



INTELLIGENT
TRANSPORTATION
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IEEE ITS SOCIETY NEWSLETTER

Vol. 14, No. 1 January 2012

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The IEEE ITS Society Newsletter is published quarterly in January, April, July, and October. The current and all past issues of the Newsletter may be downloaded at no charge from the Society's web site: <http://sites.ieee.org/itss/>.

You may subscribe to or unsubscribe from announcements at the same web site. Announcements are sent to approximately 10,000 ITS professionals from industry, academia, and government.

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Announcements, feature articles, book and meetings reviews, opinions, letters to the editor, professional activities, Abstracts of reports, and other material of interest to the ITS community are solicited. Please submit electronic material for consideration in any of the following formats: Microsoft Word, OpenOffice, plain ASCII, rich text format (rtf), or portable document format (pdf) to the Editor-in-Chief at yaobinchen@ieee.org.

SOCIETY NEWS

From the Editor



by Yaobin Chen

Happy New Years! I hope you all are off to a good start in 2012, the year of Dragon. Time passes by so quickly. I have reached the first anniversary of serving as the Editor-in-Chief of the Newsletter. I would like to take this opportunity to thank all of you, readers and subscribers of this Newsletter for your continued support and participation. I would like to thank my editorial team members for their excellent service and contributions to the Newsletter. Thanks goes to the ITS Society leadership team and all members of the Society for providing articles and other items for the Newsletter.

As we entered the new year, the Society has gone through a smooth leadership transition from Dr. Alberto Broggi to Dr. Christoph Stiller, the new President for the next two years. You can read more about this in the next page: "Message from the Past and New Presidents." Please join me in welcoming the new President!

Message from Past and New Presidents

Every two years a new president of the IEEE Intelligent Transportation Systems Society is elected. Since January 1, 2012 the former President Alberto Broggi has become Past President and Christoph Stiller has become President.

Thanks For A Great Experience!

Dear IEEE ITS Society members,

I am writing to you for the last time in my capacity as President of the Society: I had the honor to serve the Society as President for 2 years, and now I'm just about to step down and look back at what I am leaving.

It has been a great opportunity for myself to grow and understand in a more precise way all the little details that are usually not visible to IEEE members:



Countless emails related to IEEE flowing day and night (all Society Presidents are also helping the IEEE Technical Activity Board to define and establish IEEE future directions!), questions coming from all over the world about our conference, publications, meetings, and – indeed - also asking for technical involvement and support in the education of new researchers.

I started my involvement as President-Elect in 2009, and during my two-year term as President I had to face some important changes which also impacted on our Society. It's not a big news that the world crisis also reduced the attendance to conferences and membership, but the good news is that a part from a slight budget reduction in 2009, from 2010 we have continued to grow even stronger than before.

Let's jointly advance our ITSS!

Dear IEEE ITS Society members,

Since January 2012 I have taken over the task as President of the Intelligent Transportation Systems Society. The election to this position for 2012 and 2013 has of course not only been a big honor to me, but even more I feel

Challenged and obliged to give my best for our Society in this exciting position. During the next years my focus will be on consolidating our new activities, to carefully foster further expansion of the society's

technical fields and activities and to further increase the benefits that our society offers to its members.

From my past involvement as Member of the Board of Governors (since 2005), Editor-in-Chief of the Intelligent Transportation Systems Magazine (2009 - 2011) and Chair of the Intelligent Vehicles Symposium 2011, I could already learn some facets of our Society.

As a personal note at this occasion, I am happy that we could win Prof. Jeffrey Miller as our new Magazine Editor-in-Chief. Knowing Jeff for many years I am convinced the Magazine will further flourish and grow under his guidance. Together with our internet based Newsletter it is the key source of information on Intelligent Transportation Systems and its scientific and industrial community.

The ITS Magazine started in 2009: the ITS Society decided to put a lot of effort into the creation and development of this new publication, while the Editor-in-Chief worked hard in the selection of papers and in managing the whole effort in order to reach a very high quality journal. We are now waiting for the first determination of the Magazine's Impact Factor.

In the last years our Conferences have been breaking the record of participants and have grown stronger and stronger. In 2011, we also included a new conference in our portfolio, FISTS - the 1st Forum on Integrated and Sustainable Transportation Systems, which was a new very successful experiment organized together with other three IEEE Societies. And this, thanks to the dedication of our members who served on the organizing committees. Plus, in order to ease the job of the next General Chairs, a set of procedures (or best practices) have been created so that – hopefully - it will be easier to manage our conferences in the years to come and ever increase the number of attendees.

The Newsletter is still the main means with which the Society keeps its members -and not only its members!- informed about the next events and future opportunities.

Finally in my review of our latest achievements, I need to mention the IEEE Trans on ITS which, according to the ISI Impact Factor, became the number one journal in the world in the field of transportation. The number of submissions has increased so much that in the last IEEE ITSS Board of Governors it was decided to increase the number of pages published per year to 1680 starting in 2012. This is an unbelievable result if we think that this publication was started in 2000 and at that time it only had 236 pages!

At the societal level, some changes have been decided in the last months, such as the restructuring of all Technical Committees and the creation of new awards.

The past development of our young society is something we all can be proud of.

We have established strong publications by any measure. The Transactions on ITS have earned the top impact factor among all transportation journals. We will respond to the huge demand by authors and readers with a further expansion of this successful publication. The ITS Newsletter has some 10.000 subscribers and we will continue to electronically disseminate latest news on ITS through this free-of-charge publication. Finally, the recently established ITS Magazine serves as publication outlet of our Society and to spread ITS News to our members and beyond in a timely and comprehensive manner. High quality papers of practical relevance shall not only address our members but also broaden the impact and reach of our Society.

Our conferences have grown not only in number, but also have attracted a record number of participants. Just this year we have answered the demand for Green Mobility Technology with a new Forum on Integrated and Sustainable Transportation Systems, FISTS. As a next step, we will revise the structures of our technical committees to keep up with the increased number of submissions that need to be thoroughly reviewed and organized. Most importantly, the Society's conferences shall remain the meeting point for experts from academia and industry of our field.

The ITS Society is one of IEEE's youngest societies. Since its inauguration in 2005 we have already been the fastest growing IEEE society for several years. An important issue for the near future of our society is to also attract more student members. Furthermore, we need to extend our technical activities. We are a focal point in vehicles and vehicular traffic. Interconnection of all aspects of traffic shall yield truly intelligent transportation systems and will open up new opportunities for intelligent and sustainable traffic solutions.

Indeed all these great achievements are definitely very positive for our Society, but we still need to keep us focused on the Society's main objective: i.e. to create the infrastructure to help advance science in the field of Intelligent Transportation Systems. We need journals to publish our results, but also learn about our colleagues' achievements; we need conferences to present our research, but also meet our colleagues and discuss our ideas; we need places and infrastructures that help share our knowledge with the world so that we -all together- work towards the progress of science. The IEEE ITS Society is definitely the place in which we shape these possibilities, but the Society would be nothing without the dedication of our members: reviewers, associate editors, editors, conference chairs, committee members, all of them offering their very valuable time as volunteers!

Now our growing research community worldwide is aware that there is a strong and well recognized home for its activities. I'd like to recognize the effort of all the individuals that worked with me during my term as President, and in particular the members of the IEEE ITS Executive Committee and the Editors-in-Chief of our three publications, but I need to confess that it was not difficult to reach such great results, because of the presence of a number of active fellow colleagues that worked with me in this very exciting endeavor. I only acted as a catalyzer: the real effort came from them.

I'm now passing everything on to Prof. Christoph Stiller, our new President for the term 2012-2013: I couldn't be happier to see the Society in his hands since I'm sure he will be a very wise and active manager and will steer the Society through new challenges and towards new successes.

Good luck to Christoph and to all our members for a bright future into our Society!

Alberto Broggi
Past President IEEE ITSS

Clearly, the ultimate goal of our society is to serve its members and to offer solutions for transportation demands of humanity. These goals can only be approached through a joint effort of a broad variety of experts. We are fortunate to have many of those in our society and even more fortunate that many volunteer in our society as reviewers and editors for our conferences and journals, organizers of chapters, conferences, and meetings and as members in the society's self-organizing boards. Many volunteers experience that service in our active society is exciting and fosters valuable international contacts. We are permanently open to new individuals; just contact me in case you are willing to volunteer in any position of our Society. With our impressive team of volunteers, I am convinced that our Society will further advance extraordinarily.

Last not least, I know to speak for many Society members when expressing my deep gratitude to Prof. Alberto Broggi for all that he has done for our society. Alberto not only initiated our Newsletter and served as its Editor-in-Chief, but he also worked as Editor-in-Chief for our Transactions and, most recently in 2010 and 2011, as Society President. In every of these positions he actively developed and implemented new ideas and substantially advanced the respective field. Alberto: I am glad to have You in our Executive Board as Past President and hope You will stay active in our society for many years to come.

Let's jointly advance our ITS Society!

Christoph Stiller
President IEEE ITSS

2012 Board of Governors Election Results

Each year, the members of the Society elect five members to serve a three year term on the Board of Governors (BoG), the Society's governing body. The BoG consists of the fifteen elected members (five each year for a three-year term) and the officers of the Society.

The candidates for election are nominated by the Society's Nominations Committee. The chair of the Committee is designated in the Society's bylaws. This year, the chair was Bill Scherer who was president in 2008-2009. IEEE has announced the results of the election for the Board of Governors. The following five candidates have been elected to a three year term beginning January 1, 2012.



Yaobin Chen, Professor and Chair of Electrical and Computer Engineering, Director of the Transportation Active Safety Institute, Purdue School of Engineering and Technology, IUPUI.



Petros Ioannou, Professor of Electrical Engineering, Director of the Center of Advanced Transportation Technologies, University of Southern California.



Brendan Morris, Assistant Professor of Electrical and Computer Engineering, University of Nevada, Las Vegas.



Miguel Angel Sotelo, Professor of Computer Engineering, the University of Alcalá, and Director General of Guadalab Science & Technology Park, Spain.



Mohan Trivedi, Professor of Electrical and Computer Engineering, Director of the Computer Vision and Robotics Research Laboratory, University of California, San Diego.

Nomination Process for IEEE Fellow Class of 2013 is Now Open

The nomination period is now open for the IEEE Fellow Class of 2013 and will continue through 1 March 2012. Nominees for Fellow must be an IEEE Senior Member or IEEE Life Senior Member with contributions that have advanced engineering, science, and technology, bringing significant value to society. Members can be nominated in one of four categories: application engineer/practitioner, educator, research engineer/scientist, or technical leader.

Please visit the [IEEE Fellow Web](#)

page (http://www.ieee.org/membership_services/membership/fellows/index.html) for more information, detailed instructions for preparing the application, and required forms. Please use the online application for nomination and be sure to review the Before You Submit Checklist

(http://www.ieee.org/membership_services/membership/fellows/before_you_submit.html) . Using the online process, once you have submitted the completed application, notification is automatically sent to references and endorsers, alerting them that they have been asked to help with the nomination. This online application will save you a great deal of time, and you can monitor replies throughout the entire process. Please e-mail IEEE Fellows Staff (fellows@ieee.org) with questions.

IEEE Senior Member Application

Senior Member is the highest grade for which IEEE members can apply. The IEEE encourages all members to upgrade their membership to Senior Member when they are eligible to demonstrate their professional standing.

Requirements

The requirements for Senior Member include 10 years of professional experience (Your educational experience is credited toward that time as follows: three years for a baccalaureate degree in an IEEE-designated field, 4 years if you hold a baccalaureate and masters degree, 5 years if you hold a doctorate) with five years of significant performance. Please see details on the Senior Member Requirements page at <http://www.ieee.org/web/membership/senior-members/requirements.html>

Benefits of IEEE Senior Membership

- The professional recognition of your peers for technical and professional excellence.
- Senior Member Plaque: Since January 1999, all newly elevated Senior Members have received an engraved Senior Member plaque to be proudly displayed for colleagues, clients and employers to see. The plaque, an attractive fine wood with bronze engraving, is sent within six to eight weeks after elevation.
- Up to \$25.00 gift certificate toward one new Society membership.
- A letter of commendation to your employer on the achievement of senior member grade (upon the request of the newly elected Senior Member.)

