CCITT Newsletter

Center for the Commercialization of Innovative Transportation Technology

Moving Research to Realization for Surface Transportation Volume 1 Issue 2 Spring, 2009

NORTHWESTERN UNIVERSITY

CCITT Issues New Grants

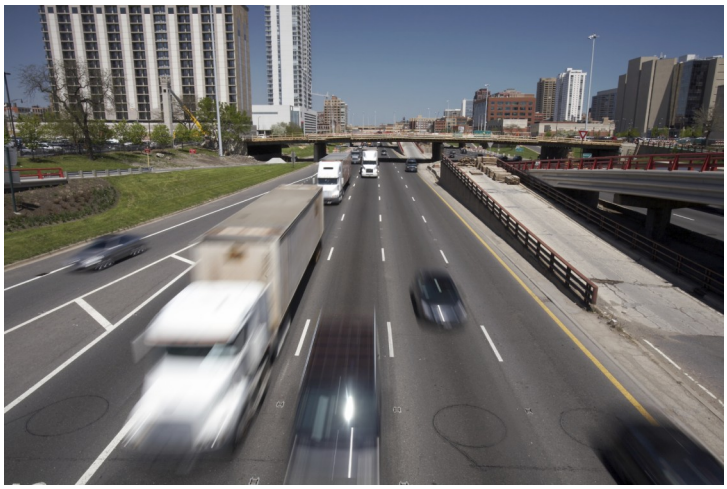
A Note From The Director

Research Grants Awarded for 2009

Providing Reliable Route Guidance: Phase II

PI: Yu "Marco" Nie

There is currently a lack of reliable travel prediction for highway users in the marketplace. The goal of Dr. Nie's research project is to provide users with reliable route guidance produced from routing algorithms that are validated with real traffic data.



Phase I of the project focused on demonstrating the value of reliable route guidance through the development of Chicago Testbed for Reliable Routing (CTR). Phase II seeks to bring reliable routing technology to the next stage through initial deployment of CTR. This will be accomplished by creating a Travel Reliability Inventory (TRI) of Northeastern Illinois that documents reliability indices between heavily traveled destination pairs. The scope of the project also includes initial market testing to understand users' need for reliable route information.

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Student of the Year Award

CCITT Education Program

Student of the Year Award

In December, Philip Reich (pictured on far right) was named student intern of the year. Reich was CCITT's first intern and worked during the summer quarter of 2008. He is a senior majoring in economics and international studies, while earning a minor from the Business Institutions Program. As a prize for the accolade he received a $1000 scholarship award and an all-expenses paid trip to the winter meeting of the Transportation Research Board.

Reich lauded the CCITT internship program for providing him with an opportunity to use the skills he learned in the Business Institutions Program curriculum and connect them with real-world experiences. During his summer-long internship, Reich first learned about the new technology he was researching --- a type of steel that is particularly weather-resistant and durable --- and then determined some unexplored markets for the product.

As part of his research, Reich talked to Northwestern professors with expertise in steel production and a local steel company to get a sense of how steel production is done. He also contacted representatives of state departments of transportation, particularly in Northern states, to garner interest in the product. Reich's research culminated in a presentation he gave to the principal investigators, where he presented them with his findings and a marketing strategy for their product.

Reich believes the real-world experience that he gained from the CCITT internship will help him land a job quickly in a stagnant hiring market.

CCITT is currently seeking a summer quarter intern to work in the Evanston office. Through this internship initiative, CCITT seeks to provide an

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opportunity for students to have an internship in marketing or industry research in the field of transportation. Consistent with the Center's theme of commercialization, its interns conduct market research and explore technology commercialization paths for the *innovation gap* research projects that the Center sponsors. The Center seeks interns from a broad range of academic majors and minors, and more information about the program can be accessed at the Center's Web site:

www.ccitt.northwestern.edu/edu-overview.

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Intelligent Structural Health Monitoring of Vehicular Bridges

