. 511-516
 Ehsanfar, Abbas Sharif Univ. of Tech.
 Farzinfard, Sina Sharif Univ. of Tech.
 Isaai, Mohammad Taghi SHARIF Univ. OF Tech.

This paper proposes an asymmetric model for urban public transportation networks. Predictive techniques are being developed, to allow advanced modeling and comparison with historical baseline data. The current trend is toward fewer costly microprocessor modules with hardware memory management and Real-Time Operating Systems. This model is formulated as a linear programming problem using LP-solvers and is developed and simulated for a large metropolitan area of Tehran, Iran. The mathematical procedure as its quantitative results is presented.

13:52-14:14 TuCT1.2
Multi-Agent Platform for Solving the Dynamic Vehicle Routing Problem, pp. 517-522
 Barbucha, Dariusz Gdynia Maritime Univ.
 Jedrzejowicz, Piotr Gdynia Maritime Univ.

Dynamic transportation is a broad domain which includes problems from transportation area where information on the problem is revealed to the decision maker concurrently with the determination of the solution. Among the most important problems belonging to this domain are on-line vehicle routing problems, which involve dynamic decision making with respect to vehicle routing in response to the flow of customer demands. The goal of such routing is to provide the required transportation and at the same time minimize service cost subject to various constraints including vehicle and fleet capacities. The paper proposes the multi-agent platform which supports solving the dynamic vehicle routing problem through simulating activities of the transportation company.

14:14-14:36 TuCT1.3
High Order Sliding Mode Observer to Estimate Vertical Forces: Experimental Results, pp. 523-527
 Imine, Hocine Lab. Central des Ponts et
 Chaussées
 Madani, Tarek, Tarek Versailles Univ.
 Srairi Salim, Salim LCPC

In this paper, an experimental validation of vertical forces estimation is presented. An original method using High Order Sliding Mode Observer is developed. The test bench is a static vehicle excited vertically by hydraulic jack. It's equipped by different sensors in order to measure its dynamics. Real time tests are done and results are presented in this paper.

14:36-14:58 TuCT1.4
EVAQ: A New Analytical Model for Voluntary and Mandatory

Evacuation Strategies on Time-Varying Networks, pp. 528-533
 Pel, Adam Delft Univ. of Tech.
 Bliemer, Michiel Delft Univ. of Tech.
 Hoogendoorn, Serge Delft Univ. of Tech.

The analytical evacuation network model EVAQ enables forecasting traffic flow conditions on a road network for a wide range of emergency situations, such as hurricanes, bushfires and floods. The proposed model is innovative as it combines voluntary evacuation, with possible pre-trip and en-route decisions, and mandatory evacuation, with prescribed destinations, routes and departure times, within a single generic model framework. Furthermore, we introduce dynamic road infrastructure, in which characteristics such as speed limits, capacity and flow direction can be time-varying due to the hazard's progress in space and time and prevailing traffic regulations and control measures. The evacuation model can function as a decision support system for regional authorities and emergency services supervising an evacuation or constructing an evacuation strategy for planning purposes.

TuCT2 Conference Room No.2
Vision: Surveillance 3 (Regular Session)

13:30-13:52 TuCT2.1
Real-Time Vehicle Classification Using a Smart Embedded Device with a 'Silicon Retina' Optical Sensor, pp. 534-538
 Litzenberger, Martin Austrian Res. Centers GmbH -
 ARC
 Donath, Nikolaus Austrian Res. Centers GmbH -
 ARC
 Gritsch, Gerhard Austrian Res. Centers GmbH -
 ARC
 Kohn, Bernhard Austrian Res. Centers GmbH -
 ARC

We present a sensor system for traffic data acquisition capable of discerning vehicles into two classes (cars and trucks). The system is based on a bio-inspired 'silicon retina' optical sensor in a compact embedded system and has been exhaustively evaluated in a real world environment at a two lane highway test site. We further present the classification approach, data from the evaluation of the system under different lighting conditions and analyze sources of classification errors. The System achieves a 94.4% classification rate for cars and 92.2% classification rate for trucks under daylight conditions.

13:52-14:14 TuCT2.2
MCMC Particle Filter for Real-Time Visual Tracking of Vehicles, pp. 539-544
 Bardet, Francois Univ. Blaise-Pascal
 Chateau Thierry, Chateau Univ. of Clermont-Ferrand

This paper addresses real-time automatic tracking and labeling of a variable number of vehicles, using one or more still cameras. The multi-vehicle configuration is tracked through a Markov Chain Monte-Carlo Particle Filter (MCMC PF) method. We show that integrating a simple vehicle kinematic model within this tracker allows to estimate the trajectories of a set of vehicles, with a moderate number of particles, allowing frame-rate computation. This paper also addresses vehicle tracking involving occlusions, deep scale and appearance changes: we propose a global observation function allowing to fairly track far vehicles as well as close vehicles. Experiment results are shown and discussed on multiple vehicle tracking sequences. Though now only tracking light vehicles, the ultimate goal of this research is to track and classify all classes of road users, also including trucks, cycles and pedestrians, in order to analyze road users interactions.

14:14-14:36 TuCT2.3
An Effective and Robust Pedestrians Detecting Algorithm, pp. 545-549
 Li, Zhi-peng Tongji Univ.
 Sun, Yun Tongji Univ.
 Liu, Fuqiang Tongji Univ.
 Shi, Wenhuan Shanghai Jiao Tong Univ.

In this paper, we present a pedestrian detection approach using

spatial histograms of oriented gradients feature. As spatial histograms of oriented gradients consist of marginal distributions of an image over local and global patches, they can preserve shape and contour of a pedestrian simultaneously. There are two main contributions in this paper. First of all, we expand the histograms of oriented gradients features from single-size to variable-size which can capture local and global feature of pedestrian automatically. We call these feature as the "spatial histograms of oriented gradients". Secondly, we employ histogram similarity and Fisher criterion to measure discriminability of features and select some discriminative features to identify the pedestrian. SVM classifier is constructed to train the selected features from target and surrounding background. The proposed algorithm is tested on some public database. Experimental results show that the proposed approach is efficient and rapid in pedestrian detection.

14:36-14:58 TuCT2.4
Real-Time Detection of Abnormal Vehicle Events with Multi-Feature Over Highway Surveillance Video, pp. 550-556

Sheng, Hao	Beihang Univ.
Li, Chao	Beihang Univ.
Wei, Qi	Beihang Univ.
Xiong, Zhang	Beihang Univ.

This paper introduces a framework of real-time abnormal vehicle event detection with multi-feature over highway high-definition surveillance video. The framework is composed of two parts: multi-feature extraction and abnormality detection. In multi-feature extraction, a fast constrained Delaunay triangulation (CDT) algorithm based on constrained-edge priority is presented to instead of complicated segmentation algorithms. After calibrating manually to extract the actual driveways from surveillance video sequence, localizing vehicle regions and tracking via detection of vehicle regions to extract static features and motional features in monitor area, multi-feature vectors are created for each vehicle. In abnormality detection, a method of adaptive detection modeling of vehicle events (ADMVE) is introduced. A Semi-supervised Mixture of Gaussian Hidden Markov Model is trained with the multi-feature vectors for each video segment. The normal model is trained by supervised mode with manual labeling, and becomes more accurate via adaptation iteration. The abnormal models are trained through the adapted Bayesian learning with unsupervised mode. Finally, experiments using real video sequence are performed to verify the proposed method.

TuCT3 **Conference Room No.3**
Traveler Services Information (Regular Session)

13:30-13:52 TuCT3.1
Fuzzy Trip Distribution Models for Discretionary Trips, pp. 557-562

Shafahi, Yousef	Sharif Univ. of Tech.
Nourbakhsh, Seyed	Sharif Univ.
Mohammad	
Seyedabrishami, Seyedehsan	Sharif Univ. of Tech.

Trip distribution is considered as the second step in urban transportation planning. The important factors which affect trip distribution are the characteristics of origins and destinations and travel impedance between O/D. Trip distribution traditionally models with the deterministic variables although it seems affective variables in trip distribution modeling are based on human perceptions. Since perceptions of people vary from one person to another, thus variables are imprecise and vague. Fuzzy approaches are proper tools of modeling non-deterministic variables. In this paper we present fuzzy estimation models of trip distribution for discretionary trip purposes including: shopping, personal, and recreation trips. Trip distribution estimation models apply fuzzy rule base which is generated by application of two procedures including Wang and Mendel, and Wang. Fuzzy rule base will be enhanced by expert knowledge; therefore the fuzzy prediction model will be more accurate. In this article fuzzy rule base generated by Wang procedure is improved by expert knowledge. Real data obtained from comprehensive transportation study of Shiraz, a large city in Iran, is used to develop conventional gravity and fuzzy models. The results of case study show that fuzzy model can be improved in order to accurately predict

trip distribution regard to gravity model.

13:52-14:14 TuCT3.2
Portable Intelligent Traffic Management System for Work Zones and Incident Management Systems: Best Practice Review, pp. 563-568
 Fang, Fang Clara Univ. of Hartford

An intelligent portable traffic management system is an integrated system which consists of portable variable messages signs (PVMSs), vehicle detection systems (such as detectors, cameras and other surveillance equipment), a computer-based control center and communication systems. Based on detected traffic information, the system automatically determines messages to be displayed on the PVMSs and may also disseminate the information through highway advisory radios (HARs) and the internet. This study involved a comprehensive review of the application of various intelligent portable traffic management systems for use in work zones and incident management and speed management technologies for use in work zones; it also identified innovative technologies that have the potential to improve highway traffic operations. Interviews were conducted with representatives from departments of transportation (DOTs) in various states and private industry regarding their experience with and knowledge of work zone and incident management deployment initiatives and innovative technologies. A summary of various systems, including their features, deployments, and evaluation results, if any, has been included in this paper. Some guidelines are developed in this study for the effective application of automated portable traffic management systems in work zones and incident areas.

14:14-14:36 TuCT3.3
SmartParking: A Secure and Intelligent Parking System Using NOTICE, pp. 569-574

Yan, Gongjun	Old Dominion Univ.
Olariu, Stephan	Old Dominion Univ.
Weigle, Michele C.	Old Dominion Univ.
Abuelela, Mahmoud	old dominion Univ.

Parking is costly and limited in almost every major city in the world. Innovative parking systems for meeting near-term parking demand are needed. In this paper, we propose a novel, secure and intelligent parking system based on the concept and framework of NOTICE [WO07], a secure and privacy-aware architecture for the notification of traffic incidents. The proposed system, called SmartParking, is a service-oriented intelligent parking system through which drivers can view and reserve a parking spot on the fly. The parking process can then be a straightforward and non-stop process. More importantly, SmartParking is a secure and privacy-aware parking system. The proposed infrastructure prevents most security/privacy attacks. We address hardware/software architecture and implementations. The evaluation of this proposed system proves its efficiency.

14:36-14:58 TuCT3.4
Modeling and Design of Regional Traffic Dynamic Guidance Algorithm, pp. 575-580

Zhou, Shaolin	Zhejiang Univ. ,Hangzhou, China
Shi, Wei	Zhejiang Univ.
Tang, Zhi	Zhejiang Univ.
Wu, Jian	Zhejiang Univ.
Wu, Zhaohui	Zhejiang Univ.

In order to manifest high superiority and high efficiency of traffic guidance system, this paper analyzes the traffic guidance system by means of variable message signs, and studies dynamic regional guidance problems under the conditions of real-time traffic, and puts forward a regional traffic dynamic guidance algorithm. The algorithm balances traffic flow by partitioning traffic guidance regions dynamically and changing the turning ratio of vehicles at intersections in the guidance regions. In order to make analysis of the algorithm, this paper applies cellular automaton to simulate traffic environment on SWARM platform, and verify the effectiveness of the algorithm. The results of the simulation show that the overall average travel time of the induced dynamic modeling approach is reduced by 20% to 25% and the average waiting time is reduced by 4% to 10% compared to the use of the static regional guidance algorithm.

TuCT4 **Conference Room No.4**

Navigation, Guidance and Control 2 (Regular Session)

13:30-13:52 TuCT4.1
Mobility Index-Based Navigation for Mandatory Re-Routing Scenarios, pp. 581-586
 Zhu, Weihua Univ. of California-Riverside
 Boriboonsomsin, Kanok Univ. of California-Riverside
 Barth, Matthew Univ. of California-Riverside

Roadway navigation systems have become increasingly popular, providing efficient routing through a roadway network. In most cases, routes are selected by minimizing some cost function, such as time or distance. However, a shortest-duration or shortest-distance route may not always work well due to unexpected roadway infrastructure conditions (e.g., unscheduled road shutdown) or major traffic problems, in which drivers will need to change routes on the fly. We refer to this as mandatory re-routing. There are several possible scenarios when mandatory re-routing is necessary, such as: 1) a major incident (i.e., accident) occurs, shutting down the roadway; 2) unscheduled emergency maintenance of the infrastructure; or 3) severe weather conditions. In many metropolitan roadway networks, traffic conditions are often very unpredictable. When roadways quickly become severely congested, drivers normally want to change their routes because the pre-defined route may no longer be optimal, i.e. the shortest-duration route may not guarantee minimal travel time and shortest-distance route may result in intolerable travel time. Re-routing capability is useful, but often real-time traffic information is delayed or non-existent. For these scenarios, it may be desirable to take a pre-defined route that gives the driver the highest degree of freedom (i.e., the path with the most routing choices) while traveling. In this paper, we describe a new routing methodology that is based on maximizing

13:52-14:14 TuCT4.2
Predict Personal Continuous Route, pp. 587-592
 Ye, Qian Zhejiang Univ.
 Chen, Ling Zhejiang Univ.
 Chen, Gencai Zhejiang Univ.

In the daily life, people often repeat regular routes in certain periods. Predicting personal future routes using this information helps to achieve many goals, including improving the quality of Intelligent Transportation Systems (ITSs) and Location-Based Services (LBSs) for individuals. In this paper, a novel system is developed to predict the personal future routes based on the continuous route patterns extracted in advance. The proposed approach predicts a person's future route through the use of a probabilistic tree model built from his / her route patterns. The route patterns are extracted from personal history of movement using a new mining algorithm, Continuous Route Pattern Mining (CRPM), which based on PrefixSpan. Furthermore, the separated system architecture guarantees the safety of personal privacy while greatly reducing the computational load on mobile devices. An evaluation using a corpus of real routes from 17 persons demonstrates the effectiveness of the system. Using only a month recorded trips data, our system can get an average correct rate of about 74.3% in one step predicting. In route prediction, the average Levenshtein distance between the real trips and predicting results produced by our system is about 30% shorter than that produced by the basic Markov method.

14:14-14:36 TuCT4.3
Mining the Shortest Path within a Travel Time Constraint in Road Network Environments, pp. 593-598
 Lu, Hsueh-Chan National Cheng-Kung Univ.
 Lin, Chia-Ching National Cheng-Kung Univ.
 Tseng, Shin-Mu National Cheng Kung Univ.

