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Map-Based Temporally Consistent Geolocalization through Learning Motion Trajectories

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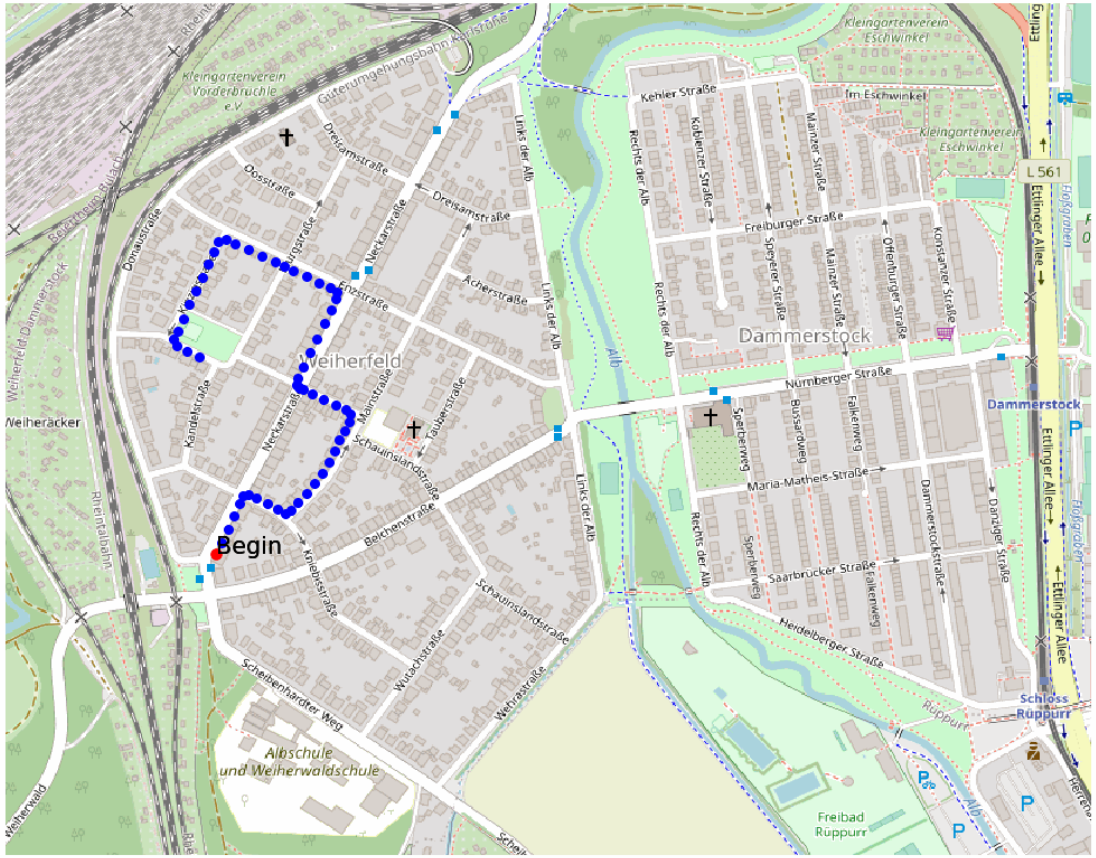
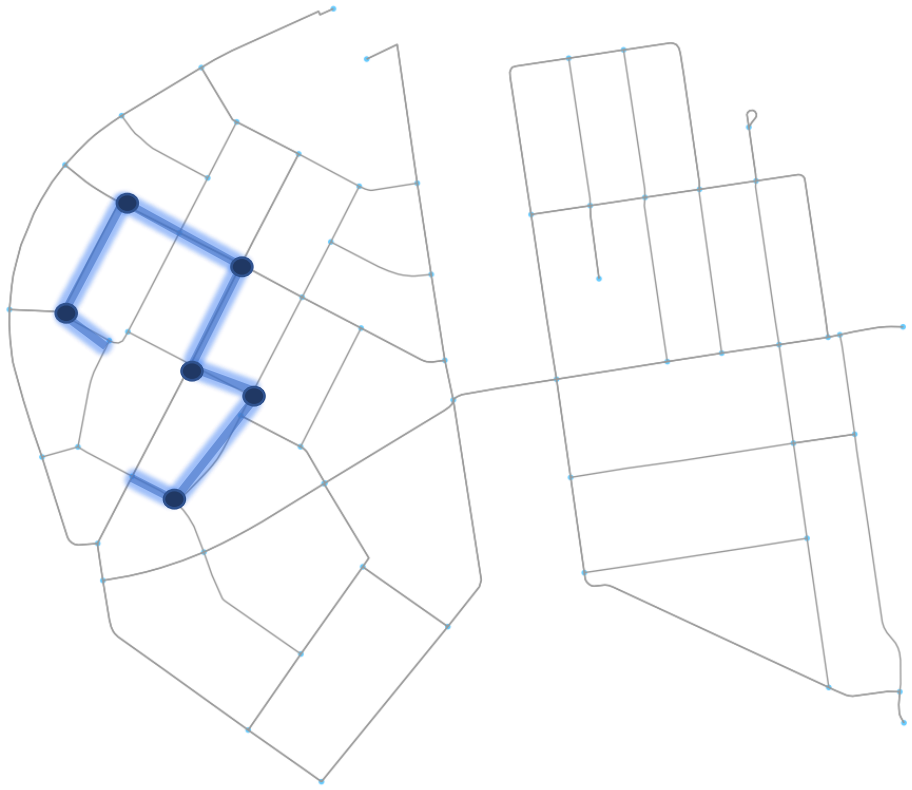
- **Goal** – Model Motion Trajectory on Graph for Consistent Geolocalization

