Carnegie Mellon

Extending ORA:: for Spatial and Temporal Data

Jamie F. Olson
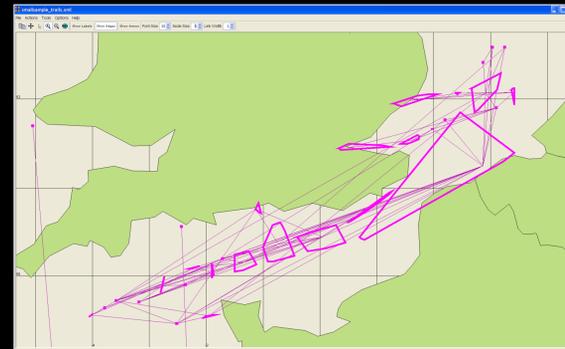jolson@cs.cmu.edu

George B. Davis
gbd@cs.cmu.edu

Prof. Kathleen M. Carley
kathleen.carley@cs.cmu.edu

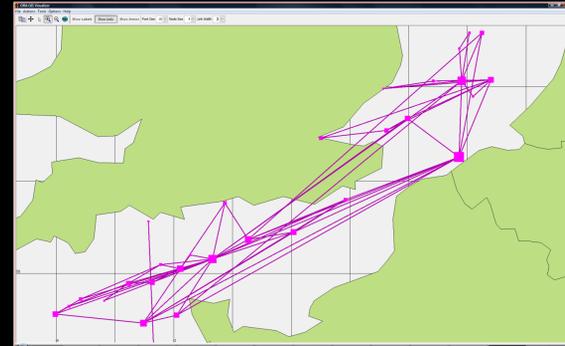## Spatial and TemporalData
Surveillance and Sensor Systems

- Dynamic network analysis (DNA) consists of a set of theories, methodologies and tools for analyzing the relationships and attributes assigned to discrete entities.

- Recent proliferation of sensor systems has produced many datasets which feature geospatial and temporal information about agent activities in addition to the attributes and relationships typically measured. Examples include data from GPS sensors embedded in vehicles or devices, logs of online activities, and collected data from intelligence networks.

- Two new tools, Loom and OraGIS, have been added to the ORA analysis platform targeted at spatially and temporally continuous data.

GPS Data on Merchant Marines
Automated Information System (AIS)

- For traffic control and security, large vessels are required internationally to carry an AIS transponder

- Sensors queried AIS transponders on vessels traveling through the English Channel over a period of 5 days.

Continuous Temporal Data
Visualizing Trails

- Loom utilizes a waterfall diagram to show discrete transitions through space. OraGIS can be used to preprocess continuous locations.

Continuous Spatial Data
Clustering and Aggregating

- Real world spatial data is defined on continuous dimensions.

- DNA consists of the analysis of discrete entities and relationships. Continuous data must be binned into discrete entities in order to apply DNA techniques.

- OraGIS allows the user to dynamically adjust the resolution and aggregation of continuous spatial data. OraGIS provides a new Information Loss metric to measure the quality of an aggregation.
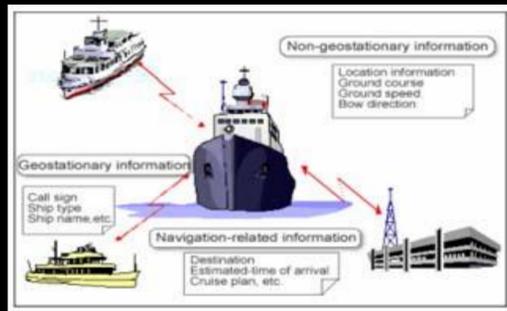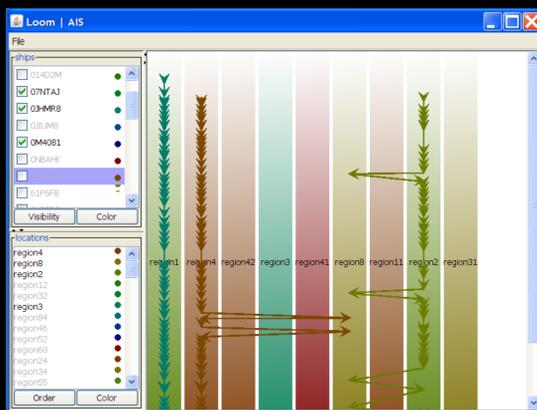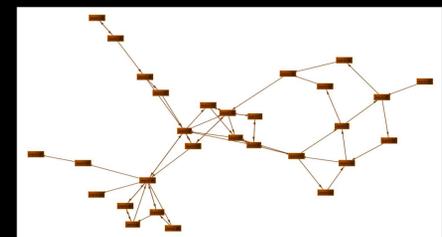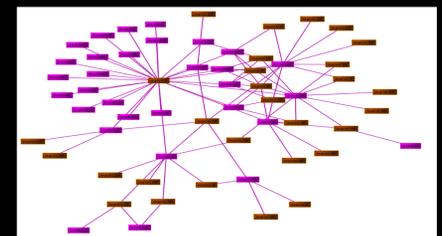

- OraGIS also allows standard Network Analysis metrics to be computed on the aggregated dataset.

Dynamic Network Analysis
Integration with ORA

- Both Loom and OraGIS can export their modified datasets to ORA.

- Port to port network exported by Loom.

- Ship to port network exported by Loom.

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