In recent years, a number of studies have been done on GPS (Global Positioning System) due to the wide applications. One important research issue is on the GPS navigation. In this paper, we propose a novel data mining algorithm named PATE (Prediction-based Algorithm for Travel time Evaluation) that can efficiently predict the travel time of a navigation path and precisely recommends the navigation path to the users under a user-specified travel time constraint in road network environments. To our best knowledge, this is the first work on discovering the shortest navigation path within a travel time constraint. Furthermore, we propose a novel search

structure named NPST (Navigation Path Search Tree) for efficiently finding the shortest navigation path that meets the user-specified travel time constraint. Through a series of experiments, the proposed method was shown to have excellent performance under different system conditions.

14:36-14:58 TuCT4.4
A Voronoi-Based Hierarchical Graph Model of Road Network for Route Planning, pp. 599-604
 Li, Qingquan Wuhan Univ.
 Zeng, Zhe Wuhan Univ.

The road network is a key part of route planning, the core function module of GIS-T. The better organization of the road network is used, the higher performance of route planning can be achieved. This paper proposes a Voronoi-based hierarchical graph model of road network for route planning. It constructs the hierarchical graph based on hierarchical spatial reasoning and utilizes graph Voronoi diagram to associate adjacent levels in hierarchical graph of road network. Because of using graph Voronoi diagram, the hierarchical graph model can make the hierarchical searching process simpler and more efficient. The searching range is shrinked and the consume time is decreased in the hierarchical route planning.

TuCT5 Conference Room No.5
Man-Machine Interface and Behavior (Regular Session)

13:30-13:52 TuCT5.1
The Effects of Motor Impulsiveness and Optimism Bias on Risky Driving Behavior in Chinese Urban Areas, pp. 605-609
 Jiang, Li Chinese Acad. of sciences
 Li, Yongjuan Chinese Acad. of sciences
 Liu, Xueyuan Chinese Acad. of sciences

The present study investigated the influence of motor impulsiveness and optimism bias on self-reported risky driving behavior. Two components of risky driving behavior, angry driving and traffic violation for convenience were identified. Structural Equation Modeling results supported motor impulsiveness directly predicting angry driving and traffic violation for convenience, with optimism bias partially mediating the relationship between motor impulsiveness and angry driving. Traffic violation for convenience significantly was related to safety performance. Practical implications and safety interventions were discussed.

13:52-14:14 TuCT5.2
Effects of Intuitive Voice Interfaces on Driving and In-Vehicle Task Performance, pp. 610-615
 Zheng, Pengjun Univ. of Southampton

This paper reported results of an on-road evaluation study of three types of voice interfaces, the traditional voice system, and two intuitive voice systems with text prompts on a central display and on a cluster display respectively. The effects of voice interfaces were evaluated based on primary driving and secondary in-vehicle task performance. The in-vehicle performance was characterized by the mean task duration and mean error rates in performing in-vehicle operations. It was found that the mean task duration was the shortest in using the intuitive voice system with cluster display and drivers made more errors when using the traditional voice system relative to intuitive voice systems. The error rates were the lowest when using intuitive voice system with cluster display. The visual distraction effects were examined in terms of glance percentage to the windscreen (road ahead) and number of glances towards the central display and the cluster display. Reductions in glance percentage to the windscreen were observed when using intuitive voice interfaces, accompanied by increases in glance percentage to the prompt display. The primary driving performance in using the three voice-activation interfaces was not significantly affected compared with baseline car following only situation. It is concluded that intuitive voice interfaces are a viable enhancement to traditional voice interface whilst intuitive voice interface with cluster display has relative advantages of good tas

14:14-14:36 TuCT5.3
Description and Tests of a Multisensorial Driving Interface for Vehicle Teleoperation, pp. 616-621

Ortiz, Jesús	Fondazione Istituto Italiano di Tecnologia
Tapia Siles, Silvia Cecilia	Italian Inst. of Tech.
Rossi, Lorenzo	Fondazione Istituto Italiano di Tecnologia
Fontaine, Jean-Guy	Fondazione Istituto Italiano di Tecnologia
Maza, Mario	Univ. of Zaragoza

This paper describes the technology and systems developed for vehicle teleoperation using a multisensorial driving interface including visual and vestibular stimuli. Special attention has been paid to the increment of dexterousness resulted when teleoperation is performed from such multisensorial driving interface compared to classical ones.

This paper also presents the results of a series of tests carried out using a small Unmanned Ground Vehicle (UGV). This UGV was tested by a human operator remotely operating the UGVs in different ways: Having direct vision contact with the vehicle; and using the images captured by embarked cameras with and without using a motion base.

14:36-14:58 TuCT5.4
Analysis of Evolutionary Game about the Route Choice of Individual Travel Mode Based on Bounded Rationality, pp. 622-626

Liu, Jianmei	Inst. of Systems Engineering, Management School, Tianjin Univ.
Ma, Shoufeng	Tianjin Univ.

The paper presents several travel learning trajectories when all travelers are regarded as bounded rational. Firstly, it gives the adjustment process of travelers' route choice using the original mechanism of best-response dynamics under the assumption that all the travelers are of high learning ability. Secondly, the improved best-response dynamics from two aspects of strategy adjustment and difference among the travelers' rationality levels are proposed, which are applied to a small example following. Finally, a new algorithm is specified when the expense of routes are considered to be real-time, and the different results are analyzed detailedly under different mechanisms.

TuDT1	Conference Room No.1
Simulation and Modeling 4 (Regular Session)	

15:30-15:52 TuDT1.1
The Markov-Gap CA Model for Entering Gaps and Departure Headways at Signalized Intersections, pp. 627-632

Wang, Fa	Tsinghua Univ.
Ji, Yan	Tsinghua Univ.
Li, Li	Tsinghua Univ.
Hu, Jianming	Tsinghua Univ.

Modeling gaps/headways has many applications in traffic theory and transportation operations. Recently, many researchers begin to show interests in microscopic simulation based interpretations on the formulation of gap and headway distributions. However, there are few Cellular Automata (CA) model proposed in this area, since most current CA models focus on phase transitions of freeway traffic only. In this paper, a so called Markov-Gap CA models is proposed, aiming on fitting the empirical gap/headway distributions collected. The model treats gap variations between consecutive vehicles approaching or leaving signalized intersections as different Markov processes and provides a concise and uniform method to describe the observed traffic flow phenomena. The agreement between the simulation results and empirical data suggests the soundness of the Markov-Gap CA model.

15:52-16:14 TuDT1.2
A CA Model for Intrusion Conflicts Simulation in Vehicles-Bicycles Laminar Traffic Flow, pp. 633-638

Cheng, Sihao	Univ.
Yao, Danya	Univ.
Zhang, Yi	Tsinghua Univ.
Su, Yuelong	Univ.
Xu, Wenda	Tsinghua Univ.

Along with the economic developments, bicycle traffic amount has

gradually decreased during the last decade in China; the intense competition of drivers and bicyclists for right of way brings significant trouble to city traffic. Based on the previous studies, this paper studies the driving and riding behaviors during intrusion conflicts in vehicles-bicycles laminar flow, which means that some bicyclists will intrude the lanes reserved for vehicles from time to time. A cellular automata model is proposed to examine the temporal-spatial dynamics of vehicle traffic flow rate which has not been emphasized in the previous studies.

16:14-16:36 TuDT1.3
A Lane-Group Based Macroscopic Model for Signalized Intersections Account for Shared Lanes and Blockages, pp. 639-644

Liu, Yue	Univ. of Maryland at Coll. Park
Chang, Gang-Len	UMD
Yu, Jie	Univ. of Maryland
Hou, Yuanyuan	Univ. of Maryland at Coll. Park
Rahwanji, Saed	Maryland State Highway Administration

This paper presents a macroscopic model of traffic able to replicate the key features occurring at signalized intersections. Different from the previous link or movement based traffic flow models, the proposed model considers explicitly queue accumulation and dissipation at the lane-group level, in order to facilitate modeling the discharging process for shared lanes. In particular, the proposed model also accounts for the blocking effects between different lane groups due to intersection geometric constraints or improper signal settings, which offer potentials for it to be integrated with optimal control models. The performance of the proposed model applied to a real-world intersection under different demand levels appears to be computer-efficient and convincing when validated by a calibrated microscopic simulation program, VISSIM.

16:36-16:58 TuDT1.4
Real-Time Implementation of Simulation-Based Dynamic Traffic Assignment Model, pp. 645-650

Hu, Ta-Yin	National Cheng Kung Univ.
Chen, Li-Wen	National Cheng Kung Univ.

This research aims at developing a real-time simulation-based dynamic traffic model for mixed traffic flow conditions for ATMS/ATIS applications. The real-time model is implemented based on rolling horizon approach. The rolling horizon is advanced for each stage, thus real-time data can be incorporated within the framework. In order to predict normative as well as predictive information, a simulation-based DTA model is employed within each stage. Empirical data for freeways, including flows from toll stations and vehicle detectors, are used to validate the model in a real-time environment.

TuDT2	Conference Room No.2
Vision: Surveillance 4 (Regular Session)	

15:30-15:52 TuDT2.1
Speed and Acceleration Distributions at a Traffic Signal Analyzed from Microscopic Real and Simulated Data, pp. 651-656

Viti, Francesco	Delft Univ. of Tech. / Katholieke Univ.
Hoogendoorn, Serge	Delft Univ. of Tech.
Van Zuylen, H.J.	Delft Univ. of Tech.
Wilmink, Isabel	TNO
van Arem, Bart	Univ. of Twente

Modeling realistic driving behavior at signalized intersections is crucial for many applications, for instance to determine the traffic signal performance, to assess the effect of different control strategies, or to estimate traffic emissions. In these applications, often microscopic models are used to simulate the trajectory of each vehicle. Despite the possibility to model vehicles with great detail and at fractions of a second, speed, acceleration and deceleration characteristics are determined by parameters that are rarely calibrated using real data, and default parameters are often chosen. This is because collecting real vehicle trajectories near traffic signals is a challenging task. This paper presents a method to collect such dataset using image processing techniques. This methodology allows one to obtain vehicle trajectories near a signal control, and to

measure individual vehicles speeds and accelerations at a microscopic level. We focus on the analysis the empirical distributions of speeds and accelerations observed with this unique dataset near and up to a few meters upstream of the stop-sign. We compared these distributions with the results of repeated simulations of two microscopic software programs, using default parameters. Some inconsistencies were found with this comparison, which suggests that the two analyzed microscopic simulation programs run with default parameters do not provide realistic results for this type of road sections.

15:52-16:14 TuDT2.2
A Generic Temporal Integration Approach for Enhancing Feature-Based Road-Detection Systems, pp. 657-663
 Michalke, Thomas Darmstadt Univ. of Tech.
 Kastner, Robert TU Darmstadt
 Fritsch, Jannik Honda Res. Inst. Europe GmbH
 Goerick, Christian Honda Res. Inst. Europe GmbH

Visual feature-based approaches for detecting the drivable area on unmarked streets and roads were introduced in recent years. Although the accumulated results are promising, the detected street segments often contain holes and show a detection performance that strongly varies in time depending on environmental conditions. This paper presents a real-time capable approach for improving the road detection results for this type of state-of-the-art systems by adding a generic postprocessing step. Our proposed architecture removes the drawbacks of said systems using a temporal integration approach based on the bird's eye view. In order to test the proposed approach, one typical visual feature-based road detection system was implemented. Still, the used road detection system can be exchanged with any other state-of-the-art system. Evaluation results computed on inner-city data show that this approach is an important enhancement for all visual feature-based road-detection systems. One of the used streams and corresponding ground truth data is accessible on the internet for benchmark testing. The proposed approach is a crucial step toward robust road detection in complex scenarios that allows building high-level applications, as, e.g., active collision avoidance or trajectory planning, based on vision as the major cue.

16:14-16:36 TuDT2.3
Real-Time Monitoring of People Flows and Indoor Temperature Distribution for Advanced Air-Conditioning Control, pp. 664-668
 Katabira, Kyoichiro Univ. of Tokyo
 Zhao, Huijing Peking Univ.
 Shibasaki, Ryosuke Univ. of Tokyo

This paper proposes an advanced air-conditioning control system by using multiple laser range scanners and wireless sensor network technologies. In public space such as railway station or exhibition hall, more economical air-conditioning system has been desired because the population density changes continuously and the surrounding temperature is also not constant. Our proposed system aims to ventilate for only where and when the cool/warm wind is necessary, that is the pedestrians' flows close up and the temperature is not sufficient. In order to track crowds flows, multiple laser range scanners are exploited, and networked temperature sensors are deployed in the target space for temperature monitoring. The obtained temperature distribution is integrated to the results of people tracking on the real-time basis, and we simulate the wind direction from air-conditioner. In order to verify our system's effectivity, we conducted an experiment at Japan railway station. Finally, we conclude the number of pedestrians who receive the wind from the air-conditioner increases with 44% and the average time increases with 20%.

16:36-16:58 TuDT2.4
A Fuzzy-Logic Classifier for Estimating the Reliability of the Self Calibration of an Embedded Stereovision System, pp. 669-674
 Kramm, Sebastien INSA Rouen
 Miche, Pierre ROUEN Univ.
 Bensrhair, Abdelaziz INSA de Rouen

Estimation of epipolar geometry can be done automatically in on-board stereovision systems, using interest points that are detected and matched. However, image disturbance that can happen in real-

life situations can considerably lower the performance. A reliability score computing method is proposed, based on a fuzzy logic classifier. Its input is the data extracted from the estimation process. The classifier is trained with artificial image disturbance, using a set of typical image pairs. Results show that the computed score is indeed related with estimation performance.

TuDT3 Conference Room No.3
Rail ITS (Regular Session)

15:30-15:52 TuDT3.1
Closed Form Expressions of Optimal Buffer Times between Scheduled Trains at Railway Bottlenecks, pp. 675-680
 Yuan, Jianxin Delft Univ. of Tech.
 Hansen, Ingo A. Delft Univ.

This paper presents an analytical approach for optimally allocating the buffer times between scheduled trains at railway bottlenecks based on a recently developed probabilistic delay propagation model. The design of the buffer times between consecutive trains in a timetable period is improved by minimizing the sum of weighted knock-on delays of the trains. Closed form expressions have been derived for the optimal buffer times by adopting a weighted exponential distribution model for primary delays. An application example reveals that the derived expressions of the optimal buffer times can be used in the design of railway timetables by incorporating the impact of primary delays and priority of trains.

