Learning-based multi-modal indoor localization

Midterm Presentation

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Master Semester Project

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Outline

- Indoor localization task
- Data generation
- Multilayer perceptron
- Autoencoder
  - Encoding into lower dimensions
  - Guide the encoding through constraints
- What’s next

Indoor Localization using machine learning

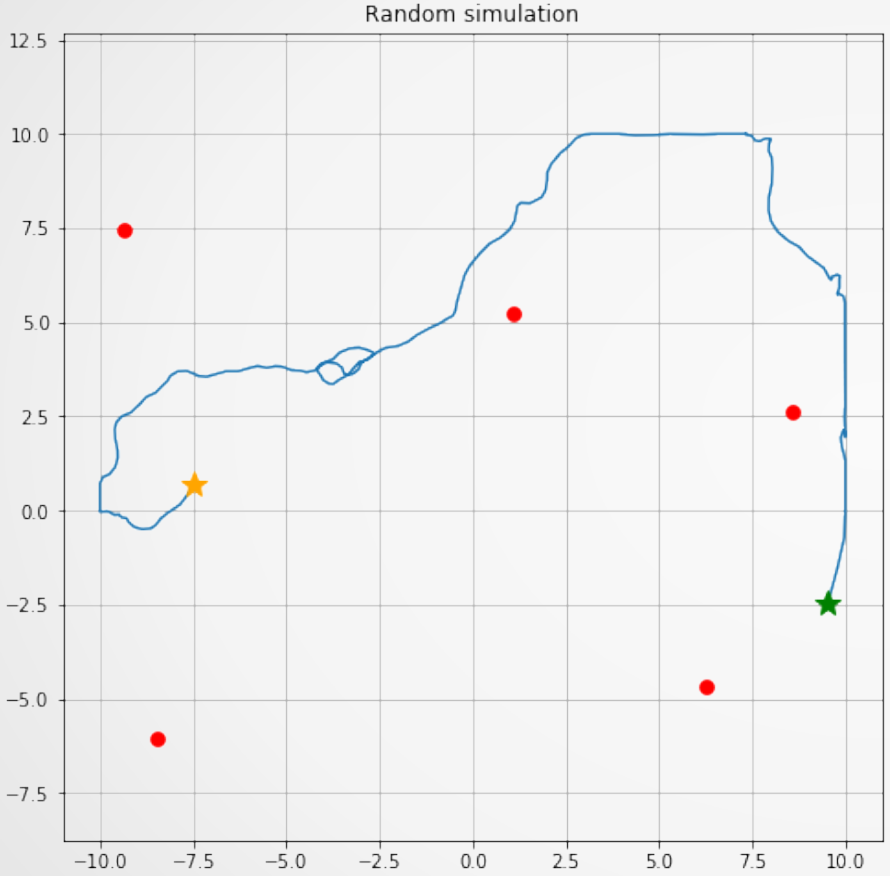
Goal: predict user's indoor position using commonly available signals

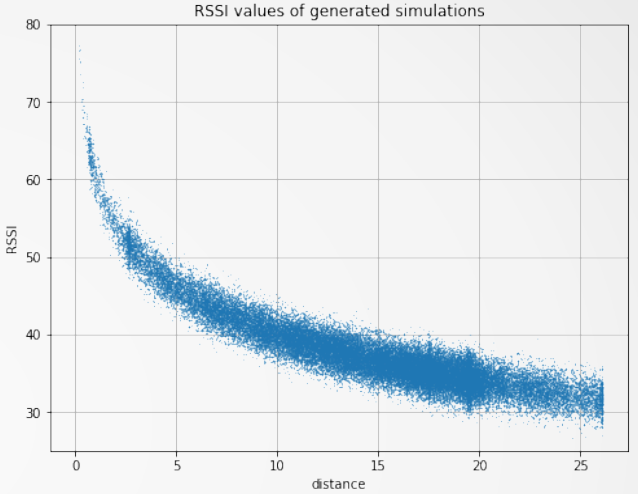
Challenges:

