
Graduate Seminar
&
Student Technical Conference



Thursday, March 17th, 2011

Department of Geodesy and Geomatics Engineering

The organizers would like to welcome you to the
2011 Graduate Seminar & Student Technical Conference

Where:

Dineen Auditorium – C13

When:

Thursday, March 17th 2011

Seminar Organizers:

Patrick Adda and Yun-ta Teng

with special thanks to Sylvia Whitaker and all our volunteers

Department of Geodesy and Geomatics Engineering

Geodesy and Geomatics Engineering
Graduate Seminar and Student Technical Conference

Dineen Auditorium – C13

Thursday, March 17th, 2011

09:00 AM Opening Remarks: Seminar Organizers

Session 1: Graduate students

Session Chair: Yun-ta Teng

09:10 AM Combination of Object-based and Pixel-based Image Analyses for
Classification of VHR Imagery over Urban Areas

Bahram Salehi

09:30 AM Canadian Forces Base Gagetown Hydrologic Model

Dan Kirkby

09:50 AM Mapping solar potential obstructions using LiDAR data

Krista Amolins

10:10 AM Canadian Forces Base Gagetown-Spill Response Tool

Vincent Gallant

10:30 AM Building detection in very high resolution satellite imagery using context
based image segmentation

Vivek Dey

10:50 AM Coffee Break

11:15 AM Presentation of Awards—Graduate Students: Dr. Sue Nichols

Section 2: Undergraduate Students

Session Chair: Bahram Salehi

- 11:30 AM Designing a Model Strategic Plan for Boundary Rehabilitation after Natural Disasters.
Geoffrey Frame
- 11:45 AM Analysis of Different Forms of Alternative Dispute Resolution in Boundary Disputes.
Dorin Resek
- 12:00 PM The Effects of Government on Water Boundaries in the Maritime Provinces.
Josh Mailman
- 12:15 PM Lunch**
- 01:00 PM Using Remote Sensing Technology for Determining the Most Desirable Location to Build a Well Site.
Adam Pleasant
- 01:15 PM Low Cost DEM Creation Using Photosynth – An Evaluation.
Nathan White
- 01:30 PM Classification of Satellite Imagery Using eCognition.
Mark Wight
- 01:45 PM Coffee Break**

CIG Paper Competition

Session Chair: Patrick Adda

- 02:00 PM Advantages of Using Virtual Reference Stations for Surveying in New Brunswick.
Kyle Headdy
- 02:15 PM The Implications of Using Coordinate Values in Land Surveying in Canada.
Alexander Penner
- 02:30 PM Pixel Based Image Classification of Digital Aerial Orthophotos of the City of Fredericton for Urban Green Space Investigation.
James Thomas
- 02:45 PM A Comparison of Precise Point Positioning GPS Elevations with the Northwest Atlantic Hydrodynamic Model on the Grand Banks.
Justin Theriault
- 03:00 PM Using Volunteered Geographic Information for Event Implementation and Management.
Lara Needham
- 03:15 PM Judges Deliberation
- 03:30 PM Presentation of Awards—Undergraduate Students : Dr James Secord**
- 03:40 PM Closing Remarks**
- 03:45 PM Reception (C-9)**

ACKNOWLEDGEMENTS



*Graduate Student Paper Competition Awards
&
Undergraduate Student Paper Competition 2nd & 3rd Place Prizes*



*Undergraduate Student Paper Competition Awards
1st Place Prize*



Reception & Coffee Breaks

Combination of object-based and pixel-based image analyses for classification of VHR imagery over urban areas