15:52-16:14 TuDT3.2
Decision Making Strategies for Intelligent Control System of Train Speed & Train Dispatch in Iran Railway, pp. 681-686
 Maryam, Jandaghian Railway Company of I.R. of Iran
 Setayeshi, Saeed Amirkabir Univ.
 Keymanesh, Mahmoud-Reza Railway Company of I.R. of Iran ,
 Iran Univ. of Science & T
 Amirkabir Univ.
 Arabalibeik, Hosein

As railway transportation is a monoblock system, smallest changes in a train movement cause many changes at timing program. Compensation of deviation from scheduling program in earliest time will cause optimal utilization from locomotive, wagon and line. Scheduling table contains information about arrival and dispatching and duration of stop time of each train in every station. It is assumed that scheduling table is accessible and goal is to proposing program that has more adaptation with scheduling table of train movement at any moment. Laws like maximum permissible speed of line or maximum permissible speed of train and amount of existence noise, produce limitation in proposed control strategy. Two fuzzy systems are proposed for designing this system. 1) Fuzzy controller about speed of train that proposes specific speed at any moment. This system causes uniformity control on train movement and efforts for compensating changes from scheduling table as soon as it possible. This controller can act as an automatic train driver for conducting transporter. 2) Fuzzy controller about controlling of dispatching trains that if fuzzy controller about speed of train could not compensate delay of train until arrive to next station, centralize fuzzy controller in station decides for dispatching. This system proposes program has more adaptability with scheduling table of train movement. It must decide which train will have the preference to occupy the distance between stations and which

16:14-16:36 TuDT3.3
Accident Risk Analysis and Model Applications of Railway Level Crossings, pp. 687-692
 Hu, Shou-Ren National Cheng Kung Univ.
 Wu, Kai-Han National Cheng Kung Univ.

In order to reduce property loss and casualties from level crossing accidents, it is crucial to develop effective accident prediction models that are capable of providing effective information of accident frequency and severity given a vector of covariates. In the present research, a set of statistical count and categorical data models are developed; they are not only able to evaluate accident frequency and severity but also capable of exploring the potential risk factors that are responsible for traffic accidents. Using the data set collected by the Ministry of Transportation and Communication (MOTC) in 1998, which consist of both historical accident data and railway level

crossing related data, the empirical study identifies a vector of factors that are significantly associated with accident frequency and/or severity. Finally, the developed accident frequency and severity models are also employed to provide the evaluation of black spots and countermeasure effects.

16:36-16:58 TuDT3.4
Application of Real-Time Precise Point Positioning and GIS for Rail Track Deformation Monitoring of the Qinghai-Tibet Railway, pp. 693-698

Gao, Rui	Wuhan Univ.
Meng, Xiaolin	The Univ. of Nottingham
Geng, Jianghui	The Univ. of Nottingham
Yu, Hai-sui	The Univ. of Nottingham
Xu, Lihua	Wuhan Univ.

The Qinghai-Tibet Railway is the highest railway in the world. The operational conditions of this railway are very harsh, such as occurrence of earthquake, potential melting of frozen soil, and severely cold and thin air. Real time monitoring the deformation of the railway system for maintaining safe operation has posed a big challenge. Extensive document review conducted by the authors reveals that the current monitoring systems do not include monitoring of the deformation of critical railway element - rail track. The authors propose in the paper a novel approach which could be implemented to conduct an automated, real time and cost-effective monitoring of whole rail track system. This new monitoring system consists of two sub-systems: a real-time rail track monitoring system with Precise Point Positioning (PPP), and the Geographical Information System (GIS) to support the development, analysis and visualization of real-time spatial and attribute data sets. Details about the system integration are also presented in the paper. The approach will have general significance to the monitoring of any large civil engineering infrastructures.

TuDT4 **Conference Room No.4**
Navigation, Guidance and Control 3 (Regular Session)

15:30-15:52 TuDT4.1
A Novel Method for Background Suppression in Millimeter-Wave Traffic Radar Sensor, pp. 699-704

Zhang, Hao	Shanghai Inst. of Microsystem and Information Tech. Ch
Yu, Wen	Shanghai Inst. of Microsystem and Information Tech. Ch
Sun, Xiaowei	Shanghai Inst. of Microsystem and Information Tech. Ch

The millimeter-wave traffic flow detection radars have been widely used in traffic information collection systems during these years in China. To improve the detection accuracy of the traffic radar sensor, background suppression is of great necessity and importance. In this paper, after analyzing the principles of the millimeter-wave traffic radar sensor and the properties of the echo power, we propose a novel method for background suppression. The proposed algorithm is on the basis of order statistics and coherent averaging. Moreover, we present the field test results in different road conditions, and additionally compare the algorithm with previous approaches. Consistency of the test results with the theory proves the feasibility of the proposed algorithm. And the capacity for background suppression of the traffic radar sensor has been noticeably improved.

15:52-16:14 TuDT4.2
Low Level Control in a Modular System Architecture for Realizing Precise Driving Maneuvers of the Autonomous Vehicle Caroline, pp. 705-710

Wille, Joern Marten	Tech. Univ. Braunschweig
Form, Thomas	Tech. Univ. Braunschweig

Autonomous transportation on public roads has been demonstrated on German Highways since the early nineties. So far, there are few approaches to extend activities to urban scenarios. The 2007 DARPA Urban Challenge afforded the opportunity to demonstrate the abilities of the Technische Universität Braunschweig to develop the autonomous vehicle Caroline and to show its capabilities in urban like environments. Among 11 teams from the initial 89, team CarOLO mastered the challenges to qualify for the final DARPA Urban

Challenge event. This paper describes the overall concept implemented in the field of autonomous vehicle guidance of team CarOLO for the DARPA Urban Challenge 2007. Compared to autonomous driving on highways, an urban environment requires an efficient and flexible interface to realize precise driving maneuvers. The approaches taken to handle complex maneuvers as well as the control structure of the system is shown, which was developed at the Institute of Control Engineering.

16:14-16:36 TuDT4.3
Making an Enhanced Map for Lane Location Based Services, pp. 711-716

Betaille, David	LCPC
Toledo-Moreo, Rafael	Univ. of Murcia
Jean, Laneurit	LASMEA

Latest investigations show the benefits of fusing map information with GNSS (Global Navigation Satellite System) and dead-reckoning measurements for road vehicle navigation. However, to achieve success enhanced maps (Emaps) that take into account this new capability must be developed. In this paper, we present a method to create an Emap that includes road shape information, capable to serve as an input of a combined Fusion/Map-Matching algorithm. Details of the processes of road segments extraction and connection are given in the text. The analysis of the results obtained using the proposed method and future guidelines conclude the paper.

16:36-16:58 TuDT4.4
A Fast Integer Ambiguity Repair Method for the Land Vehicle Attitude Determination Using GPS, pp. 717-722

Wang, Bo	Beijing Inst. of Tech.
Miao, Lingjuan	Beijing Inst. of Tech.
Wang, Shunting	Beijing Inst. of Tech.
Shen, Jun	Beijing Inst. of Tech.

The integer ambiguity needs re-computation when cycle slips occur in the carrier phase signal during attitude determination using global positioning system (GPS). This paper presents a new method for fast integer ambiguity repair for land vehicle application. The velocity vector is utilized to obtain the baseline vector when cycle slips occur. And then observation equations are solved with the obtained baseline vector for the float ambiguity solution which can be used as a constraint condition to accelerate the integer ambiguity search procedure at next epochs. Experimental results demonstrate that the proposed method gives a fast approach to obtain new fixed ambiguities while the regular method takes longer time and sometimes results in incorrect solutions.

TuDT5 **Conference Room No.5**
Public Transportation Management (Regular Session)

15:30-15:52 TuDT5.1
NimbleTransit: Public Transportation Transit Planning Using Semantic Service Composition Schemes, pp. 723-728

Chen, Kuong-Ho	Feng Chia Univ.
Dow, Chyi-Ren	Feng Chia Univ.
Guan, Sheng-Jie	Feng Chia Univ.

Advanced Traveler Information Systems (ATIS) aim at collecting and disseminating helpful information to travelers. Among them there are systems providing public transit information as well as path planning services, called Advanced Public Transportation Systems (APTS). However, most modern APTSs maintained their own individual transportation service information in a non-sharable fashion, thus planning paths for large scope is difficult since there is no information exchanging methods for existing APTS. In addition, existing researches usually employ shortest path algorithms, and did not take advantages of other semantic information such as geographic locations, service information, etc., thus usually are not scalable well for large scope trip planning. This work proposes a Semantic-based APTS framework for transit planning, where Semantic Web-based service interfaces are specified for information exchanging, making it possible to integrate and organize heterogeneous data from various APTS and transportation enterprises. In addition, a semantic-based trip-planning scheme is designed to be used in NimbleTransit, where service information is aggregated in advance using semantic knowledge. Semantic service composition is then used to construct

the path. A system prototype is implemented, and the results showed that the proposed scheme is indeed more effective and scalable than existing schemes.

15:52-16:14 TuDT5.2
An Approach of Transit Passive Priority with Transit Phase Overlapped at Intersection of Arterial Signal Progression, pp. 729-733

Li, Feng	JiLin Univ.
Wang, Dian-Hai	Jilin Univ.
Wang, Jian	Jilin Univ.
Jin, Sheng	Jilin Univ.

Previous experience has shown that transit responsive signal control has ability to reduce delay of buses in urban areas when compared to traditional fixed-time control at arterial signal progression. However, most of these experiences have focused primarily on the impact on buses or delay per person. This paper describes development and evaluation of Transit Passive Priority with Transit Phase Overlapped (TPPTPO) that explicitly considers impacts of private automobiles. This signal control method is unique in two ways. First, this method explicitly considers the interference caused to the general traffic by transit vehicles waiting for the right of priority. Second, when this method overlaps transit phase to automobiles phase at a certain point, the signal timing of transit phase and split-flash phase that might have potential treatment on automobiles are explicitly quantified to ensure safety of intersection and keep cycle the same. Evaluation of its performance with VISSIM and the calculations of priority control parameters have been conducted and will appear in the literature in the near future.

16:14-16:36 TuDT5.3
A BRT Network Route Design Model, pp. 734-741
 An, Jian Tongji Univ.

In this research, a hyper graph of multi-modal urban transit network is developed to describe the architecture of urban transit system; the cost functions of travel strategies is promoted based on the analysis of passengers' strategy-choosing preference, taking travel time reliability, waiting times, seat expectation and a variety of unexpected delay into account. A set of bi-level programming models are proposed for the purpose of finding a feasible solution for BRT network design problem, aiming at diverse performance indexes. A hybrid heuristic algorithm, particle swarm optimization, is employed to solve the models. Finally, a numerical example is presented to verify one of the models proposed and the algorithm designed, in which the algorithms for the lower-level model and those for the upper-level model are compared for performance and searching efficiency, respectively. Conclusions and recommendations are presented based on the analysis of the comparison.

16:36-16:58 TuDT5.4
Estimating Pedestrian Movement Characteristics for Crowd Control at Public Transport Facilities, pp. 742-747

Seer, Stefan	arsenal Res.
Bauer, Dietmar	arsenal Res.
Brändle, Norbert	arsenal Res.
Ray, Markus	arsenal Res.

Capacities of doors, staircases and other bottlenecks are a key aspect in the design of infrastructures for public transport. Especially major events like soccer games and concerts may lead to large crowds which need to be accommodated, while at the same time potential safety hazards like overcrowding must be avoided. The bottleneck capacities limit the capacities of the whole system and control the potential of high crowd densities on critical elements such as the platforms. We present an approach to estimate the maximum and effective capacity of key bottleneck elements based on controlled experiments and real world data sets of pedestrian movements for a subway station next to the main soccer stadium in Vienna. The focus is the fundamental diagram revealing both the maximal capacity as well as the effective capacity in terms of pedestrian flow rates. We present two controlled experiments and results based on real world data obtained during the European Soccer Championship (UEFA EURO 2008™).

Wednesday, October 13, 2008

WeAT1 **Conference Room No.1**
Statistical Modeling (Regular Session)

08:30-08:52 WeAT1.1
The Use of Telematics to Monitor Traffic in Urban Areas: Theory and Applications, pp. 748-753

Geroliminis, Nikolas	Univ. of Minnesota
Kuwahara, Masao	Univ. of Tokyo

To alleviate urban congestion, macroscopic feedback control strategies have recently introduced which rely on real-time observation of relevant spatially aggregated measures of traffic performance. Ample monitoring of the system is necessary for those strategies to be successfully implemented. An efficient and practical methodology is developed to estimate the fraction of vehicles in a city that should be tracked. A filter to identify passenger-carrying taxis based on GPS data is described. An application in a real city and comparison with detector data show that the average speed can be predicted quite accurately.

08:52-09:14 WeAT1.2
Traffic Flow Characteristic Based on a Phase Plane Approach, pp. 754-759

Hsu, Chih-Ming	National Taiwan Univ.
Lian, Feng-Li	National Taiwan Univ.

This paper proposes a phase-plane approach for analyzing the interpretation of various traffic flow characteristics. Using the phase-plane analysis, the dynamical switching behaviors of traffic flow can be easily studied. By analyzing the mathematical models of traffic flow transition, the dynamical behaviors can be characterized within the phase plane. Furthermore, five types of traffic flow patterns are identified based on a real traffic dataset from Taiwan highway systems. Each traffic flow pattern can indicate a different interpretation of a special dynamical traffic behavior. A critical discussion of switching conditions for five types of flow patterns is also presented.

09:14-09:36 WeAT1.3
HMM Based Segmentation of Continuous Eddy Current Sensor Signals, pp. 760-765

Hensel, Stefan	Univ. of Karlsruhe
Hasberg, Carsten	Univ. of Karlsruhe

An exact train localization is essential for effective disposition and design of modern train operating systems, allowing a better use of the given infrastructure. In this paper we propose to use turnouts on rail tracks as absolute landmarks and re-calibration points for onboard location systems. The measurements base on an eddy current sensor system, additionally providing speed information through correlating inhomogeneities along the rail track. This paper presents a hidden Markov model approach that offers a robust detection and separation of turnouts. The proposed algorithm makes it possible to process whole train stations continuously, to perform a first low-level classification and to separate close events that can be accurately cut out of the signal, which is a basis for an advanced classification.

09:36-09:58 WeAT1.4
Influence of In-Vehicle Real-Time Traffic Safety Warning Information on Driving Stability at Limited Signal Visibility Approaches: Use of an Ordered Probit Model, pp. 766-771

Kim, Wonchul	Hiroshima Univ.
Zhang, Junyi	Hiroshima Univ.
Fujiwara, Akimasa	Hiroshima Univ.
Chikaraishi, Makoto	Hiroshima Univ.

Some laboratory experiments based on driving simulators have been reported that provision of traffic safety warning at signalized intersection approaches can result in safer driving behavior. To see the influence of the in-vehicle real-time traffic safety warning information on driving stability at signalized intersection approach, a field driving experiment was implemented in Hiroshima City, Japan. This paper presents an ordered probit model to analyze those impacts, and discusses the results of elasticity analysis for relative

importance and sensitivity analysis for the probability change in driving stability risk.

WeAT2 **Conference Room No.2**
Imaging and Image Analysis (Regular Session)

08:30-08:52 WeAT2.1
Content-Based Auto Exposure Control for On-Board CMOS Camera, pp. 772-777

Pan, Shengdong National Univ. of Defense Tech.
 An, Xiangjing National Univ. of Defense Tech.

