Quantifying changes in local movement patterns relative to landscape modification

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Spatial-temporal methods have and are being developed to quantify movement patterns across a range of spatial and temporal scales. Analysis approaches include modelling spatial processes (ie. random walks) and quantifying space-time patterns of movement. Beyond characterizing movement, it is often important to monitor and identify when movement has changed. For instance, it is useful to be able to determine when anthropogenic disturbance is impacting wildlife movement and to highlight an unexpected change in traffic flow along a road network.

The goal of our research is to develop a method that is effective at quantifying spatial-temporal changes of local movement patterns in response to environmental change. To meet our research goal, local movement patterns will be quantified to (1) evaluate the scales and distances at which movement is impacted by modified features (2) to compare how local patterns of movement vary geographically, and for different types of modification (3) to compare how local patterns of movement vary for an individual through time, or between individuals concurrently (concurrent individuals). Our objectives will be accomplished through the application of a new movement method, the Potential Path Area (PPA) that is based on time geography, in conjunction with standard movement metrics such as turning angle and velocity. Movement patterns will be quantified using local movement metrics for individual data points, and within local spatial neighbourhoods defined by PPA. Methods for summarizing the associations between movement and distance to modified features will also be demonstrated. The utility of the developed method will be demonstrated through a case study on fine scale movements of grizzly bears in west-central Alberta in relation to roads. Our method will be widely applicable to other studies interested in assessing change in movement relative to landscape features, and will have particular relevance for wildlife investigations.