Bahram Salehi

Supervisors: Dr. Yun Zhang

Abstract

Although spatial measures such as texture and shape extracted from very high resolution imagery (VHR) have been successfully employed in pixel-based classifications, the effectiveness of such measures in classification mainly depends on the optimal window size in which spatial measures are calculated. However, an optimal window size is usually subjective and varies for different image and different land cover types. Multiresolution segmentation of object-based image analysis, on the other hand, results objects with different size and shape, which are meaningful and better represent the real size and shape of land cover types. This paper introduces a new approach to land cover classification which benefits from both pixel-based and object-based image analyses. The VHR image is firstly segmented into different levels of segmentations. For each level, one set of spectral measures and two sets of spatial measures, texture and morphology, are extracted and then stacked to the original bands of VHR image forming a several-band image. To determine the contribution of each set of measures in separating urban land cover classes, the separability distance for all class pairs are calculated based on Bhattacharyya distance for each set of measures (i.e. spectral, texture and morphology). A pixel-based maximum likelihood classification is then applied to each set of bands. Results show that adding either texture or morphology to the original bands of VHR image has almost the same effect in increasing the overall classification accuracy. Furthermore, the classification accuracy of buildings and roads increases significantly by incorporation of spatial measures in classification procedure.

Canadian Forces Base Gagetown Hydrologic Model

Dan Kirkby

Supervisors: Dr. David Coleman, Dr. Sue Nichols

Abstract

Canadian Forces Base Gagetown is the largest army training base in Canada, encompassing one of the largest Range and Training Areas in the entire Commonwealth, covering an area of 1,100 km². Due to the size, varying topography and austere nature of the training area, predicting peak storm runoff volumes used in culvert design is difficult. This has resulted in numerous culvert designs being inappropriately undersized, leading to failures and road washouts during periods of elevated runoff.

The primary objective of this work is to develop, using the Rational, Soil Conservation Service Curve Number and Provincial Methods, an *ArcGIS* based hydrologic model of the base and training area which offers a simplified and accurate means of predicting water discharge volumes used in culvert design for critical storm durations of 2-, 5-, 10-, 50- and 100-year frequencies.

Recommendations will also be presented indicating which of the three discharge methods offers the most accurate outputs as a function of watershed size and topography differences, as well as showing the current state of culvert infrastructure by identifying adequate and potential under-designed areas based on tool outputs.

Mapping solar potential obstructions using LiDAR data

Krista Amolins

Supervisor: Dr. David Coleman

Abstract

In recent years, there has been a growing interest in solar and other green energy technologies. In regions at lower latitudes where significant solar radiation is received yearround or in areas where installations are free of obstruction, solar technologies are a viable alternative to traditional energy generation. However, at higher latitudes and in areas where the sky is partially obscured, such as in urban areas, careful consideration must be given to the location of solar installations.

Data from airborne laser scanning (ALS), also referred to as LiDAR, consist of elevation and intensity measurements from discrete points and can be used to identify suitable locations for solar installations. In this paper, a system is proposed that uses a LiDAR point cloud to determine the degree of sky obstruction at any location. A series of images can be produced for a selected area or an analysis can be performed for a specific location. The level of approximation and the extent of the analysis can be adjusted according to the data available and the application; for instance, for solar installations, the direction of obstructions can be limited to the range of azimuths for the sun at the given latitude. The output can also be combined with GNSS positional information to calculate dilution of precision values for specific locations at specific epochs. Results for the proposed system are shown using LiDAR data taken over Fredericton, NB, Canada.

Canadian Forces Base Gagetown - Spill Response Tool

Vincent Gallant

Supervisors: Dr. David Coleman, Dr. Sue Nichols

Abstract

In the last five years, the Canadian Forces Base Gagetown has worked hard to reduce the environmental impact caused by the intense workouts on its territory. The large-scale military exercises, the arrival of new vehicles, and multiple construction sites on the base have greatly increased the risks of accidental fuel spills. The intervention by the Hazardous Materials (HAZMAT) Response Team becomes a very complex operation because, when spilled, the materials are transported downwind and downstream. The Environment Section of the Base requested an improved decision-support system for the HAZMAT Response Team in order to help them with planning emergency interventions.

The objective of this project is to create a user friendly ArcGIS™ tool that models an overland spill of hazardous liquid and highlights the possible impacts on the sensitive elements affected by the spill moving downstream and downwind.