With the development of the Active Safety Technology on Automobile, more and more applications need the on-board camera to get the information of the road. In this paper we propose a new approach to auto exposure control bases on the content of the scene for on-board CMOS cameras. Traditional mean value based auto exposure algorithms are widely used for better visual quality. However, in automobile application concerned active safety technology, better image quality does not always mean better visual quality. Such applications include lane detection, vehicle detection and pedestrian detection. Thus we use a triple-slope CMOS camera to realize the content-based algorithm aiming at such a problem. Our approach finds out the lane markings in a pre-defined window of interest in the image, and then estimates the variables to feature the triple-slope response of the camera. Experiments show that the algorithm has a robust performance, and is able to adapt to the rapidly changing luminance of the environment and achieve an acceptable image in one or two frames.

08:52-09:14 WeAT2.2
Vehicle Detection Based on the Stereo Concept of (axis, Width, Disparity) Symmetry Map, pp. 778-783

Li, Yaqian INSA de Rouen
 Toulminet, Gwenaëlle INRIA Paris - Rocquencourt
 Bensrhair, Abdelaziz INSA de Rouen

In this paper, we introduced the concept of (axis,width,disparity) symmetry map. It is a stereo extension of the monocular concept of (axis,width) symmetry map. In its principle, this concept can be used for the detection of any symmetric obstacle provided that its approximate width and height are known. In this paper, we used it for vehicle detection. As the presence or absence of road features, and hilly or plan road do not perturb the process, the proposed method is an alternative to v-disparity approach.

09:14-09:36 WeAT2.3
An Enhanced Background Estimation Algorithm for Vehicle Detection in Urban Traffic Video, pp. 784-790

Vargas, Manuel Univ. of Seville
 Toral-Marín, Sergio Univ. of Seville
 Barrero, Federico Univ. of Seville
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Abstract—This paper proposes an enhanced version of the sigma delta background estimation method, suitable for urban traffic scenes. In the original algorithm, the background model quickly degrades in such complex scenes, being easily contaminated by slow moving or temporarily stopped vehicles. Some heuristics have been added to the basic algorithm in order to make a selective background model updating at the pixel level. Experimental tests made over typical urban traffic streams prove the validity of the proposed enhanced version.

09:36-09:58 WeAT2.4
Localization of Objects in Automotive Scenes with Spatial and Temporal Information, pp. 791-796

Legrand, Capucine PSA Peugeot citroen
 Fremont, Vincent Univ. de Tech. de Compiègne
 Large, Frederic PSA Peugeot Citroen

In the context of automotive driving assistance, this paper describes a generic (i.e. applicable to both vehicle interior and exterior scenes) vision based approach for scene content analysis. It makes use of temporal and spatial information from a stereoscopic sequence of images to localize objects and estimate their position and motion. The proposed method is divided into three steps. First, image features are selected, tracked and reconstructed in the 3D world

space. Second, a clustering step is processed in the 5D space made of the positions and 2D motions parameters. The last step is devoted to clusters interpretation: it is out of the scope of the paper, however orientations are given to illustrate the capabilities of the proposed approach. The paper is organized as follows: first, the use of temporal and spatial information from a stereoscopic sequence is investigated. A state of the art of existing methods is presented. Then, a generic approach for object segmentation is proposed. Lastly, experimental results are presented.

WeAT3 **Conference Room No.3**
Cooperative Systems (Regular Session)

08:30-08:52 WeAT3.1
Denial of Service Attacks on Inter-Vehicle Communication Networks, pp. 797-802

Blum, Jeremy Pennsylvania State Univ.
 Neiswender, Andrew Pennsylvania State Univ.
 Eskandarian, Azim George Washington Univ. Virginia

Future safety systems will rely on the transmission of vehicle positions and kinematics through direct vehicle-to-vehicle wireless communication. The Wireless Access in Vehicular Environments (WAVE) standards, however, are vulnerable to Denial of Service (DoS) attacks which could significantly reduce the message delivery rate for these heart-beat messages. The WAVE standards were implemented in a simulation system in order to evaluate three different types of DoS attacks on these messages in a highway environment. These simulations show that the characteristics of the vehicular environments and heart-beat messages amplify the effect of these attacks, reducing the performance in the network in areas far from the attacking node. The amplification was due to the aggregate strength of the attacker's and legitimate node's signals. These combined signals reduced both the ability of nodes to receive messages clearly and the ability of nodes to detect that media is idle.

08:52-09:14 WeAT3.2
Cooperative Path Prediction in Vehicular Environments, pp. 803-808

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 Thomaidis, Georgios Inst. of Comm. and Comp. Syst.
 Amditis, Angelos Inst. of Communications and Computer Systems

The prediction of the future path of the ego vehicle and of other vehicles in the road environment is very important for safety applications, especially for collision avoidance systems. Today's available advanced driver assistance systems are mainly based on sensors that are installed in the vehicle. Due to the evolution of wireless networks the current trend is to exploit the cooperation among vehicles to enhance road safety. In this paper a cooperative path prediction algorithm is presented. This algorithm gathers position, velocity and yaw rate measurements from all vehicles in order to calculate the future paths. A specific care is taken for the manipulation of the latency of the wireless vehicular network. Also map data concerning the road geometry are used to enhance the estimation of path prediction. This work shows both the advances of using communications among road users and the corresponding challenges.

09:14-09:36 WeAT3.3
Comparative Synthesis of the 3 Main European Projects Dealing with Cooperative Systems (CVIS, SAFESPOT and COOPERS) and Description of COOPERS Demonstration Site 4, pp. 809-814

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 Bousuge, Jacques ASFA
 Laugeau, Claude Mines ParisTech

Today's motorways utilize innovative technologies to manage a real-time traffic information database which supplies users with information via FM 107.7 radio, variable message panels and the internet. In the future, information will be supplied directly to intelligent in-vehicle systems based on GPS technology. This data exchange will be a two-way process, with the vehicle sending information to the infrastructure, and even to other vehicles. Driver, vehicle and infrastructure will form an interactive triangle in which information exchange performs a key function. From this perspective ASFA members are participating to the CVIS, SAFESPOT and

COOPERS projects to use the data collecting on the infrastructure, including in-vehicle data, to provide better information on board the vehicle. In this paper, we propose a comparative synthesis of these 3 major European projects dealing with cooperative systems; we introduce the contribution of ASFA members for CVIS and SAFESPOT; a section is dedicated to their contribution for COOPERS. We also introduce the European strategy regarding Intelligent Transport Systems.

09:36-09:58 WeAT3.4
Novel Index for Objective Evaluation of Road Detection Algorithms, pp. 815-820

Alvarez, José M. Univ. Autonoma de Barcelona
 López, Antonio Univ. Autñoma de Barcelona

Road detection is a relevant task within vision-based systems devoted to assist the driver. Although they have been improved during the last decade, these algorithms are usually validated using qualitative results. Nonetheless, quantitative valuation is necessary either to enable the comparison between different algorithms or to achieve the optimal performance of a given one. In this paper we present a composite index to quantitatively assess the performance of road detection algorithms. The measure is based on a weighted combination of different evaluations which use a trade-off between precision and recall scores. Obtaining a single index score is a major benefit. It can be used to easily compare algorithms or to properly set their parameters. Moreover, innovatively our proposal includes a human perception criterion to improve its usefulness. Experiments on real-world data corroborate the usefulness of the proposed index.

WeAT4 Conference Room No.4
Traffic Control: Dynamic Speeds (Regular Session)

08:30-08:52 WeAT4.1
Dynamic Speed Limits and On-Ramp Metering for IVHS Using Model Predictive Control, pp. 821-826

Baskar, Lakshmi Dhevi Delft Univ. of Tech.
 De Schutter, Bart Delft Univ. of Tech.
 Hellendoorn, Hans Delft Univ. of Tech.

We consider traffic management and control approaches for Intelligent Vehicle Highway Systems (IVHS), which consist of interacting intelligent vehicles and intelligent roadside controllers. The vehicles are organized in platoons with short intraplatoon distances, and larger distances between platoons. All vehicles are assumed to be fully automated, i.e., throttle, braking, and steering commands are determined by an automated on-board controller. We consider both dynamic speed limit control for the platoons in the IVHS and access control at the on-ramps using ramp metering. We propose a model-based predictive control (MPC) approach to determine appropriate speed limits and release times at the on-ramps for the platoons. The proposed approach is also applied to a simple simulation example in which the aim is to minimize the total time all vehicles spend in the network by optimally assigning dynamic speed limits and on-ramp release times.

08:52-09:14 WeAT4.2
SPECIALIST: A Dynamic Speed Limit Control Algorithm Based on Shock Wave Theory, pp. 827-832

Hegyí, Andreas Delft Univ. of Tech.
 Hoogendoorn, Serge Delft Univ. of Tech.
 Schreuder, Marco Dutch Ministry of Transport, Public Works and Water Management
 Stoelhorst, Henk Dutch Ministry of Transport, Public Works and Water Management
 Viti, Francesco Delft Univ. of Tech. / Katholieke Univ.

In literature there are several approaches to eliminate shock waves on freeways by dynamic speed limits. Most of them incorporate control systems that have a high computational complexity or that contain parameters without direct physical interpretation, which may make the application in real life difficult. Here we present an approach called SPECIALIST that is based on shock wave theory, and that has parameters with clear physical meaning. The clear interpretation of the parameters leads to an intuitive and insightful formulation of the tuning guidelines. One of the most important

features related to the parameter tuning is that the stability of the traffic flow can be ensured by selecting a proper maximum density that is allowed to occur in the speed-controlled area. In addition, other parameters can be tuned for more robust behavior of the algorithm.

We first present the theory of shock wave resolution, and next we develop a practical control algorithm based on the theory. A unique feature of the algorithm is that it first judges the solvability of a shock wave and only starts controlling the speed limits if the shock wave is classified as solvable.

The algorithm is demonstrated with a simulation example, and it is shown that its performance is similar to existing approaches.

09:14-09:36 WeAT4.3
Safety Impacts of Variable Speed Limits – a Simulation Study, pp. 833-837

Piao, Jinan Univ. of Southampton
 McDonald, Mike Univ. of Southampton

Variable speed limits have great potential for smoothing traffic and increasing traffic safety. In this study, safety impacts of variable speed limits applications on motorways have been assessed by using microscopic simulation. The main factors considered include range of speed limits, penetration rates, and enforcement levels. The study results show that application of variable speed limits on motorways can significantly reduce speed differences between and within lanes and number of small headways, an indication of safety benefits to drivers. This is part of European COOPERS project which aims to develop cooperative vehicle-infrastructure systems for increasing road safety.

09:36-09:58 WeAT4.4
Flatness Based Control of Traffic Flow for Coordination of Ramp Metering and Variable Speed Limits, pp. 838-843

Kamel, Boumediene Univ. of Artois, France
 Benasser, Amar Univ. d'Artois - IUT de Béthune
 Jolly, Daniel Univ. d'Artois - Faculté des Sciences Appliquées

We apply in this article the concept of flatness control to coordinate variable speed and ramp metering in order to regulate the flow at the mainline section of the road. The same approach was applied in the case of traffic control to single section with on-ramp without combination with variable speed limits [1]. The basic idea is that speed limits can increase the (density) range in which ramp metering is useful [7], [9], [8]. We use LWR traffic flow model with the functions of supply and demand between the segments to take into account the back propagation of the traffic jams [11]. The purpose of the control task is to maximize the flow and minimizing the queue length at the on-ramp. We illustrate the flatness approach by comparing the cases 'ramp metering only' and 'coordinated ramp metering and speed limits' for a simple network.

WeAT5 Conference Room No.5
Vehicle Location Systems 1 (Regular Session)

08:30-08:52 WeAT5.1
A GPS/GIS Integrated System for Urban Traffic Flow Analysis, pp. 844-849

Shi, Wenhuan Shanghai Jiao Tong Univ.
 Kong, Qing-Jie Shanghai Jiao Tong Univ.
 Liu, Yuncai Shanghai Jiao Tong Univ.

In this paper, a GPS/GIS integrated system for urban traffic flow analysis is proposed. Urban GIS-T data are used to construct the GIS map of urban area when the system begins its work. Afterwards, real-time GPS data of probe vehicles are periodically collected to implement the location amendment. And then, location-amended GPS data are dynamically fitted with the adaptive traffic flow model. By using fitted traffic flow models, states of traffic flow are ultimately estimated along rolling time periods. Compared with conventional works, the proposed system successfully preserves the continuity of vehicle travels without additional data sources. Experiments based on GIS-T data of Shanghai and GPS signals of taxis in Shanghai indicate that the new system is both efficient and robust.

08:52-09:14 WeAT5.2
An Estimation-Based Automatic Vehicle Location System for Public Transport Vehicles, pp. 850-856
 Morenz, Tino Trinity Coll. Dublin
 Meier, René Trinity Coll. Dublin

Public transport vehicles often share a road network with other road users making their journeys susceptible to changing road conditions and especially to congestion. Travelers using such public transport increasingly depend on real-time information to plan their journeys. While such information can be provided by Automatic Vehicle Location (AVL) systems, AVLs depend heavily on large-scale deployment of designated sensory equipment, which may prevent their pervasive adoption. This paper presents a system for estimating vehicle location based on information generated by data sources typically integrated within existing ITS platforms. This enables location estimation for public transport vehicles without the need for deploying a designated sensor infrastructure in each vehicle, thereby reducing deployment and maintenance cost significantly. A prototypical vehicle location estimation system has been realized as part of and using data provided by the iTransIT ITS framework. Initial evaluation results show that such a system is feasible in a distributed manner and that estimated results are within 20% compared to empirical data.

09:14-09:36 WeAT5.3
Improved Filtering-Smoothing Algorithm for GPS Positioning, pp. 857-861
 Cao, Yi Shanghai Jiao Tong Univ.
 Mao, Xuchao Shanghai Jiao Tong Univ.

The well-known Unscented Kalman Filter (UKF) is suitable for nonlinear system while smoothing algorithm is widely used in postprocessing application to improve accuracy, but conventional filter is harassed with roundoff error due to processor's finite-wordlength in practice, this paper proposes to replace UKF with Square-Root UKF(SR-UKF), and incorporates it with two smoother, fixed-interval smoother and fixed-lag smoother, to form two filtering-smoothing algorithms for GPS positioning estimation. System model is addressed first, then SR-UKF and smoothers' implementations are described respectively, new algorithms' validity is evaluated through analyzing experiment results, future work is also discussed.

09:36-09:58 WeAT5.4
A Statistical Approach to Map Matching Using Road Network Geometry, Topology and Vehicular Motion Constraints, pp. 862-867
 Pink, Oliver Univ. of Karlsruhe
 Hummel, Britta Univ. of Karlsruhe

This paper presents a method for reliable matching of position and orientation measurements from a standard GPS receiver to a digital map. By incorporating road network topology in the matching process using a hidden Markov model, an optimum position and orientation history can be computed from a sequence of GPS measurements. Increased robustness is achieved by introducing constraints for vehicular motion in an extended Kalman filter and by reconstructing the original road network from the digital map using cubic spline interpolation. The proposed method delivers robust matching results for standard inner-city scenarios and gives a reliable estimate of the optimal position history even for severely disturbed GPS measurements.

