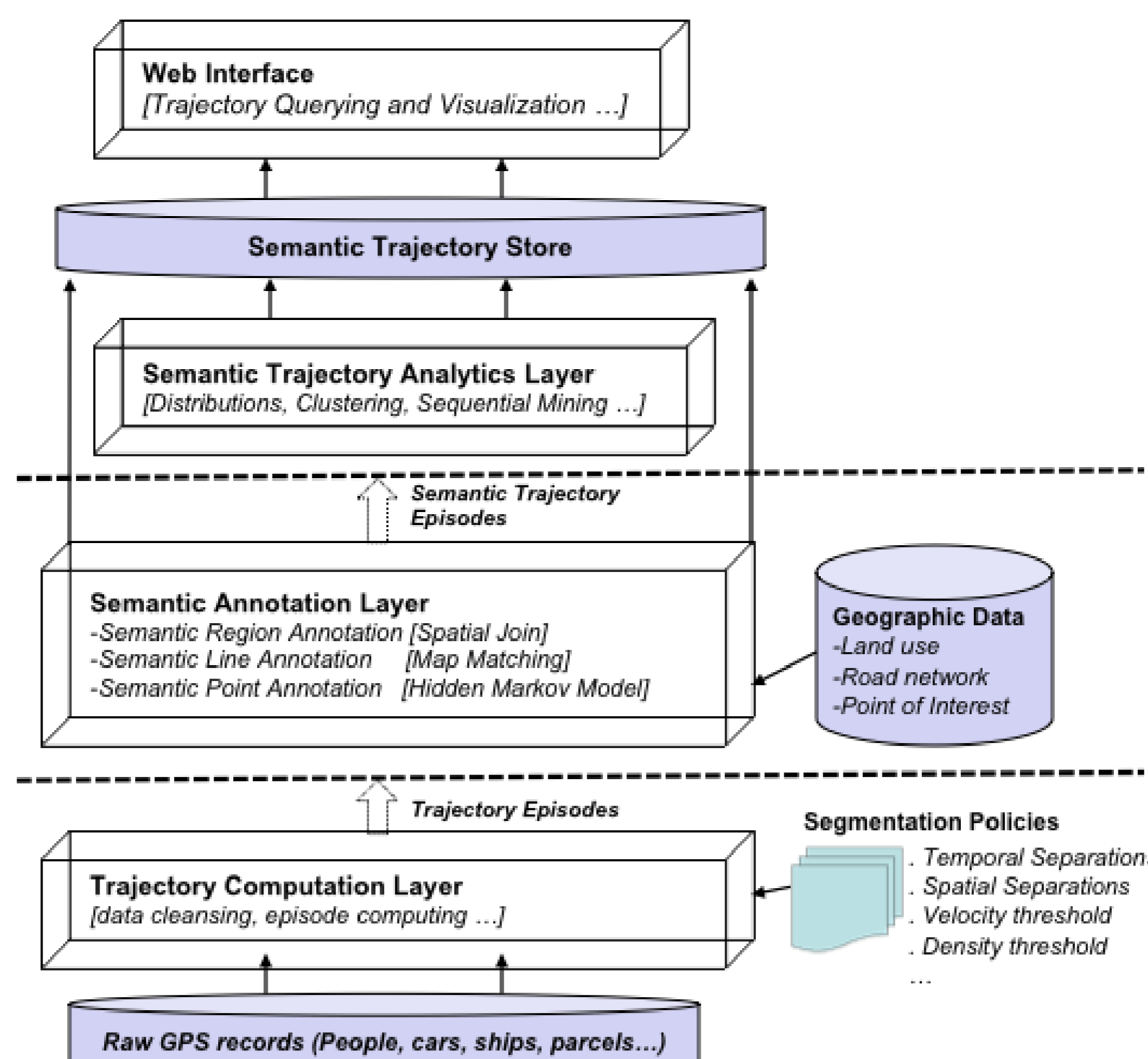