- Announcement of elevation in Section/Society and/or local newsletters, newspapers and notices.
- Eligibility to hold executive IEEE volunteer positions. Can serve as Reference for Senior Member applicants. Invited to be on the panel to review Senior Member applications.

How to Apply for IEEE Senior Membership

- Contact qualifying references, and request them to fill out the required **Reference Form** on your behalf. You can download the form at <http://www.ieee.org/web/membership/senior-members/reference.html>
- Complete online application/nomination form. You may submit your application in any of the formats provided, but for the quickest processing, use the online form. You can find the form at <http://www.ieee.org/web/membership/senior-members/application.html>

Note: The applicant must also provide three references from current IEEE members holding Senior Member, Fellow or Honorary Member grade. If you have difficulty in locating Senior Members or Fellows to serve as references, please contact one of the Section Officers (<http://www.ieeecincinnati.org/section-officers/>). We will assist you in the application process and in identifying references for you. Please check out application deadlines and checklist at the link below

<http://www.ieee.org/web/membership/senior-members/apply.html>

Jason Geng
VP for Membership
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Conferences

2011 International IEEE Conference on Intelligent Transportation Systems Report

General Chair: Prof. Azim Eskandarian, GWU, USA

Program Chair: Prof. Kyongsu Yi, Seoul National University, Korea

The 14th International IEEE Conference on Intelligent Transportation Systems (IEEE ITSC 2011) was successfully held during October 5-7, 2011 at The George Washington University (GWU) Marvin Center, Washington, DC, USA. (<http://www.seas.gwu.edu/itsc2011/>). At the heart of the nation's capital on the campus of The George Washington University, this IEEE Conference provided an ideal setting for exchange of ideas between academic/industry researchers and Government decision makers. The 14th IEEE ITS Conference theme was Safe, Secure, and Sustainable transportation, which ensures saving energy and the environment.



General chair Dr. Azim Eskandarian



Conference opening ceremony

ITSC is the annual flagship conference of the IEEE Intelligent Transportation Systems Society (ITSS) and a leading forum where the state-of-the-art research, latest developments, and future prospects relating to intelligent transportation systems are presented and discussed each year. The conference was organized by an Organizing Committee and an International Technical Committee as follows:

General Chair: Prof. Azim Eskandarian, GWU, USA

Program Chair: Prof. Kyongsu Yi, Seoul National University, Korea

Special Session Chair: Professor Jeremy Blum, Penn State University, USA

Treasurer, Publication, Registration/Local Chair: Prof. Samer Hamdar, GWU, USA

Publicity Chair: Dr. Reinhard Pfliegl, Austria Tech, Austria

The International Technical Committee had 32 members, all renowned experts in their respective fields. Their names are listed on the conference web site.

The ITSC 2011 call for papers led to 475 submissions (including 13 special session proposals) from more than 20 countries. 356 papers were accepted after a rigorous peer review process. The paper review was handled by the conference program committee, chaired by Professor Kyongsu Yi, and the special sessions committee was chaired by Prof. Jeremy Blum. Technical and special session chairs and co-chairs were invited from the conference contributors.

Over 394 participants registered/attended the conference from all over the world as a wide range of topics were covered. The conference program included 356 oral presentations arranged in 72 parallel sessions, including 39 special sessions papers covering a variety of highly focused topics. As expected in any international conference, a few presenters could not make travel arrangements in time due to visa and other institutional issues. However, for the most part the sessions were conducted smoothly as planned.

The submitted papers were organized into five regular profiles:

- ITS modeling and analysis (119 submissions)
- Travel, traffic and emergency management (81 submissions)
- Advanced safety systems & intelligent vehicles (184 submissions)
- Electric vehicle transportation systems (13 submissions)
- Communications (V2V, V2I ...etc) (17 submissions).

On October the 6th of 2011, the conference plenary session brought together four speakers with diversified backgrounds. Mrs. Shelley J. Row, the director of the U.S. Department of Transportation's Intelligent Transportation Systems (ITS) Joint Program Office (JPO) offered a presentation titled "The Next 50 Years: Moving Toward a New Era of Roadway Safety and Efficiency". Professor Kostantinos Triantis, the National Science Foundation Civil Infrastructure Systems (CIS) Program director presented the "Issues and Future Research Opportunities in Engineering and Performance Measurements". The third speaker was Professor Mathew J. Barth, the director of the Center of Environmental Research and Technology at the University of California, Riverside. His presentation was titled "The role of ITS in Sustainable Transportation: Issues and Research Opportunities". Finally, Mr. Richard Bishop from Bishop Consulting presented the "Next Steps for ITS Technology to Getting Research Results into User's Hands". Insights from the academic, the federal/governmental and the consulting/industry communities were provided and discussed with the audience.

The lunches were served in open air on the conference center balconies with wonderful city views. The conference banquet took place at the Grand Ballroom and the Continental Room of the Cafritz Conference Center (Marvin Center /GWU.) In the evening of October 6, at the conference banquet, the IEEE ITSS awards were presented.

During the conference the IEEE ITS transactions editors meeting took place where the chief editor (Dr. FeiYu Wang) shared his plans for the transactions during a dinner. Immediately after the conference on October 8, the IEEE ITS executive committee and the IEEE ITS Board of Governors meetings were held (see report in Oct 2011 Issue).

ITSC 2011 has made several new records for ITSC, particularly in relation to the number of the registrants, the number of parallel sessions and the corresponding number of oral presentations. Overall, the conference was featured by its dedicated organizing team, excellent program, enthusiastic atmosphere, warm hospitality, and a strategically located conference venue. The organizers have received several positive feedbacks ever since the conference ended.



Keynote speakers in the plenary session: Mathew J. Barth, Richard Bishop, Shelley J. Row, and Kostantinos Triantis



Conference plenary session



Dr. Feiyue Wang receives 2011 IEEE ITS Outstanding Research Award (from left: Feiyue Wang, Alberto Broggi, Jason Geng)



ITSC 2012

Intelligent transportation systems conference

<http://www.itsc2012.org>



Anchorage, Alaska, USA September 16-19, 2012

Intelligent Transportation Systems (ITS) hold the promise of improving mobility, safety, and security, while ensuring energy efficiency and reducing environmental impacts of transportation systems.

The 15th IEEE Intelligent Transportation Systems Conference theme is **The Wild Frontier in Intelligent Transportation**. The conference brings together researchers, engineers, practitioners, managers, and policy makers from academia, industry, and government to share and discuss the latest in ITS research and development (R&D) results and implementation strategies. It will include dedicated sessions, workshops, and forums at which researchers, practitioners, government experts, and decision makers will share the latest research, success stories, and implementation needs of ITS.

Venue

Hilton Anchorage, 500 West Third Avenue, Anchorage, Alaska 99501, USA



Located in beautiful Anchorage, Alaska, the Hilton Anchorage is located in downtown Anchorage and is an ideal place for conferences with plenty of stylish, functional, and flexible meeting facilities. Being an important tour destination, Anchorage is the largest city in Alaska and has a curious mix of industry and culture. Anchorage offers numerous



technical and siteseeing opportunities to conference participants and their guests. Its natural beauty, well-conserved environment, and unique species of animals and plants make it a superbly attractive place for world-wide travelers.

Technical and Special Tours

Special technical tours will be arranged to visit with the State of Alaska Department of Transportation and the Municipality of Anchorage traffic management centers. Siteseeing tours will also be available, including half-day or full-day cruises to see many of Alaska's glaciers, rides on the Alaska railroad along the Cook Inlet (where humpback whales may be seen on one side and moose and dall sheep often frequent the other), flight-seeing tours into the famous Denali National Park, trips to the Alaska Zoo (located in Anchorage, it is the only place you can see live polar bears in the city), and escorted or unescorted museum tours where you can experience native Alaskan culture firsthand.

Who Should Attend

Those in ITS research, development, design, deployment, planning, and decision making who are in academic institutions, transportation industry, automotive manufacturers and suppliers, government, local transport authorities, national labs, international organizations, public transport authorities, freight and transport operators, public transport operators, service providers, telecom operators, system integrators, commercial fleet owners, road operators, and motoring organizations and all others who are in the energy and environment sector with an interest in transportation systems will benefit by attending this unique conference.



ITSC 2012

September 16-19, 2012
Anchorage, Alaska, USA

<http://www.itsc2012.org>

Call for Papers

Original and innovative contributions in ITS research and advanced implementations and deployments are sought for technical sessions. Please submit articles conveying new developments in theory, analytical, and numerical simulation and modeling, experimentation, advanced deployment and case studies, results of laboratory or field operational tests, and other related creative endeavors as well as special educational development for ITS curriculum. The conference theme is The Wild Frontier in Intelligent Transportation. The technical areas include but are not limited to the following:

- Traffic theory, modelling, simulation
- Intelligent algorithms
- Sensors and actuators
- Vision systems and processing
- Evacuation Systems
- Traffic and Communications Networks
- Traffic Control Systems
- Technologies for ITS User services: ATMS, ATIS, AVCS, etc.
- Multi-modal ITS
- Commercial Vehicle Operations
- ITS Implementation
- V2V and V2I Communications
- Intelligent Vehicles
- Driver Assistance
- Safety Systems
- Vehicle Collision Avoidance
- Integrated Safety Systems
- Pedestrian and Bicyclist Safety and Mobility systems
- ITS for Special Needs
- Security Systems
- Emergency Services

In the tradition of successful IEEE ITS Conferences, only the highest quality papers will be accepted through an on-line peer review process. The final version of the accepted papers will be included in the Conference proceedings only after at least one author officially registers and presents the paper at the Conference.

Important Dates

- | | |
|---|-------------------|
| ➤ Full-paper submission deadline: | March 15, 2012 |
| ➤ Notification of acceptance: | June 1, 2012 |
| ➤ Final paper submission deadline: | July 1, 2012 |
| ➤ Special Session proposal submission deadline: | February 25, 2012 |
| ➤ Workshop/Tutorial proposal submission deadline: | March 15, 2012 |

Best Student Paper Award

Articles written and presented by a primary author who is a student will be specially selected for the *Best Student Paper Award* recognition during the Conference.

Special Issue of *IEEE Transactions on ITS*

Selected exceptional quality papers will be invited for submission to a special issue of the *IEEE Transactions on Intelligent Transportation Systems*; Authors will be asked to revise their papers according to the standards of the transactions, which will be subjected to the Transactions' review process.

Workshops

Proposals are sought for Special Workshops and Tutorials related to the topics and themes of the conference.

