INSTITUTION: University of Minnesota-Twin Cities
NSF PROGRAM: INFO INTEGRATION & INFORMATICS
PROPOSAL TITLE: III: Small: Investigating Spatial Big Data for Next Generation Routing Services

OVERVIEW OF THE PROPOSAL:
An excellent proposal that presents a clear set of research questions about next-generation vehicle routing services in the context of spatial big data. With the growth of GPS and mobile device availability, more and more data are available for researchers to develop new methods for providing better routing services. The focus of this research is on the computational support that underlies individualized routing and that minimizes time for travel, and also weighs routing according to eco-fuel consumption in order to reduce vehicle fuel needs.

INTELLECTUAL MERIT:
+ Strengths

Multiple topics have been proposed that are creative, such as using Lagrangian Xgraphs for representing node, edge, and turns; critical time-point based divide and conquer approach to address non-FIFO and non-stationarity challenges; and K-Median approaches for route-collection based on route similarity. The results could be ground breaking for the computer sciences and geospatial sciences fields.

A plan for evaluation is given using for example, road travel and airline flight schedule data, and includes using the expertise of collaborators.

The PI and his team are highly qualified to carry out the proposed research especially in the field of spatial databases and spatial data mining.

- Weaknesses

The panel discussed whether the proposed eco-fuel consumption aspects were a part of the shortest route problem or a separate one. The writing could be clearer on this point.

* Potentially transformative?
This research into spatial big data for individual routing is considered to be potentially transformative, for example, the work using Lagrangian Xgraphs for turns and on on-the-fly computation of critical time points could be transformative.

BROADER IMPACTS:
Impacts on science and society:

The results of this research have the potential to reduce energy consumption and greenhouse emission through the development of eco-friendly vehicle routing services.

Integration of Research and Education and Broadening Participation:

The education component of the project includes developing a new curriculum for spatial big data and routing, involving undergraduate and graduate students, and incorporating K-12 education. There are plans to broaden the participation of underrepresented undergraduate and graduate students.

Postdoc Mentoring Plan (if applicable):

N/A

DATA MANAGEMENT PLAN, including dissemination of results:

The data management plan is very strong with good plans for data storage and handling. The investigator gives a long-term plan for data curation and data archiving with a digital conservancy group at the University of Minnesota.

COLLABORATION PLAN (if applicable):

The proposal refers to working with collaborators from Center of Transportation at the University of Minnesota, and commitments from ORNL, Oracle Spatial, Microsoft Research, NAVTEQ and other strong partners in providing data and expertise. A collaboration plan for how these collaborators will be involved with the research would be helpful.

RESULTS FROM PRIOR NSF SUPPORT (if applicable):

No concerns identified.

HUMAN SUBJECTS (if applicable):

N/A

BUDGET (if necessary):

No concerns with budget.

ADDITIONAL SUGGESTIONS:

The results could also presumably be used for overall traffic management as well as individual routing, and so dissemination could be viewed even more broadly, for example, to include transportation and urban planners.
PANEL RECOMMENDATION:

_X_ Highly Competitive (HC)
__ Competitive (C)
__ Low Competitive (LC)
__ Not Recommended for Funding by Panel (NRFP)

* Justification, including key strengths and critical weaknesses:

A very strong proposal that investigates the computational needs and approaches for routing in new temporally detailed route settings that involve spatial big data and eco-fuel consumption constraints. Clear set of research questions using new techniques that involve both space and time, and solid plans for evaluation and expected outcomes. Very strong broader impacts for both transportation services and education.

The summary was read by the panel, and the panel concurred that the Panel Summary accurately reflects the panel discussion.

PANEL RECOMMENDATION: Highly Competitive

PANEL RECOMMENDATION KEY:
NRFP: Not Recommended for Funding by Panel, LC: Low Competitive, C: Competitive, HC: Highly Competitive