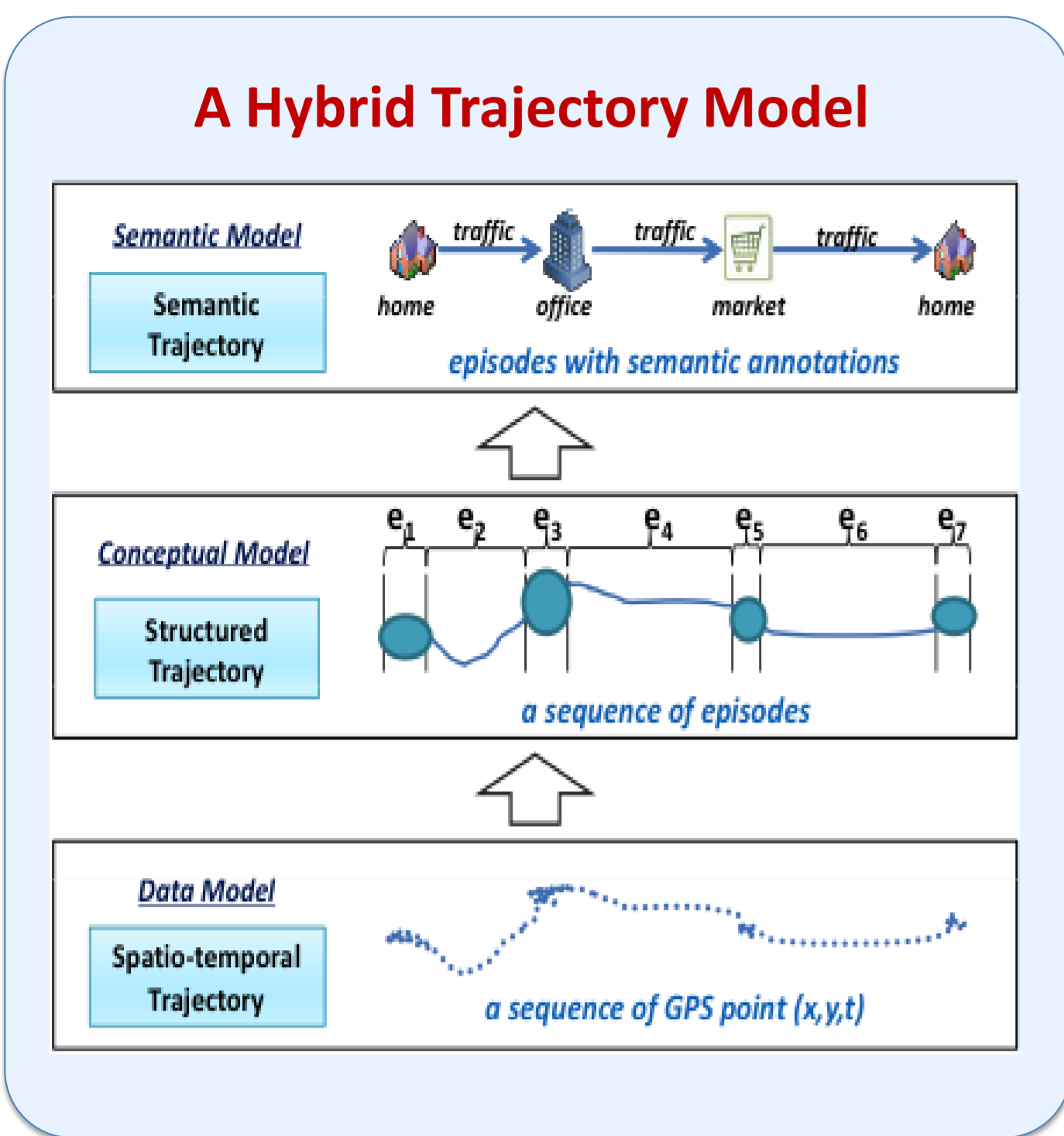