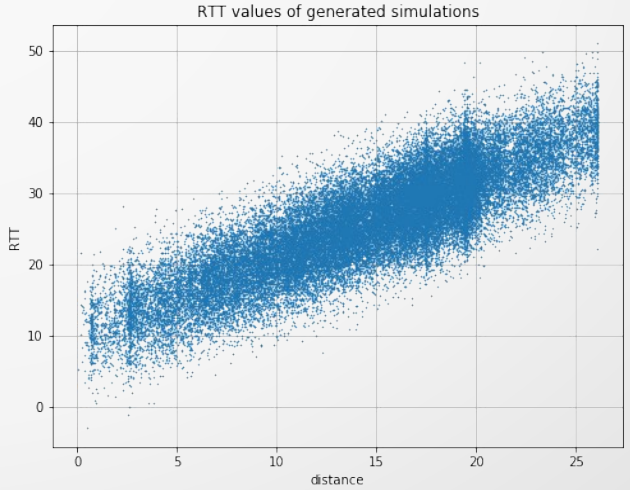
- Handle noisy and non-linear signals
- Capture complex dependencies

How: neural networks

Data generation: Walk Simulation





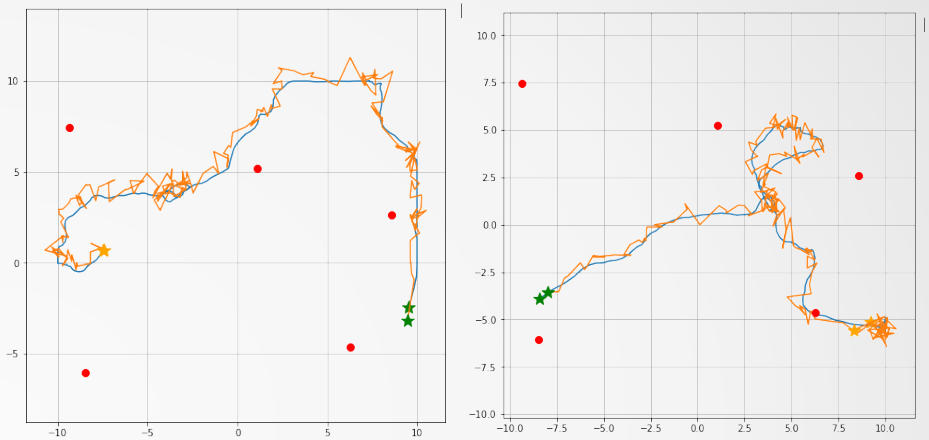


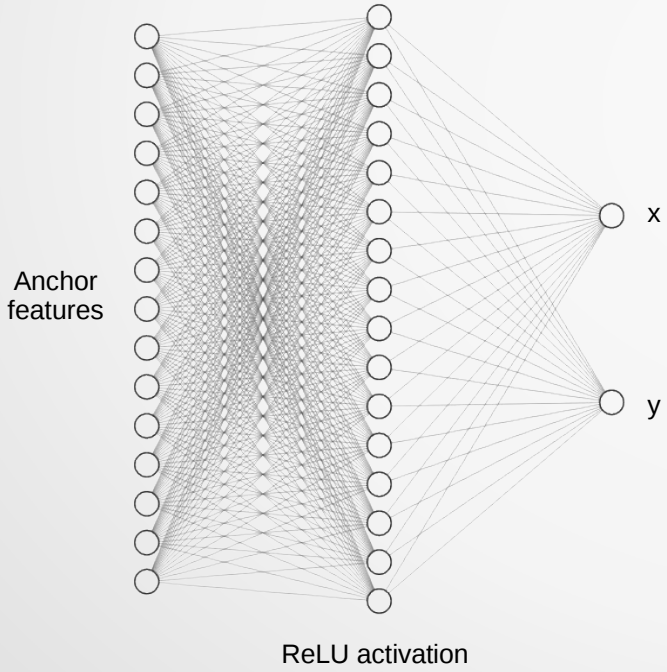
Anchor features: RSSI, std(RSSI), RTT

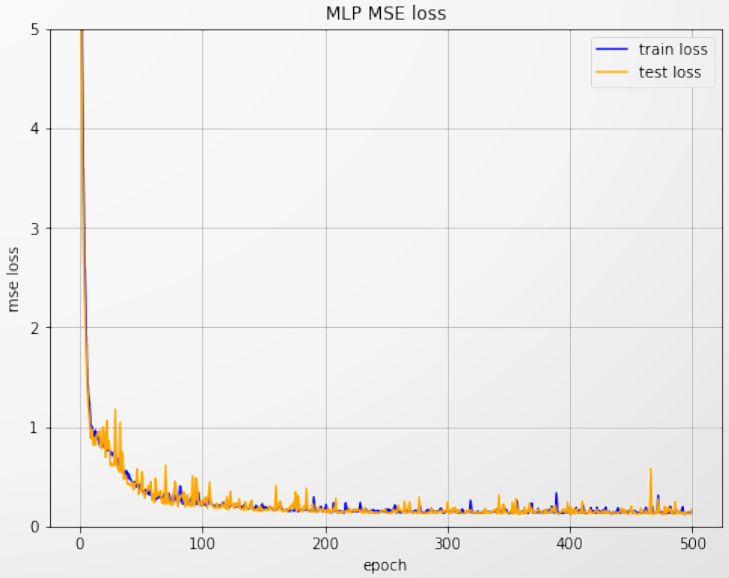
Multilayer perceptron

