Graduate Seminar

&

Student Technical Conference

Tuesday November 15th, 2016

Department of Geodesy and Geomatics Engineering

University of New Brunswick

The Department would like to welcome you to the

Fall 2016 Graduate Seminar & Student Technical Conference

Where:

Gillin Hall – Room D-108

When:

Tuesday, November 15th 2016 at 10:30am

Department of Geodesy and Geomatics Engineering

Geodesy and Geomatics Engineering

Graduate Seminar and Student Technical Conference

Fall 2016

Chair: *Thalia Nikolaidou (PhD; year 2)*

Tuesday, November 15th 2016 *(GD108)*	
10:25	**Welcome note**
10:30	**Understanding the Impact of Spatial Interactions on Phase Locking for Moving Objects** *Ma Dolores Arteaga Revert (PhD; year 4)*
10:45	**DEM Fusion of REST API Data in Support of Rapid Flood Modelling** *Heather McGrath (PhD; year 3)*
11:00	**Implementing a Scalable Web Tile Management Framework** *Menelaos Kotsollaris (MScE; year 2)*
11:15	**Comparing Mobile Location-aware Services using Beacons or GPS** *Marta Padilla-Ruiz (MScE; year 1)*
11:30	**Modeling and Querying Transit Data through Time-Varying Graph** *Maduako Ikechukwu Derek (PhD; year 2)*
11:45	**Road Detection using a Patch-based Deep Network for Satellite and Aerial Images** *Mohammad Rezaee (PhD; year 4)*
12:00	**Closing Remarks**

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ABSTRACTS

Contact the Authors for a copy of the full papers.

Department of Geodesy and Geomatics Engineering

Understanding the Impact of Spatial Interactions on Phase Locking for Moving Objects

Ma Dolores Arteaga Revert

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Abstract

This paper presents a spatial extension of the Kuramoto model in networks for studying the phase locking of interacting objects that are moving not randomly in the geographical space. This novel extension defines the interactions between oscillators based on the Euclidean distance between oscillators, which change thru time due to the motion of the oscillators The paper tests numerically the conditions of phase locking after applying the spatially-aware Kuramoto Model for different interaction definitions between moving objects. The test considers the oscillators as vehicles moving in a segment of a highway and the interactions are defined as the inverse of the Euclidean distances between vehicles. The results show how the higher the interactions between vehicles in motion, the fastest the phase locking of the oscillators is reached.

DEM Fusion of REST API Data in Support of Rapid Flood Modelling

Heather McGrath

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Abstract

Digital elevation models (DEM) are an integral part of flood modelling. High resolution DEM data is not always available or affordable for communities, thus other elevation data sources are explored. While the accuracy of some of these sources has been rigorously tested (e.g.: SRTM, ASTER), others, such as Natural Resources Canada's Canadian Digital Elevation Model (CDEM), and Google and Bings' Elevation REST APIs have not yet been properly evaluated. There are several advantages to using these products, including: Canada wide coverage and machine readable data acquisition, however, limitations include lack of metadata detailing acquisition source and unreported accuracy. To include these data in geospatial applications and test and reduce uncertainty, data fusion is explored. This novel method of data fusion incorporates data mining clustering and inverse distance weighting (IDW) concepts in the computation of a new fusion elevation surface. The results of the individual DEMs and fusion DEMs are compared to a high-resolution Light Detection and Ranging (LiDAR) surface and derived flood inundation maps for two study areas in New Brunswick. Comparison of individual surfaces to LiDAR find the Bing data computing the smallest mean bias while the CDEM has the smallest RMSE. Fusion of all three surfaces via the proposed method minimizes the mean bias and RMSE while increasing the correlation when compared to LiDAR, independent of the terrain, thus producing a more accurate DEM.

Implementing a Scalable Web Tile Management Framework

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Abstract

When implementing a Web Tile Management Framework, one of the most important problems that we are facing is which will be the technique of storing the immensely large number of tiles in a way that can be efficient and satisfactory for the users. The two most common approaches are either storing the files by using a database or storing them on the file system. While those ways have been around for some years, we adopt a third way, named LevelFilesSet. Instead of accessing the tile files by heavily depending on the filesystem, we store and retrieve the tile dataset directly by parsing a large file that contains all the tiles. Furthermore, we compare these three solutions based on their efficiency and capabilities. We showcase a general conceptual design of the LevelFilesSet API that highlights its flexibility and usability and we confirm that as the number of the tile files keep increasing per each zoom level, the LevelFilesSet is giving us better results over the other solutions. Finally, the LevelFilesSet seems to be efficient not only for storing tile files, but also for storing any type of information that has to be accessed frequently; thus the LevelFilesSet could be used in other areas apart from Geographical Information Systems.

