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SUMMER 2011

GEOMATICS ENGINEERING

SCHULICH School of Engineering

UNIVERSITY OF CALGARY

DEPARTMENT OF GEOMATICS ENGINEERING

Geomatics News

Message from the Head

Dear Valued Reader

I hope that you had a chance to enjoy your summer and renew your energy. In this message, I would like to update you about what has been going on in the Department since the last newsletter. As in previous years, the great majority of our graduating students have been able to secure employment opportunities in different sectors of Geomatics. An APEGGA survey indicated that Geomatics ranked as one of the top four engineering programs in terms of securing employment among graduating students. Also, we had a good number of third year students participating in the internship program.

On another front, we have 54 incoming Second Year Students to the Department. The Geomatics Engineering Student Society (GESS) had a successful reception on Thursday, September 29, 2001 for these students. During the Fall semester we will have several initiatives to increase the First Year Engineering Students' awareness of Geomatics, including a presentation by Ed Parsons – Google's Geospatial Technologist – of the role of Geomatics in Google.

Finally, I am pleased to let you know that the Department as a whole has been quite successful in attracting significant funding from competitive sources as well as obtaining prestigious awards from national and international organizations.

Dr. Ayman Habib
Professor and Head

GESS COUNCIL 2011-2012

Back(L to R): Ryan Horton, Vassu Khurana, Kale Pominville, Carey Lavoie, Pam Starratt, Claudia Potok, Andrew Salmon, Stephan Normandeau. Middle (L to R):Alfred D'Mello, Alex Lidell, Tasha Wong Ken, Shana Davis. Front(L to R): Towfique Ahmed, Bryan Leedham, Jaime Dainton

Inside this issue:

Congratulations

- Congratulations to students who completed their graduate studies: Ahmed Kamel, PhD; Mohamed Tamazin, MSc; Navedeep Sekhon, MSc; Pratibha Anantharamu, PhD; Shashank Satyanarayana, PhD; Mohammad Keshvadi, MSc; Shammi Musa Akther, MSc; Kazi Rahman, MSc.

- Forty-two teaching assistants recently received a Schulich School of Engineering Teaching Assistant Award. From Goematics Enigneering, congratulations to the following: for **Teaching Assistant Excellence Awards** Ana Kersting, ENGO 531; Jacky Chow, ENGO 343. For **Teaching Assistant Effectiveness Awards,** Andrew Phillips, ENGO 551; Billy Chan, ENGO 421 & ENGO 465; Feng Xu, ENGO 361; Navdeep Sekhon, ENGO 559 & ENGO 583; Herve Lahamy, ENGG 233; Fatemeh Ghafoori, ENGG 233; Feng Tang, ENGG 233; Baijie Wang, ENGG 233;

Other News

- Newly funded TECTERRA projects are as follows:

Low cost GNSS PPP and MEMS IMU integration and prototype system. Lead investigator: Dr. Yang Gao.

Automated feature extraction from multi -modal imagery for corridor transport mapping. Lead investigator: Dr. Ayman Habib.

A web-based spatial decision support system for water management in Alberta. Principal investigator: Dr. Danielle Marceau.

Airborne gravity gradiometer system for exploration of minerals, oil and gas. Lead investigator: Dr. Michael Sideris.

Survey Camp August 2011

Visits

- Dr. Wolfgang Förstner, Head of the Department of Photogrammetry at the Institute for Geodesy and Geoinformation, University Bonn gave a one day tutorial entitled "Probabilistic Data Analysis Usning Graphical Models" on September 01, 2011. The tutorial focused on the modeling and analysis of both image and LiDar data. Dr. Förstner is very well known in the photogrammetric and computer vision communities for his scientific and service contributions and has been the recipient of numerous awards to recognize his efforts.

- Laser Scanning 2011 was held at the University of Calgary (the Sponsoring Organization) campus from 29-31 August 2011. A tutorial was also held on 1 September 2011. The Workshop Chair and Co-Chair were Derek Lichti and Ayman Habib, respectively. It was the 7th in a series of ISPRS workshops on laser scanning that began in 1999. Papers were accepted on the basis of the results of a double-blind peer review process. Each paper was reviewed by two referees. The final program comprised 34 papers presented orally and 22 papers presented as posters.