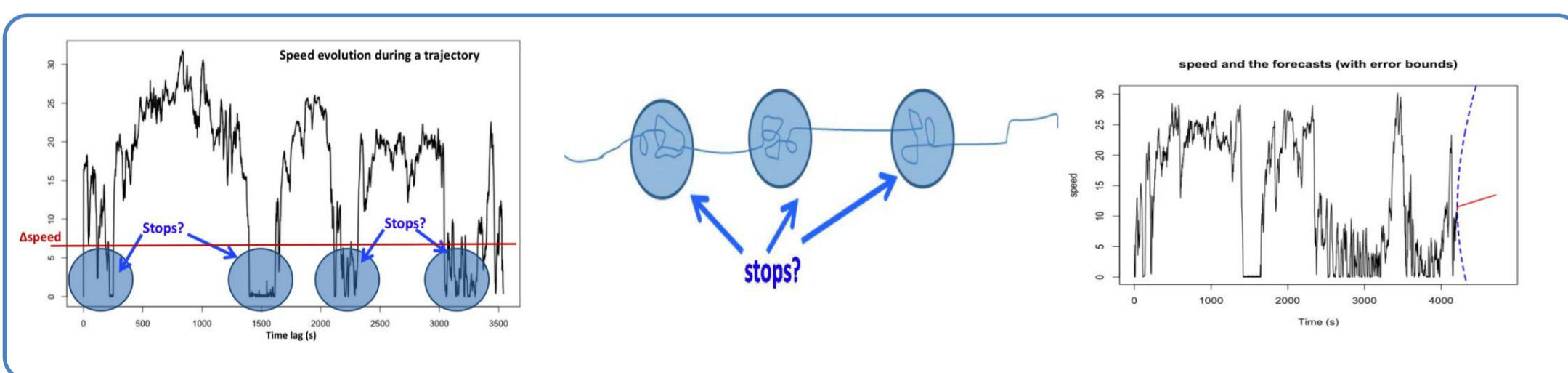
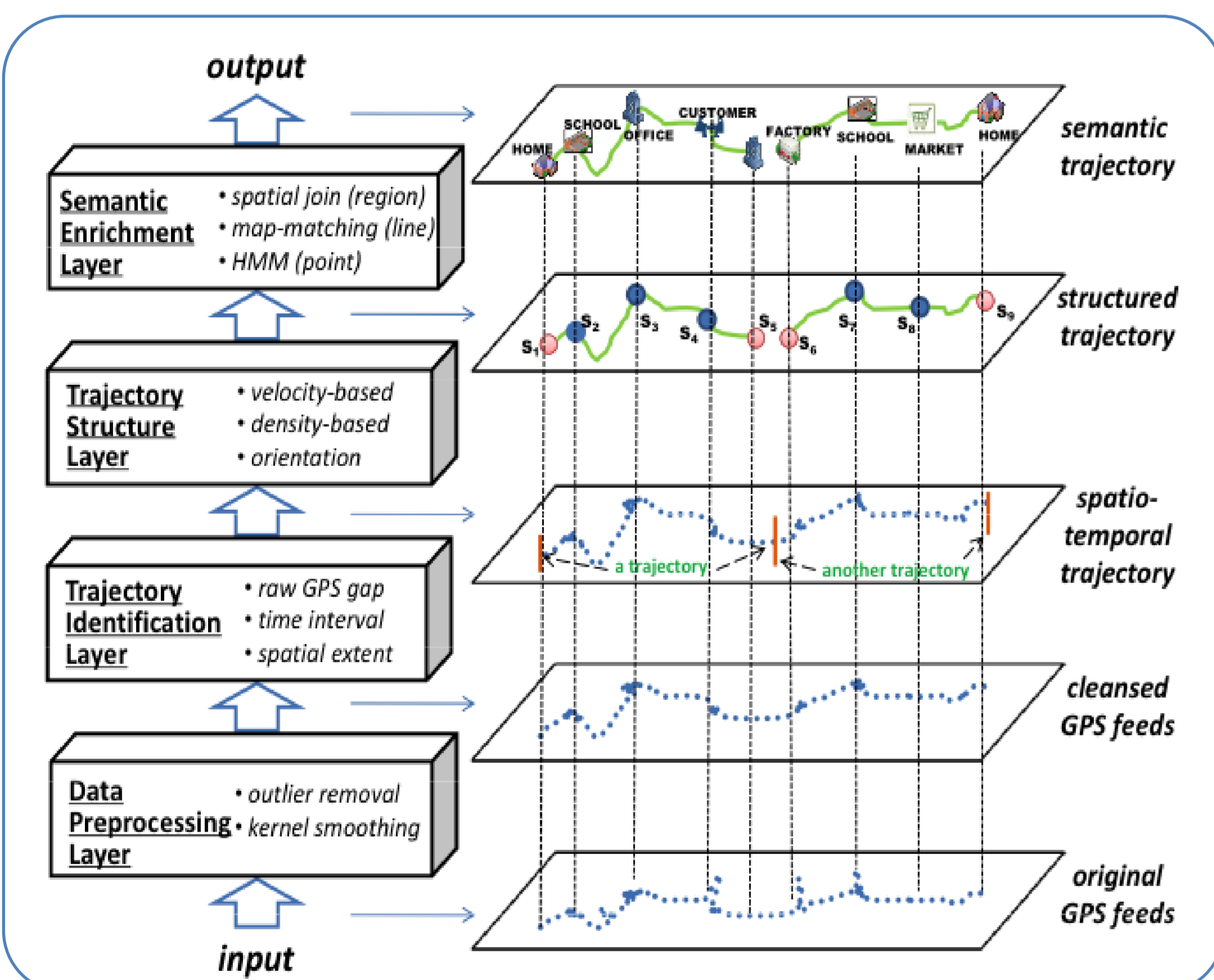
Zhixian Yan (EPFL), Lazar Spremic (EPFL), Dipanjan Chakraborty (IBM Research, India),  
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## Hybrid Trajectory Model & System Architecture