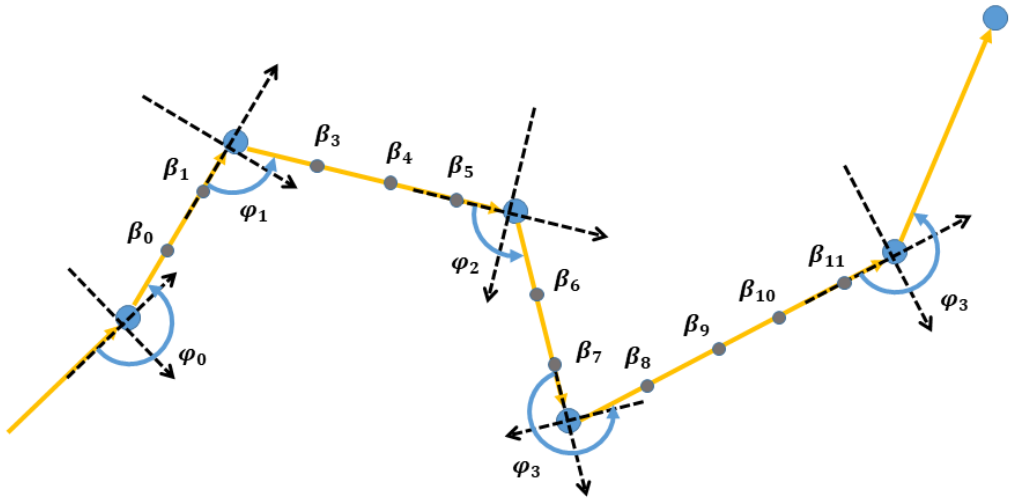


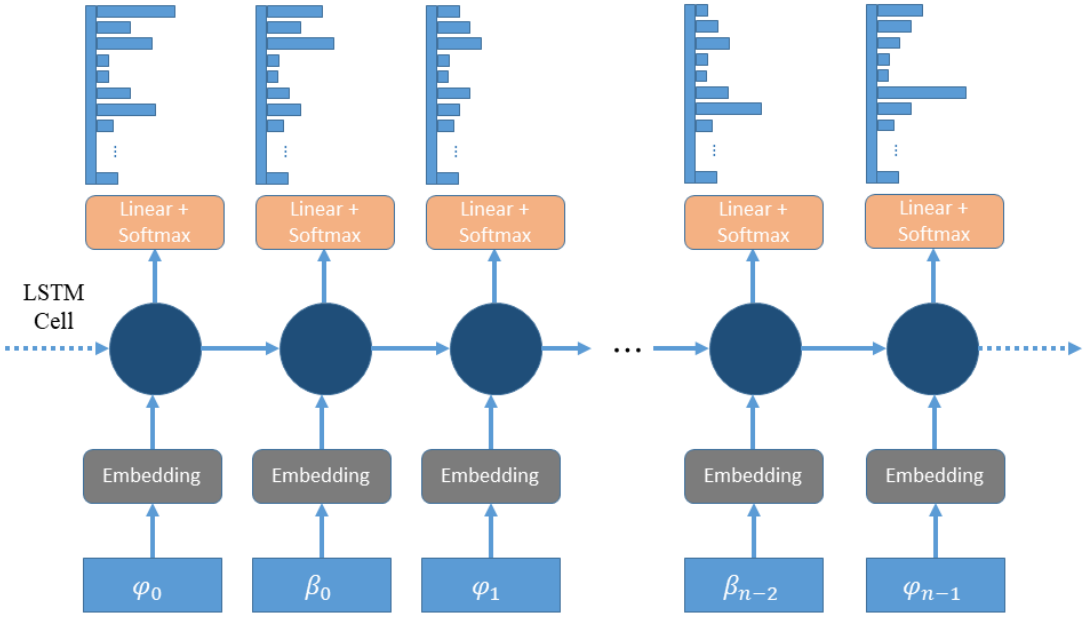


Input: Motion Trajectory (direction + distance)

Prediction: Inconsistent to consistent edge location

• Sequential Motion Trajectories with RNN





$$P_{loc} = P(s_t|\varphi, \beta_{1:t}, M)$$

output edge turning distance map

