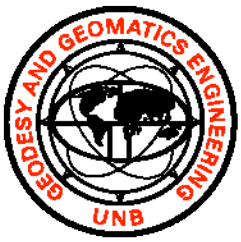
Graduate Seminar

&

Student Technical Conference



Wednesday November 24th, 2010

Department of Geodesy and Geomatics Engineering

The organizer would like to welcome you to the

2010 Graduate Seminar & Student Technical Conference

Where:

Head Hall – E11

When:

Wednesday, November 24th 2010

Please join us for refreshments after in room E4.

Seminar Organizer:

Reenu Toodesh

with thanks to Sylvia Whitaker

Department of Geodesy and Geomatics Engineering

Geodesy and Geomatics Engineering

Graduate Seminar and Student Technical Conference

09:00AM	**Opening Remarks**
	Chair: Reenu Toodesh
Session 1:	**GPS and Remote Sensing**
09:10AM	Active RFID Indoor Positioning Based on Probability Method. *Hui Tang*
09:30AM	Global Assessment of UNB's Online Precise Point Positioning Software. *Landon Urquhart*
09:50 AM	Evaluation of soil moisture information using illumination-corrected surface temperature and enhanced vegetation index in a forest-dominated region of eastern Canada. *Amer Ahmed*
10:20 AM	Multisource object-based land cover classification of VHR imagery over urban areas. *Bahram Salehi*
10:40AM	**Coffee Break**

Session 2:	**Remote Sensing and Ocean Mapping**
10:55AM	A Fuzzy approach towards improving the performance of multi-resolution ground object segmentation. *Vivek Dey*
11:15 AM	Relative performance of Kongsberg EM302 and EM3002 on the outer continental shelf of the Beaufort Sea. *Jose Luis Sanchez de Lamadrid Jaques*
11:35 AM	Limits on achievable absolute hydrographic survey accuracies at the Port of Saint John: application to seabed change assessment. *Sven Commandeur*
11:50 AM	**Closing Remarks**

Active RFID Indoor Positioning Based on Probability Method

Hui Tang

Supervisor: Dr. Don Kim

Abstract

Many autonomous mobile robot applications require high-accuracy positioning in an indoor environment. Radio Frequency Identification (RFID) is a rapid developing technology which can be employed for positioning based on received signal strength indication (RSSI) values.

Although RFID-based indoor positioning systems have been developed by many researchers over the world, improving positioning accuracy to a higher level (e.g., better than 1 m) is still a challenging task. Conventionally, the received signal strength is converted to a tag-reader range and the location is determined using trilateration. However, in a typical indoor environment, it is difficult to model precisely the relationship of received signal strength and a tag-reader range due to multipath.

In this work, a probabilistic localization approach was investigated to handle uncertainties and errors in the received signal strength. A redistributed particle filter was developed to deal with nonlinear, non-Gaussian problems typically in indoor positioning. In the training phase, a three dimensional observation model, describing the probability of receiving the measurement from a certain range and direction, was built based on the probabilistic characteristics of sample calibration data. During the real-time positioning phase, particles are predicted based on a motion model. The weight of each particle is updated by applying the observation model when a new set of RSSI measurements are obtained. The estimation of the robot's position can be calculated from the weighted mean of these particles.

Although our research and development is still in an early stage, we could attain promising results by improving the observation model and sub-optimal estimator used for the particle filter.

Global Assessment of UNB's Online Precise Point Positioning Software

Landon Urquhart

Supervisor: Dr. Marcelo Santos

Abstract

Over the past several years UNB has developed and maintained a precise point positioning (PPP) application called the GPS Analysis and Positioning Software (GAPS). PPP is a technique for processing Global Positioning System (GPS) observations that can achieve accuracies comparable to relative positioning, anywhere in the world, while only requiring a single receiver from the user.

By using precise satellite orbit and clock products and a single dual-frequency receiver, PPP provides accuracies of several centimetres given sufficient convergence time and proper error modelling. Current surveying operations using GPS typically rely on relative positioning which suffers from the need for a stable, nearby reference station which in remote areas can be very costly. PPP frees the user from the restrictions of relative positioning and in the future may replace or at least complement current surveying field practices.