WeBT1 Conference Room No.1
Traffic Theory for ITS 1 (Regular Session)

10:30-10:52 WeBT1.1
Phase Transition of Urban Freeway Traffic Flow, pp. 868-874
 Guan, Wei Beijing Jiaotong Univ. Beijing P.R.C
 He, Shuyan Beijing Jiaotong Univ.

At present, research on traffic flow theory has mainly focused on highway traffic, which is significantly different from urban freeway traffic. Traffic science is an "empirical science", and as such is it is based on empirical urban freeway traffic flow data. In this study, first four steady phases are identified in the flow-density plane of traffic flow: free flow, coherent-moving flow, synchronized flow and jam.

Then, three modes of phase transition, i.e. spontaneous transition, propagating transition (PT) and induced transition (IT) are analyzed, and the judgment conditions as well as computable methods of PT and IT are discussed in detail. Finally, based on actual data of the Beijing urban freeway, an empirical analysis of phase transition from coherent-moving flow to synchronized flow, which is the process of "smooth traffic" transferring to "congested traffic", is presented to validate the concepts and methods proposed in this paper.

10:52-11:14 WeBT1.2
Real Urban Traffic Flow Chaotic Phase Space Study, pp. 875-879
 Zhang, Lidong shandong computer science center
 Wang, Yinglong shandong computer science center
 Sun, Zhanquan Shandong Computer Science Center
 Pan, Jing Shan Shandong Computer Science Center

Phase space reconstruction is the base of chaotic traffic flow prediction. To determine objectively the embedding delay time t ; and embedding dimension m of real urban traffic flow time series chaotic phase space, we put forward a new kind of average calculation method. For delay time value, we first calculated its value of single day with auto-correlation and improved auto-correlation function, then we averaged seven days' values to degrade error. As to embedding dimension, we studied it with G-P algorithm and CAO algorithm respectively on base of data processing. Last, the method's feasibility was tested by analyzing the chaotic characteristics of Ji'nan city traffic flow and the reference parameters were offered.

11:14-11:36 WeBT1.3
Empirical Investigation on Phase Diagram at Urban Freeway with On-Ramp, pp. 880-887
 He, Shuyan Beijing Jiaotong Univ.
 Guan, Wei Beijing Jiaotong Univ. Beijing P.R.C

Bottlenecks at highway or urban freeway are one of origins of traffic congestion. Based on empirical investigation on field data of Beijing urban freeway, schematic phase diagram at on-ramp vicinity is developed and detailed phase transition processes are investigated. There are five phases in the phase diagram of on-ramp vicinity in connection with on-ramp flow and upstream flow, among which are two phases only observed in urban freeway traffic. It's also found that the empirical phase diagram developed in this paper is different from previous theoretical phase diagram of highway traffic. The boundaries of each phase are influenced by traffic demand at locations, such that empirical phase diagrams are vary in quantities at different locations. Moreover, according to investigation on empirical phase transition process, coherent moving flow, as a new phase observed in urban freeway flow in our previous work, is confirmed.

11:36-11:58 WeBT1.4
System Optimization Model for Traffic Network with ATIS, pp. 888-893
 Si, Bingfeng Beijing Jiaotong Univ.

In this paper, a bi-level programming model is presented to determine the optimal system performance for urban traffic network under the scenario that the drivers' parking and route choice behaviors with or without advanced transportation information system (ATIS) are considered. An extension of the successive average algorithm based sensitivity analysis method is proposed for solving the bi-level programming. Finally, a numerical example is used to illustrate the application of the proposed model and solution algorithm.

WeBT2 Conference Room No.2
Multi-Sensor Fusion 1 (Regular Session)

10:30-10:52 WeBT2.1
Sensor Fusion on an Embedded System for Traffic Data Analysis - ETRADA-V System, pp. 894-899
 Litzenberger, Martin Austrian Res. Centers GmbH - ARC

Glasl, Holger Kohn, Bernhard	ARC Seibersdorf Res. GmbH Austrian Res. Centers GmbH - ARC
Schalko, Bernhard Fernandez Dominguez, Gustavo	ASFİNAG Mautservice GMBH ARC Seibersdorf Res. GmbH

This paper describes an embedded system for traffic flow analysis based on fused traffic information coming from two different sensors. This can be used as test bed for traffic monitoring. Data is acquired by two sensor systems, Embedded Traffic Data Sensor (TDS) and a CCTV camera. Video data acquired by the CCTV camera is transmitted to an embedded hardware platform, where the image processing software runs in order to detect and track objects with the final goal of event detection and event prediction. The system is tested in a real scenario. Experimental results are presented considering the image processing analysis, i.e. object detection and object tracking, and statistical data inferred from previous analysis.

10:52-11:14 WeBT2.2
Improvement of the Proprioceptive-Sensors Based EKF and IMM Localization, pp. 900-905

Ndjeng Ndjeng, Alexandre	LPCP
Gruyer, Dominique	INRETS/LPCP
Glaser, Sébastien	LPCP

This paper presents the localization problem of outdoor vehicles using Interacting Multiple Model (IMM) and Extended Kalman Filter (EKF), in their predictive step without exteroceptive sensors data. Usually, hybridization operates between exteroceptive sensors (e.g. GNSS1) and proprioceptive sensors (e.g. Odometer, Inertial Measurement Unit etc.) through a merging algorithm. Common experiments use the GPS receiver PPS time for stamping the odometric, gyrometric and IMU measurements, after what all these sensors are in the same UTC reference time. Now it is well known that the low cost GNSS devices have a very low frequency compared to proprioceptive sensors, combined to a low accuracy. Therefore in order to assess the vehicle positioning at higher frequency for safety applications, the sensors measurements are generally synchronized before being exploited in the merging algorithm. In our approach, the sensors remain in their original frequencies. The objective is to design a reliable and robust system that exploits asynchronous data. In order to reach this goal it is important to guarantee accuracy and integrity of filters even during the predictive steps, when exteroceptive GNSS data are not available: that is proprioceptive-sensors based positioning. We introduce in this paper, a study on the influence of the road bank angle assessment on the output. This parameter is used to correct the gyrometric and inertial unit measurements leading to an improvement of both IMM and EKF

11:14-11:36 WeBT2.3
Multi-Sensor Fusion Method Using Bayesian Network for Precise Multi-Vehicle Localization, pp. 906-911

Smaili, Cherif	MAIA Team
E. El Najjar, Maan	MAIA Team
Charpillat, François	MAIA Team

The multi-sensor fusion approach for multi-vehicle localization presented in this paper is based on the use of Bayesian network in order to fuse measurements sensors. For each vehicle, a Bayesian network is implemented to fuse measurement of embedded sensors. For the train of vehicle localization, a global Bayesian network is implemented in which we have modelled vehicles interconnections. The leader vehicle is supposed to be equipped by especially accurate sensors. With this approach, one can see that the follower's geo-positions computing are quite improved in using the Leader vehicle path and followers relative positioning provide for each follower using a rangefinder. Real data sensors are used to validate and to test the proposed approach. Experimental results are presented to shown approach performance.

11:36-11:58 WeBT2.4
Research on Fuzzy Adaptive H_∞; Robust Filter for Integrated Navigation System, pp. 912-916

Liu, Jiang	Beijing Jiaotong Univ.
Wang, Jian	Beijing Jiaotong Univ.
Cai, Bogen	Beijing Jiaotong Univ. Beijing

This paper presents a novel integrated navigation algorithm based on the fuzzy adaptive H_∞; robust filter. By monitoring covariance between abstract and actual residual error, the definition of filtering performance factor is given. Based on the relationship between filtering performance factor, attenuation level and the parameter λ ; in H_∞; robust filter, a fuzzy inference system is designed to choose λ ; suitably and adaptively, so that there could be a balance between filtering accuracy and robustness performance accordingly. Analysis with practical train integrated navigation data validates the performance and practical value of the proposed algorithm.

WeBT3 **Conference Room No.3**
Advanced Safety Systems (Regular Session)

10:30-10:52 WeBT3.1

Driver-Independent Assessment of Arousal States from Video Sequences Based on the Classification of Eyeblick Patterns, pp. 917-924

Nopsuwanchai, Roongroj	Asahi Kasei Corp.
Noguchi, Yoshihiro	Asahi Kasei Corp.
Ohsuga, Mieko	Osaka Inst. of Tech.
Kamakura, Yoshiyuki	Osaka Inst. of Tech.
Inoue, Yumiko	Osaka Inst. of Tech.

In this paper, we propose a novel approach to assess driver's arousal states based on the analysis of eyeblink characteristics. We focus on a non-intrusive and driver-independent system. We use Hidden Markov Models (HMMs) to classify eyeblink patterns from the video of the drivers, and the arousal states are estimated from the histogram variations of these typical blink patterns. A strong correlation between the eyeblink patterns derived from this approach and those derived from the recorded EOG (electro-oculography) waveforms can be observed. The arousal assessment results are also verified against the rating results by a trained rater.

10:52-11:14 WeBT3.2

Driving Force Control Method to Perform Slip Control in Cooperation with the Front and Rear Wheels for Front-And-Rear Wheel-Independent-Drive-Type EVs (FRID EVs), pp. 925-930

Mutoh, Nobuyoshi	Graduate School, Tokyo Metropolitan Univ.
Tadahito, Saitoh	Graduate School, Tokyo Metropolitan Univ.
Yusuke, Sasaki	Graduate School, Tokyo Metropolitan Univ.

In this study, we have proposed a driving force (torque) control method that is suitable for front-and-rear-wheel independent-drive-type electric vehicles (FRID EVs). By using this method, it is possible to prevent slipping or spinning of the wheel, which can cause rear-end collisions on bad roads. The method achieves this by communicating information from a vehicle to the vehicle behind it. When the first vehicle performs wheel spin control, the resultant information is transmitted to the vehicle behind it. For this reason, each vehicle must have the capability to suppress wheel spin individually. In order to provide this wheel spin control, we propose a driving force control method, which allows us to control the slipping of a vehicle by distributing appropriate amounts of driving force between the front and rear wheels on the basis of the friction coefficient. This coefficient is estimated by considering data regarding the road conditions. We verified the effectiveness of the proposed driving control method for various low- μ ; roads by performing simulations.

11:14-11:36 WeBT3.3

Towards a Driver Model: Preliminary Study of Lane Change Behavior, pp. 931-937

Dogan, Ueruen	Ruhr-Univ. Bochum
Edelbrunner, Hannes	NISYS
Iossifidis, Ioannis	Ruhr-Univ. Bochum

The presented work formulates an framework in which early prediction of drivers lane change behavior is realized. We aim to build a representation of drivers lane change behavior in order to recognize and to predict driver's intentions as a first step towards a realistic driver model. In the test bed of the Institute of Neuroinformatik, based on the traffic simulator NISYS TRS 1, 10

individuals have driven in the experiments and they performed more than 150 lane change maneuvers. Lane-offset, distance to the front car and time to contact, were recorded. The acquired data was used to train – in parallel– a recurrent neural network, a feed forward neural network and a set of support vector machines. In the followed test drives the system was able of performing a lane change prediction time of 1.5 sec beforehand. The proposed approach describes a framework for lane-change detection and prediction, which will serve as a prerequisite for a successful driver model.

11:36-11:58 WeBT3.4
Design a Support Vector Machine-Based Intelligent System for Vehicle Driving Safety Warning, pp. 938-943

Lin, Che-Chung	Intelligent Mobility Tech. Div. Mechanical and Systems
Lin, Chi-Wei	Intelligent Mobility Tech. Div. Mechanical and Systems R
Huang, Dau-Chen	Intelligent Mobility Tech. Div. Mechanical and Systems
Chen, Yung-Hsin	Asia Univ. (also Industrial Tech. and Res.

This paper reports the advancement of a research extension. The outcome is a device installed in a long-haul bus for daily operation. The incumbent system features the combination of Lane Departure Warning (LDW) function and Forward Collision Warning (FCW) function employing the Support Vector Machine (SVM) as the classifier. LDW recognizes the environment as in daytime or in nighttime by detecting a vanishing point and applies the appropriate thresholds for daytime and nighttime to enhance the detecting rate. The algorithmic components of LDW function include image overlapping, median filter, edge-enhancement filter and Hough Transform, while the FCW function identifies vehicles with a feature-based approach and verifies the vehicle candidates by the appearance-based approach. In addition, we propose a new detecting scheme by motion vector (MV) estimation, where the detection doesn't rely on the whole image inside the region of interest (ROI) but on the detection range of three different ranges to concurrently secure high detecting rate and low computing power. Besides, as distance estimation is the crucial part of FCW function, we create an innovative camera calibration algorithm working with an adjustment mechanism to enhance the accuracy of the distance estimation. The combination of refined LDW and FCW functions has successfully implemented in ADI-BF561 600MHz dual core DSP-based embedded system.

WeBT4 **Conference Room No.4**
Traffic Control: Video (Regular Session)

10:30-10:52 WeBT4.1
Automatic Daytime Road Trajectory Control and Monitoring System, pp. 944-949

Fernández Alcantarilla, Pablo	Univ. of Alcalá
Sotelo Vázquez, Miguel Ángel	Univ. of Alcalá
Bergasa, Luis M.	Univ. of Alcalá

This paper presents an automatic road trajectory control and monitoring system for daytime sequences using a B&W camera. Important road trajectory information such as mean speed, dimension and vehicles counting are obtained using computer vision methods. Firstly, moving objects are extracted from the scene by means of a frame differencing algorithm and texture information based on grey scale intensity. However, shadows of moving objects belong also to the foreground. Shadows are removed from the foreground objects using top hat transformations and morphological operators. Finally, objects are tracked in a Kalman filtering process, and parameters such as position, dimensions, distance and speed of moving objects are measured. Then, according to these parameters moving objects are classified as vehicles (trucks or cars) or nuisance artifacts. For results visualization, a 3D model is projected onto vehicles in the image plane. Some experimental results using real outdoor sequences of images are shown. These results demonstrate the accuracy of the proposed system under daytime interurban trajectory conditions.

10:52-11:14 WeBT4.2

Video Based Traffic Congestion Prediction on an Embedded System, pp. 950-955

Glasl, Holger	ARC Seibersdorf Res. GmbH
Schreiber, David	Smart Systems Div. Austrian Res. Centers GmbH(ARC)
Viertl, Nikolaus	ARC Seibersdorf Res. GmbH
Veigl, Stephan	ARC Seibersdorf Res. GmbH
Fernandez Dominguez, Gustavo	ARC Seibersdorf Res. GmbH

In recent years, computer vision methods have been exploited in traffic surveillance systems to perform video image analysis, e.g. extracting statistical traffic information and detecting events. However, not much work was dedicated to the prediction of events, in particular of traffic congestions. This paper has two contributions: First, it presents an embedded computer vision system which collects traffic data, and secondly, it reports an innovative method for predicting traffic congestions. For the latter purpose, three traffic parameters are measured and analysed: average speed, vehicle density and the amount of lane changes. The novelty of the current work resides in the use of lane changes in order to predict a traffic congestion. It is shown how the amount of lane changes can be used for improving the prediction of a traffic congestion event some minutes before the traffic congestion starts. The validity of the proposed method is tested using data from a real scenario, which have been collected by the embedded computer vision system also presented in this work. The obtained results are discussed, along with possible future improvements and new research directions.