First approach: just feed it into a MLP

Problem: Need real positions to train

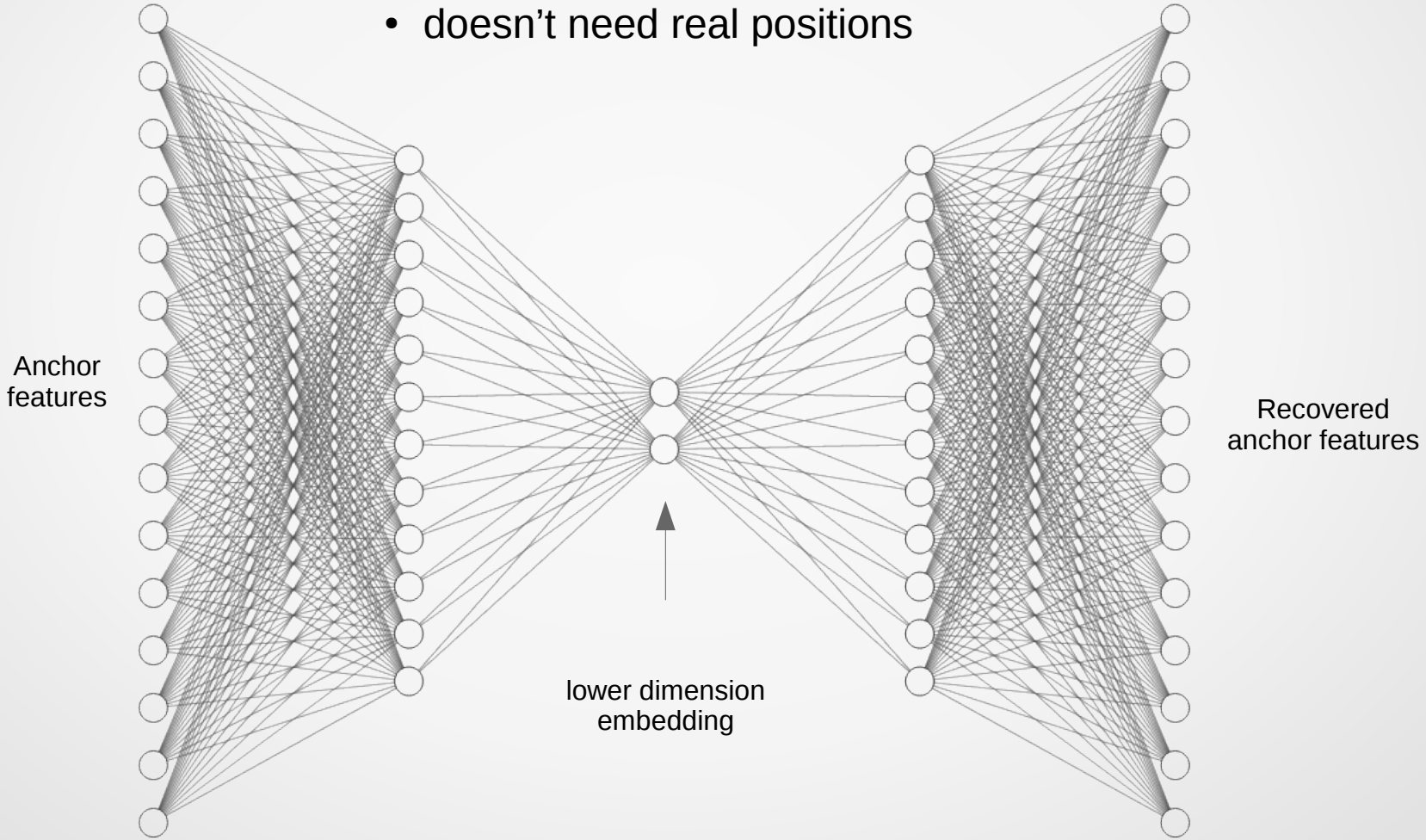




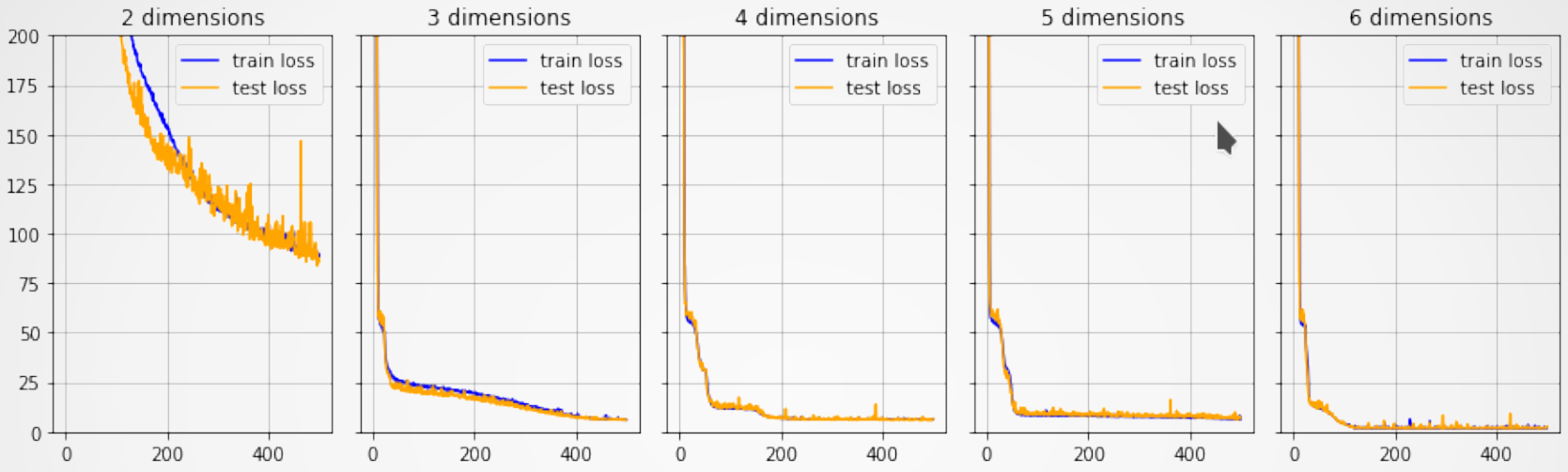