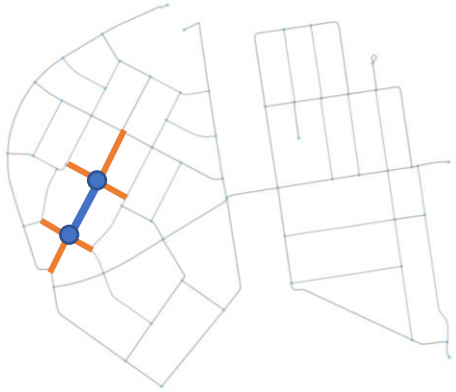
$$h_s = f_\alpha(x_s, h_{s-1}) \quad \forall s = 1, \cdots, t$$

$$y_t = f_\beta(h_t)$$

$$P(Y = i|y) = softmax(y) = \frac{e^y}{\sum_{j=0}^{k} e^y}$$

• Temporal Consistent Strategy on Graph

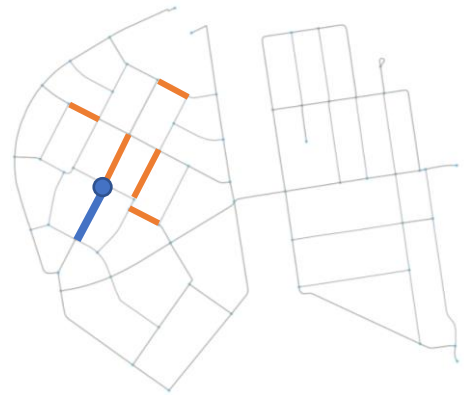
Strategy 1 (Like Prim Algorithm, Local)