General Chair:	Prof. Jeffrey Miller, University of Alaska Anchorage, USA
Program Co-Chairs:	Prof. Wei-Bin Zhang, University of California, Berkeley, USA
	Prof. Yin Hai Wang, University of Washington, USA
Finance Chair	Prof. James Krogmeier, Purdue University, USA
Publication Chair	Prof. Heng Wei, University of Cincinnati, USA
Workshop/Tutorials Chair:	Prof. Zhiheng Li, Tsinghua University, China
Local Arrangement Chair:	Prof. Sun-il Kim, University of Alaska Anchorage, USA
Student Activities Chair:	Dr. Brendan Morris, University of California, San Diego, USA
Registration Chair:	Prof. Javier Jesus Sanchez Medina, Universidad de Las Palmas de Gran Canaria, Canary Island, Spain
Publicity Co-chairs:	Prof. Urbano Nunes, University of Coimbra, Portugal
	Prof. Fei-Yue Wang, Chinese Academy of Sciences, China
	Prof. Matthew Barth, University of California, Riverside, USA

International Technical Program Committee:

Dr. S. Yu	Korea Automotive Technology Institute
Prof. T. Suzuki	Nagoya University
Dr. Y. Moon	Koti, Korea
Dr. S. Shladover	California PATH
Prof. T. Shim	University of Michigan-Dearborn
Prof. A. Broggi	University of Parma
Prof. D. Zeng	University of Arizona
Prof. L. Li	Tsinghua University
Prof. U. Nunes	University of Coimbra
Prof. C. Stiller	Karlsruhe University
Dr. H. Dia	ANZ ITS Technical Leader
Prof. N. Papanikolopoulos	University of Minnesota
Prof. A. Haghani	University of Maryland
Dr. A. Mortazavi	University of California, Berkeley
Prof. M. Abbas	Virginia Polytechnic Institute and State University
Dr. O. Altintas	Toyota InfoTechnology Center
Prof. M. Barth	University of California, Riverside
Prof. J. Gozalvez	Universidad Miguel Hernandez
Dr. R. Krishnan	Imperial College
Dr. Y. Li	National Information and Communications Technology Australia
Prof. T. Mathew	Indian Institute of Technology Bombay
Prof. H. Rakha	Virginia Tech
Dr. A. Ranganathan	IBM Thomas J. Watson Research Center
Prof. Shankar	Penn State University
Prof. S. Ukkusuri	Purdue University
Prof. G. Zhang	University of New Mexico
Prof. Y. Wu	University of St. Louis

CALL FOR PAPERS: IEEE ITSC 2012 WORKSHOP ON INFORMATION FUSION FOR INTELLIGENT TRANSPORTATION SYSTEMS

[HTTP://WWW.ITSC2012.ORG/IFITS_2012](http://www.itsc2012.org/ifits_2012)

15TH INTERNATIONAL IEEE CONFERENCE ON INTELLIGENT TRANSPORTATION SYSTEMS (ITSC2012)

Anchorage, Alaska, USA, 16 – 19 September 2012



ABSTRACT (FULL-DAY WORKSHOP)

We are living in a world where cars will soon all be very well-equipped with sensors such as GPS sensors, laser radars, infrared parking sensors, rear dead angle cameras, etc. Besides that, the infrastructure itself is likely to soon exploit technologies currently widely used, like smartphones, navigators and digital radio broadcast. Finally, there have been huge advances on traffic simulation, optimization, intensive computational techniques, distributed computing, data networks, wireless connectivity, and many others.

If we combine all of this, there is the richest variety ever of information sources available for intelligent transportation systems. The technology is out there, and now it is needed to take firm steps towards wisely combining the sources of information into smart applications that make roads safer and more efficient.

Hence, multi-sensor, multi-source information fusion is a research area that is becoming of utmost importance for the future development of intelligent traffic infrastructures and transportation systems.

The aim of the proposed workshop is to enhance profitable discussions on what processing/networking equipment, techniques, software, methodologies, and in general, data fusion techniques are being explored for its use for traffic simulation and management and other intelligent transportation system applications.

What software workbenches are used? What programming approaches are taken? Do people use open initiatives or proprietary software? Do people use parallel computers, desktops, laptops, or even smartphones? PC or Mac? Ad hoc devices or smartphones? Linux, Apple or Windows? Cheap off-the-shelf devices or custom made electronics? The questions are endless. That kind of information may be of the highest pragmatic value to practitioners, both engineers and scientists.

CALL FOR PAPERS

The workshop will consist of invited talks and submitted presentations. Interested authors are welcome to submit their contributions. Topics of interest include (but are not limited to):

- ⤴ Distributed and Wireless Sensor Networks for Transportation Applications
- ⤴ Data fusion and Smart cars
- ⤴ Multi-Sensor Systems, Distributed Sensor Systems and Real-Time Transportation Applications
- ⤴ Implementation Issues such as Algorithmic Issues, Real-World Computational Demands, Real-Time Constraints in the context of Fusion systems for Transportation Infrastructures.
- ⤴ Smart communication devices for ATIS applications
- ⤴ Advanced Architectures for Traffic Simulation using Data Mining as Real-World input.
- ⤴ Environmental Aware Smart Data Fusion applications.
- ⤴ Human-machine interfaces, human factors and behavioural responses to information systems.
- ⤴ Citizen-science networks as Information Fusion Source

SUBMISSIONS

Authors may chose to send a PDF paper (6 pages long) or a PDF slide file, or a video.

Paper contributions should follow the IEEE ITSC Conferences format/style (<http://its.papercept.net/conferences/support/files/ieeeeconf.zip>). LaTeX is the advised edition system, but also MSWord or Similar systems can be used (http://its.papercept.net/conferences/support/files/ieeeeconf_letter.dot)

Multimedia contributions should follow IEEE Transactions/Journals guidelines (http://www.ieee.org/portal/cms_docs_iportals/iportals/publications/journmag/transactions/MMdocumentation.pdf).

All the papers presented along with the multimedia materials will be compiled in a Proceedings file that will be delivered.

All submissions should be sent to Javier J. Sanchez-Medina (jsanchez@polaris.ulpgc.es). Please, include the words "IFITS submission" in the abstract, and the contribution title and author names in the email.

IMPORTANT DATES

- ⤴ Contributed papers/multimedia due: May 1, 2012
- ⤴ Notification of acceptance: June 1, 2012
- ⤴ Final Camera-ready paper submission deadline: July 1, 2012
- ⤴ ITSC 2012 commences in Anchorage, Alaska, USA: 16 – 19 September 2012
- ⤴ Workshops date: 16 September 2012

WHO SHOULD ATTEND

- ⤴ Engineers and Practitioners
- ⤴ Traffic Managers in Traffic Control Centers
- ⤴ Traffic Modelers

WORKSHOP ORGANIZERS

- ⤴ Jeffrey Miller, Department of Computer Engineering, University of Alaska Anchorage, USA
- ⤴ Javier J. Sánchez Medina, CICEI, University of Las Palmas de Gran Canaria, Spain

PROGRAM COMMITTEE

- ⤴ Onur Altintas – Toyota Infotechnology Center, Japan
- ⤴ Erel Avineri – University of the West of England, Bristol, UK
- ⤴ Matthew Barth – University of California, Riverside, USA

IEEE Intelligent Vehicles Symposium June 3-7, 2012, Alcalá de Henares, Spain

Sponsored by the IEEE Intelligent Transportation Systems Society

Call for Papers



THE INTELLIGENT VEHICLES SYMPOSIUM (IV'12) is the premier annual forum sponsored by the **IEEE INTELLIGENT TRANSPORTATION SYSTEMS SOCIETY (ITSS)**. Researchers, academicians, practitioners, and students from universities, industry, and government agencies are invited to discuss research and applications for Intelligent Vehicles and Vehicle-Infrastructure Cooperation. The technical presentations are characterized by a single session format so that all attendees remain in a single room for multilateral communications in an informal atmosphere. Tutorials will be offered on the first day followed by three days of presentations and a vehicle demonstration day. An exhibition area will be available for the presentation of products and projects, as well as for small demonstrations.

Program topics include but are not limited to:

- Advanced Driver Assistance Systems
- Automated Vehicles
- Vehicular Safety, Active and Passive
- Vehicle Environment Perception
- Driver State and Intent Recognition
- Eco-driving and Energy-Efficient Vehicles
- Impact on Traffic Flows
- Cooperative Vehicle-Infrastructure Systems
- Collision Avoidance
- Pedestrian Protection
- V2I / V2V Communication
- Assistive Mobility Systems
- Intelligent Ground, Air and Space Vehicles
- Autonomous / Intelligent Robotic Vehicles
- Image, Radar, Lidar Signal Processing
- Information Fusion
- Vehicle Control
- Telematics
- Human Factors and HMI
- Electric and Hybrid Technologies
- Novel Interfaces and Displays
- Intelligent Vehicle Software Infrastructure

Manuscripts of 6 pages in PDF format must be electronically submitted for peer-review in IEEE standard-format. For detailed submission instructions visit the conference website www.robosafe.es/IV2012

Important Dates

Special Session Proposal: **January 31st, 2012**
Paper submission deadline: **January 31st, 2012**
Notification of acceptance: **March 30th, 2012**
Final paper submission: **April 20th, 2012**

Contact

For proposal of a special session, demonstration, and exhibition contact the organization committee at iv2012@robosafe.es

General Chair

Miguel Ángel Sotelo
University of Alcalá, Spain
miguel.sotelo@uah.es

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Meng Lu
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SCOPE

The 2012 IEEE International Conference on Vehicular Electronics and Safety (ICVES'12) which is an annual forum sponsored by the IEEE Intelligent Transportation Systems Society will take place in İstanbul during July 24-27, 2012. It brings together researchers and practitioners to discuss vehicle electronics, and safety systems research and practice. ICVES'12 welcomes papers dealing with any aspect of vehicle electronics and safety systems.

ICVES is the Conference the ITS Society has specifically identified for presentations on Electric Vehicles, Hybrid and Plug-In Hybrid Vehicle related presentations. Researchers in these areas are especially encouraged to submit their latest results and attend.

The motto for ICVES'12 is: Let's meet where the continents meet. İstanbul connecting the two continents of Europe and Asia and being a cross-road of civilizations for many centuries is an ideal location for the IEEE International Conference on Vehicular Electronics and Safety. The conference venue is Military Museum and Cultural Center located at the center of İstanbul.

TOPICS

Original contributions are solicited in all Vehicular Electronics and Safety research and applications. Contributions for industry and application sessions are also solicited. Topics include, but are not limited to:

- * Active and Passive Safety Systems
- * Telematics
- * Vehicular Power Networks
- * X*By Wire Technology
- * System*On*a*Chip
- * Vehicular Sensor
- * Vehicle Bus
- * Sensor Network
- * Electro Magnetic Compatibility
- * Inter*Vehicular Network
- * Vehicle Testing
- * Vehicle Hardware / Software System
- * Navigation and Localization Systems
- * Vehicular Measurement Technology
- * Vehicular Signal Processing
- * Micro*electromechanical Systems
- * Image Sensor
- * Vehicle / Engine Control
- * Embedded Operation System
- * Driver Assistance Systems
- * Adaptive Cruise Control Systems
- * Pattern Recognition for Vehicles
- * Human Machine Interaction
- * Diagnostics on Line
- * Virtual / Digital System
- * Others

PAPER SUBMISSION

Prospective authors are requested to submit their paper as a pdf file in IEEE two column format through The IEEE Intelligent Transportation Systems Society Conference Management System no later than February 15, 2012. A LaTeX style file and a Microsoft Word template are available at the website: <http://its.papercept.net/conferences/index.html>.

IMPORTANT DATES

- * **Submission deadline** : February 15, 2012
- * **Notification of acceptance** : May 15, 2012
- * **Final Manuscript due** : June 1, 2012
- * **Workshop proposals due** : June 8, 2012

Workshop organization is encouraged. Prospective organizers should contact the program chair at icves2012@gsu.edu.tr and please visit the web site.

<http://icves2012.gsu.edu.tr>,

For e-mail correspondence: icves2012@gsu.edu.tr



2012 IEEE International Electric Vehicle Conference

Date:

4-8 March 2012

Location:

TD Conference Center

Greenville, SC USA

-and-

Clemson University

International Center for

Automotive Research (CU-ICAR)

Greenville, SC USA

Sponsors/Patrons:



For more information and to register, visit:

<http://electricvehicle.ieee.org>



From Prototype to Mass Production and Mass Use

The first IEEE International Electric Vehicle Conference (IEVC) will facilitate the exchange of information on new global trends in technology, engineering, standards and deployment aspects among academic and industrial thought leaders of the fast-growing electric mobility ecosystem via a unique cross-organizational platform.

