University of Victoria | Graduate Studies

Notice of the Final Oral Examination
for the Degree of Master of Science

of

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BSc (University of Victoria, 2011)

"Monitoring Changes in Patterns of Cycling Safety and Ridership: A Spatial Analysis"

Department of Geography

July 20, 2017
1:00 P.M.
David Turpin Building
Boardroom

Supervisory Committee:
Dr. Trisalyn Nelson, Department of Geography, University of Victoria (Supervisor)
Dr. Meghan Winters, Department of Geography, UVic (Member)

External Examiner:
Mr. John Hicks, Regional Planning and Protective Services, Capital Regional District

Chair of Oral Examination:
Dr. Chris Lalonde, Department of Psychology, UVic

Dr. David Capson, Dean, Faculty of Graduate Studies

Abstract

Cycling is an underutilized mode of transportation in cities across North America. Numerous factors contribute to low ridership levels, but a key deterrent to cycling is concern for personal safety. In an effort to increase cycling mode share, many cities are investing in cycling infrastructure, with several cities constructing connected bicycle networks. Monitoring the impact of new infrastructure is important for accountability to citizens and to encourage political will for future investments in cycling facilities. A lack of spatially continuous ridership data and methodological challenges have limited monitoring and evaluation of the impacts of infrastructure changes. The goal of our research was to demonstrate spatially explicit approaches for monitoring city-wide changes in patterns of safety and ridership following improvements to cycling infrastructure.

To meet our goal, our first analysis demonstrated a method for monitoring changes in the spatial-temporal distribution of cycling incidents across a city. We compared planar versus network constrained kernel density estimation for visualizing cycling incident intensity across the street network of Vancouver, Canada using cycling incidents reported to the Insurance Corporation of British Columbia. Next, we applied a change detection algorithm to detect statistically significant change between maps of kernel density estimates. The utility of the network kernel density change detection method is demonstrated through a case study in the city of Vancouver, Canada where we compare cycling incident densities following construction of two cycle tracks in the downtown core. The methods developed and demonstrated for this study provide city planners, transportation engineers and researchers a means of monitoring city-wide changes in the patterns of cycling incidents following enhancements to cycling infrastructure.

Our second analysis demonstrated how network constrained spatial analysis methods can be applied to emerging sources of crowdsourced cycling data to monitor city-wide changes in patterns of ridership. We used network constrained global and local measures of spatial autocorrelation, applied to crowdsourced ridership data from Strava, to examine changes in ridership patterns across Ottawa-Gatineau, Canada, following installation and closures of cycling infrastructure. City planners, transportation engineers and researchers can use the methods outlined here to monitor city-wide changes in ridership patterns following investment in cycling infrastructure or other changes to the transportation network.

Through this thesis we help overcome the challenges associated with monitoring the impact of infrastructure changes on ridership and cycling safety. We demonstrated how network constrained spatial analysis methods can be applied to officially reported cycling incident data to identify changes in the spatial-temporal distribution of cycling safety across a transportation network. We also demonstrated how network appropriate spatial analysis techniques can be applied to large, emerging crowdsourced cycling datasets to monitor changes in patterns of ridership. These methods enhance our understanding of the city-wide impact of infrastructure changes on cycling safety and ridership patterns.