Each day of the workshop commenced with an invited presentation; Drs. Jan Skaloud, Grady Tuell and Hans-Gerd Maas were the invited speakers.

Ninety (90) participants from 22 different countries registered for the workshop. Thirty-six (36) participants registered for the September 1st tutorial "Probabilistic Data Analysis Using Graphical Models" offered by Prof. Dr.-Ing. Wolfgang Förstner, University Bonn

- Dr. Jan Skaloud, Senior Research Fellow and lecturer at Ecole Polytechnique Federal Lausanne, Switzerland and an alumnus of our department, taught the Tecterra sponsored course, ENGO 699.55 — 'Special Studies in Integrated Sensor Orientation'.

Research Spotlight

Modelling the Impact of Industrial Activities on Woodland Caribou Behavior and Habitat Use in West Central Alberta

Article by Danielle Marceau and Christina Semenuik (GIS and Land Tenure)

Figure 1. Woodland caribou (copyright Mark Bradley, Parks Canada)

Alberta woodland caribou (*Rangifer tarandus*) are classified as threatened in Canada, and a local population in the west-central region, the Little Smoky herd, is at immediate risk of extirpation due, in part, to anthropogenic activities such as oil, gas, and forestry that have altered the ecosystem dynamics. The Alberta government resultantly recommends the assessment and management of cumulative effects on caribou, as well as the identification and provision of adequate habitat, to allow for caribou persistence. Furthermore, understanding the relative contribution of major industrial landscape-level disturbances to caribou population decline will assist the energy sector with better short- and long-term planning, and in meeting sustainable development goals. To this end, we are working with a team of experts in caribou ecology and remote sensing – Dr. Marco Musiani at the University of Calgary's Faculty of Environmental Design, Dr. Mark Hebblewhite at the College of Forestry and Conservation, University of Montana, and Dr. Greg McDermid at the University of Calgary's Department of Geography. We are also collaborating with our industry partner, ConocoPhillips Canada (CPC), represented by Scott Grindal, the Environmental Coordinator for CPC's Health, Safety, Environment and Sustainable Development division.

To investigate the impact of industrial activities on woodland caribou, we have developed a spatially explicit, agent-based model (ABM) to simulate winter habitat selection and use of woodland caribou, and to determine the relative impacts of different industrial features on caribou habitat-selection strategies. The ABM model is composed of cognitive caribou agents possessing memory and decision-making heuristics that act to optimize trade-offs between energy acquisition and disturbance. A set of environmental data layers is used to develop a virtual grid representing the landscape over which caribou move. This grid contains forage-availability, energy-content, and predation-risk values. The model is calibrated with caribou bioenergetic values from known literature values, and validated using GPS data from thirteen caribou radio-collars deployed over six months from 2004 to 2005, representing caribou winter activities. Simulations have been conducted on alternative caribou habitat-selection strategies by assigning different fitness-maximizing goals to agents: predation-and-energetics vs. predation-insensitive vs. predation-hypersensitive strategies. Model outcomes were evaluated by verifying which resultant simulations of caribou movement patterns most closely matched real-world caribou distributions and other patterns extracted from the GPS data. The 'predation-and-energetics' strategy, in which the caribou agent must trade off the competing goals of obtaining its daily energy requirement, minimizing reproductive-energy loss, and minimizing predation risk, was the best-fit scenario. Not recognizing industrial features as predation risk ('predation-insensitive') causes simulated caribou to unrealistically reduce their daily and landscape movements; equally, having predation risk take precedence ('predation-hypersensitive') results in unrealistic energetic deficits and large-scale movement patterns, unlike those observed in real-world caribou (Figure 2).