Who Will Be There

Keynote speakers and panel leaders include executives and leading experts from organizations such as BMW, Bosch, Chrysler, Delphi, Duke Energy, EDTA, GE, FedEx, KEMET, MBTech, SAE, Valeo, Volkswagen...and many others.

Who Should Attend

IEVC is an international venue for those with an interest in the transformation of the transportation industry via electrification, including electrical vehicle designers, component and infrastructure system developers, manufacturers, utility experts, corporate executives, technical analysts, researchers, educators, entrepreneurs, venture capitalists, legislators, regulators and standardization experts.



ITST 2012

Taipei, Taiwan

Nov. 5-8, 2012



International Conference on ITS Telecommunications

Call for Paper

Wireless communication for intelligent transportation systems (ITS) is a promising technology to improve safety and security for all transport modes, to reduce traffic congestion, to optimize the use of existing infrastructures (road, rail maritime, fluvial) and support information services in vehicles with the general purpose of reducing the impact of transport on the environment. The development of sustainable mobility is a key challenge for the development of urban areas. A new era of vehicular technology that includes vehicle-to-vehicle (V2V) and vehicle-to-infrastructure (V2I) communication is already there in the public transport domain and this should be generalized. This era will be driven by both (pre-competitive) public-sector and private-sector funding. Safety-related applications are not only taken into consideration, but non-safety multimedia content providers are also becoming a new topic of research. Key players in the industry, such as automotive companies, public transport operators, railway industries and government agencies, are investing heavily in the advanced research and development of many ITS technologies and applications. This research effort primarily focuses on the system development and standardization of telematics. During recent ITS developments, transportation telematics techniques have exhibited much progress, e.g., interaction between vehicles and the infrastructure for delivering services such as road-side assistance, automatic crash notification, concierge assistance and vehicle condition reports. These progresses are also really important in the public transport domain (buses, metro, trains, tramways) for which V2V and V2I for safety and non safety applications are a key component for the exploitation but also for reducing energy consumption. A number of IEEE 802.11p-like equipment prototypes have been built, and several technical reports based on field trials have demonstrated the lack of cutting-edge techniques to improve system performance. Furthermore, all these applications require accurate and reliable positioning using GNSS solutions alone or enhanced with map-matching and sensors fusion. Technology and applications for ITS and telematics design are rapidly emerging, and there is a critical need to bring together professional researchers, intelligent engineers, academia, industry, standard committees, the private sector and the public sector to exchange new ideas. This conference aims to spur research progress by serving as a forum in which both academia and industry can share experiences and report original work regarding all aspects of vehicular communication, e.g., Vehicular Ad hoc Networks (VANETs), cooperative systems, information dissemination, road and rail safety, information and emergency services, etc. Our primary goal is to promote meaningful research in the cross-layered design of architectures, algorithms and applications for vehicular communication environments in all transport modes.

Track1: Smart Vehicle

- Video/Audio signal processing for driver-assistance systems
- In-vehicle communications/telematics
- Analog/Digital circuit design for in-car smart systems
- SoC architecture/platform for smart vehicle systems
- Green design techniques for ITS
- Security and privacy in vehicular networks
- Field operational tests and testbeds for smart vehicular
- Vehicle collision avoidance
- Sensors and actuators

Track2: Intelligent Transportation Systems (ITS)

- Data-collection, organization and dissemination methods
- New ITS/Telematics applications
- Ongoing ITS/Telematics activities

Track3: Telecommunications and Positioning

- V2V, V2I and V2X communications
- Network protocols including MAC, routing, addressing, multicast, TCP protocols and end-to-end quality of service, resource management, security and privacy
- Design with multiple wireless data links (802.11p, 802.11x, WiMAX, WiFi, cell phone, LTE-A, GPS)
- Mobility or handover technology
- System-level, board-level and chip-level electronics
- PHY issues: channel measurements, channel modeling, channel estimation, antenna arrangement, pilot arrangement, etc.
- Physical layer and antenna technologies for vehicular networks
- RF propagation models for vehicular networks
- Radio resource management for vehicular networks
- GPS, GALILEO and terrestrial solutions for accurate and reliable positioning of vehicles

Track4: Green Life Toward Blue Planet

- Field operational tests and testbeds for vehicular networks
- Assessment of impact of vehicular networks on transportation efficiency and safety
- Emission modeling and environmental impact assessment
- Regional requirements and their consequences
- Interference-Management and Spectrally-Efficient Technologies
- Resource-Efficient Networking Technology and Application Design
- Cross-Layer Design/Optimization and Green Transceiver Design
- Novel technologies to reduce human electromagnetic exposure and electromagnetic pollution

Important Notes

PDF format via <http://edas.info/11573>

Author's guidelines are announced on conference web site <http://www.itst2012.org>

Important Dates

- ▶ Manuscript Submission Due: May 31, 2012
- ▶ Final Acceptance notification: July 31, 2012
- ▶ Final Manuscript Due: August 31, 2012
- ▶ Early Registration: August 31, 2012

General Chair: Jia-Chin Lin jiachin@ieee.org

Contact: Chi-Sheng Lin info@nucomm.org



IEEE Intelligence and Security Informatics (ISI) 2012

Call for Papers

June 11-14, 2012 / Washington, DC, USA

THEME: Cyberspace, Border, and Immigration Securities

HOST: The University of Arizona

Intelligence and Security Informatics (ISI) research is an interdisciplinary research field involving academic researchers in information technologies, computer science, public policy, bioinformatics, and social and behavior studies as well as local, state, and federal law enforcement and intelligence experts, and information technology industry consultants and practitioners to support counterterrorism and homeland security missions of anticipation, interdiction, prevention, preparedness and response to terrorist acts. The annual IEEE International ISI Conference series (<http://www.isiconference.org/>) was started in 2003, and the first nine meetings were held in Tucson, AZ (twice); Atlanta, GA; San Diego, CA; New Brunswick, NJ; Taipei, Taiwan; Dallas, TX; Vancouver, Canada; and Beijing, China. Proceedings of these ISI meetings and workshops have been published by the IEEE Press and in the Springer Lecture Notes in Computer Science (LNCS) series.

ISI 2012 will be organized in four main streams focusing on

- Information Sharing and Data/Text Mining,
- Infrastructure Protection and Emergency Responses,
- Terrorism Informatics, and
- Enterprise Risk Management and Information Systems Security

Submissions may include systems, methodology, testbed, modeling, evaluation, and policy papers. Research should be relevant to informatics, organization, or public policy in applications of counter-terrorism or protection of local/ national/international security in the physical world or cyberspace. Topics include but are not limited to:

1. Information Sharing and Data/Text Mining
 - Intelligence-related knowledge discovery
 - Computer or cyber crime investigations and digital forensics
 - Criminal investigative criteria and standard of procedure on Computer crime
 - Criminal data mining and network analysis
 - Forecasting crime and the impact of crime
 - Criminal/intelligence information sharing and visualization
 - Crime pattern recognition and modeling tools
 - Web-based intelligence monitoring and analysis
 - Spatial-temporal data analysis/GIS for crime analysis and security informatics
 - Deception and intent detection
 - Cyber-crime detection and analysis

- Authorship analysis and identification
 - Applications of digital library technologies in intelligence data processing, preservation, sharing, and analysis
 - Agents and collaborative systems for intelligence sharing
 - HCI and user interfaces of relevance to intelligence and security
 - Information sharing policy and governance
 - Privacy, security, and civil liberties issues
 - Intelligence-computerized community security and surveillance system
2. Infrastructure Protection and Emergency Responses
- Cyber-Physical-Social system security and incident management
 - Cyber-infrastructure design and protection
 - Intrusion detection
 - Bio-terrorism tracking, alerting, and analysis
 - Bio-terrorism information infrastructure
 - Transportation and communication infrastructure protection
 - Border/transportation safety
 - Law Enforcement decision support systems
 - Emergency response and management
 - Disaster prevention, detection, and management
 - Communication and decision support for search and rescue
 - Assisting citizens' responses to terrorism and catastrophic events
 - Computer forensics and crime lead discovery
 - Anti-fraud information technology
3. Terrorism Informatics
- Terrorism related analytical methodologies and software tools
 - Terrorism knowledge portals and databases
 - Terrorist incident chronology databases
 - Terrorism root cause analysis
 - Social network analysis (radicalization, recruitment, conducting operations), visualization, and simulation
 - Forecasting terrorism
 - Countering terrorism
 - Measuring the impact of terrorism on society
 - Measuring the effectiveness of counter-terrorism campaigns
 - Crime intelligence and cyberspace crime investigation
 - Immigration and security
4. Enterprise Risk Management and Information Systems Security
- Information security management standards
 - Information systems security policies
 - Behavior issues in information systems security
 - Fraud detection
 - Cyber crime and social impacts
 - Corporate going concerns and risks
 - Accounting and IT auditing
 - Corporate governance and monitoring
 - Board activism and influence

- Corporate sentiment surveillance
- Market influence analytics and media intelligence
- Consumer-generated media and social media analytics

Paper submission instructions and template information can soon be found on the Submissions page at <http://isi.borders.arizona.edu/>

WORKSHOPS

In conjunction with ISI 2012, several workshops will be held on June 11, 2012. The currently committed ones include (1) the Border Security Workshop, (2) the Immigration Studies Workshop, and (3) the International Workshop on Social Computing (SoCo). Workshop proposals are welcome.

IMPORTANT DATES

- Paper submission due date for ISI 2012: March 1, 2012
- Notification of acceptance: March 30, 2012
- The due date for Tutorial/ Workshop proposals: February 27, 2012

PAPER SUBMISSION

Submission file formats are PDF and Microsoft Word. Required Word/LaTeX templates (IEEE two-column format) can be found at the conference Web site. Long (6,000 words, 6 pages max.) and short (3000 words, 3 pages max.) papers in English must be submitted electronically via the conference Web site. The accepted papers from ISI 2012 and its affiliated workshops will be published by the IEEE Press in a formal Proceedings. IEEE ISI Proceedings are EI-indexed. Authors who wish to present a poster and/or demo may submit a 1-page extended abstract, which, if selected, will appear in Proceedings. The selected IEEE ISI 2012 best papers will be invited for contribution to the new Springer Security Informatics journal.

Proposals for tutorials and special-topic workshops in any areas of Intelligence and Security Informatics research and practice are welcome. Such events will be an integral part of the ISI-2012 conference program. Proposals in PDF or Microsoft Word not exceeding 3 pages should be emailed to the conference organizing committee at zeng@email.arizona.edu by February 27, 2012 and contain the following information.

- Title of tutorial/workshop
- Preferred duration (half day vs. full day)
- Brief bios of proposed instructor(s)/organizer(s)
- Objectives to be achieved
- Scope of topics to be covered
- Target audience and evidence of interest (for tutorials)
- Target audience and the list of potential presenters/contributors (for workshops)

Organizing Committee

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Conference Calendar

Massimo Bertozzi / Paolo Grisleri

Conference Calendar

This section lists upcoming ITS-related conferences, workshops, or exhibits. Contributions are welcome; please send announcements to itsconfs@ce.unipr.it.

