Presented Virtually:

Geomatics Innovation @UNB

Winter 2020 Graduate Seminar

April 9, 2020 | 10am-12:15pm

UNIVERSITY OF NEW BRUNSWICK

Join us virtually, via Zoom:

The GGE Department would like to welcome you to our virtual Winter 2020 Graduate Seminar.

To join in, please follow the link below.

Join Zoom Meeting at 10:00am, April 9th, 2020: https://zoom.us/j/114470590

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Winter 2020 Geomatics Graduate Seminar

10:00 Opening Remarks

10:05 Evolution Analysis on Spatiotemporal Networks | Rouzbeh Forouzandeh, PhD

10:25 Evaluating the use of sliding time windows with Affinity Propagation for clustering IoT data streams | Nasrin Eshraghi Ivari, MScE

10:45 Stream Clustering Wearable Data with Assorted Time Windows | Luke McCully, MScE

11:05 Break

11:10 A Three-Dimensional Hydrodynamic Model to Study the Baroclini Conditions of the Bay of Fundy | Ahmadreza Alleosfour, PhD

11:30 Flood Modelling Using Random Forest and Identifying the Essential Conditioning Factors; a case study in Fredericton, New Brunswick, Canada | Morteza Esfandiari, MScE

11:50 Level of Detail 2 3D City Model Recreation over Fredericton, New Brunswick, Canada | Mitchell Krafczek, MScE

12:10 Vote for Best Presentation (LimeSurvey)

12:15 Closing Remarks

Abstracts

You may contact the Authors for a copy of the full papers.

Department of Geodesy and Geomatics Engineering

Evolution Analysis on Spatiotemporal Networks

Rouzbeh Forouzandeh
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Abstract

With the emergence of connected datasets (e.g. social networks, world wide web, and sensor networks) massive research efforts have been dedicated to evolutionary network analysis. However, studying the evolution of spatio-temporal networks has been mostly neglected, especially link prediction algorithms are not currently tailored for real-world spatio-temporal networks. This paper aims to address this research gap by introducing a framework for link prediction in spatio-temporal networks. We use a probabilistic model to capture and incorporate the spatio-temporal dependencies between the network objects/relations and take into account the dynamics of the link formation. We also incorporate the objects/relations attributes into the link prediction algorithm. The functionality and efficiency of our framework is evaluated using transportation datasets from Chicago city.

Evaluating the use of sliding time windows with Affinity Propagation for clustering IoT data streams

Nasrin Eshraghi Ivari
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Abstract

Data stream clustering is an emerging research field focused on discovering evolving clusters generated from continuous IoT data streams by using different time windows and geographical locations. The main challenge is to determine the type of a time window that should be used for the exploration of the streams over a widespread geographical area, and simultaneously providing a much deeper understanding of the evolving behavior of the clusters. In this paper, the Affinity Propagation algorithm is evaluated for clustering data streams being generated by indoor e-counters. It is proposed as a data stream clustering algorithm since it allows the extraction of a set of exemplars that best represents a data stream using a message passing method. The sliding time window is selected for performing unsupervised learning. The preliminary results from analyzing indoor e-counters data are showing that the Affinity Propagation algorithm has improved applicability, extensibility, efficiency and can get an accurate clustering effect.

Stream Clustering Wearable Data With Assorted Time Windows

Luke McCully
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Abstract

Wearable technology has become more prevalent in today's society since it boasts self-monitoring activities. A new research domain known as the "Quantified Self" has recently emerged and is described as gaining self-knowledge through numbers. Many wearable devices such as Fitbit and a variety of market-ready products are widely used in this domain with a large amount of data being collected around the world. This paper explores stream clustering wearable data with assorted time windows to produce new self-knowledge insights for market available wearables to be used by the end users. The assorted time window model is proposed to support the stream K-means algorithm for analyzing Fitbit data, which was collected by the University of Flinders, Australia. Due to k-means having the requirement of setting the amount of clusters before it runs, the elbow method is proposed to determine the optimal cluster amount for each one-hour interval. The results so far have been promising and unique to the domain due to time window models not being researched exclusively, as they are viewed as a minor step in current stream clustering algorithms and not understood in depth.