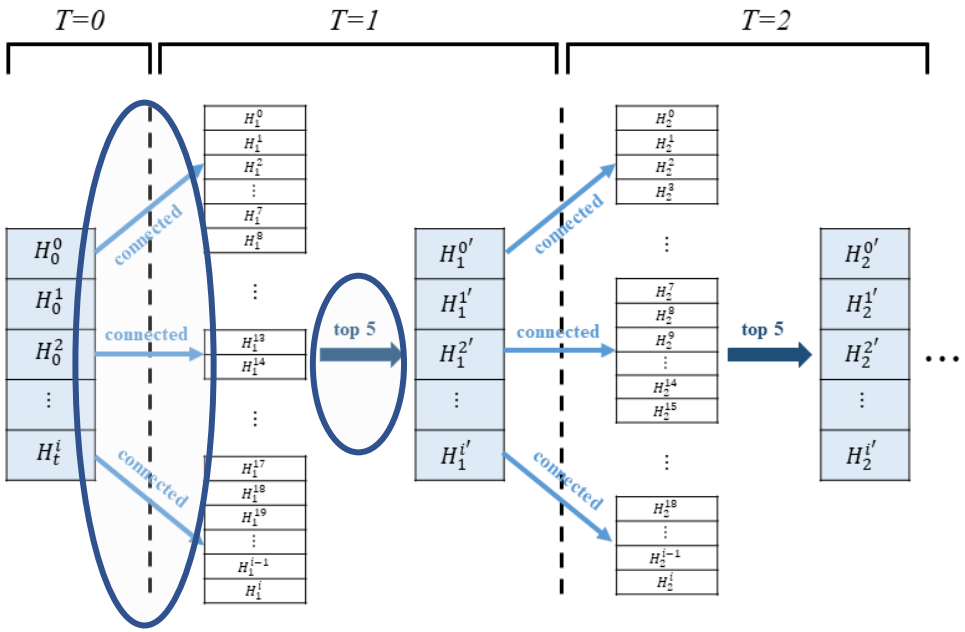


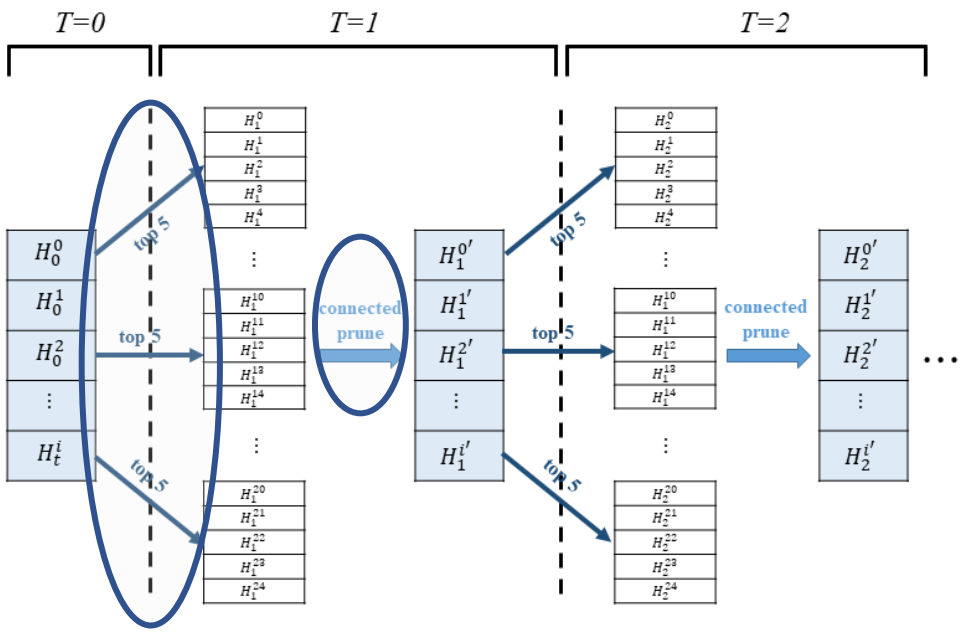
Current location

Hypothetical location

Strategy 2 (Like Kruskal Algorithm, Global)