A review of the GAPS online application will be given. As the user requirements for PPP can be somewhat more demanding than relative baseline processing over short baselines, a review of "best practices" will be discussed to allow users to obtain the most accurate results from GAPS or any PPP software.

In order to evaluate the accuracy and precision achievable with GAPS, a subset of 17 stations from the International GNSS Service (IGS) global network were processed using GAPS, for the entirety of the year 2008. The results of the campaign are compared to the published IGS station coordinates to determine the achievable accuracy and precision of GAPS on a global level.

Evaluation of soil moisture information using illumination-corrected surface temperature and enhanced vegetation index in a forest-dominated region of eastern Canada

Amer Ahmad

Supervisor: Dr. Yun Zhang

Abstract

Optical imagery is considered as a valuable source for estimating soil moisture information from the imagery pixel values. Imagery pixel values are contaminated by different atmospheric and topography changes; hence, these changes degrade the image extracted soil information.

This paper applies a pre-processing step, represented by topography correction, prior to estimation of soil moisture information from 8-day composite data of Moderate Resolution Imaging Spectroradiometer (MODIS).

To remove the topography effect, a Lambertian technique, using C correction method, is applied to correct the image pixel values using an illumination surface and image digital numbers (DN).Then, a temperature-vegetation dryness index (TVDI), using land surface temperature (LST) reflectance and Enhanced Vegetation Index (EVI), is calculated to estimate the soil moisture information before and after the correction. Later, the estimated information before and after the correction are compared visually and statistically.

The results shown that the estimated soil moisture information, using TVDI, after implementing the topographic correction has improved as compared with the estimated information before the correction. This improvement is resulted from the better correlation between the LST and EVI as compared with the correlation before the correction.

Multisource object-based land cover classification of VHR imagery over urban areas

Bahram Salehi

Supervisor: Dr. Yun Zhang

Abstract

Classification of very high resolution (VHR) imagery, particularly in urban areas, is a challenging task. This is, firstly, because the complex nature of urban scenes where a variety of lands cover types with similar spectral properties presents and secondly, the high spatial and relative low spectral resolution of VHR imagery. Utilizing other data sources such as existing GIS layers in classification process (multisource classification) is a solution to address the problems of VHR land cover classification over urban environments. When multisource data are integrated for image analysis purposes usually the misregistration among data from different sources (e.g., image layers and GIS thematic layers) is a problem. Fortunately, in object-based approach this negative effect, of multi source image analysis, is less prominent than in pixel based approaches. In this research, a Quickbird image along with a Spot Height layer is combined to carry out an object-based classification over uptown Fredericton, New Brunswick which is covered mainly by large commercial buildings, parking lots, highway and street and vegetation areas. The image was firstly segmented into three different levels and then an efficient rule set was developed to accomplish a hierarchical classification. In the rule set the Spot Height layer was utilized to separate parking lot areas from buildings. All four classified land cover types were exported in shape file format and two ground truth layers (building footprint and road network) were overlaid over the exported layers. The visual inspection of the result shows the very high potential of multisource object-based classification in urban environments.

A Fuzzy approach towards improving the performance of multi-resolution ground object segmentation

Vivek Dey

Supervisor: Dr. Yun Zhang

Abstract

With the advent of very high spatial resolution satellite (VHR), spectral variation within the image scene has increased considerably. This has led to the upsurge of object based image analysis from traditional pixel based classification. The basic step in such an analysis is image segmentation which governs the further object based image classification considerably. Thus, efficient image segmentation is crucial for VHR image analysis.

While segmentation has been widely researched for the last decade, it is still an ill posed problem with solution being application specific and not generalized. Among existing segmentation techniques for very high resolution remote sensing imagery, multi-resolution segmentation is one of the most efficient technique for efficient VHR image analysis. Further, it has been incorporated in commercial software named eCognition Developer. However, it suffers due to trial and error based optimization of its parameters namely, scale, shape weight and compactness weight. Each image scene requires such analysis requiring considerable time of human operators.