This presentation will show how the hydrological modeling is used to determine the flow path through the terrain of a dangerous material spilled at a source point. Based on a Digital Elevation Model as input, a Least Cost Path analysis within ArcGIS and the Emergency Response Guidebook which is the first reference in dangerous goods incident, the findings will be highlighted and assessed in order to achieve the needs of the HAZMAT Response Team.

Building detection in very high resolution satellite imagery using context based image segmentation

Vivek Dey

Supervisor: Dr. Yun Zhang

Abstract

With the advent of very high spatial resolution (VHR) satellite, details within the image scene have increased considerably. This led to the use of VHR satellite imageries in detailed urban applications, e.g. update of GIS database of a city. The human mind delineates the ground objects of VHR imageries precisely using various image interpretation elements. However, such an approach is not practical due to the growing rate of image generation. This led to the research of automated or semi automated processes for feature extraction using digital computers. This study proposes an automated approach for building feature extraction.

While building extraction is easy for humans, it is not easy for computers. This is due to the fact that buildings have various colors, shapes, sizes, structures, illuminations, and texture. A human mind detects building based on edges and surrounding context, e.g., shadows, trees, roads and parking lots. Hence, automated solution requires such sensory cues in context based approach for building detection. Object-based approach utilizes context in the best way through neighbourhood and topological analysis. Hence, this study proposes a segmentation based analysis for building feature extraction from Quickbird imagery of Hobart, Australia.

This study uses only 2D information, like shadow, edge and illumination invariant properties, for building detection in a multi-level segmentation approach using eCognition. Finally, both quantitative and qualitative accuracy analysis of building detection is performed to determine practical applications. The results obtained are promising but need modifications for practical applications

Designing a model strategic plan for boundary rehabilitation after natural disasters

Geoffrey Frame

Supervisor: Dr. Nichols

Abstract

This report outlines key issues in the rehabilitation of property surveys following natural disasters. This is becoming more and more imperative as natural disasters continue to affect the world, its land and the people living in it. The purpose of this report is to investigate previous and ongoing situations that provide information on those issues along with the measures that have been and are being taken to deal with them. This report compiles the information obtained to design a strategic plan that can be used by land tenure specialists, surveyors and government organizations to aid in the development of a plan of action.

Analysis of Different Forms of Alternative Dispute Resolution in Boundary Disputes

Dorin Resek

Supervisor: Dr. Sue Nichols

Abstract

This report examines Alternative Dispute Resolution (ADR) as a technique where a compromise can be reached that leaves those involved feeling like they came out on relatively equal terms rather than declaring one side the winner or the loser. There are skills, techniques, and non-judicial mechanisms that surveyors can utilize to help resolve boundary issues rather than taking them to court. By researching what has been done in other provinces in Canada and in other countries, this report shows that the ADR method can be effective and utilized as an alternate path to court proceeding. In this report the analysis of different non-judicial mechanisms is investigated and evaluated based on the control exercised by the parties, the overall cost of the process, the time it takes to resolve the dispute and the finality of the decision.

This report also explores the skill sets needed to deal with people in land dispute situations who, more often than not, let their passions cloud their judgment. The report shows how surveyors working in their capacity as professionals can deal with these issues. This is important for the profession because it can give guidelines and procedures for those who may be just starting their careers or have limited experience with landowners and boundary disputes.

The Effects of Government on Water Boundaries in the Maritime Provinces

Josh Mailman

Supervisor: Dr. James Secord

Abstract

Professional land surveying requires a clear and concise understanding of both common law, as well as legislation for a particular region in order to best serve the public interest. This report focuses on the current situation regarding boundary decisions by professional land surveyors in the Maritime Provinces, with a primary focus on water boundaries. Through the examination of case law, legislation, policies and communication with professional land surveyors in Nova Scotia, New Brunswick, and Prince Edward Island, the boundary decisions required to locate and delineate tidal waters, inland riparian boundaries as well as water lots are indentified. Also, with the developing interest in wetlands and conservation, a brief investigation is conducted into the developments of policy, regulation and restrictions on land regarding wetlands and their subsidiaries.