Comparing Mobile Location-aware Services using Beacons or GPS

Marta Padilla-Ruiz

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Abstract

The growth of Internet of Things (IoT) has accelerated and come to reality nowadays. The main concept of IoT involves devices that can be connected and monitored. Mobile technology has greatly improved in recent years and mobile devices with various wireless network connectiv- ity and sensing functions have been released, allowing to know the location of mobile users in real-time.

Due to the huge amount of devices that will be deployed, there is an opportunity to apply these devices to design innovative location-aware services which can provide the users the information they need on the move, at the right time and place. However, it is necessary to identify the differences with previous technologies commonly used in location-aware services (e.g. GPS, cell towers), and to identify the possibilities of using these new devices, in order to know what are the current limitations which can be overcome by using IoT.

In this research, geofencing in location aware services is compared using two different technologies: GPS and beacons. To perform the comparison, a mobile location aware service is developed, consisting of an Android application connected to the cloud and a notification server, which will provide notifications to tourists in a simulated tourist scenario.

Two kind of experiments are conducted: a functional experiment, to verify whether the application works; and a system performance experiment, to compare the performance of both technologies, measuring the time that it takes to trigger the location events and receive the notifications in the mobile application.

The results show that beacon technology is more accurate and faster than GPS. However, wireless network is of paramount importance in the performance, and future research will be focused on monitoring this issue. Beacons have a limited range, restricting the region they can cover and making them more appropriate for using in indoor applications, where distances are shorter. GPS range could be infinite, since they are defined by coordinates, and the possibilities outdoors are incremented. However, beacons can be combined to set a region with a larger range, which could be applied to use them also outdoors. Battery consumption is a well-known problem for location-aware services and more experiments are needed regarding this concern.

Modeling and Querying Transit Data through Time-Varying Graph

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Abstract

Modeling, managing and efficiently querying time-varying transit mobility network data as a large time-varying graph is the central challenge in this work. We acknowledge the fact that addressing this challenge would help in supporting emerging applications of transit big spatial data for smart transit systems and fleet management. The focus is to model and manage big spatial mobility data through time-varying graph that allows rich queries and analytics with the capability of retrieving structural, temporal and observational information of the mobility network. Here we present a process of data curation and modeling of time-varying mobility graph from bus transit data in Moncton as well as informative analytical queries that could support fleet management. We proposed a space-time aggregated time-varying graph to efficiently manage transit data and pointed out some of its advantages.

Road Detection using a Patch-based Deep Network for Satellite and Aerial Images

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Abstract

Satellite images brought a new information era to monitor the Earth. However, the ac-quired data is raw and needs a process to be converted into information. This process can be in the form of classification, object detection or any other pattern recognition methods. Deep net-works in machine learning have shown capabilities in automatic object detection from aerial and satellite imageries and have shown promising results.

The patch-based deep Neural Network (NN) is one of the architectures that is designed for a pixel-based object detection in aerial images. The network was designed for the images with 1.2 m spatial resolution for the Toronto area. Although it shows the potentiality in extract-ing road network in that data set, the model is not capable enough to perform a similar task for another data set with a huge difference in spatial resolution (such as ortho-photo aerial images with 15 cm spatial resolution).

In this paper, the patched-based deep neural network is further improved for detecting roads in ortho-photo aerial images from Fredericton city with 15 cm resolution. In order to detect the desired object in the mentioned data set, the architecture of the network should be re-de-signed. This change in the architecture is about the number of hidden layers and convolution ker-nels' size. In order to find the proper architecture, different networks are designed, trained and evaluated using Precision and Recall (P-R) method by finding the breakeven value of the correct-ness curve. The final network is trained and applied to the test data set. Results are compared qualitatively to the result of Support Vector Machines (SVMs) method using P-R. The P-R breakeven point for the proposed Deep Neural Network is 0.89 which is higher than those related to the old version of the patch-based NN (0.78) and SVMs (0.74). This shows the high capability of the proposed Deep Neural Network for road detection in high spatial image data.

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