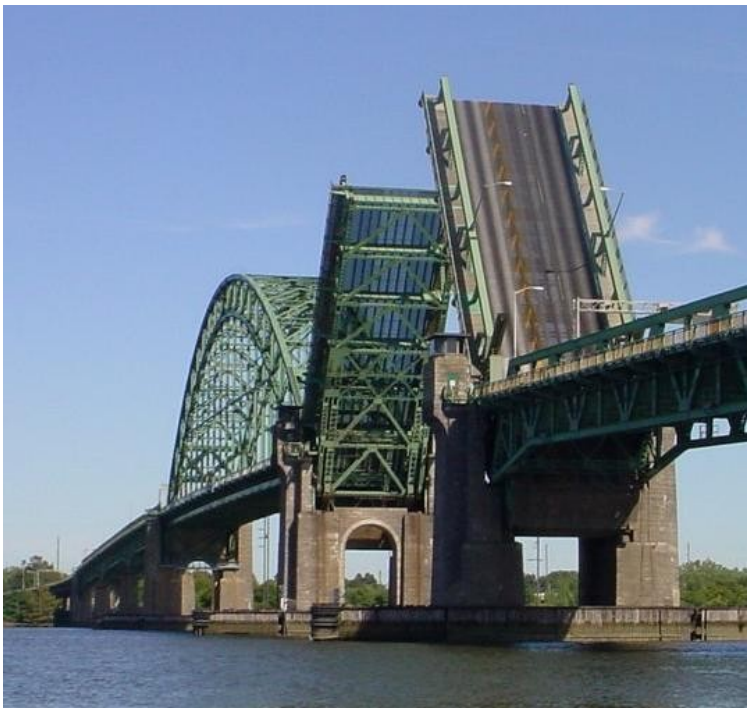
PI's: Krishnaswamy, Balogun, Regez

After the catastrophic I-35W bridge collapse, engineers have been seeking and pursuing alternative inspection techniques to monitor a bridge's structural health. One technology that has been proven successful for such a purpose is Acoustic Emissions (AE). Current AE inspection systems use piezoelectric sensors to listen to the structure.

However, piezoelectric sensor systems have drawbacks. First, piezoelectric systems can be expensive to deploy. Second, it is not uncommon for inspectors to pick up local radio stations with these sensors as they are susceptible to electromagnetic interference. Third, sensors also have a limited operating frequency range so most AE technicians carry around a box of transducers to cover the full 30-1000 kHz wave band.

The proposed AE system utilizes optical Fiver Bragg Grating (FBG) in place of piezoelectric sensors. FBG sensors offer numerous advantages compared to piezoelectric sensors for AE monitoring. FBG sensors are low cost and readily available, light-weight, immune to electromagnetic noise sources, and do not require pre-amplification. It is possible to set up a FBG array at great distances from the control box without any signal loss because the FBG are connected to the control box by fiber optic and not a cable.

To date, a laboratory breadboard prototype of a fiber Bragg grating based acoustic emission sensor system has been developed by the researchers. The focus of this research project is to fabricate a rugged prototype of the sensor system for field testing of in-service vehicular bridges. The proposed research work would provide a pathway for transforming the sensing technique into a practical tool for monitoring damage evolution in vehicular bridges and the prediction of impending structural failure, which can lead to the loss of human life.



Business Intelligence For Gang Scheduling

PI: Klabjan

Railways incur significant expenses related to the deterioration of the materials used to build their transportation systems. Thus there is a need to constantly maintain their operations, which is done by groups of workers, called gangs. Throughout a given year, a gang works for a few days in a particular track section and then relocates to another section. The expense for these gangs range from direct costs—such as salary and travel allowance - to indirect costs consisting primarily of the impact to operational disruptions. It is thus of vital importance to railways to schedule the gangs efficiently.

In conjunction with a Class 1 railroad, this research project has undertaken development of a gang scheduling information system, based on business intelligence and state-of-the-art analytics. At the core of the system is a sophisticated optimization algorithm. The algorithm will be composed of initially constructing a schedule and then iteratively refining the schedule based on mathematical programming techniques combined with very large neighborhood local search strategies.

Currently there are no off-the-shelf gang scheduling packages. In most railways, gang scheduling is a manual and tedious process. Thus an automated system is a significant savings opportunity.

iTRAC: Intelligent Compression of Traffic Video

PI's: Tsaftaris, Katsaggelos

Non-intrusive video imaging sensors are commonly used in traffic monitoring and surveillance. However, due to increased requirements of bitrates, the result is expensive wired communication links that are used, or the video data is heavily compressed to not exceed the allowed communications bandwidth. Current video imaging solutions use dated video compression standards and require dedicated wired communication lines. Recently, H.264 (the newest video compression standard) has been proposed to be used in transportation applications. However, most video compression algorithms are not optimized for traffic video data and do not take into account the possible data analysis that will follow (either in real time at the control center or offline). As a result of compression, the visual quality of the data may be low. More importantly research efforts show with vehicle tracking, accuracy and efficiency is severely affected. This research project proposes to develop a set of algorithms (implemented in the form of a software module) that will operate within the constraints of the H.264 video compression. This capturing enhanced performance of traffic tracking applications, while using the same transmission bandwidth and reducing bandwidth usage. The output of this research project will be a software module that will be integrated into the logic of hardware video compression encoders.

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