2012

February 24-26, 2012
VISIGRAPP-2012 Conference
Rome, Italy
<http://www.visigrapp.org/>

March 4-8
2012 IEEE International Electrical Vehicle Conference (IEVC)
Technology, Engineering, Standards – Challenges and Opportunities
Greenville, South Carolina, USA
<http://electricvehicle.ieee.org>

March 21-23
International Conference on Automotive Technologies
Melbourne, Australia
<http://www.icsat2012.com/>
Submissions due by: June 15, 2008

April 24-26
SAE 2012 World Congress
Cobo Center
Detroit, Michigan, USA
<http://www.sae.org/congress>

May 6-9 2012
IEEE Vehicular Technology Conference: VTC2012-Spring
Yokohama, Japan
<http://www.ieeevtc.org/vtc2012spring/index.php>

May 14-18, 2012
IEEE International Conference on Robotics and Automation
St. Paul - MN, USA

<http://www.icra2012.org/>

May 28-31, 2012

ISIE 2011 - 21th IEEE International Symposium on Industrial Electronics

Hangzhou, Zhejiang, China

<http://www.isie2012.com/>

May 30-31, 2012

16th International Forum on Advanced Microsystems for Automotive Applications (AMAA 2012)

Harnack House, Berlin (Germany)

<http://www.amaa.de/>

Submission due by: January 31, 2012

June 3-7, 2012

IEEE Intelligent Vehicle Symposium

Alcala de HERNANDEZ, Spain

<http://www.robosafe.es/iv2012/>

Submission due by: January 31st, 2012

July 2-4, 2012

IEEE International Conference on Virtual Environments, Human Computer Interfaces and Measurement System (VECIMS2012)

Tianjin, China

<http://vecims2012.ieee-ims.org/>

Submission due by: March 15, 2012

July 17-19, 2013

International Symposium on Transportation and Traffic Theory

Noordwijk, the Netherlands

Submissions due by: January 15, 2012

<http://www.isttt.org/>

June 18-20, 2012

Computer Vision and Pattern Recognition: CVPR 2011

Providence, Rhode Island, USA

<http://www.cvpr2012.org/>

July 14, 16

12th Asia-Pacific ITS Forum & Exhibition

Kuala Lumpur, Malaysia

<http://www.itsasiapacific2008.com/>

Submission due by: April 16-18, 2012

July 24-27

2012 IEEE International Conference on Vehicular Electronics and Safety (ICVES12)

Istanbul, Turkey
<http://www.ICVES2012.gsu.edu.tr>
Paper submission deadline: Feb 15, 2012

3-6 September 2012
IEEE Vehicular Technology Conference: VTC2012-Fall
Quebec City, Canada
<http://www.ieeevtc.org/vtc2012fall/index.php>
Submission due by: 19 January 2012

September 16-19, 2012
IEEE Intelligent Transportation Systems Conference
Anchorage, Alaska, USA
<http://www.itsc2012.org>
Submission due by: March 15, 2012

September 16-19, 2012
National Rural ITS Conference
Biloxi, Mississippi, USA
<http://www.nritsconference.org>
Submission due by: March 2nd, 2012

October 3-5, 2012
2012 IEEE Multi-Conference on Systems and Control
Dubrovnik, Croatia
<http://www.msc2012.org/>
Submission due by: February 10, 2012

October 7-12, 2012
2012 IEEE/RSJ International Conference on Intelligent Robots and Systems
Vilamoura-Algarve, Portugal
<http://www.iros2012.org/site/>
Submission due by: March 10, 2012

October 10-13, 2012
12th International Conference on Transport Systems Telematics
Katowice-Ustroń, Poland
<http://www.tst-conference.org/index.php?page=home&lang=en>

October 22-26, 2012
19th World Congress on ITS
Vienna, Austria
<http://2012.itsworldcongress.com/content>
Submission due by: January 13, 2012

November 5-8, 2012
12th International Conference on ITS Telecommunications
Taipei, Taiwan
Submission due by: May 31,2012

Abstracts for Transactions on ITS Papers (EARLY ACCESS via IEEE Xplore)

A New Approach for Co-Operative Bus Priority at Traffic Signals

Hounsell, N.; Shrestha, B.;

Bus priority at traffic signals is a growing area of cooperative transport system applications. Interest in bus priority continues to grow as the cities pay more attention to the needs of buses to provide fast, frequent, and reliable services, thus contributing to a sustainable transport system. Bus priority at traffic signals is particularly favored at places where road space is limited and traffic signal density is high. With increasing the use of automatic vehicle location (AVL) systems, it is now possible to provide "differential" priority, where different levels of priority can be awarded to buses at traffic signals according to chosen criteria (e.g., to improve regularity). At present, common strategies are based on the comparison of the time headway of a bus with the scheduled headway. However, this paper shows that greater regularity benefits could be achieved through a strategy where priority for a bus is based not only on its own headway but also the headway of the bus behind (the following bus). This paper demonstrates the benefits of this on a theoretical basis and quantifies the benefits from simulation modeling of a high-frequency bus route. Such a strategy provides an opportunity to exploit the more detailed location information available from the growing number of AVL-based systems for buses being implemented around the world.

Localized Extended Kalman Filter for Scalable Real-Time Traffic State Estimation

van Hinsbergen, C. P. I. J.; Schreiter, T.; Zuurbier, F. S.; van Lint, J. W. C.; van Zuylen, H. J.;

Current or historic traffic states are essential input to advanced traveler information, dynamic traffic management, and model predictive control systems. As traffic states are usually not perfectly measured and are everywhere, they need to be estimated from local and noisy sensor data. One of the most widely applied estimation methods is the Lighthill-Whitham and Richards (LWR) model with an extended Kalman filter (EKF). A large disadvantage of the EKF is that it is too slow to perform in real time on large networks. To overcome this problem, the novel localized EKF (L-EKF) is proposed in this paper. The logic of the traffic network is used to correct only the state in the vicinity of a detector. The L-EKF does not use all information available to correct the state of the network; the resulting accuracy is equal, however, if the radius of the local filters is sufficiently large. In two experiments, it is shown that the L-EKF is much faster than the traditional Global EKF (G-EKF), that it scales much better with the network size, and that it leads to estimates with nearly the same accuracy as the G-EKF and when the spacing between detectors is varied somewhere between 0.7 and 5.1 km. Compared with the G-EKF, the L-EKF is a highly scalable solution to the state estimation problem.

Collaborative Vision-Integrated Pseudorange Error Removal: Team-Estimated Differential GNSS Corrections with no Stationary Reference Receiver

Rife, J.;

This paper presents an approach for generating Global Navigation Satellite System (GNSS) differential corrections by distributing GNSS and georeferenced vision measurements through a vehicle-to-vehicle (V2V) communications network. Conventionally, high-quality differential GNSS corrections are generated from a stationary reference receiver in close proximity to a set of mobile users. The proposed method, which is called Collaborative Vision Integrated Pseudorange Error Removal (C-VIPER), instead generates differential corrections using data from moving vehicles, thus eliminating the need for an infrastructure of stationary receivers. An important feature of the proposed algorithm is that individual differential corrections are computed for each satellite, so that corrections can be shared among users with different satellites in view. As demonstrated in simulation, measurement sharing significantly improves positioning accuracy in both the cross-track direction, where the quality of visual lane-boundary measurements is high, and the along-track direction, where the quality is low. Furthermore, because measurements are shared among many vehicles, the networked solution is robust to vision-sensor dropouts that may occur for individual vehicles.

Amplitude-Modulated Laser Radar for Range and Speed Measurement in Car Applications

Mao, X. ; Inoue, D. ; Kato, S. ; Kagami, M. ;

Doppler laser radar can improve the precision of speed measurement by about two orders of magnitude compared with time-of-flight range finders, which obtain target speeds by range differentiation. However, in a car environment, the usage of traditional Doppler laser radar schemes is limited, because they do not satisfy the requirement of simultaneously measuring the target range together with speed with high precision. First, in this paper, we describe a new in-car laser radar system and show a new modulation scheme that enables the in-car laser radar to simultaneously measure the target range and speed with high precision. Then, we perform simulations and experiments to verify the accuracy of the proposed method. In the Appendix, a brief review of current widely used laser radar schemes is given. The limitations of these schemes to their employment in car applications are also discussed.

Experimental Development of a New Target and Control Driver Steering Model Based on DLC Test Data

Tan, H.-S. ; Huang, J.;

This paper describes the development of a driver steering model that captures driver key steering mechanisms based on the analyses of vehicle test data on the standard double lane change (DLC) course. These analyses indicate that, instead of planning and following a desired

path according to the traditional trajectory-planning concept, drivers simply use the next lane center as the target points for control during lane changes. The data also suggest that drivers engage steering rate control instead of the conventional steering angle control to steer the vehicle. Accordingly, this paper proposes a relatively straightforward driver steering model based on this target and control scheme. Both the open-loop identification and closed-loop simulations verify that this relatively simple driver steering model is capable of capturing individual driver steering behavior and that the simulated steering rate matches well with the actual steering rate for all 80 vehicle test runs conducted by 20 different drivers.

Optimizing Pushback Decisions to Value Airport Surface Surveillance Information

Burgain, P. ; Pinon, O. J. ; Feron, E. ; Clarke, J.-P. ; Mavris, D. N. ;

As airport surface surveillance technologies develop, aircraft ground position information becomes more easily available and accurate. This paper provides a better understanding of the value of future surface surveillance systems where departures, and more specifically pushback times, will be optimized. It analytically quantifies the potential benefits yielded by providing surveillance information to the agent or system that is entrusted with tactically optimizing pushback clearances under nominal conditions. A stochastic model of surface operations is developed for single-ramp surface operations and calibrated to emulate departure surface operations at LaGuardia Airport. Two levels of information are examined within a tactically optimized collaborative decision-making framework. For each level, emissions, number of taxiing aircraft, and runway utilization rate are analyzed and compared with a simple threshold policy to evaluate surface surveillance information. Safety benefits, however, are not considered in this paper. It is estimated that optimally controlling pushback clearances from a single-ramp area using detailed surface surveillance information does not provide significant benefits when compared with controlling pushback clearances using a gate-holding policy based on the number of aircraft currently taxiing. However, when the runway is functioning at intermediate capacity (50%–72% runway utilization rates), e.g., under adverse weather conditions, surveillance information may improve optimization of departure operations. In such case, emissions and the number of taxiing aircraft are reduced by up to 6% when compared with the gate-holding policy and by up to 3% when compared with the performance of an intelligent operator with limited.

Phase Transition of Message Propagation Speed in Delay-Tolerant Vehicular Networks

Agarwal, A. ; Starobinski, D. ; Little, T. D. C. ;

Delay-tolerant network (DTN) architectures have recently been proposed as a means to enable efficient routing of messages in vehicular area networks (VANETs), which are characterized by alternating periods of connectivity and disconnection. Under such architectures, when multihop connectivity is available, messages propagate at the speed of radio over connected vehicles. On the other hand, when vehicles are disconnected, messages are carried by vehicles and propagate at vehicle speed. Our goal in this paper is to analytically determine what gains are achieved by DTN architectures and under which conditions, using the average message

propagation speed as the primary metric of interest. We develop an analytical model for a bidirectional linear network of vehicles, as found on highways. We derive both upper and lower bounds on the average message propagation speed by exploiting a connection with the classical pattern-matching problem in probability theory. The bounds reveal an interesting phase transition behavior. Specifically, we find out that, below a certain critical threshold, which is a function of the traffic density in each direction, the average message speed is the same as the average vehicle speed, i.e., DTN architectures provide no gain. On the other hand, we determine another threshold above which the average message speed quickly increases as a function of traffic density and approaches radio speed. Based on the bounds, we also develop an approximation model for the average message propagation speed that we validate through numerical simulations.

Parallelized Particle and Gaussian Sum Particle Filters for Large-Scale Freeway Traffic Systems

Mihaylova, L. ; Hegyi, A. ; Gning, A. ; Boel, R. K. ;

Large-scale traffic systems require techniques that are able to 1) deal with high amounts of data and heterogenous data coming from different types of sensors, 2) provide robustness in the presence of sparse sensor data, 3) incorporate different models that can deal with various traffic regimes, and 4) cope with multimodal conditional probability density functions (pdfs) for the states. Often, centralized architectures face challenges due to high communication demands. This paper develops new estimation techniques that are able to cope with these problems of large traffic network systems. These are parallelized particle filters (PPFs) and a parallelized Gaussian sum particle filter (PGSPF) that are suitable for online traffic management. We show how complex pdfs of the high-dimensional traffic state can be decomposed into functions with simpler forms and how the whole estimation problem solved in an efficient way. The proposed approach is general, with limited interactions, which reduce the computational time and provide high estimation accuracy. The efficiency of the PPFs and PGSPFs is evaluated in terms of accuracy, complexity, and communication demands and compared with the case where all processing is centralized.