These results elucidate the most likely behavioral strategies caribou use to select their habitat, the extent to which caribou perceive industry features as disturbance, and the differential energetic costs associated with each, thus offering insight into why caribou are choosing the habitats they use. Further work is underway to differentiate caribou responses to industrial features based on type, age, density, and buffer distances to improve model fit. In addition, a Cellular Automaton (CA) is

Continued on page 4

Alumni Voice

I graduated from the Geomatics program back in 2000 and I was drawn to the program because it focused on some cutting edge technology, and applying that to real world problems. Since that date almost a dozen years ago, my career has jumped from one Geomatics application to another: from helping to manage one of the largest online database of high resolution imagery, to building out a cutting edge terrestrial positioning system, to creating North America's first location-based mobile game, SwordFish. I have been fortunate enough to be able to work on some of the latest technologies available even with the occasional tech bubble thrown in. Currently I am the Chief Technical Officer at Mob4Hire directing a crowd-sourced mobile testing program worldwide and run a consulting company that designs, develops and markets mobile applications. I'm currently focused on the mobile industry because without the range of Geomatics technologies we would be looking at a very different mobile landscape. Whether it is for personal navigation, contextualizing search results or even planning cellular locations, the mobile industry was shaped by the spatial technologies. Understanding how those tools work helped me move quickly in the industry.

The high-tech industry is clamouring for new ideas and applications and having a solid Geomatics background gives you the capability to bring real innovation to them. Now if only I can find an application for hydrography.

John Carpenter , *BSc 2000*

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being developed to allow a dynamic representation of the environment and the simulation of future plausible scenarios of industrial activities and land-use management in the Little Smoky landscapes. This combined ABM/CA model represents a unique tool to explore how changes in the landscape might affect woodland caribou habitat, its use, and caribou fitness.

Our research is funded by the MITACS Accelerate Program, GEOIDE, Tecterra Inc., and ConocoPhillips Canada. Support is also provided by two University Technologies International Postdoctoral Scholarships awarded to C. Semeniuk, and the Schulich Research Chair in GIS and Environmental Modelling awarded to D. Marceau.

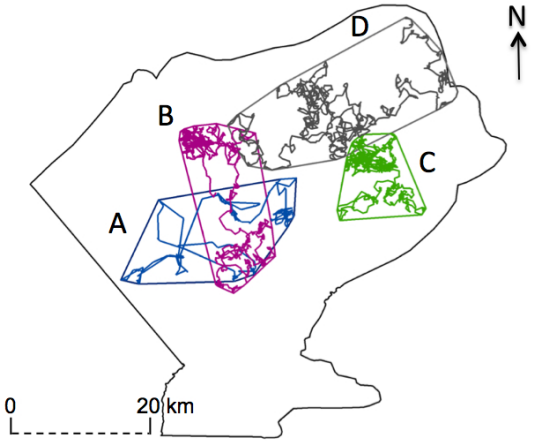

Figure 2
Representative spatial trajectories of real-world ('A') and simulated woodland caribou ('B', 'C', 'D') within the designated Little Smoky herd. B = Predation-and-Energetics strategy; C = Predation-Insensitive strategy; D = Predation-Hypersensitive strategy.

Department Activities

Farewell Julia Lai who retired after 24 years of committed service to the department and university. She will be greatly missed.

Courtenay

Melissa

Please welcome two new team members who joined our support staff in the Geomatics Department: Courtenay Canivet and Melissa Ostrowski. Courtenay is our Undergraduate Administrator, and Melissa our Graduate Administrator.

Coming Events

- Come and meet Ed Parsons, Google's Geospatial Technologist—Wednesday, November 16, 2011. Hosted by TECTERRA
- Fall Term Lectures End—December 09, 2011
- Fall Term Final Exams—December 12-21, 2010
- Geomatics Engineering Liaison Committee (GELC) - Wednesday, February 01, 2012.
- Geomatics Career Day - Thursday, February 2, 2012.

Sites to Visit:

- *http://www.tecterra.com/*
- *http://gess.geomatics.ucalgary.ca/*
- *http://www.ipb.uni-bonn.de/*
- *http://www.mob4hire.com/*