11:14-11:36 WeBT4.3
Real-Time License Plate Localization Based on a New Scale and Rotation Invariant Texture Descriptor, pp. 956-961

Nguyen, Chu-Duc	Ec. Centrale of Lyon
Ardabilian, Mohsen	Ec. Centrale de Lyon
Chen, Liming	Ec. Centrale de Lyon

In this paper, we present a real-time and robust license plate localization method for traffic control applications. According to our approach, edge content of gray-scale image is approximated using line segments features by means of a local connective Hough transform. Then a new, scale and rotation invariant, texture descriptor which describes the regularity, similarity, directionality and alignment is proposed for grouping lines segments into potential license plates. After a line-based slope estimation and correction, false candidates are eliminated by using geometrical and statistical constraints. Proposed method has been integrated in a optimal license plate localization system. Evaluation is conducted on two image databases which were taken from real scene under various configurations and variability. The result shows that our method is real-time, robust to illumination condition and viewpoint changes.

WeBT5 **Conference Room No.5**
Vehicle Location Systems 2 (Regular Session)

10:30-10:52 WeBT5.1
Development of Satellite Based Positioning and Navigation Facilities for Precise ITS Applications, pp. 962-967

Meng, Xiaolin	The Univ. of Nottingham
Yang, Lei	The Univ. of Nottingham, Univ. Park
Aponte, Jose	The Univ. of Nottingham, Univ. Park
Hill, Chris	The Univ. of Nottingham, Univ. Park
Moore, Terry	The Univ. of Nottingham, Univ. Park
Dodson, Alan	The Univ. of Nottingham, Univ. Park

Recent advance in network reference based real-time kinematic GPS (NRTK GPS) positioning makes it possible to track moving objects of centimeter accuracy. This capacity will undoubtedly help implement many new applications for future ITS services, for instance, precise navigation, autonomous driving, lane based traffic or fleet management, lane based road use charging, and law enforcement. To support these activities, a testbed network of GPS reference

stations has been established jointly by the authors institute and Leica Geosystems (UK) in the past three years. This testbed NRTK facility covers an area of about 20,000 sq kilometers in the central region of the United Kingdom. Real-time raw GPS measurements are streamed to a data server situated in the University of Nottingham via broadband connections. Real-time corrections that are used to compensate spatially correlated errors and biases between the reference station network and user terminals are generated by the data server and sent to these authorized user terminal receivers wirelessly for delivering real-time position solutions of centimeter accuracy. Trials have been carried out recently on a variety of different classes of UK roads to test the delay and completeness of the NRTK corrections, wireless connection and coverage, positioning accuracy, etc, aiming at the evaluation of the feasibility of NRTK GPS positioning for rapid roadway geometry data acquisition and the exploitation of this latest technology fo

10:52-11:14 WeBT5.2

Adaptive Traffic Lane Detection Based on Normalized Power Accumulation, pp. 968-973

Zhang, Hao	Shanghai Inst. of Microsystem and Information Tech. Ch
Yu, Wen	Shanghai Inst. of Microsystem and Information Tech. Ch
Sun, Xiaowei	Shanghai Inst. of Microsystem and Information Tech. Ch

Precise traffic lane boundary identification is the precondition for a good performance of the side-looking traffic flow detection radar. Some approaches have been proposed and developed for this specific purpose. However, these methods either require onerous measurements and prior knowledge, or large amounts of statistics and a long learning duration which cause great difficulties on the practical application of the device. Motivated by this, we propose a novel practical lane boundary estimation algorithm. The proposed method is on the basis of normalized power accumulation. In this method, an adaptive threshold is set to detect the vehicles in the detection region of the traffic radar as well as a vehicle filter to select the vehicle having the strongest echo power. Then the power distribution of the selected vehicle is normalized and put into the power accumulation procedure. Finally, traffic lane boundaries are identified on the basis of the distribution of the normalized power accumulation. Some of the previous approaches are also analyzed in this paper. To test the performance of the proposed algorithm, a great deal of field tests in different locations is conducted and the test results as well as the comparisons with the previous work are presented.

11:14-11:36 WeBT5.3

Hybridized GPS/DR Positioning System with Unknown Initial Heading for Land Vehicles, pp. 974-979

Dumitrache, Alexandru	Tech. Univ. of Bucharest
Zamora-Izquierdo, Miguel A.	Univ. of Murcia
Toledo-Moreo, Rafael	Univ. of Murcia
Gomez-Skarmeta, Antonio, F.	Univ. of Murcia

In the Intelligent Transportation Systems (ITS) field, the number of applications that demand a high integrity positioning system is growing. In order to improve the integrity of localization systems, GPS is usually hybridized with additional proprioceptive sensors. In this paper, a new hybridization algorithm based on GPS plus odometry and a gyro is proposed as an improvement of the most common extended Kalman filter (EKF) approach. In concrete, these investigations focus on the performance of the system under bad initial conditions. Results show the suitability of the proposed system for navigation under bad initial values of heading, and its benefits as compared to two state-of-the-art methods of the literature: an EKF, and a particle filter based solution.

11:36-11:58 WeBT5.4

Beacon Placement for Indoor Localization Using Bluetooth, pp. 980-985

Chawathe, Sudarshan	Univ. of Maine
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We describe a method for determining the location of a mobile device, such as a handheld computer or mobile phone, in an indoor environment using Bluetooth beacons. Since it uses inexpensive

commodity devices, this method is inexpensive to deploy. The limited range of Bluetooth reception is used to advantage. Another important advantage of this method is that it allows the mobile device to determine its location while remaining anonymous, unidentified to the beacons or other nearby devices. In such a deployment, an important design task is the placement of beacons. Signal propagation in indoor environments is complex, affected by factors such as floor-plans and duct-work, varying transmission and reflection properties of building materials and furniture, and interference from other devices. Therefore, the area from which a beacon is visible is very irregular and not well approximated by simple models such as ellipsoids. Our solution permits complex reception characteristics to be accurately modeled and provides a simple method for choosing beacon locations.

WeCT1 **Conference Room No.1**
Traffic Theory for ITS 2 (Regular Session)

13:30-13:52 WeCT1.1

A Dynamic Model for Acceleration Behaviour Description in Congested Traffic, pp. 986-991

Celikoglu, Hilmi Berk	Tech. Univ. of Istanbul
Dell'Orco, Mauro	Tech. Univ. of Bari

In this paper, a mesoscopic dynamic model is utilized to depict the acceleration behaviour of congested traffic flow by overcoming the speed averaging drawback. The model is developed by both considering the oversaturation phenomenon and improving the computational efficiency on a previously proposed link model. Link exit function formulation, discretisation on time dimension, definition of capacity constraint rules for over-saturated states and uniformly accelerated speed assumption that allows a realistic representation of flow dynamics is made while setting out the model. Computation of link flows is performed regarding the acceleration of vehicles that validates the consistency of flow propagation with speed. In the presence of step-ups and step-downs on speed, adaptation of flow propagation is simultaneous, relative to the time lag defined to discretise time dimension. The iterative structure of the model enables convergence to any target performance criteria with the coded algorithm.

13:52-14:14 WeCT1.2

Characteristics of Mixed Traffic with Different Acceleration Vehicles on Single-Lane, pp. 992-997

Zhang, Fa	Xi'an JiaoTong Univ.
Zhao, Qiao-Xia	Air Force Engineering Univ.
Li, JinLing	Xi'an JiaoTong Univ.

Vehicles have different normal accelerations. However, the characteristics of the mixed traffic of vehicles with different accelerations have not been studied. In this paper, we present a microscopic model of longitudinal driving, and investigate the characteristics of mixed traffic of two types of vehicles with different accelerations on a single lane using simulation. We obtain the flow-density and velocity-density relationships of the traffic with different mix ratios of low-acceleration vehicles, and show that the max-flux decreases when the mix ratio increases, whereas the critical density are approximately invariable. Then we observe the transition process of the mixed traffic, and find that the mean velocity drops significantly in low density regime. Finally we explore the spatial-temporal evolution of the mixed traffic, and summarize four patterns appeared in different density regimes. The conclusion is that the difference of vehicle's acceleration has significant effect on the characteristics of traffic, and the effect varies in a complicated manner.

14:14-14:36 WeCT1.3

A Novel Approach to Forecast Weakly Regular Traffic Status, pp. 998-1002

Zhang, Yang	Shanghai Jiao Tong Univ.
Liu, Yuncai	Shanghai Jiao Tong Univ.

How to accurately predict traffic data with weak regularity is difficult for various forecasting models. In this paper, least squares support vector machines (LS-SVMs) are proposed to deal with such a problem. It is the first time to apply the technique and analyze the forecast performance in the field. For comparison purpose, other three baseline predictors are selected because of their effectiveness

proved in past research. Having good generalization ability and guaranteeing global minima, LS-SVMs perform better than the others. Providing sufficient improvement in stability and robustness reveals that the approach is practically promising.

14:36-14:58 WeCT1.4
Gradient Projection Algorithm Using Curry's Steplength for Traffic Assignment, pp. 1003-1008

Li, Zichuan Univ. of Maryland, Coll. Park
 Chang, Gang-Len UMD
 Natarajan, Suhasini Univ. of Maryland, Coll. Park

Recent researches have indicated the viability of path-based algorithms for traffic assignment problem and much attention has been received by gradient projection (GP) algorithm. However, the GP algorithm experiences problems near optimal point when trying to obtain high accurate results. To improve its performance near optimal point, this study employs bisection method to find the Curry's steplength of each iteration as so to achieve that goal. A numerical example is provided to demonstrate the advantage of the GP algorithm using Curry's steplength.

WeCT2 Conference Room No.2
Multi-Sensor Fusion 2 (Regular Session)

13:30-13:52 WeCT2.1
Integrating Spline Curves in Road Constraint Object Tracking, pp. 1009-1014

Hasberg, Carsten Univ. of Karlsruhe
 Hensel, Stefan Univ. of Karlsruhe

Including road map information in the tracking of ground moving objects is a challenging problem. While many self localizing algorithms base on a modelling in global Cartesian coordinates a few approaches prefer a modelling in a local map coordinate frame. Throughout this contribution both strategies are compared theoretically and in numerical simulations. To achieve robust tracking results current onboard sensor information is utilized in the tracking framework. Commonly available on cars or trains are absolute position information, estimated e.g. by a GPS unit, and relative velocity measurements, e.g. measured by an odometer. To integrate road map knowledge with this sensor information time- and measurement-update equations are derived for both modelling strategies.

Roads or tracks are often composed by a sequence of geometric primitives. Approximating this progression of geometric elements with smooth piecewise defined polynomials yields an accurate model, which can easily be integrated in the tracking framework. General preconditions using curves for tracking purposes are presented. In particular, cubic Hermite spline curves are chosen and implemented into the tracking framework.

13:52-14:14 WeCT2.2
Low-Power Vehicle Speed Estimation Model and Algorithm Based on WSN, pp. 1015-1020

Ding, Nan Dalian Univ. of Tech.
 Tan, Guozhen Dalian Univ. of Tech.
 Lin, Mingwen Dalian Univ. of Tech.
 Shang, Yao Dalian Univ. of Tech.
 Ma, Honglian Dalian Univ. of Tech.

According to the characteristics of actual traffic stream, an on-road speed estimation model and algorithm based on wireless magnetic sensor networks was researched. In this model, we used 3 sensor nodes working together to estimate the speed of passing vehicle. To achieve long-life of the model, the mode was designed as a hierarchy architecture to reduce the power consumption. Furthermore, we presented a power consumed scheme, Duty-cycling-V, which could take the speed of vehicle queue as parameter for dynamically adjusting the working cycle of the sensor node. And we used it to the key sensor node of the model, which could farther reduce the power consumption. And the results of the emulation and on-road experiments are demonstrated that the vehicle speed captured by the 3 nodes model is more precise and better power efficiency than the 2 nodes detection model.

14:14-14:36 WeCT2.3

A UKF-NN Framework for System Identification of Small Unmanned Aerial Vehicles, pp. 1021-1026

Kallapur, Abhijit UNSW @ADFA
 Samal, Mahendra UNSW @ADFA
 Puttige, Vishwas Ramadas UNSW @ADFA
 Anavatti, Sreenatha Univ. of New South Wales
 Garratt, Matthew UNSW @ADFA

This paper presents a novel system identification framework for small unmanned aerial vehicles (UAVs) by combining an unscented Kalman filter (UKF) estimator with a neural network (NN) identifier. The method is effective for systems with low-cost, erroneous sensors where the sensor outputs cannot be used directly for system identification and control. The UKF state estimator computes error-compensated attitude and velocities by integrating sensor data from an inertial measurement unit (IMU) and a global positioning system (GPS). The NN identifier approximates the nonlinear dynamics of the UAV from the UKF estimated states, hence identifying the system. As an illustration, the UKF-NN system identification framework is applied to fixed-wing as well as rotary-wing 6-DOF multi-input-multi-output (MIMO) nonlinear UAV models.

14:36-14:58 WeCT2.4
A Hierarchical Bus Rapid Transit System Based on Wireless Sensor Networks, pp. 1027-1031

Huang, Wu-Ling Inst. of Automation Chinese Acad. of Sciences
 Tang, Shuming Inst. of Automation, Chinese Acad. of Sciences
 Li, Zhenjiang Inst. of automation Chinese Acad. sciences
 Zhu, Fenghua Key Lab. of Complex Systems and Intelligence Science, Inst. Coll. of Computing and Communication Engineering
 Ai, Yunfeng

Bus Rapid Transit (BRT) system is the key technology of Intelligent Transportation Systems (ITS). This paper is about the research on a novel hierarchical BRT system based on multi-tier Wireless Sensor Networks (WSN). It maps the features of WSN to BRT system and provides solutions for BRT technologies, such as Transit Signal Priority.

WeCT3 Conference Room No.3
Collision Detection/Avoidance (Regular Session)

13:30-13:52 WeCT3.1
Contrast-Invariant Obstacle Detection System Using Color Stereo Vision, pp. 1032-1037

Cabani, Iyadh INSA de Rouen
 Touliminet, Gwenaëlle INRIA Paris - Rocquencourt
 Benshair, Abdelaziz INSA de Rouen

In this article, we present a color stereo vision system conceived to detect road obstacles. Color matching algorithm based on dynamic programming is presented. This algorithm is invariant in the contrast. With this property, the gain of cameras is configured in automatic mode without decrease the performance of color matching. As a consequence, 3D edges of obstacle are correctly extracted even in difficult cases (for example, entrance and exit of the tunnel). Experimental results are shown in the last section of the paper.