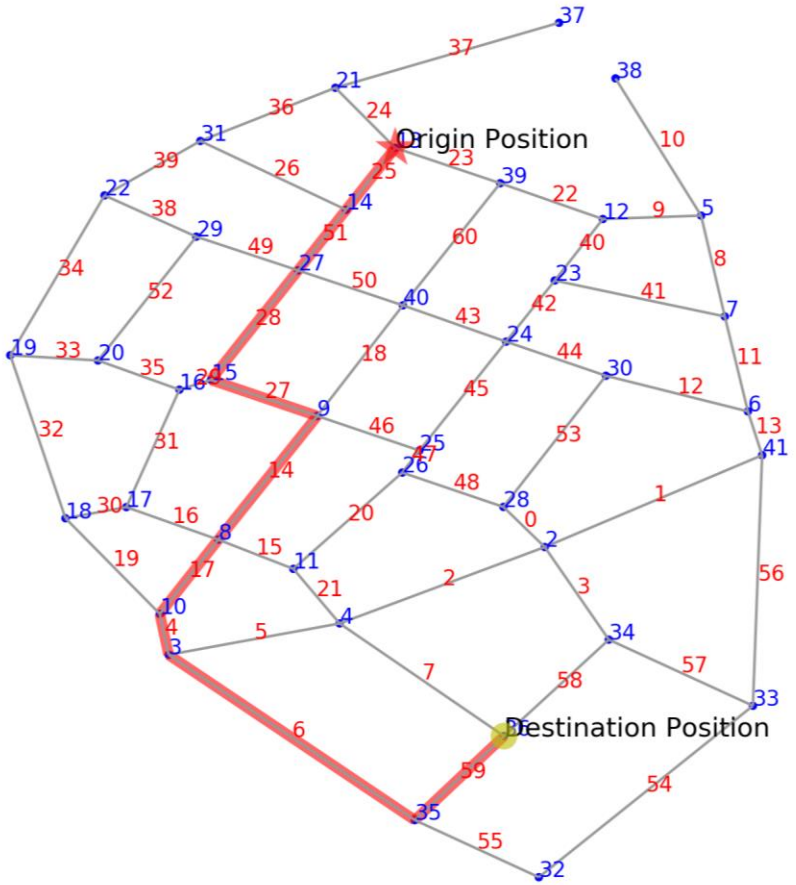






• Experiment – Synthetic Dataset

✓ Simple path generation by depth-first algorithm



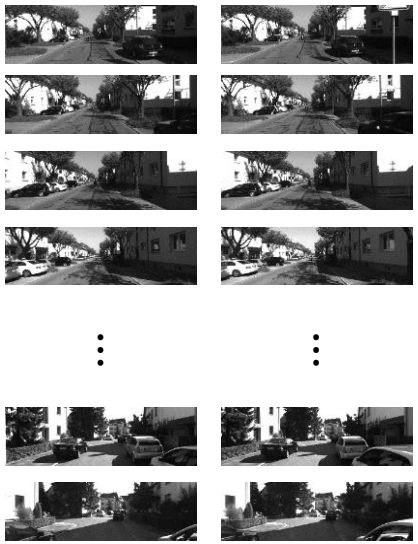
Map graph for KITTI dataset

Data	Statistics
Topological Map	40 nodes, 61 edges
Trajectory Length	10 nodes
All Trajectories	17537
All Classes	61
Input Feature Space	20
Training Trajectories	17536
Training Output Classes	61