Using Remote Sensing Technology for Determining the Most Desirable Location to Build a Well Site

Adam Pleasant

Supervisor: Yun Zhang

Abstract

A proposed drilling location in the Birch Mountains of Alberta is selected by geologist for oil or gas extraction. The consultant scouts, or land surveying firm is assigned, to complete an Enhanced Approval Process (EAP) for the client. In order for such a proposal to be submitted, a designated location for a well site lease near the proposed drilling location has to be chosen. The right of way for entering and exiting the well site has to be scouted as well. All construction and environmental regulations will also affect the placement of the well site and its route.

In the oil and gas exploration sector, preliminary decision making for construction of well sites and rights of way are performed by consultants, scouts or survey crews. The personnel would physically visit the proposed site locations. This preliminary process for large scale exploration projects is costly due to the cost for transportation, board and trained personnel.

This report focusses on using remote sensing technology for determining the most desirable location to build a well site. The application will use geographic data from: aerial photographs, Light Detection and Ranging (LiDAR) survey data and other spatial data to solve for a suitable location to construct well sites.

Low Cost DEM Creation Using Photosynth – An Evaluation

Nathan White

Supervisor: Dr. Yun Zhang

Abstract

Creating a Digital Elevation Model (DEM) requires a great deal of data collection and processing. Often, the cost to create a DEM is too expensive for a project. Using free and open source software, the ability to create low cost DEMs greatly increases. Photosynth by Microsoft has the ability to reconstruct real world scenes from photographs. The result produces a 3D point cloud that can be extracted and processed into a DEM. Photosynth uses structure-from-motion (SfM) algorithms that match key points in multiple photographs. These key points compose the 3D point cloud that, when extracted, is used for the DEM. Using existing data and the aid from the Photosynth community, an evaluation of key point accuracy was conducted. Results achieved varied from centimetre level accuracy to sub-metre accuracy, depending on the point cloud created by Photosynth. The methodology behind creating the DEM is also discussed because of the use of open source software to extract and georeference the Photosynth point cloud. The ability to create low cost DEMs using photographs offers the potential for a wide variety of users to do 3D mapping without the use of highly specialized equipment. It also provides a methodology for further research that does not require a large budget or team.

Classification of Satellite Imagery Using eCognition

Mark Wight

Supervisor: Dr. Yun Zhang

Abstract

This report illustrates a variety of techniques utilized in order to classify features contained within satellite based imagery. An issue was presented by the City of Fredericton that they did not possess sufficient detail as to total amount of green space which currently exists in the city. This information is deemed relevant as the city is uncertain if new neighbourhoods which are being constructed adhere to the green space requirements. As well, it is relevant for tourism and attracting new residents.

A discussion takes place which illustrates the background behind satellite imagery technologies which exist in satellite imagery and resolution of images. The technologies which are utilized in a variety of classification methods are also discussed. In addition we have an overview of eCognition Developer 8 which details the background, application specifics and the base technique it utilizes in order to classify images.

The main algorithms, and their parameters, which were utilized in classification are discussed. Definitions of specific algorithms are contained within the appendix.

The final section discusses results and comparisons of the data. Using a variety of algorithms and techniques classification of approximately 69% to 71% green space was acquired. These differing techniques and the benefits or disadvantages of each are discussed.

Advantages of Using Virtual Reference Stations for Surveying in New Brunswick

Kyle Headdy

Supervisor: Dr. Peter Dare

Abstract

Virtual Reference Stations are the latest implementation of a multiple reference station network to allow for corrections to be broadcasted over the internet to the user in the field using a cellular modem. These corrections are then used for real-time kinematic positioning.

This report provides background information on how virtual reference station networks operate, the virtual reference station network in Canada known as Can-Net, and information on the fieldwork and analysis performed to evaluate the system's performance.