13:52-14:14 WeCT3.2
Evaluation and Improvement of Required Deceleration Algorithm in Frontal Collision Warning Systems, pp. 1038-1042

Li, Chaoyi Tsinghua Univ.
 Meng, Huadong Tsinghua Univ.
 Zhang, Hao Tsinghua Univ.
 Wang, Xiqin Tsinghua Univ.

Different kinds of warning algorithms were used in the Frontal Collision Warning Systems (FCWS) for threat assessment, which were based on different kinds of kinematics measures of vehicles. In this paper, we discuss the required deceleration warning algorithm in two different situations, and consider a more complicated scenario. Based on field experiment data, we use an experienced driver's action which is denoted as "Real Acceleration" to evaluate the

proposed algorithm's efficiency, and several other algorithms are evaluated for comparison. Furthermore, an improvement of required deceleration algorithm is proposed. The threat of lane-changing vehicle is also considered in the new algorithm.

14:14-14:36 WeCT3.3
Collision Probability Assessment for Speed Control, pp. 1043-1048
 Lambert, Alain IEF Univ. d'Orsay
 Gruyer, Dominique INRETS/LCPC
 Saint Pierre, Guillaume INRETS/LCPC
 Ndjeng Ndjeng, Alexandre LCPC

In order to navigate safely, it is important to detect and to react to a potentially dangerous situation. Such a situation can be underlined by a judicious use of the locations and the uncertainties of both the navigating vehicle and the obstacles. We propose to build an estimation of the collision probability from the environment perception with its probabilistic modelling. Then this probability is used for updating a braking order applied to our vehicle either to avoid or to mitigate a collision. The probability of collision is computed from a product of integrals of a product of Gaussians. The integrals take into account the uncertain configurations and the volume of both the vehicle and the obstacles.

14:36-14:58 WeCT3.4
Enhanced Control of Steering System for Vehicle Evasive Maneuvers, pp. 1049-1054
 Eskandarian, Azim George Washington Univ. Virginia
 Soubakhsh, Dameron The George Washington Univ.

Design of an advanced controller for active steering systems in evasive maneuvers of vehicles is investigated. Dynamics of the vehicle is modeled with an extended bicycle model using a nonlinear tire model. The developed model is validated with results from commercial vehicle dynamics simulation software. Two control methods were implemented and studied with the desired trajectory path as an input. Both controllers gave very good results comparing to the ones achieved from PID controller. Deviations of the LQR were in the range of only 1 mm, even for the severe maneuvers. The pole placement controller resulted in deviations in the range of micrometers. Both controllers handled disturbances very well.

WeCT4 Conference Room No.4
Traffic Control: Signalization 1 (Regular Session)

13:30-13:52 WeCT4.1
Wide-Area Traffic Signal Control Using Predicted Traffic Based on Real-Time Information, pp. 1055-1060
 Muraki, Yuji Univ. of Tsukuba
 Kanoh, Hitoshi Univ. of Tsukuba

In this paper, we propose a wide-area traffic signal control using predicted traffic based on real-time information. In conventional studies, the advanced methods of traffic signal control usually require the installation of detectors on all links in the network. As proposed method has an interpolation function, it can be applied to a wide-area road network that includes links on which traffic meters have been not installed. The experimental results using actual traffic data and an actual road map showed that this method is effective at making traffic flow more smoothly.

13:52-14:14 WeCT4.2
SMART-SIGNAL: Systematic Monitoring of Arterial Road Traffic Signals, pp. 1061-1066
 Liu, Henry X. Univ. of Minnesota
 Ma, Wenteng Univ. of Minnesota
 Hu, Heng Univ. of Minnesota
 Wu, Xinkai Univ. of Minnesota
 Yu, Guizhen Beihang Univ.

Data collection and performance measurement for signalized arterial roads is an area of emerging focus in the United States. As indicated by the results of the 2005 Traffic Signal Operation Self-Assessment Survey, a majority of agencies involved in the operation and maintenance of traffic signal systems do not monitor or archive traffic system performance and thus have limited means to improve their operation. With the support from the Transportation Department of Hennepin County, Minnesota, we have successfully built a system for

high resolution traffic signal data collection and arterial performance measurement. The system, named SMART-SIGNAL (Systematic Monitoring of Arterial Road Traffic Signals), is able to collect and archive event-based traffic signal data simultaneously at multiple intersections. Using the event-based traffic data, SMART-SIGNAL can generate time-dependent performance measures for both individual intersections and arterials including intersection queue length and arterial travel time. The SMART-SIGNAL system has been deployed at an 11-intersection corridor along France Avenue in Minneapolis, MN and the estimated performance measures for both intersection queue and arterial travel times are highly consistent with the observed data.

14:14-14:36 WeCT4.3
Interactive Signal Control for Over-Saturated Arterial Intersections Using Fuzzy Logic, pp. 1067-1072
 Tian, Ye Tsinghua Univ.
 Li, Zhiheng Tsinghua Univ.
 Song, Jingyan Tsinghua Univ.
 Xiao, Deyun Tsinghua Univ.
 Zhou, Dabing Tsinghua Univ.

On an arterial, over-saturated intersections raise the risk of congestion. Once congestion happens, it may spread to neighboring intersections along the road. This paper proposes an interactive fuzzy logic signal controller utilizing neighboring traffic information to avoid congestion under over-saturated condition. The fuzzy signal controller decides to extend, early cut or terminate a signal phase according to evaluation of traffic condition. The structure and method of fuzzy logic controller is stated. A simulation taken under Paramics is presented. Comparison with traditional vehicle-actuated method and local fuzzy control for signal intersection is also made. Results show the effectiveness of the proposed method.

14:36-14:58 WeCT4.4
Design and Evaluation of an Adaptive Bus Signal Priority System Base on Wireless Sensor Network, pp. 1073-1077
 Ma, Wanjiang Tongji Univ.
 Yang, Xiaoguang Tongji Univ.

Transit priority control strategy can not only improve operation performance of transit vehicles, also increase transit schedule reliability, reduce operation cost and attract passenger volume. This paper presents a framework for real-time bus priority control system. This derived framework composes one control center and two modules, detection-communication module (DCM) and signal priority control module (PCM). DCM receives bus priority requests in real-time and send them to the center by wireless sensor network (WSN). The WSN system has been validate that much economical and efficient than other AVL systems. PCM includes three hierarchies: priority classification, passive priority strategy and active priority strategy. The upper level of PCM focuses on classifying and filtering different priority requests. The middle level gives a priority timing plan based on statistical data. The lower level will make priority decisions on-line. These decisions include predicting schedule deviation, selecting control object of signal priority, finding critical intersections, deciding the priority frequency and establishing a recovery strategy. The proposed system architecture integrated active and passive strategies and adding a priority classification level, can provide efficient bus priority control and minimize overall effects to motor vehicle movements under different traffic condition.

WeCT5 Conference Room No.5
Vehicle Location Systems 3 (Regular Session)

13:30-13:52 WeCT5.1
Comparison of EKF and PEKF in a SLAM Context, pp. 1078-1083
 Chanier, Francois Univ. Blaise Pascal LASMEA
 Checchin, Paul Univ. Blaise Pascal - Clermont-Ferrand - FRANCE
 Blanc, Christophe Blaise Pascal Univ.
 Trassoudaine, Laurent Univ. of clermont-ferrand

This paper introduces an implementation of the Polynomial Extended Kalman Filter (PEKF) to solve the Simultaneous Localization and Map building (SLAM) problem. The proposed solution is a filtering algorithm which is a polynomial transformation of state evolution and

measurement equations. The performances of the algorithm have been evaluated through two simulation runs. The first ones underline consistency improvement in comparison with the standard Extended Kalman Filter. The other simulation results show the PEKF efficiency when the values of measurement noises are high. At the end, experiments with Victoria Park data are presented too.

13:52-14:14 WeCT5.2
A Precise Road Network Modeling and Map Matching for Vehicle Navigation, pp. 1084-1089

Wang, Chenhao kumamoto Univ.
 Hu, Zhencheng Kumamoto Univ.
 Uchimura, Keiichi Kumamoto Univ.

In this paper, we describe a precise road model for vehicle localization and map matching for the purpose of driver assistance. This model utilizes the prevalent digital road map and road points ('IP' points) such as: intersection points and supporting points with orientation variation, to estimate road curvature in two-dimensional alignment. In our work, road geometries such as clothoid curve and circle are used to reconstruct road shape, which was approximated by piece-wise lines before. Therefore, we design the whole network modeling consisting of 'IP' points, linear segments and curve segments. And new map matching approach is also proposed according to different segments. Finally, in order to test the performance of this model in practical situation, we employed VICNAS system with new hybrid vehicle localization approach combining commercial GPS and inertial sensors, and experimental results verified the effectiveness and efficiency of our approach.

14:14-14:36 WeCT5.3
Level of Service Reliability in Route Guidance System, pp. 1090-1094

Kuang, Aiwu Changsha Univ. of Science & Tech.
 Huang, Zhongxiang Changsha Univ. of Science & Tech.
 Wang, Renying Changsha Univ. of Science and Tech.
 Long, Kejun changsha Univ. of science & Tech.

In this paper, we study the level of service reliability (LOS reliability) problem in a transportation environment with advanced traveler information systems (ATIS). Two classes of drivers, equipped with and unequipped with ATIS respectively, exist in the system and make their route choices in a logit-based stochastic manner with different travel time perception errors. Treating the capacity of each link and each OD pair as discrete random variables, we establish an approximation algorithm to estimate the road network LOS reliability based on the road network most probable states generation method. Finally, a numerical example of a small road network is presented to validate the proposed model and algorithm.

14:36-14:58 WeCT5.4
Dynamic Management of Intelligent Urban Vehicles, pp. 1095-1100

Melki, Asma Ec. centrale de Lille

The management of cybercar fleet is a complex process that combine different intelligent system fields: communication, science computing, optimization, etc. In this paper, we will consider a complex side of management: A Dynamic fleet management. In fact, new requests could occur via PDA pedestrian, the management system has to integrate the new request into the process. We accentuate the flexible aspect of Cybercars that permits to adjust the trip to respond to dynamic requests.

WeDT1 Conference Room No.1
Driver Assistance Services (Regular Session)

15:30-15:52 WeDT1.1
Stability of String of Adaptive Cruise Control Vehicles with Parasitic Delays and Lags, pp. 1101-1106

Xiao, Lingyun Texas A&M Univ. Coll. Station
 Darbha, Swaroop Texas A&M Univ. Coll. Station
 Gao, Feng Beihang Univ.

In this paper, we examine the effect of parasitic delays and lags on the stability of a string of vehicles equipped with Adaptive Cruise

Control (ACC) system which is employed a constant time headway (CTH) policy. The control law of the ACC system is based on a simpler model of the vehicle that doesn't ignore the parasitic delays and lags. The main result of this paper is that string stability can be guaranteed if the constant time headway is at least twice the sum of the parasitic delays and the parasitic lags. This result extends and generalizes the earlier results of Darbha by considering parasitic delays and lags and provides a practical direction for ACC system design and implementation from the viewpoint of robustness to parasitic delays and lags.

15:52-16:14 WeDT1.2
Improving Safety through Online Driver Workload Assessment, pp. 1107-1112

Younsi, Karine LAMIH Univ. de Valenciennes et du Hainaut Cambrésis
 Girard, Jean-Marc LAMIH Univ. de Valenciennes et du Hainaut Cambrésis
 Popieul, Jean-Christophe Univ. de Valenciennes
 Loslever, Pierre Univ. de Valenciennes
 Simon, Philippe Univ. de Valenciennes

The continuous increasing number of car embedded systems requires to wonder about the compatibility of the use of such systems while the driving. The richness of their interface, their complexity and their numbers need to ensure that their use doesn't exceed the driver capacity. To bring elements of answer to this question, this paper presents a methodology for the development of a real-time workload estimator. This methodology is based on the simultaneous analysis of objective and subjective data by the mean of an exploratory multivariate approach. Objective data are composed of driving performance indicators while subjective data are results from subjective workload assessments. The data were collected during an experimentation set on a driving situation which was designed to induce several levels of task demand.

16:14-16:36 WeDT1.3
Error Correcting Scheme for Road-To-Vehicle Visible Light Communication Using LED Array, pp. 1113-1117

Mase, Shohei Nagoya Univ.
 Arai, Shintaro Nagoya Univ.
 Yamazato, Takaya Nagoya Univ.
 Yendo, Tomohiro Nagoya Univ.
 Fujii, Toshiaki Nagoya Univ.
 Tanimoto, Masayuki Nagoya Univ.
 Yoshikatsu, Kimura TOYOTA CENTRAL R&D Lab.

In, this paper, we propose an improved coding scheme for optical wireless communication systems using a LED traffic array transmitter and a high-speed camera as the receiver on a vehicle. Previously, we have proposed a hierarchical coding scheme which allocated the data to spatial frequency components depending on the priority. In that scheme, the high-priority data can be received even if the receiver was far from the transmitter. We confirmed the advantage of the hierarchical coding scheme, but the bit error performance was not sufficient. In this paper, we divide the data into spatial frequency components' data. Experimental evaluation demonstrates the improvement in BER performance. This improvement implies that the system range increased compared to the previous method.

16:36-16:58 WeDT1.4
Dangerous Prediction by Case-Based Approach on Expressways, pp. 1118-1123

Wu, Po-Yen National Taiwan Normal Univ.
 Fang, Chiung-Yao National Taiwan Normal Univ.
 Chen, Sei-Wang National Taiwan Normal Univ.

The purpose of this system is to reduce the rate of dangerous events caused by various driving factors. We compose a driving relational map as the system inputs factors of driver behavior, nearby vehicles and roadway factors, and then put this driving relational map into the matching process with dangerous driving relational maps. If the similarity between the driving relational map and one of the dangerous driving relational maps is high, a dangerous event may occur. At this time the system will warn the driver to watch out for the dangerous event. Along with the learning process based on case-

base reasoning, the system will become a flawless danger prediction system.

WeDT2 **Conference Room No.2**
Multi-Sensor Fusion 3 (Regular Session)

15:30-15:52 WeDT2.1
Low Cost Sensors Ego Localization with IMM Approach for Unusual Maneuvers, pp. 1124-1129
 Ndjeng Ndjeng, Alexandre LCPC
 Gruyer, Dominique INRETS/LCPC
 Glaser, Sébastien LCPC

This paper presents the problematic of outdoor vehicle localization in unusual maneuvers under the IMM (Interacting Multiple Model) approach. The IMM, contrary to the non modular methods, is based on the discretization of the vehicle evolution space into simple maneuvers, represented each by a simple dynamic model such as constant velocity or constant turning etc. This allows the method to be optimized for highly dynamic vehicles. In this work, we focus on the various vehicle dynamics identification in some special driving situations, including very strong accelerations, turning with a high speed (more than 15m·s⁻¹) or backward driving with stops. The presented results are based on real measurements collected from different scenarios. These results show a real interest in using the IMM method in order to reach our goal.