Dataset statistics

• Experiment – Real Dataset

✓ Stereo Visual Odometry



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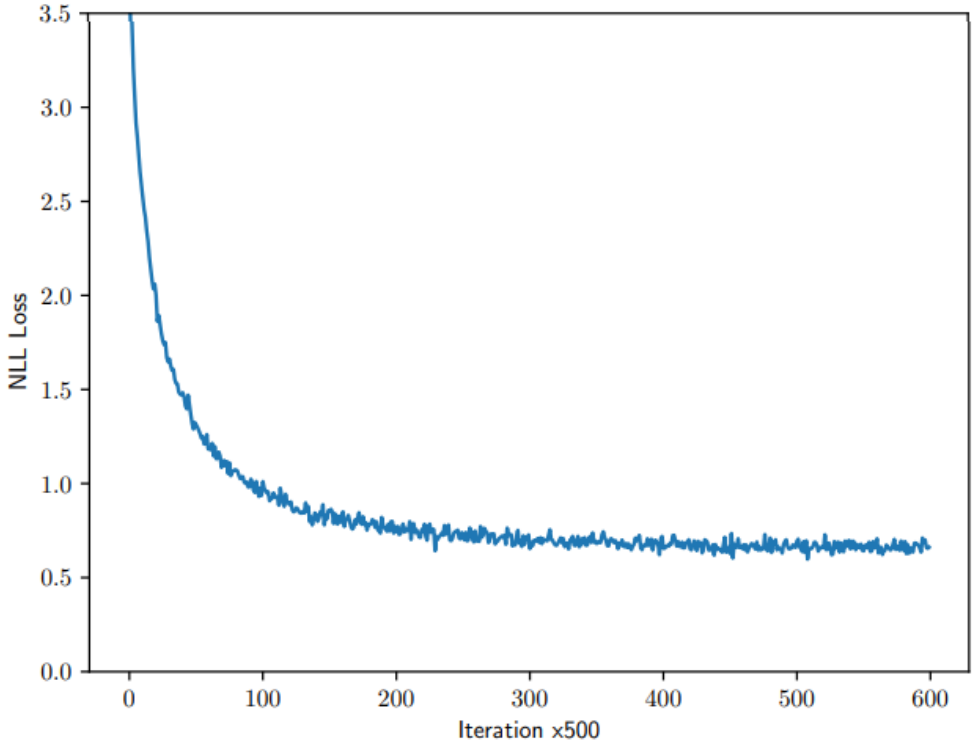
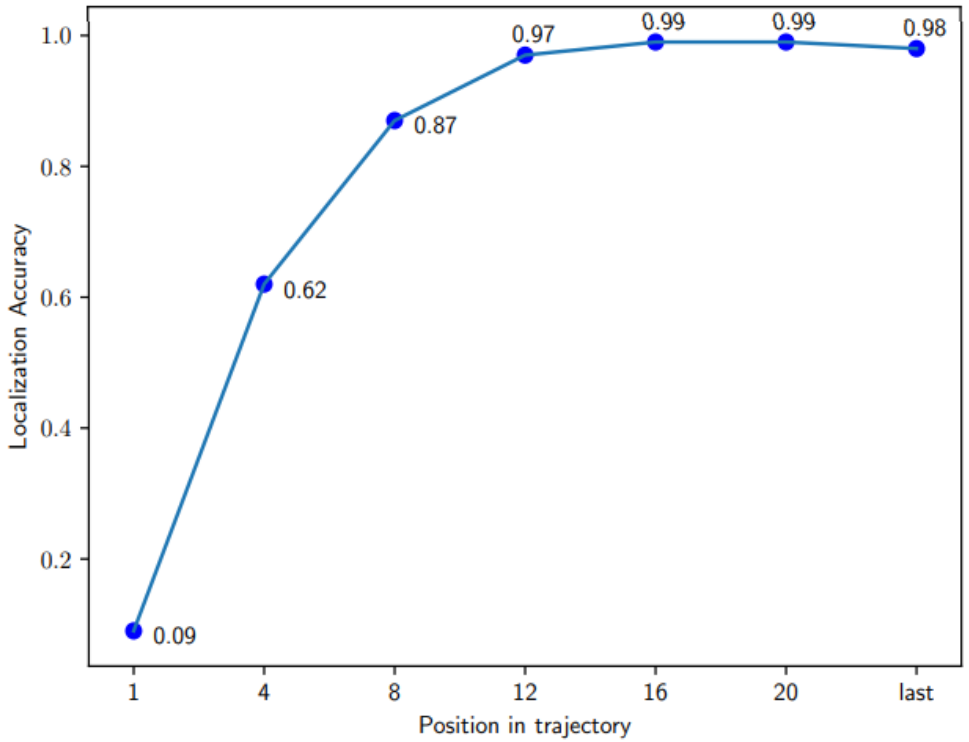
raw trajectory

