CSE 594: Spatial Data Science & Engineering

Overview of Moving Object Data

Trajectory of Moving Objects

- A type of spatiotemporal data generated by moving objects
- A trajectory is a polyline in three-dimensional space
- Two dimensions refer to the space and the third dimension refers to the time
- Represented as a sequence of position points $Tr(P_1, P_2, ..., P_n)$
  - Each position point P_i is represented as (lat, lon, t), where lat and lon are location coordinates and t is the timestamp

Queries on Trajectory Data

Temporal Query

- Given a dataset, a moving object id, a time range $[t_s, t_e]$, the query returns all the trajectory line segments of the corresponding object such that all position points P_i of the line segments have the timestamp value within the given time range
- If the object id is not given, return all trajectory line segments satisfying the above constraints

Spatial Range Query

- Given a dataset, a spatial range $\{lat_{min}, lon_{min}, lat_{max}, lon_{max}\}$, the query returns all trajectory line segments such that all position points P_i of the line segments are located in the spatial range

Queries on Trajectory Data

Spatiotemporal Range Query

- Given a dataset, a spatial range {lat_{min}, lon_{min}, lat_{max}, lon_{max}}, and a time range [t_s, t_e], the query returns all trajectory line segments such that all position points P_i of the line segments are within the spatial and temporal range

Similarity Query

- Given a dataset, a query trajectory q, a distance function, and a distance threshold, the similarity query returns all trajectories Tr_i where the distance between q and Tr_i is not greater than the given distance threshold.

Queries on Trajectory Data

K-NN Query

- Given a dataset, a query trajectory q, a positive integer k, and a distance function, the K-NN query returns k nearest trajectories of q, where the distance from q to other trajectories is measured based on the given distance function

Popular Moving Object Databases

- MobilityDB
- Secondo
- TrajMesa
- TrajStore

Libraries for Analyzing Moving Objects

- MovingPandas
- Sci-kit mobility