Maxwell (2005) proposed a successful fuzzy based approach to mitigate parameter optimization procedure but on rural image only. This work extends and modifies Maxwell's work to achieve required segmentation efficiency on VHR imagery underlying urban scene. The generated segmentation results are assessed both quantitatively and qualitatively for validation of results.

Relative performance of Kongsberg EM302 and EM3002 on the outer continental shelf of the Beaufort Sea.

Jose Luis Sanchez de Lamadrid Jaques

Supervisor: Dr. John Hughes Clarke

Abstract

Spanish Navy Hydrographic vessels, Malaspina class and Astrolabio class, are equipped with Multibeam Echo Sounders (MBES) provided by the company Kongsberg. These MBES include an EM302, with a nominal frequency of 30 KHz (design depth range 10-7000 meters) and EM3002, with a frequency of 300 KHz (design depth range 1-200 meters). The main problem for the Navy has been to establish a depth at which to switch between these systems.

In 2009 a collaborative mapping program took place between ArcticNet and Imperial Oil in the Beaufort Sea. This project involved three MBES platforms: CCGS Amundsen, equipped with EM302, CCGS Nahidik and CSL Petrel, both equipped with EM3002. The overlap area that was surveyed by these three Canadian vessels was the outer edge of the continental shelf. This extends from 50 meters up to 220 meters.

Herein we present analysis aimed at quantifying the achievable vertical accuracy and resolution of both MBES. These statistics show how the high frequency systems work better in terms of accuracy, resolution and bottom tracking even in the deeper areas of the survey, especially deeper than 150 meters. The main drawback in the deep water comes when dealing with the swath width as it becomes very narrow, due to greater attenuation of these higher frequencies.

So regarding the problem of where to switch between the systems, the conclusion would be a trade-off between the complete coverage of the bottom in terms of the duration of the survey, and sufficient accuracy or resolution. This depth range spans the critical

region where danger to surface or shallow submerged operations exists and thus high accuracy is required.

Limits on achievable absolute hydrographic survey accuracies at the Port of Saint John: application to seabed change assessment

Sven Commandeur

Supervisor: Dr. John Hughes Clarke

Abstract

The University of New Brunswick has conducted multiple repeat multibeam echo sounder surveys in the port of St. John to investigate the annual and seasonal variations in erosion and deposition of sediments around the port. Any apparent change may be either due to real erosion, deposition, or reflect errors in the individual surveys. To assess the smallest possible change that can be reliably detected the uncertainty of the integrated multibeam echo sounder system needs to be assessed. Of the multiple potential sources of errors in the integrated solution, it is clear that the refraction component dominates. This study focuses on quantifying the magnitude of that contribution.

The port of St. John is within an estuarine environment where two water masses come together. On one side, there is a fresh water outflow of the river, and on the other side, there is a salt water influx. The tidal currents and the mixing and interleaving of salt and fresh water lead to a temporally and spatially variable oceanography. This changes the propagation and refraction of sound in the water and thus affects the depth estimates of the multibeam echo sounder. The trouble with sound speed profiles is that they only represent the sound speed in the water at an instant time and position. As the vessel moves around the port the water mass below will change drastically. This results in an uncertainty in the depth estimates.

To express the uncertainty, all sound speed profiles collected during the survey are analysed as a function of their separation in time and space. In each case, a sequential pair of sound speed profiles is compared. The comparison is performed by calculating ray trace solutions over the utilized range of incidence angles (0 to 65 degrees) to a range of representative depth using both the sound speed profiles. In this way the scale and sign of

the error may be estimated as a function of depth and incidence angle. The relationship of the scale and sign of the error to the separation in time and/or space is explained in terms of the known oceanography of the port.

University of New Brunswick
Department of Geodesy and Geomatics Engineering

Head Hall – 15 Dineen Drive
PO Box 4400
Fredericton, NB
Canada E3B 5A3