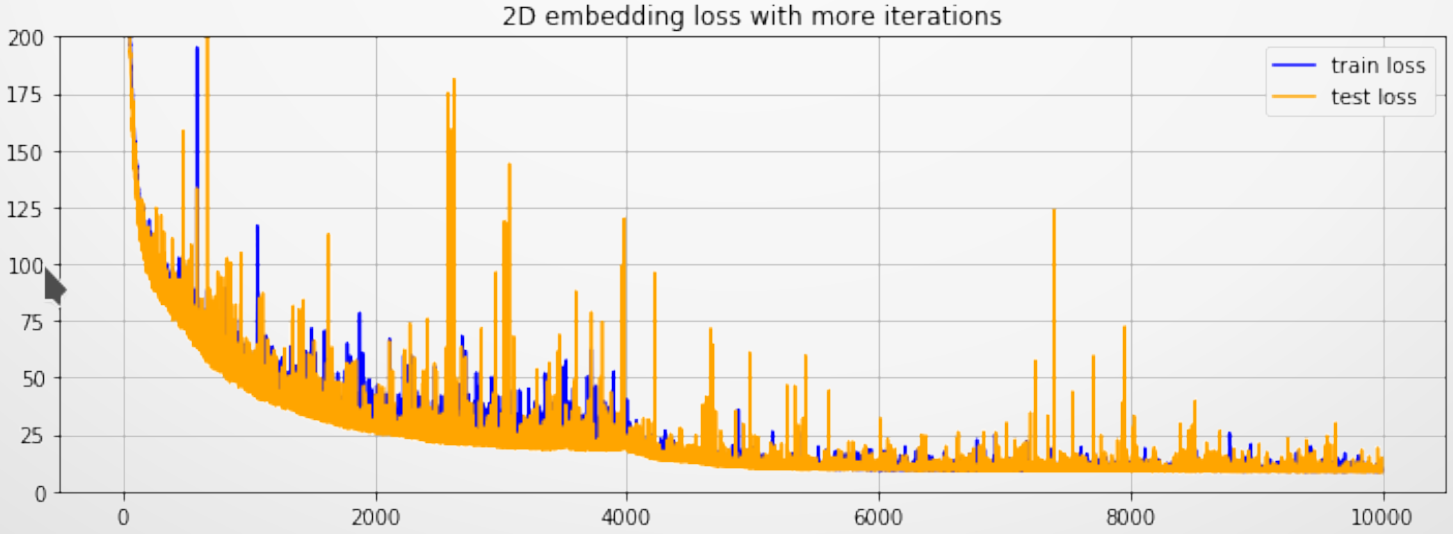
Autoencoder

- Keep best components
- Suppress noise
- doesn’t need real positions

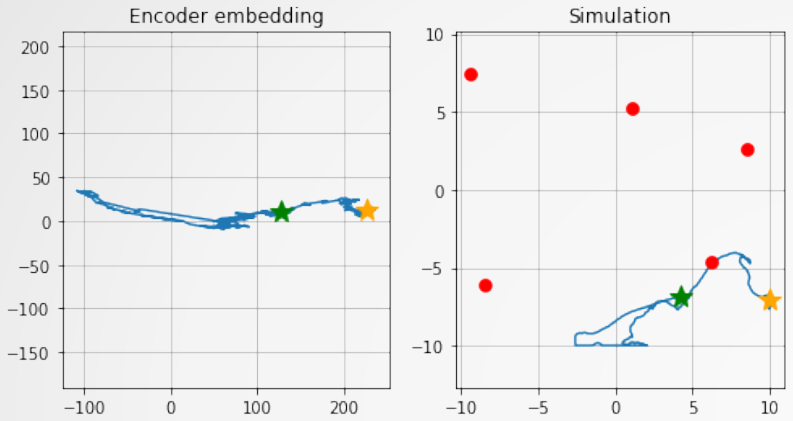