- ❖ **Trajectory Computation Layer**  
Compute high-level trajectories (like meaningful episodes) from low-level and raw GPS tracking feeds.
- ❖ **Semantic Annotation Layer**  
Annotate trajectory episode with the suitable geographic data sources (like POI, ROI, LOI).
- ❖ **Semantic Trajectory Analytic Layer**  
Compute additional statistical information (e.g. mean, variance, other distribution info) of movement characteristics.
- ❖ **Trajectory Query and Visualization**  
Query and visualize trajectories at different levels, from spatio-temporal to semantics.

## Semantic Trajectory Construction & Annotation



### Data Preprocessing

Design preprocessing algorithms for the movement data captured by GPS/GSM tracking devices.

- ❖ Trajectory data cleaning, such as outlier removal
- ❖ Trajectory data smoothing or/and compression

### Trajectory Identification

Cut the cleaned GPS sequential data into several segments, in which each segment represents a separate trajectory.

- ❖ Raw GPS gap
- ❖ Predefined time interval
- ❖ Predefined space extent
- ❖ Automatic segmentation based on statistical correlations

### Trajectory Segmentation

Further segment a trajectory into several self-homogeneous episodes.

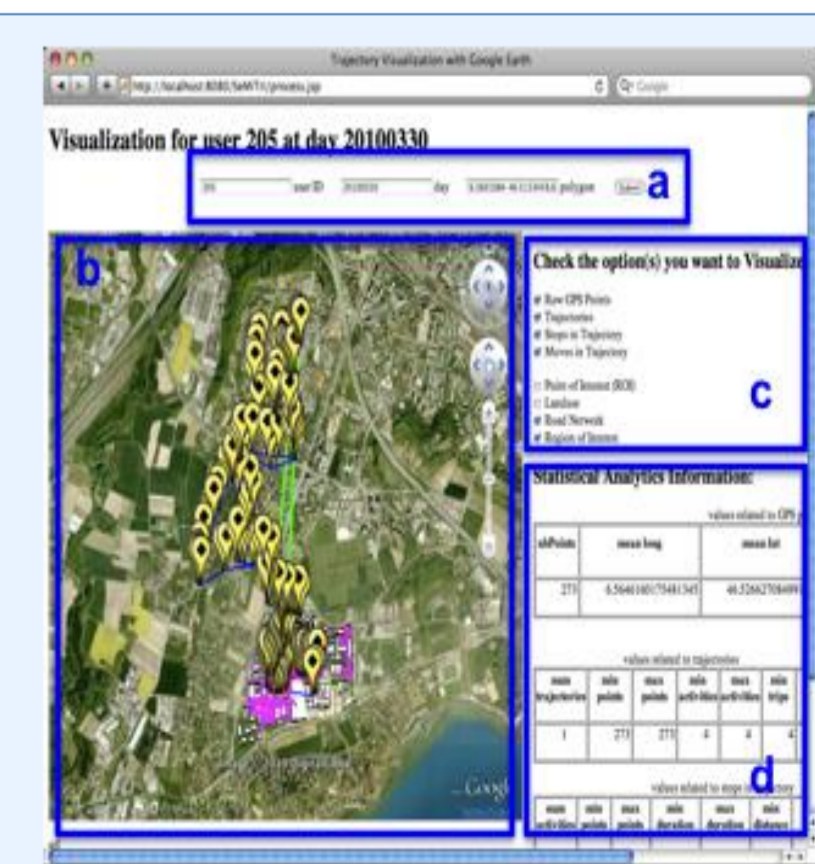
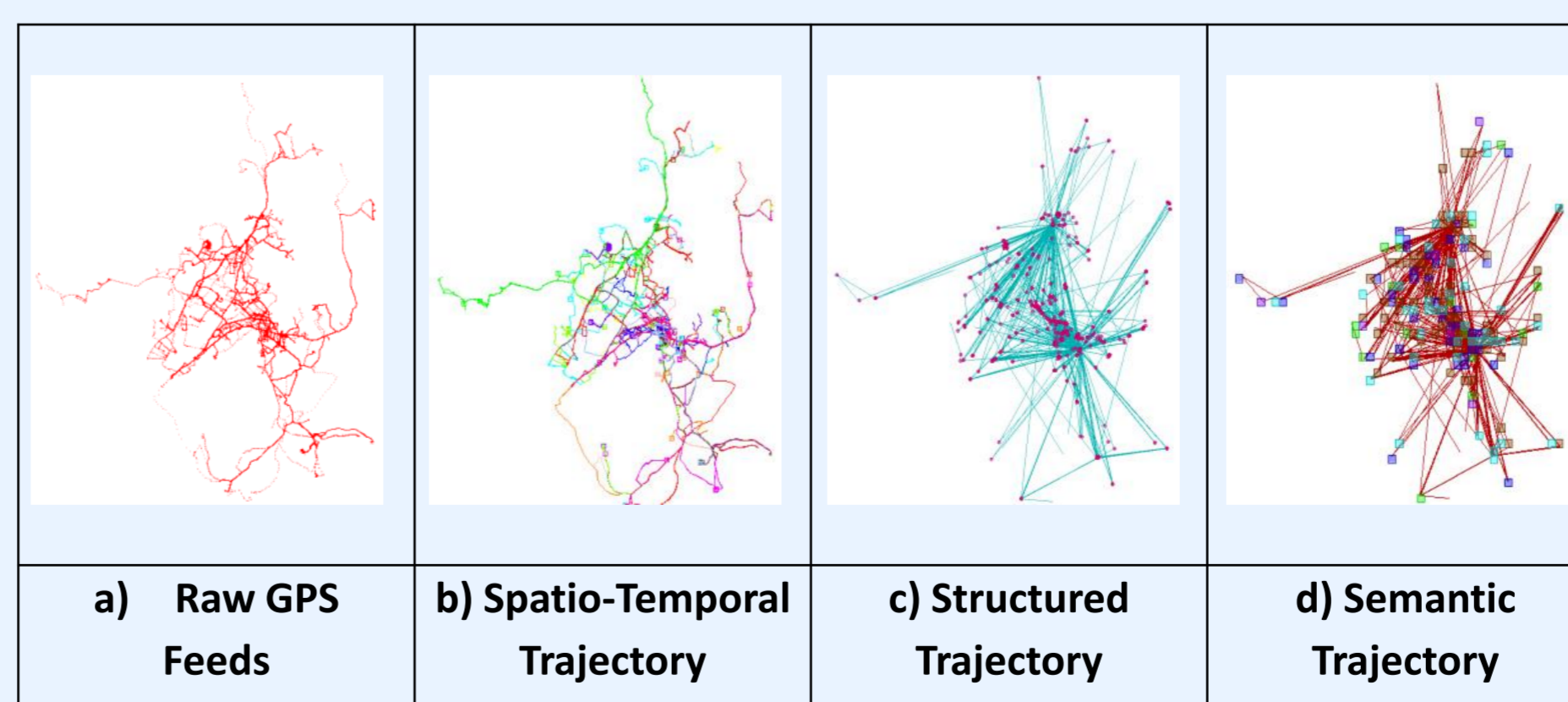
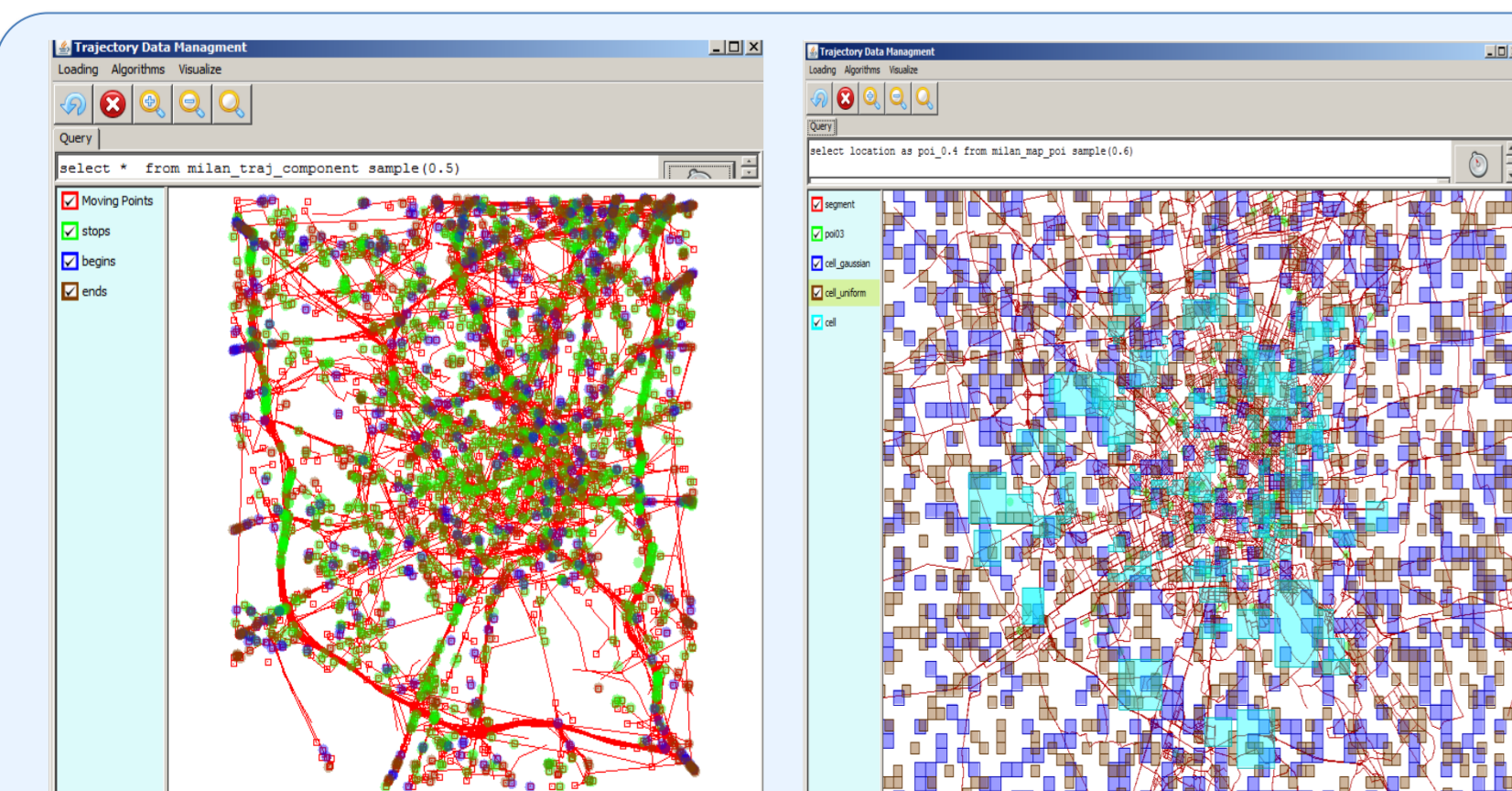
- ❖ Velocity-based episode identification
- ❖ Density-based episode identification
- ❖ Direction-based episode identification
- ❖ Time series based method

### Semantic Enrichment

Extend semantic knowledge for stops and moves to achieve semantic trajectories, i.e. by integrating knowledge from geographic sources.

- ❖ Spatial join with ROI (Regions of Interest)
- ❖ Map matching with LOI (Road Networks)
- ❖ Hidden Markov Model with POI (Points of Interest)

## Trajectory Query & Visualization



- Zhixian Yan, Christine Parent, Stefano Spaccapietra, Dipanjan Chakraborty. **A Hybrid Model and Computing Platform for Spatio-Semantic Trajectories**. 7th Extended Semantic Web Conference (ESWC), Pages 60-75, Heraklion, Greece, May 2010
- Zhixian Yan, José Macêdo, Christine Parent, Stefano Spaccapietra. **Trajectory Ontologies and Queries**. Transactions in GIS, 12(s1), Pages 75-91, 2008
- Stefano Spaccapietra, Christine Parent, Maria Luisa Damiani, José Macêdo, Fabio Porto, Christelle Vangenot. **A Conceptual View on Trajectories**. Data Knowledge Engineering, 65(1), Pages 126-146, 2008