Robust Train Timetabling Problem: Mathematical Model and Branch and Bound Algorithm

Shafia, M. A. ; Pourseyed Aghaee, M. ; Sadjadi, S. J. ; Jamili, A. ;

This paper illustrates the results of an investigation into developing a new robust train-timetabling problem in a single-track railway line. The proposed model is formulated as a robust form of the mixed integer approach. A branch-and-bound (B&B) algorithm, along with a new heuristic beam search (BS) algorithm, is presented to solve the model for large-scale problems in reasonable time. We also propose two different methods to measure the required buffer times under the assumption of unknown and known distribution functions of disturbances. We have generated some random instances, and the efficiency of the B&B and BS algorithms are demonstrated by comparing the results with common software packages as well as a new lower bound method. The results demonstrate that the B&B algorithm can find optimum solutions in a shorter amount of time compared with common software packages

such as Lingo. Moreover, the BS algorithm can effectively find a near-optimum solution in a rational amount of time.

A Novel Lane Detection System With Efficient Ground Truth Generation

Borkar, A. ; Hayes, M. ; Smith, M. T. ;

A new night-time lane detection system and its accompanying framework are presented in this paper. The accompanying framework consists of an automated ground truth process and systematic storage of captured videos that will be used for training and testing. The proposed Advanced Lane Detector 2.0 (ALD 2.0) is an improvement over the ALD 1.0 or Layered Approach with integration of pixel remapping, outlier removal, and prediction with tracking. Additionally, a novel procedure to generate the ground truth data for lane marker locations is also proposed. The procedure consists of an original process called time slicing, which provides the user with unique visualization of the captured video and enables quick generation of ground truth information. Finally, the setup and implementation of a database hosting lane detection videos and standardized data sets for testing are also described. The ALD 2.0 is evaluated by means of the user-created annotations accompanying the videos. Finally, the planned improvements and remaining work are addressed.

An Intelligent V2I-Based Traffic Management System

Milanes, V. ; Villagra ; , J. ; Godoy, J. ; Simo ; , J. ; Perez, J. ; Onieva, E. ;

Vehicles equipped with intelligent systems designed to prevent accidents, such as collision warning systems (CWSs) or lane-keeping assistance (LKA), are now on the market. The next step in reducing road accidents is to coordinate such vehicles in advance not only to avoid collisions but to improve traffic flow as well. To this end, vehicle-to-infrastructure (V2I) communications are essential to properly manage traffic situations. This paper describes the AUTOPIA approach toward an intelligent traffic management system based on V2I communications. A fuzzy-based control algorithm that takes into account each vehicle's safe and comfortable distance and speed adjustment for collision avoidance and better traffic flow has been developed. The proposed solution was validated by an IEEE-802.11p-based communications study. The entire system showed good performance in testing in real-world scenarios, first by computer simulation and then with real vehicles.

Interacting Multiple Model Filter-Based Sensor Fusion of GPS With In-Vehicle Sensors for Real-Time Vehicle Positioning

Jo, K. ; Chu, K. ; Sunwoo, M. ;

Vehicle position estimation for intelligent vehicles requires not only highly accurate position information but reliable and continuous information provision as well. A low-cost Global Positioning System (GPS) receiver has widely been used for conventional automotive applications, but it does not guarantee accuracy, reliability, or continuity of position data when GPS errors occur. To mitigate GPS errors, numerous Bayesian filters based on sensor fusion algorithms have been studied. The estimation performance of Bayesian filters primarily relies on the choice of process model. For this reason, the change in vehicle dynamics with driving conditions should be addressed in the process model of the Bayesian filters. This paper presents a positioning algorithm based on an interacting multiple model (IMM) filter that integrates low-cost GPS and in-vehicle sensors to adapt the vehicle model to various driving conditions. The model set of the IMM filter is composed of a kinematic vehicle model and a dynamic vehicle model. The algorithm developed in this paper is verified via intensive simulation and evaluated through experimentation with a real-time embedded system. Experimental results show that the performance of the positioning system is accurate and reliable under a wide range of driving conditions.

A Novel Approach for Modeling Land Vehicle Kinematics to Improve GPS Performance Under Urban Environment Conditions

Tzoreff, E. ; Bobrovsky, B.-Z. ;

The satellite blockage problem, which adversely affects Global Positioning System (GPS) accuracy in urban environments, is addressed in this work. To provide a position solution, there must be at least four satellites within line of sight (LOS) of the receiver (vehicle). However, when satellite blockage occurs, this requirement is not met because most of the sky is obscured by tall buildings, and only a narrow sky sector is exposed to the receiver. Given the short duration of satellite blockages, an efficient solution to this problem can be accomplished through reliable modeling of vehicle motion. In this manner, information regarding vehicle motion can be more precisely obtained in the absence of a sufficient number of measurements. In this paper, a model that uses intrinsic quantities as part of the description of the vehicle path, such as curvature, tangent angle, and tangential speed, is proposed to achieve a more accurate modeling of both the trajectory and kinematics of a land vehicle. The model, which was implemented via an extended Kalman filter, was examined against currently known models during satellite blockage scenarios and demonstrated superior performance.

Intelligent Environment-Friendly Vehicles: Concept and Case Studies

Li, K. ; Chen, T. ; Luo, Y. ; Wang, J. ;

The concept of an intelligent environment-friendly vehicle (i-EFV) is proposed in this paper. It integrates three components, i.e., clean-energy powertrain, electrified chassis, and intelligent information interaction devices. By employing such technologies as structure sharing, data fusion, and control coordination, more comprehensive performances are achievable, in terms of traffic safety, fuel efficiency, and environmental protection. Based on its definition and

configuration, some key technologies, including design for resource effectiveness, driving environment identification, and coordinated control, are studied. As a basic application, a platform of an intelligent hybrid electric vehicle (i-HEV), which incorporates a hybrid powertrain with adaptive cruise control, has been designed and implemented. Both simulation and experimental results demonstrated that the i-EFV performed better than a conventional vehicle.

FPGA-Based Track Circuit for Railways Using Transmission Encoding

Hernández, Á ; Pérez, M. C. ; García, J. J. ; Jiménez, A. ; García, J. C. ; Espinosa, F. ; Mazo, M. ; Ureña, J. ;

The current stage of railway transportation systems must deal with increased safety and reliability issues. A key point is improving occupancy track circuit performance and providing them with redundancy, higher noise immunity, and the capability to acquire additional information about the track section involved. This work proposes a novel track circuit based on the encoding of the electrical transmissions with Kasami codes. Track circuit emitters send signals coded with a known sequence that can be identified by the corresponding receivers using correlation techniques; these processes increase immunity to noise and changes in environmental conditions. An appropriate selection of orthogonal sequences for encoding, as well as different carrier frequencies for transmissions, allow simultaneous emissions and receptions without cross interference.

Vehicle Identification Via Sparse Representation

Wang, S. ; Cui, L. ; Liu, D. ; Huck, R. ; Verma, P. ; Sluss, J. J. ; Cheng, S. ;

In this paper, we propose a system using video cameras to perform vehicle identification. We tackle this problem by reconstructing an input by using multiple linear regression models and compressed sensing, which provide new ways to deal with three crucial issues in vehicle identification, namely, feature extraction, online vehicle identification database buildup, and robustness to occlusions and misalignment. The results show the capability of the proposed approach.

Evaluating the Utility of Driving: Toward Automated Decision Making Under Uncertainty

Schubert, R. ;

The complexity of advanced driver-assistance systems (ADASs) is steadily increasing. While the first applications were based on mere warnings, current systems actively intervene in the driving process. Due to this development, such systems have to automatically choose between different action alternatives. From an algorithmic point of view, this requires automatic decision making on the basis of uncertain data. In this paper, the application of decision networks for this problem is proposed. It is demonstrated how this approach facilitates

automatic maneuver decisions in a prototypical lane change assistance system. Furthermore, relevant research questions and unsolved problems related to this topic are identified.

An IEEE 802.11p-Based Multichannel MAC Scheme With Channel Coordination for Vehicular Ad Hoc Networks

Wang, Q. ; Leng, S. ; Fu, H. ; Zhang, Y. ;

In recent years, governments, standardization bodies, automobile manufacturers, and academia are working together to develop vehicular ad hoc network (VANET)-based communication technologies. VANETs apply multiple channels, i.e., control channel (CCH) and service channels (SCHs), to provide open public road safety services and the improve comfort and efficiency of driving. Based on the latest standard draft IEEE 802.11p and IEEE 1609.4, this paper proposes a variable CCH interval (VCI) multichannel medium access control (MAC) scheme, which can dynamically adjust the length ratio between CCH and SCHs. The scheme also introduces a multichannel coordination mechanism to provide contention-free access of SCHs. Markov modeling is conducted to optimize the intervals based on the traffic condition. Theoretical analysis and simulation results show that the proposed scheme is able to help IEEE 1609.4 MAC significantly enhance the saturated throughput of SCHs and reduce the transmission delay of service packets while maintaining the prioritized transmission of critical safety information on CCH.

The Viability of Using Automatic Vehicle Identification Data for Real-Time Crash Prediction

Ahmed, M. M. ; Abdel-Aty, M. A. ;

Real-time crash prediction research attempted the use of data from inductive loop detectors; however, no safety analysis has been carried out using traffic data from one of the most growing nonintrusive surveillance systems, i.e., the tag readers on toll roads known as automatic vehicle identification (AVI) systems. In this paper, for the first time, the identification of freeway locations with high crash potential has been examined using real-time speed data collected from AVI. Travel time and space mean speed data collected by AVI systems and crash data of a total of 78 mi on the expressway network in Orlando in 2008 were collected. Utilizing a random forest technique for significant variable selection and stratified matched case-control to account for the confounding effects of location, time, and season, the log odds of crash occurrence were calculated. The length of the AVI segment was found to be a crucial factor that affects the usefulness of the AVI traffic data. While the results showed that the likelihood of a crash is statistically related to speed data obtained from AVI segments within an average length of 1.5 mi and crashes can be classified with about 70% accuracy, all speed parameters obtained from AVI systems spaced at 3 mi or more apart were found to be statistically insignificant to identify crash-prone conditions. The findings of this study illustrate a promising real-time safety application for one of the most widely used and already present intelligent transportation systems, with many possible advances in the context of advanced traffic management.

Control Strategies for Dispersing Incident-Based Traffic Jams in Two-Way Grid Networks

Long, J. ; Gao, Z. ; Orenstein, P. ; Ren, H. ;

Effective control strategies are required to disperse incident-based traffic jams in urban networks when dispersal cannot be achieved simply by removing the obstruction. This paper develops a selection of such control strategies and demonstrates their effectiveness in dispersing incident-based traffic jams in two-way rectangular grid networks. Using the spatial topology of traffic jam propagation, we apply the concept of vehicle movement ban, which is frequently adopted in real urban networks as a temporary traffic management measure. Four control strategies were developed, which are referred to as single-line control, multiline control, area control, and diamond control. We also explore a combination of these control strategies and evaluate the impact of these control strategies on the changes in traffic jam size and congestion delay. Finally, we simulate the processes of traffic jam formation and dissipation using the cell transmission model and demonstrate the performance of the proposed strategies. Simulation results show that the proposed strategies can indeed disperse incident-based traffic jams efficiently.