An analysis of the data shows that there is very little degradation in the accuracy and reliability of the system in the suggested working area. Similar results can be achieved in areas outside the coverage area, but precautionary measures are required as the reliability of the corrections decreases outside the coverage area.

The Implications of Using Coordinate Values in Land Surveying in Canada

Alexander D. Penner

Supervisor: Dr. James M. Secord

Abstract

As technology and techniques in land surveying progress, the use of coordinates in land surveying is becoming a viable option. Their use is merely for convenience, although areas across Canada do exist that allow the exclusive use of coordinates. A review of the context of coordinates across Canada demonstrates this. The technical, legal and social issues are investigated to attempt to predict the implications of using coordinates in land surveying, while case studies in two countries already well versed in the use of coordinates are presented to learn from their efforts. While not currently available for use across the entire country, the changing legislation and the increases in technology and techniques are quickly making coordinates a feasible option in land surveying in Canada.

Pixel Based Image Classification of Digital Aerial Orthophotos of the City of Fredericton for Urban Green Space Investigation

James Thomas

Supervisor: Dr. Yun Zhang

Abstract

In June of 2010 the City of Fredericton, Department of Development Services extended a request for assistance in determining the percentage and land area of three ground cover types within the city limits. The ground cover types of interest included: Urban Forest, Green Space and Hard Surface. Through the use of supervised pixel based image classification and digital aerial orthophotos of the Fredericton area, determinations of these three ground cover types were completed. This information will aid the City of Fredericton in planning and future development of the local community with regard to the vast supply of green assets within the municipality. This project will also serve as an investigation into the achievable accuracy of green space determinations using supervised image classification techniques applied to digital aerial orthophotography.

A Comparison of Precise Point Positioning GPS Elevations with the Northwest Atlantic Hydrodynamic Model on the Grand Banks

Justin Theriault

Supervisors: Dr. John Hughes Clarke, Ian Church

Abstract

Varying water levels are a source of depth independent errors in hydrographic surveys; therefore, they must be taken into account when reducing surveyed depths to a chart datum. In some cases the water level reduction can be the most significant correction in the hydrographic survey as it can range several metres within 6 hours. When surveying in offshore regions far from the coast, the methods used to account for these tides can be limited in accuracy and reliability.

An alternative method to account for tides in hydrographic survey reductions to chart datum is investigated by using Precise Point Positioning (PPP) DGPS vertical solutions. The raw RINEX files from a vessel transit on the Grand Banks off the coast of Newfoundland were processed using UNB GAPS PPP software. These solutions were subsequently filtered for heave and corrected for geoid-ellipsoid separation, Dynamic Ocean Topography and GPS antenna vertical offsets. The final vertical GPS solution is referenced to mean sea level and compared with tide predictions from the Northwest Atlantic hydrodynamic model using Webtide services. The difference between both tidal profiles can be used to determine any sea surface anomalies and validate the viability of using GPS vertical solutions for tidal reductions on the Grand Banks.

Using Volunteered Geographic Information for Event Implementation and Management

Lara Needham

Supervisor: Dr. Dave Coleman

Abstract

The increasing use of Volunteered Geographic Information (VGI) has ignited the creation of many new applications and uses for this method of spatial data collection. One possibility is investigating the potential usability and effectiveness of VGI as a tool for assisting with the management and execution of the Canadian Federation for the Humanities and Social Sciences Congress 2011. In examining the effectiveness of this technology, the major concerns surrounding the use of VGI such as data reliability and accuracy, equipment positioning capabilities, data security and accessibility are addressed and evaluated. A potential design for the Congress 2011 application was created to illustrate the benefits and uses of this application. The design is limited by the current inability of GPS enabled mobile phones to provide accurate indoor positioning. Further recommendations are made to enhance the future use of VGI by increasing the accuracy capabilities of three-dimensional indoor positioning through the use of pseudolites or node matched positions.



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