Enabling Query Processing on Spatial Networks

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Abstract

A system that enables real time query processing on large spatial networks is demonstrated. The system provides functionality for processing a wide range of spatial queries such as nearest neighbor searches and spatial joins on spatial networks of sufficiently large sizes.

1 System

We demonstrate a system that augments a general purpose spatial database with the SILC framework [2] thereby providing the database with the necessary functionalities to perform spatial queries on spatial networks. We have augmented SILC with the SAND [1] spatial database system which is being developed at the University of Maryland. We demonstrate a wide variety of spatial techniques including operations such as nearest neighbor searches and spatial join techniques on a dataset of locations (vertices on a spatial network) using an extensive road network. The following are the unique contributions of our system:

1. To the best of our knowledge, we believe that our system is the first to allow efficient processing of most spatial queries on spatial networks using a general purpose spatial database engine.
2. The system performs real-time processing of both approximate and exact spatial queries on spatial networks, with little or no modifications to existing spatial query processing techniques, thus reusing existing knowledge and code base rather than developing new techniques to handle queries on spatial networks.
3. The system design and the concepts we demonstrate are general enough to be applied to any spatial database system.

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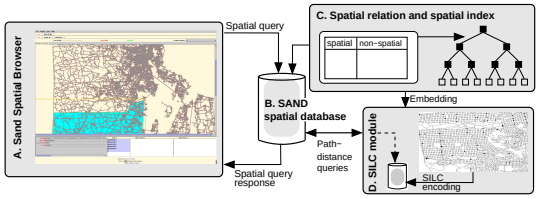

Figure 1. Block diagram representation of the demonstrated system.

2 Demonstration

We demonstrate a system that performs a variety of spatial queries on a spatial network as well as discuss the functionalities of the system.

- **path and distance queries:** Compute the shortest path and distance between two locations on a spatial network.
- **range queries:** Find all locations that exist within a distance of r from a specified query point.
- **nearest neighbors:** Incrementally retrieve the nearest neighbors to a query point.
- **distance join and distance semi-join:** Given two sets of spatial objects, A and B, incrementally retrieve the closest pair of objects. The difference between the distance join and distance semi-join is that the distance semi-join requires that objects from set A appear only once in the output.

References

[1] H. Samet, H. Alborzi, F. Brabec, C. Esperança, G. R. Hjaltason, F. Morgan, and E. Tanin. Use of the SAND spatial browser for digital government applications. *Commun. ACM*, 46(1):63–66, Jan. 2003.

[2] J. Sankaranarayanan, H. Alborzi, and H. Samet. Efficient query processing on spatial networks. In *Proceedings of the 13th ACM International Symposium on Advances in Geographic Information Systems*, Bremen, Germany, Nov. 2005.