Optimal Lane Reservation in Transportation Network

Fang, Y. ; Chu, F. ; Mammar, S. ; Zhou, M. ;

This work studies a lane reservation problem in a transportation network. It aims to design task paths and optimally select lanes to be reserved in a transportation network. In this problem, each lane has limited residual capacity, which is the lane capacity that can be used for the tasks causing no delay in this lane. If the residual capacity of a lane is not large enough to allow tasks to use it, the reservation of this lane is necessary. Once reserved, the lane can be used by the tasks only. Therefore, the travel time in this reserved lane is less than that when it is not reserved. Such lane reservation strategy ensures that each task can transport the commodity from its source to destination within a given travel time. However, this reserved lane generates traffic impact on nonreserved lanes. The objective of the problem is to minimize the total impact of all reserved lanes on nonreserved lanes subject to the timely completion of all the concerned tasks. In this paper, two integer linear programming models are, for the first time, formulated. The complexity of the problem is demonstrated to be non-deterministic polynomial-time hard. Then, an optimal algorithm based on the cut-and-solve method is developed for the problem. The computational results of randomly generated network instances up to 120 nodes and 468 arcs show that the proposed algorithm significantly outperforms the direct use of an optimization solver of CPLEX.

Real-Time Lagrangian Traffic State Estimator for Freeways

Yuan, Y. ; van Lint, J. W. C. ; Wilson, R. E. ; van Wageningen-Kessels, F. ; Hoogendoorn, S. P. ;

Freeway traffic state estimation and prediction are central components in real-time traffic management and information applications. Model-based traffic state estimators consist of a dynamic model for the state variables (e.g., a first- or second-order macroscopic traffic flow

model), a set of observation equations relating sensor observations to the system state (e.g., the fundamental diagrams), and a data-assimilation technique to combine the model predictions with the sensor observations [e.g., the extended Kalman filter (EKF)]. Commonly, both process and observation models are formulated in Eulerian (space–time) coordinates. Recent studies have shown that this model can be formulated and solved more efficiently and accurately in Lagrangian (vehicle number–time) coordinates. In this paper, we propose a new model-based state estimator based on the EKF technique, in which the discretized Lagrangian Lighthill-Whitham and Richards (LWR) model is used as the process equation, and in which observation models for both Eulerian and Lagrangian sensor data (from loop detectors and vehicle trajectories, respectively) are incorporated. This Lagrangian state estimator is validated and compared with a Eulerian state estimator based on the same LWR model using an empirical microscopic traffic data set from the U.K. The results indicate that the Lagrangian estimator is significantly more accurate and offers computational and theoretical benefits over the Eulerian approach.

A Stochastic Model for Chain Collisions of Vehicles Equipped With Vehicular Communications

Garcia-Costa, C. ; Egea-Lopez, E. ; Tomas-Gabarron, J. B. ; Garcia-Haro, J. ; Haas, Z. J. ;

Improvement of traffic safety by cooperative vehicular applications is one of the most promising benefits of vehicular ad hoc networks (VANETs). However, to properly develop such applications, the influence of different driving parameters on the event of vehicle collision must be assessed at an early design stage. In this paper, we derive a stochastic model for the number of accidents in a platoon of vehicles equipped with a warning collision notification system, which is able to inform all the vehicles about an emergency event. In fact, the assumption of communications being used is key to simplify the derivation of a stochastic model. The model enables the computation of the average number of collisions that occur in the platoon, the probabilities of the different ways in which the collisions may take place, as well as other statistics of interest. Although an exponential distribution has been used for the traffic density, it is also valid for different probability distributions for traffic densities, as well as for other significant parameters of the model. Moreover, the actual communication system employed is independent of the model since it is abstracted by a message delay variable, which allows it to be used to evaluate different communication technologies. We validate the proposed model with Monte Carlo simulations. With this model, one can quickly evaluate numerically the influence of different model parameters (vehicle density, velocities, decelerations, and delays) on the collision process and draw conclusions that shed relevant guidelines for the design of vehicular communication systems, as well as chain collision avoidance applications. Illustrative examples of application are provided, although a systematic characterization and evaluation of different scenarios is left as future work.

Real-Time Traffic Flow Forecasting Using Spectral Analysis

Tchraikian, T. T. ; Basu, B. ; O'Mahony, M. ;

An algorithm for the implementation of short-term prediction of traffic with real-time updating based on spectral analysis is described. The prediction is based on the characterization of the flow based on modal functions associated with a covariance matrix constructed from historical

flow data. The number of these modal functions used for prediction depends on the local traffic characteristics. Although the method works well for the examples in this paper using the lower frequency modes, it can be adapted to include modes of higher frequency, as traffic conditions dictate. This paper describes the intended online implementation of the method that predicts within-day traffic flow using a forecasting horizon of 1 h 15 min with a 15-min step. Thus, every 15 min, the traffic flow for a further 1 h 15 min is predicted. As well as forecasting to this horizon, a second algorithm incorporating a weighted averaging technique is developed, which allows the prediction of one 15-min step ahead by using current and previous predictions of traffic flows at the given time instant while placing more weight on the more recent predictions. This technique combines the features of a time-series-based prediction with spectral analysis. The development of an algorithm for the real-time implementation is described, and results are presented for a number of different schemes.

Adaptive Multicue Background Subtraction for Robust Vehicle Counting and Classification

Unzueta, L. ; Nieto, M. ; Cortés, A. ; Barandiaran, J. ; Otaegui, O. ; Sanchez, P. ;

In this paper, we present a robust vision-based system for vehicle tracking and classification devised for traffic flow surveillance. The system performs in real time, achieving good results, even in challenging situations, such as with moving casted shadows on sunny days, headlight reflections on the road, rainy days, and traffic jams, using only a single standard camera. We propose a robust adaptive multicue segmentation strategy that detects foreground pixels corresponding to moving and stopped vehicles, even with noisy images due to compression. First, the approach adaptively thresholds a combination of luminance and chromaticity disparity maps between the learned background and the current frame. It then adds extra features derived from gradient differences to improve the segmentation of dark vehicles with casted shadows and removes headlight reflections on the road. The segmentation is further used by a two-step tracking approach, which combines the simplicity of a linear 2-D Kalman filter and the complexity of a 3-D volume estimation using Markov chain Monte Carlo (MCMC) methods. Experimental results show that our method can count and classify vehicles in real time with a high level of performance under different environmental situations comparable with those of inductive loop detectors.

Subliminal Persuasion and Its Potential for Driver Behavior Adaptation

Riener, A. ;

Mental overload is a problem drivers are increasingly exposed to in today's complex task of vehicle operation and is one of the causes of traffic accidents or hazards. To keep road safety high but allow for additional information to be forwarded to the driver, we propose to employ subliminal persuasion: a technique where the information is transferred below the level of conscious awareness. Thus, the driver becomes aware of the information, but his/her cognitive load is unaltered. To analyze the potential of this approach, we have designed a case study implementing an "eco-driving" strategy operating in the background. Driving economy is thereby estimated based on vehicles' mileage gathered in real time from numerous sensors in

and around the car, and information is conveyed to the driver with very light, not attentively perceivable, vibration patterns originating from tactor elements integrated into the safety belt or the car seat. The main research hypothesis followed in this paper and investigated in real driving studies is that drivers would operate their vehicles more economically on vibrotactile instructions perceived inattentively, as compared with the case without any notifications. Indeed, results indicate an improvement in driving economy for segments driven with subliminal feedback compared with routes driven without assistance but not without qualifications. Statistical significance has been proven for the safety belt interface, whereas it has not been substantiated for the tactile car seat. (However, more research is needed to validate the applicability of subliminal persuasion across a wider range of driving and in-vehicle tasks.)

Simultaneous Localization and Mapping for Path-Constrained Motion

Hasberg, C. ; Hensel, S. ; Stiller, C. ;

Accurate localization is a fundamental component of driver-assistance systems and autonomous vehicles. For path-constrained motion, a map offers significant information and assists localization with valuable information about the evolution of the kinematic vehicle states. We propose natural parameterized cubic spline curves to approximate true motion constraints, particularly the centerline of individual road lanes or rail tracks. Vehicle kinematics is modeled in 1-D curve coordinates. Since map information is subject to uncertainties, a probabilistic treatment is a prerequisite to obtaining consistent localization results. The proposed probabilistic curvemap (PCM) and the close map-to-vehicle relation enable a straightforward derivation of measurement update equations without additional map-matching steps and offer themselves to classical filter techniques. Incoming sensor measurements are used for simultaneous vehicle localization and local PCM update around the current vehicle position. Thus, every revisit of a location reduces uncertainty in the local PCM. Moreover, when no prior information is provided in the PCM, extrapolation is carried out to handle these situations with incomplete maps. The proposed filter is validated through simulations and real-world railway experiments.

Development and Evaluation of a Cooperative Vehicle Intersection Control Algorithm Under the Connected Vehicles Environment

Lee, J. ; Park, B. ;

Under the Connected Vehicles (CV) environment, it is possible to create a Cooperative Vehicle Intersection Control (CVIC) system that enables cooperation between vehicles and infrastructure for effective intersection operations and management when all vehicles are fully automated. Assuming such a CVIC environment, this paper proposed a CVIC algorithm that does not require a traffic signal. The CVIC algorithm was designed to manipulate individual vehicles' maneuvers so that vehicles can safely cross the intersection without colliding with other vehicles. By eliminating the potential overlaps of vehicular trajectories coming from all conflicting approaches at the intersection, the CVIC algorithm seeks a safe maneuver for every

vehicle approaching the intersection and manipulates each of them. An additional algorithm was designed to deal with the system failure cases resulting from inevitable trajectory overlaps at the intersection and infeasible solutions. A simulation-based case study implemented on a hypothetical four-way single-lane approach intersection under varying congestion conditions showed that the CVIC algorithm significantly improved intersection performance compared with conventional actuated intersection control: 99% and 33% of stop delay and total travel time reductions, respectively, were achieved. In addition, the CVIC algorithm significantly improved air quality and energy savings: 44% reductions of CO_2 and 44% savings of fuel consumption.

Processing of Eye/Head-Tracking Data in Large-Scale Naturalistic Driving Data Sets

Ahlstrom, C. ; Victor, T. ; Wege, C. ; Steinmetz, E. ;

Driver distraction and driver inattention are frequently recognized as leading causes of crashes and incidents. Despite this fact, there are few methods available for the automatic detection of driver distraction. Eye tracking has come forward as the most promising detection technology, but the technique suffers from quality issues when used in the field over an extended period of time. Eye-tracking data acquired in the field clearly differs from what is acquired in a laboratory setting or a driving simulator, and algorithms that have been developed in these settings are often unable to operate on noisy field data. The aim of this paper is to develop algorithms for quality handling and signal enhancement of naturalistic eye- and head-tracking data within the setting of visual driver distraction. In particular, practical issues are highlighted. Developed algorithms are evaluated on large-scale field operational test data acquired in the Sweden–Michigan Field Operational Test (SeMiFOT) project, including data from 44 unique drivers and more than 10 000 trips from 13 eye-tracker-equipped vehicles. Results indicate that, by applying advanced data-processing methods, sensitivity and specificity of eyes-off-road glance detection can be increased by about 10%. In conclusion, postenhancement and quality handling is critical when analyzing large databases with naturalistic eye-tracking data. The presented algorithms provide the first holistic approach to accomplish this task.

Stochastic Demand Dynamic Traffic Models Using Generalized Beta-Gaussian Bayesian Networks

Castillo, E. ; Nogal, M. ; Menéndez, J. M. ; Sánchez-Cambronero, S. ; Jiménez, P. ;

A stochastic demand dynamic traffic model is presented to predict some traffic variables, such as link travel times, link flows, or link densities, and their time evolution in real networks. The model considers that the variables are generalized beta variables such that when they are marginally transformed to standard normal, they become multivariate normal. This gives sufficient degrees of freedom to reproduce (approximate) the considered variables at a discrete set of time–location pairs. Two options to learn the parameters of the model are provided—one based on previous observations of the same variables and one based on simulated data using existing dynamic models. The model is able to provide a point estimate, a confidence interval, or the density of the variable being predicted. To this end, a closed

formula for the conditional future variable values (link travel times or flows), given the available past variable information, is provided. Since only local information is relevant to short-term link flow predictions, the model is applicable to very large networks. The following three examples of application are given: 1) the Nguyen–Dupuis network; 2) the Ciudad Real network; and 3) the Vermont state network. The resulting traffic predictions seem to be promising for real traffic networks and can be done in real time.

