# Map Matching algorithm

## Design purpose

Match the raw GPS data to the corresponding road segments. So, it takes GPS signals as the input, and Positions on a road network as the output.

### GPS signals (component)

1. Latitude
2. Longitude
3. Speed (how fast it travels)
4. Course (the direction of travels)

### Positions on a road network (component)

1. Latitude (On an actual road)
2. Longitude (On an actual road)
3. Road segment ID
4. Road name
5. Direction / heading

## Why we need map matching algorithm

Reduce the noise and sparseness of raw GPS data

Chart, scatter chart

Description automatically generated

Use cases

1. Online map matching: driver position
2. “offline” map matching: Fare calculation

# Map Matching + Hidden Markov model: Candidate’s selection

Diagram

Description automatically generated

1. Use the k-nearest neighbor look the road candidates for GPS signal using a geospatial index (R-tree or Kd-Tree) – also have a minimum search radius
2. Project GPS signal to the candidate road segment (perpendicular drawn from GPS to road)
3. Setting up the hidden Markov model and calculate the emission probability

Diagram

Description automatically generated

1. Calculate the transaction probability

Diagram, schematic

Description automatically generated

1. Using the Viterbi Algorithm to decode the possible path