A Three-Dimensional Hydrodynamic Model to Study the Baroclinic Conditions of the Bay of Fundy

Ahmadreza Alleosfour

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Abstract

The Bay of Fundy is home to a diverse biological environment, and to provide marine protection plans and better insight on the species communities on the seafloor, benthic habitat mapping is required. These maps are based on an integration of seabed bathymetry, backscatter and physical oceanographic layers such as temperature, salinity, and currents from ocean models. For this study, the Finite-Volume Community Ocean Model (FVCOM) has been adopted, which covers the Bay and includes the Saint John River up to Evandale.-The horizontal resolution ranges from 20m to 6000m in the Reversing Falls and open boundary respectively, and in the vertical coordinate, the model consists of 40 terrain-following layers.

The presence of strong tidal forces, especially in the Minas Passage, the complex geometry of the Saint John River, and the huge river runoff at the freshet are the most important challenges in this area. The model is forced to run by the tidal elevation, temperature, and salinity at the open boundary close to the Bay entrance and river water level, salinity, and temperature at the upper part of Saint John River. The model has been initialized with the temperature and salinity from a lower resolution regional model. The model results were evaluated with observational data and present good agreement with tidal elevation, gyre locations, the high tidal current locations, temperature, and salinity. Also, the model was able to capture the freshwater discharge from Saint John River to the north of Grand Manan Island.

Flood modelling using random forest and identifying the essential conditioning factors; a case study in Fredericton, New Brunswick, Canada

Morteza Esfandiari
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Abstract

Flood is one of the most damaging natural hazards in urban areas in many places around the world as well as the city of Fredericton, New Brunswick, Canada. Recently, Fredericton has been flooded in two consecutive years in 2018 and 2019. Due to the complicated behaviour of water when a river overflows its bank, estimating the flood extent is challenging. The issue gets even more challenging when several different factors are affecting the water flow, like the land texture or the surface flatness, with varying degrees of intensity. Recently, machine learning algorithms and statistical methods are being used in many research studies for generating flood susceptibility maps using topographical, hydrological, and geological conditioning factors. One of the major issues that researchers have been facing is the complexity and the number of features required to input in a machine-learning algorithm to produce acceptable results. In this research, we used Random Forest to model the 2018 flood in Fredericton and analysed the effect of several combinations of 12 different flood conditioning factors. The factors were tested against a Sentinel-2 optical satellite image available around the flood peak day. The highest accuracy was obtained using only 5 factors namely, altitude, slope, aspect, distance from the river, and land-use/cover with 97.57% overall accuracy and 95.14% kappa coefficient.

Level of Detail 2 3D City Model Recreation over Fredericton, New Brunswick, Canada

Mitchell Krafczek
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Abstract

The world's population is growing as is the urban population of its people. Many cities already face challenges in meeting the needs of their growing urban population and basic services have become overwhelmed and inaccessible to many. 3D city model can aid in this problem by enabling the smart city paradigm and giving insight into the inner workings of the city. New 3D city models need to be created and updated regularly so the most up-to-date information is used for future planning's. To do this, this written submission named "Level of Detail 2 3D City Model Recreation over Fredericton, New Brunswick, Canada" aims to establish a semi-automatic method for creating LOD2 3D city models. The purpose of this written submission is to develop and test if support vector machine (SVM) learning and ESRI's software CityEngine, which is based on procedural modeling and mainly used for creating a 3D content of urban areas, can be applied for the 3D modeling of urban environment. This task includes four main steps. The first step is the collection of all necessary data and attributes of buildings to create a database for modeling and preprocessing for creation and data preparation. The second step is the segmentation of roof tops into major components. The third step is a K-means function on each section to collect the centroid of each aspect and slope. The final step is the creation of a 3D model in ESRI's CityEngine software, using rule files that are created. At the end, the final results of the 3D model generated are compared against the LiDAR point cloud to compare the difference in area between the original and the new model. The result is a procedurally generated 3D city model Fredericton, New Brunswick, Canada.