Multiple-Target Tracking for Intelligent Headlights Control

Rubio, J. C. ; Serrat, J. ; López, A. M. ; Ponsa, D. ;

Intelligent vehicle lighting systems aim at automatically regulating the headlights' beam to illuminate as much of the road ahead as possible while avoiding dazzling other drivers. A key component of such a system is computer vision software that is able to distinguish blobs due to vehicles' headlights and rear lights from those due to road lamps and reflective elements such as poles and traffic signs. In a previous work, we have devised a set of specialized supervised classifiers to make such decisions based on blob features related to its intensity and shape. Despite the overall good performance, there remain challenging that have yet to be solved: notably, faint and tiny blobs corresponding to quite distant vehicles. In fact, for such distant blobs, classification decisions can be taken after observing them during a few frames. Hence, incorporating tracking could improve the overall lighting system performance by enforcing the temporal consistency of the classifier decision. Accordingly, this paper focuses on the problem of constructing blob tracks, which is actually one of multiple-target tracking (MTT), but under two special conditions: We have to deal with frequent occlusions, as well as blob splits and merges. We approach it in a novel way by formulating the problem as a maximum a posteriori inference on a Markov random field. The qualitative (in video form) and quantitative evaluation of our new MTT method shows good tracking results. In addition, we will also see that the classification performance of the problematic blobs improves due to the proposed MTT algorithm.

Modified Iterative-Learning-Control-Based Ramp Metering Strategies for Freeway Traffic Control With Iteration-Dependent Factors

Hou, Z. ; Yan, J. ; Xu, J.-X. ; Li, Z. ;

For a freeway traffic system with strict repeatable pattern, iterative learning control (ILC) has been successfully applied to local ramp metering for a macroscopic freeway environment by formulating the original ramp metering problem as an output tracking, disturbance rejection, and error compensation problem. In this paper, we address the freeway traffic ramp-metering system under a nonstrict repeatable pattern. ILC-based ramp metering and ILC add-on to ALINEA strategies are modified to deal with the presence of iteration-dependent parameters, iteration-dependent desired trajectory, and input constraints. Theoretical analysis and extensive simulations are used to verify the effectiveness of the proposed approaches.

Dynamic Traveling Salesman Problem: Value of Real-Time Traffic Information

Cheong, T. ; White, C. C. ;

We investigate the value of choosing the next stop to visit in a multistop trip based on current traffic conditions to minimize the expected total travel time of the tour. We model this problem as a Markov decision process. Numerical examples are presented that indicate that the value of using current traffic information for dynamic tour determination can be significant.

An Efficient Traffic Information Forwarding Solution for Vehicle Safety Communications on Highways

Chu, Y.-C. ; Huang, N.-F. ;

Efficiently propagating adequate and effective traffic information to drivers helps increase driving safety and reduces traffic jams on highways. To achieve this, we designed an overlay solution that considers the challenges of propagating multisource information caused by vehicle mobility and multihop forwarding. The overlay solution is composed of a mobility-adaptive information reduction scheme (IR scheme) and a vehicle-adaptive cluster-to-cluster multihop forwarding method (VAC method). The IR scheme creates a mobility-adaptive cluster to represent local traffic information. The purpose of the scheme is to simplify individual high-speed movements and reduce large amounts of information broadcasts. Based on the results of the IR scheme, the VAC method selects the optimal relay node of the intercluster forwarding pair to increase the efficiency of multihop propagation. In the simulation, we compared network performance with two other protocols by defining three objective metrics of driving-perceived quality under different traffic scenarios and analyzed the results. Furthermore, we explored protocol overhead, broadcasting reduction ratio, and technological deviations to verify the advantages and efficiencies of our solution. The simulation proves that our solution is an efficient multisource and multihop forwarding framework that allows well-connected vehicular networks to disseminate a higher degree of correct traffic information, particularly for highway safety-related information.

Neural-Network-Based Models for Short-Term Traffic Flow Forecasting Using a Hybrid Exponential Smoothing and Levenberg–Marquardt Algorithm

Chan, K. Y. ; Dillon, T. S. ; Singh, J. ; Chang, E. ;

This paper proposes a novel neural network (NN) training method that employs the hybrid exponential smoothing method and the Levenberg–Marquardt (LM) algorithm, which aims to improve the generalization capabilities of previously used methods for training NNs for short-term traffic flow forecasting. The approach uses exponential smoothing to preprocess traffic flow data by removing the lumpiness from collected traffic flow data, before employing a variant of the LM algorithm to train the NN weights of an NN model. This approach aids NN training, as the preprocessed traffic flow data are more smooth and continuous than the original unprocessed traffic flow data. The proposed method was evaluated by forecasting

short-term traffic flow conditions on the Mitchell freeway in Western Australia. With regard to the generalization capabilities for short-term traffic flow forecasting, the NN models developed using the proposed approach outperform those that are developed based on the alternative tested algorithms, which are particularly designed either for short-term traffic flow forecasting or for enhancing generalization capabilities of NNs.

Detection and Tracking of Moving Objects at Intersections Using a Network of Laser Scanners

Zhao, H. ; Sha, J. ; Zhao, Y. ; Xi, J. ; Cui, J. ; Zha, H. ; Shibasaki, R. ;

In our previous work, we reported a system that monitors an intersection using a network of horizontal laser scanners. This paper focuses on an algorithm for moving-object detection and tracking, given a sequence of distributed laser scan data of an intersection. The goal is to detect each moving object that enters the intersection; estimate state parameters such as size; and track its location, speed, and direction while it passes through the intersection. This work is unique, to the best of the authors' knowledge, in that the data is novel, which provides new possibilities but with great challenges; the algorithm is the first proposal that uses such data in detecting and tracking all moving objects that pass through a large crowded intersection with focus on achieving robustness to partial observations, some of which result from occlusions, and on performing correct data associations in crowded situations. Promising results are demonstrated using experimental data from real intersections, whereby, for 1063 objects moving through an intersection over 20 min, 988 are perfectly tracked from entrance to exit with an excellent tracking ratio of 92.9%. System advantages, limitations, and future work are discussed.

Accurate Motion Detection Using a Self-Adaptive Background Matching Framework

Cheng, F.-C. ; Ruan, S.-J. ;

Automatic video surveillance is of critical importance to security in commercial, law enforcement, military, and many other environments due to terrorist activity and other social problems. Generally, motion detection plays an important role as the threshold function of background and moving objects in video surveillance systems. This paper proposes a novel motion detection method with a background model module and an object mask generation module. We propose a self-adaptive background matching method to select the background pixel at each frame with regard to background model generation. After generating the adaptive background model, the binary motion mask can be computed by the proposed object mask generation module that consists of the absolute difference estimation and the Cauchy distribution model. We analyze the detection quality of the proposed method based on qualitative visual inspection. On the other hand, quantitative accuracy measurement is also obtained by using four accuracy metrics, namely, Recall, Precision, Similarity, and F_{1} . Experimental results demonstrate the effectiveness of the proposed method in providing a promising detection outcome and a low computational cost.

Intelligent Traction Control Model for Speed Sensor Vehicles in Computer-Based Transit System

Noori, K. ; Jenab, K. ;

In this paper, a real-time intelligent traction control model for speed sensor vehicles in computer-based transit systems is proposed. Using the Bayesian decision theory, the model analyzes speed sensor data to learn and classify the train traction conditions (i.e., spin/slip, normal, and slide) that are required for studying vehicle motion patterns. The patterns are applied on the sensor input in real-time format to classify train traction and reduce the error/risk of classification that may cause service interruptions and incidents. The model can enable us to manage a number of state natures (i.e., spin/slip, normal, and slide), features (i.e., delta speed and train speed), and prior knowledge traction conditions. This model engine can be implemented in any programming language in onboard or embedded computers. As a result, the impact of noisy sensors (inaccurate data) and its delays in such a hard real-time control system is mitigated. This conceptual model is applied to a case study with promising results for target and simulation systems.

Three-Dimensional Model-Based Human Detection in Crowded Scenes

Wang, L. ; Yung, N. H. C. ;

In this paper, the problem of human detection in crowded scenes is formulated as a maximum a posteriori problem, in which, given a set of candidates, predefined 3-D human shape models are matched with image evidence, provided by foreground extraction and probability of boundary, to estimate the human configuration. The optimal solution is obtained by decomposing the mutually related candidates into unoccluded and occluded ones in each iteration according to a graph description of the candidate relations and then only matching models for the unoccluded candidates. A candidate validation and rejection process based on minimum description length and local occlusion reasoning is carried out after each iteration of model matching. The advantage of the proposed optimization procedure is that its computational cost is much smaller than that of global optimization methods, while its performance is comparable to them. The proposed method achieves a detection rate of about 2% higher on a subset of images of the Caviar data set than the best result reported by previous works. We also demonstrate the performance of the proposed method using another challenging data set.

A Probe-Vehicle-Based Evaluation of Adaptive Traffic Signal Control

Hunter, M. P. ; Wu, S. K. ; Kim, H. K. ; Suh, W. ;

In 2005, the Cobb County Department of Transportation, Cobb County, GA, conducted an adaptive signal control pilot study implementing the Sydney Coordinated Adaptive Traffic System (SCATS) on 15 intersections. This paper presents the results of a before-and-after probe-vehicle-based operational comparison of optimized time-of-day (i.e., before control) and

SCATS (i.e., after control) traffic control system performance. The focus of this operational analysis is the typical operating performance during the weekday peak, weekday off-peak, and weekend travel periods. Travel time data were collected using Global-Positioning-System (GPS)-equipped test vehicles. The results showed that both systems provided good performance, whereas neither the before time-of-day or after SCATS is clearly dominant, except on Cumberland Parkway, where SCATS control consistently provides equivalent or superior performance to that of the time-of-day control.

Validation of a New Functional Design of Automatic Protection Systems at Level Crossings with Model-Checking Techniques

Mekki, A. ; Ghazel, M. ; Toguyeni, A. ;

Level crossings (LCs) are considered to be a safety black spot for railway transportation since LC accidents/incidents dominate the railway accident landscape in Europe, thus considerably damaging the reputation of railway transportation. LC accidents cause more than 300 fatalities every year throughout Europe, which represents up to 50% of all deaths for railways. That is why LC safety is a major concern for railway stakeholders in particular and transportation authorities in general. LCs with an important traffic moment¹ are generally equipped with automatic protection systems (APSs). Here, we focus on two main risky situations, which have caused several accidents at LCs. The first is the short opening duration between successive closure cycles relative to trains passing in opposite directions. The second is the long LC closure duration relative to slow trains. In this paper, we suggest a new APS architecture that prevents these kinds of scenarios and therefore increases the global safety of LCs. To validate the new architecture, a method based on well-formalized means has been developed, allowing us to obtain sound and trustworthy results. Our method uses a formal notation, i.e., timed automata (TA), for the specification phase and the model-checking formal technique for the verification process. All the steps are progressively discussed and illustrated.

Estimation of Lane Marker Parameters With High Correlation to Steering Signal

Demčenko, A. ; Tamošiūnaitė ; , M. ; Vidugirienė ; , A. ; Jakevič ; ius, L. ;

This paper considers the design and analysis of lane marker parameters in 2-D images. Five different parameters, which have high correlation to the steering angle of a vehicle, are proposed, and their correspondence to the steering signal is analyzed. The parameters are based on the position, angle, area, and curvature of the lane marker and have not been reported in the literature before, except the curvature. A new derivative-free method is proposed for curvature estimation. The stability of the proposed parameters is analyzed with respect to the look-ahead distance. Possible application of the parameters for overtaking detection is presented. This paper is performed using signals from real country road driving.

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