processed trajectory

- Experiment – Training

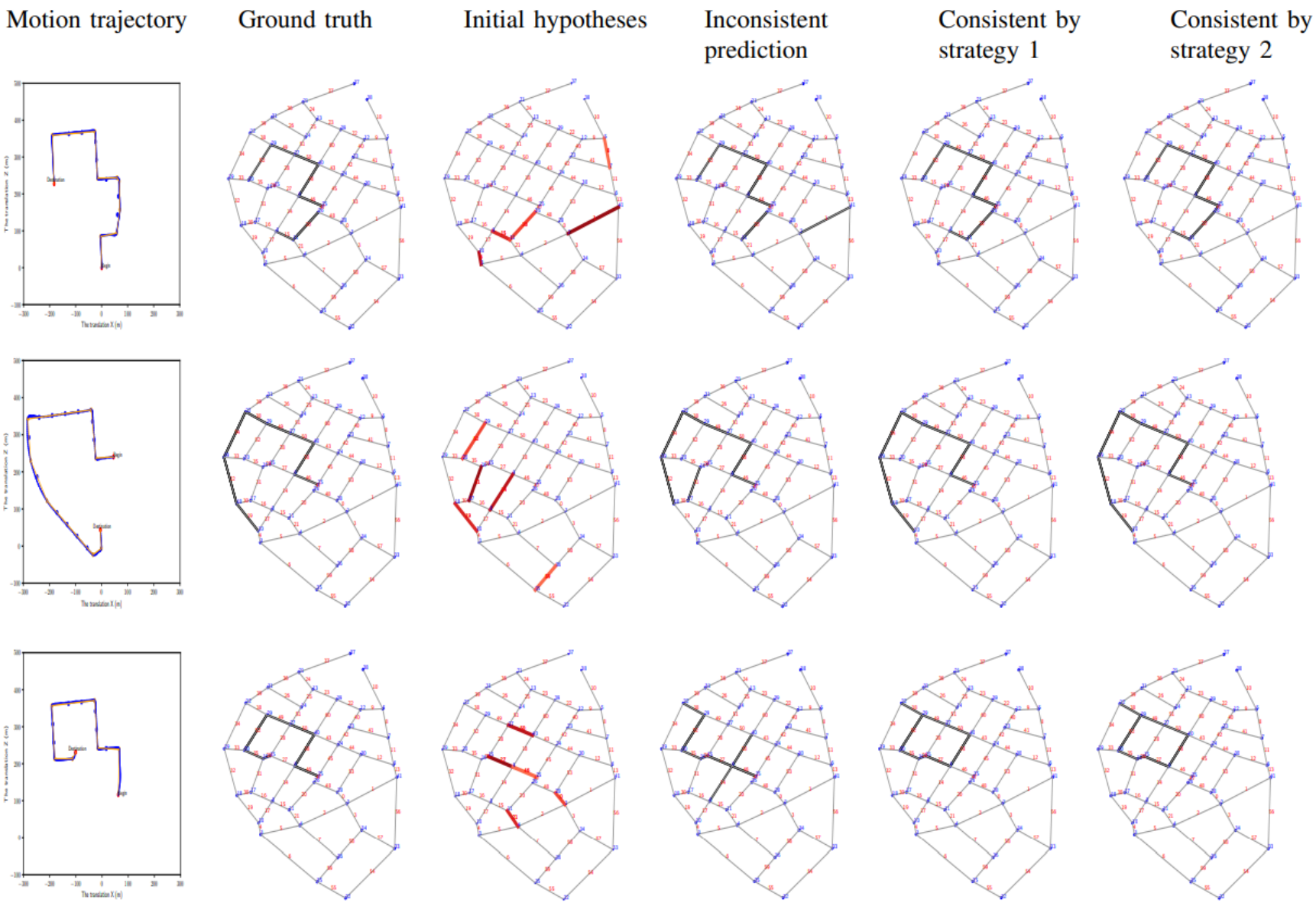


(a) Training loss.



(b) Accuracy.

• Experiment – Consistent Geolocalization



• Conclusion

✓ Learning **motion** trajectory with RNN

✓ Temporally **consistent** localization with two strategies

Thank you!

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