15:52-16:14 WeDT2.2
Kernel and Feature Selection for Visible and Infrared Based Obstacle Recognition, pp. 1130-1135
 Apatean, Anca Ioana Tech. Univ. of Cluj Napoca
 Rogozan, Alexandrina LITIS
 Benshair, Abdelaziz INSA de Rouen

In this article we propose a fusion model at datalevel based on a linear combination of kernels. These kernels functions will be evaluated on disjoint entries, on the signature acquired from visible respective infrared spectrum. Therefore, we have to choose the proper numeric signature for the visible and for the infrared images. In order to retain just the best suited features, different feature extraction and feature selection algorithms have been investigated. In this way, important information can be achieved in a small number of coefficients, implying thus a significant reduction of the computation time. Our purpose is to develop the obstacle recognition module and to examine if a visible-infrared fusion is efficient for this task.

16:14-16:36 WeDT2.3
Hybrid Localization Approach of a Bi-Steerable Mobile Robot Based on Grids Matching and Extended Kalman Filter, pp. 1136-1141
 Bouraine, Sara advanced Tech. developpement center
 Djekoune, A. Oualid Advanced Tech. Development Center.
 Azouaoui, Ouahiba Centre de Développement des Tech. Avancées (CDTA)

This paper presents a mobile robot self localization method used to determine the position of the mobile robot Robucar. The localization approach is based on using both grids matching method and Extended Kalman Filter (EKF) method. The grids matching method provides accurate results but requires a large computational time that is why the EKF is introduced. EKF fuses odometric data and laser data to estimate the robot position. The developed algorithms are implemented and tested on the mobile robot Robucar.

16:36-16:58 WeDT2.4
Spatio-Temporal RANSAC for Robust Estimation of Ground Plane in Video Range Images for Automotive Applications, pp. 1142-1148
 Mufti, Faisal Australian National Univ.
 Mahony, Robert Australian National Univ.
 Heinzmann, Jochen Seeing Machines

This paper considers the problem of ground plane estimation in range image data obtained from Time-of-Flight camera. We extend the 3D spatial RANSAC for ground plane estimation to 4D spatio-temporal RANSAC by incorporating a time axis. Ground plane models are derived from spatio-temporal random data points, thereby robustifying the algorithm against short term temporal effects such as

passing cars, pedestrians, etc. The computationally fast and robust estimation of ground plane leads to reliable identification of obstacles and pedestrians using statistically derived spatial thresholds. Experimental results with real video data from range sensor mounted on a vehicle moving in a car park are presented.

WeDT3 **Conference Room No.3**
Vision: Driver Assistance (Regular Session)

15:30-15:52 WeDT3.1
Analysing Driver's Attention Level Using Computer Vision, pp. 1149-1154
 Bergasa, Luis M. Univ. of Alcalá
 Buenaposada, Jose Miguel Univ. Rey Juan Carlos
 Nuevo, Jesus Univ. of Alcalá
 Jiménez, Pedro Univ. of Alcalá
 Baumela, Luis Univ. Pol. de Madrid

This paper presents a system for evaluating the attention level of a driver using computer vision. The system detects head movements, facial expressions and the presence of visual cues that are known to reflect the user's level of alertness. The fusion of these data allows our system to detect both aspects of inattention (drowsiness and distraction), improving the reliability of the monitoring over previous approaches mainly based on detecting only one (drowsiness). Head movements are estimated by robustly tracking a 3D face model with RANSAC and POSIT methods. The 3D model is automatically initialized. Facial expressions are recognized with a model-based method, where different expressions are represented by a set of samples in a low-dimensional manifold in the space of deformations. The system is able to work with different drivers without specific training. The approach has been tested on video sequences recorded in a driving simulator and in real driving situations. The methods are computationally efficient and the system is able to run in real-time.

15:52-16:14 WeDT3.2
Pedestrian Detection Using Boosted HOG Features, pp. 1155-1160
 Wang, Zhen-ruí Xi'an Jiaotong Univ.
 Jia, Yulan Xi'an Jiaotong Univ.
 Huang, Hua Xi'an Jiaotong Univ.
 Tang, Shuming Inst. of Automation, Chinese Acad. of Sciences

This paper presents a novel approach in pedestrian detection in static images. The state-of-art feature named Histograms of Oriented Gradients (HOG) [1] is adopted as the basic feature from which we derive a new feature using boosting algorithm. The detection is achieved by training a linear SVM with the boosted HOG feature. We experimentally demonstrate that our solution could outperform the HOG algorithm on the INRIA pedestrian dataset and considerably reduce the computational complexity in terms of elementary operations and storage requirement.

16:14-16:36 WeDT3.3
Driver's Head Detection Model in Color Image for Driver's Status Monitoring, pp. 1161-1166
 Won, Woong Jae Dagegu-Gyeongbuk Inst. of S&T
 Son, Joonwoo Daegu Gyeongbuk Inst. of Science & Tech.

In this paper, we proposed a simple driver's head detection model for driver's status monitoring, in order to implement interactive safety driving agent system. For intensifying the driver's head region, we consider normalized color feature combination method with skin color filter. And, the center-surround difference and normalization algorithms are applied for making saliency map of driver's head in order to not only reduce the background noise, but also more reinforce the intensity of driver's head regions than non-head area. The driver's head regions are simply selected through searching local maximum energy with histogram projection method. And, we adopt the 2D+3D active appearance model(AAM) for tracking driver's head region and estimating driver's head pose. Experimental results show that proposed model can successfully detect driver's head region and estimate driver's head pose.

16:36-16:58 WeDT3.4
Pedestrian Detection for a Near Infrared Imaging System, pp. 1167-

1172

Soga, Mineki
Hiratsuka, Shigeyoshi
Fukamachi, Hideo
Ninomiya, Yoshiki

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This paper considers pedestrian detection, specialized for a near infrared imaging system at night. The main objective is the detection of a distant pedestrian, beyond an illuminated area in a low-beam mode, using a monocular on-board camera. In this method, the region of interest (ROI) is first selected by extracting bright regions, and shape information from a whole human body, is later used for verification. Motion information is not used, due to difficulties in cancellation of ego-motion. The ROI selector is implemented by a modified boosted cascade, in combination with dynamic perspective constraints. After filtering out typical non-pedestrian objects, the remaining ROIs are verified using a support vector machine (SVM). The verified ROIs are tracked with a simple alpha-beta tracker, in combination with final validation, based on a classification score from the SVM. The effectiveness of the proposed modules has been confirmed using several typical night time scenarios.

WeDT4 **Conference Room No.4**
Topics in ITS 2 (Regular Session)

15:30-15:52 WeDT4.1
Experimental Research of Real-Time Floating Car System in Beijing, pp. 1173-1176

Zhu, Liyun
Sun, Jianping
Wen, Huimin
Chen, Feng
Gao, Yong

Beijing Transportation Res. Center
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As a new dynamic real-time traffic information collecting technology, floating car system is being paid more and more attention in the area of transportation. Based on the actual data condition of Beijing, this paper puts forward a processing flow of real-time floating car system applied to modern metropolises with complex urban road network. And a series of experiments are reported to validate the feasibility and operational efficiency of the system from the aspects of map-matching efficiency, road network coverage and result reliability.

15:52-16:14 WeDT4.2
Model-Based Estimation of Driver Intentions Using Particle Filtering, pp. 1177-1182

Lidström, Kristoffer
Larsson, Tony

Halmstad Univ.
Halmstad Univ.

Proactive vehicle alert systems that warn the driver about dangerous situations must be able to reason about, and predict, likely future states of the traffic environment. Our prediction method is based on a combination of a fuzzy logic model for intersection turning behavior and Gipps model for car following behavior. The stochastic models are used together with a particle filter to recursively approximate the state probability distribution as measurements are received over time. Estimates of the unobservable part of the state are used to predict path choice and thus driver intentions. The approach is evaluated on trajectory data gathered from video footage of an intersection, however it is also relevant for trajectories acquired through vehicle-to-vehicle communication.

16:14-16:36 WeDT4.3
Analysis on Urban Traffic Network States Evolution Based on Grid Clustering and Wavelet De-Noising, pp. 1183-1188

Zhang, Zuo
Zhang, Pingxin
Yin, Yaomin
Hou, Lin

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Traffic state and evolution are important for better knowledge of urban traffic properties, as well as for the better traffic control and management. Therefore, it has attracted much attention recently. Model-based and data-driven are two kinds of methods in handling with such issues. With the wide deployment of ITS, large volume traffic data are available and data-driven methods such as clustering analysis have found their applications in ITS. According to physical

characteristics of urban traffic flow, the paper follows the data-driven analysis and develops a grid-based clustering method for traffic state extraction and state evolution analysis. It also designs a wavelet transformation as a filter to decrease the noise in raw traffic data. Results on de-noised signals show more definite trends for traffic state evolutions.

16:36-16:58 WeDT4.4
Continuous Driver Intention Recognition with Hidden Markov Models, pp. 1189-1194

Berndt, Holger
Emmert, Jörg
Dietmayer, Klaus Christian
Jürgen

Univ. of Ulm
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Univ. of Ulm

The most common cause of accidents in individual road traffic is human failure. Accidents often arise from misbehavior of one or several drivers when inducing a driving manoeuvre. Dangers can occur either when the intended manoeuvre is not well adjusted to the current traffic situation, or when the manoeuvre is not properly announced to the environment so that the intention is misinterpreted. When designing advanced driver assistance systems, it is beneficial to gather information about driver behaviors as accurately and early as possible. This work investigates early driver intention inference with Hidden Markov Models by observing easily accessible vehicle and environment signals such as pedal positions or global vehicle position on a digital map in real traffic.

WeDT5 **Conference Room No.5**
Travel Information and Guidance (Regular Session)

15:30-15:52 WeDT5.1
An On-Road Wireless Sensor Network Approach for Urban Traffic State Monitoring, pp. 1195-1200

Shuai, Meng
Xie, Kunqing
Ma, Xiujun
Song, Guojie

School of EECS, Peking Univ.
Peking Univ.
School of Ec. Peking Univ.
PKU

Wireless sensor networks are expected to be deployed on urban roadways to monitor the traffic continuously. One of the requirements of traffic monitoring is displaying the traffic states of the front roadways, which can guide the drivers to choose the right way and avoid potential traffic congestions. In this scenario, the information of traffic state changes should be refreshed as early as possible. We propose an adaptive segmentation of the traffic flow based on discrete Fourier transform, which responses timely to traffic state changes without inducing large error. On the other hand, considering the limited power of wireless sensor networks, we propose a novel algorithm for in-network aggregation of the traffic flow time-series, which reduces the communication cost between the sensor nodes and base station significantly. The proposed algorithm scales well with the size of the sensor networks. Our methods are computationally efficient and suitable to be implemented on sensor nodes. The primary experiments on PeMS data demonstrate the effectiveness and energy efficiency of our approach.

15:52-16:14 WeDT5.2
Hierarchical Software Architectures and Vehicular Path Prediction for Cooperative Driving Applications, pp. 1201-1206

Caveney, Derek
Toyota Tech. Center

This paper investigates software architectures and path prediction techniques for Vehicle-to-Vehicle (V2V) cooperative systems. It proposes how software architectures should be constructed to enable the greatest flexibility for different cooperative driving applications while leveraging the full advantage of wireless communications. The applications may be designed for safety, mobility, or comfort objectives and incorporate autonomous behaviors available with non-communication-based sensing. The paper elaborates on the fundamental element of environment mapping, which includes vehicular path histories, vehicular path predictions, and target classifications. Within vehicular path prediction, the paper focuses on parametric and non-parametric path prediction approaches and illustrates the advantages and disadvantages of various existing methods.

16:14-16:36

WeDT5.3

Analysis of Vehicle Lane Changes for Determining Fastest Paths in the V2V2I ITS Architecture, pp. 1207-1212

Miller, Jeffrey

Univ. of Alaska, Anchorage

In this paper I perform an analysis of vehicle lane changes and how they relate to fastest path determination. I converted live discrete loop detector data from the California Department of Transportation into continuous data to be utilized by vehicles in a vehicle-to-vehicle-to-infrastructure (V2V2I) intelligent transportation system (ITS) architecture. The continuous data was then used by FreeSim (<http://www.freewaysimulator.com>) to simulate live traffic conditions. As the time to traverse the edges in the transportation network were being constantly updated, additional vehicles were inserted into the network to determine travel times and fastest paths from a source node to a destination node. The output shows that faster and more accurate paths can be found if lane data is obtained rather than just summary data of loop detectors. Further, if vehicles can be routed along paths with optimal lane changes to decrease the total travel time, a savings of approximately 33% of the travel time can be experienced. It is also shown that the number of lane changes needed in the fastest path with regards to lanes is lower than the number of lane changes needed for other candidate fastest paths, and highways with less congestion require fewer lane changes.

16:36-16:58

WeDT5.4

Infrastructureless Inter-Vehicular Real-Time Route Guidance, pp. 1213-1219

Hawas, Yaser

UAE Univ.

Napeñas, Marc Joseph

UAE Univ.

This paper presents an inter-vehicular communication (IVC)-based algorithm for real-time route guidance in urban traffic networks. It is built on information sharing among some searcher vehicle and candidate vehicles traveling in the same direction, to the same destination and within a specific communication range. The paper discusses in details the algorithmic procedure and conditions for information sharing. A microscopic simulation model is utilized to assess the effectiveness of the algorithm against another benchmark algorithm; namely, centralized shortest path algorithm. Comparisons of the two algorithms' average travel time, and overall network productivity are presented. The algorithms performances are captured for various scenarios reflecting network congestion levels, link speeds and link lengths.

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Travel Behavior under ITS	MoDT5.1, MoDT5.4, SuDT1.1, TuBT1.4, TuBT3.1, TuCT2.4, TuCT4.2, TuCT4.3, TuCT5.4, TuDT2.1, WeAT1.4, WeAT4.3, WeBT1.1, WeBT1.4, WeCT5.3, WeDT1.4
Travel Demand Management	TuBT1.3, TuBT5.4, TuCT3.3, TuDT5.3, WeAT1.1, WeCT5.4
Travel Information and Guidance	MoCT1.1, MoCT1.4, MoCT3.1, MoCT3.2, MoCT3.3, MoCT3.4, MoCT5.2, MoDT1.4, MoDT3.1, MoDT3.2, MoDT3.3, MoDT3.4, MoDT4.1, MoDT5.3, TuAT4.4, TuBT4.3, TuCT3.1, TuCT3.2, TuCT3.3, TuCT3.4, TuDT4.1, WeAT1.3, WeAT5.1, WeBT1.4, WeBT5.4, WeCT1.4, WeCT5.3, WeDT4.1, WeDT5.1, WeDT5.3, WeDT5.4
Traveler Services Information	MoCT1.4, MoCT3.1, MoCT3.3, MoCT3.4, MoDT3.1, MoDT3.2, MoDT3.3, MoDT3.4, TuCT2.3, TuCT3.1, TuCT3.2, TuCT3.3, TuCT3.4, WeAT3.3, WeAT5.2, WeBT5.4