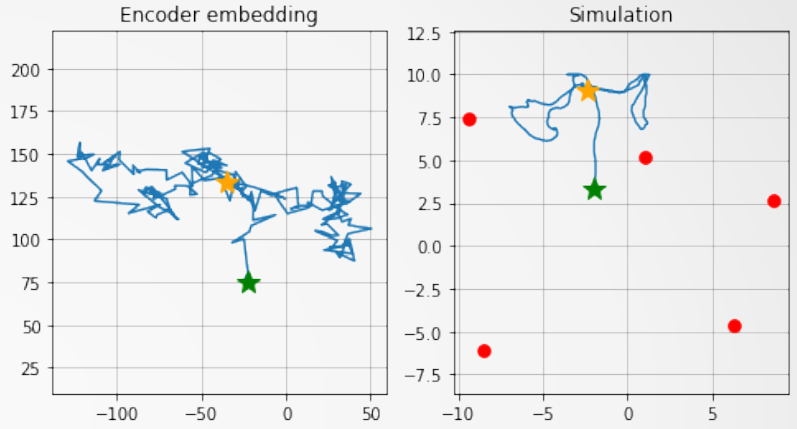
Autoencoder: Encoding into lower dimensions

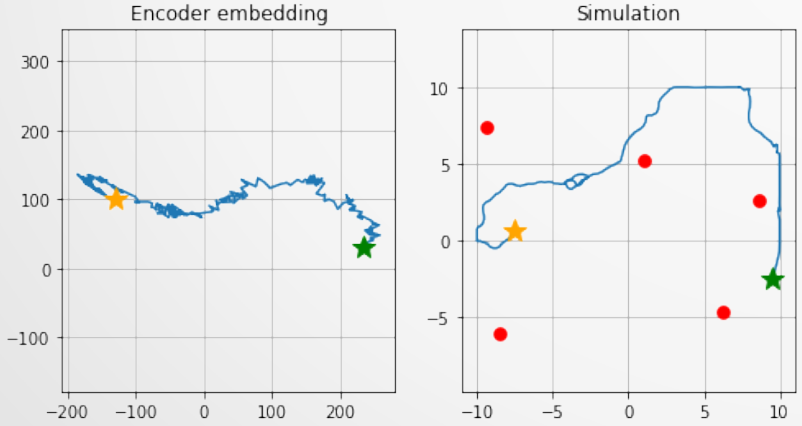


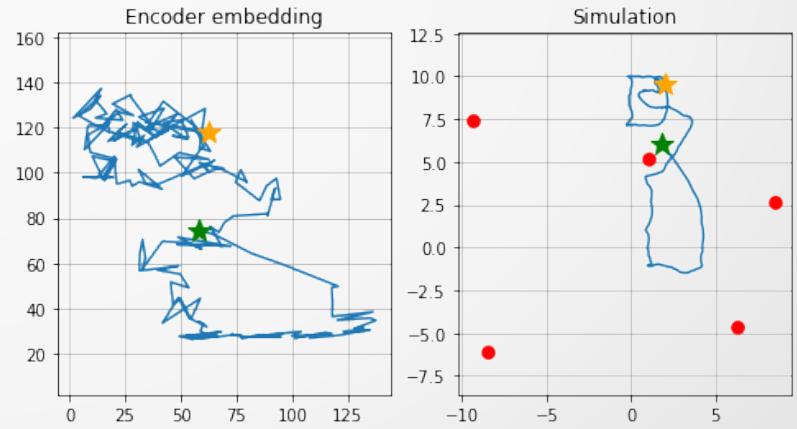


2D embedding





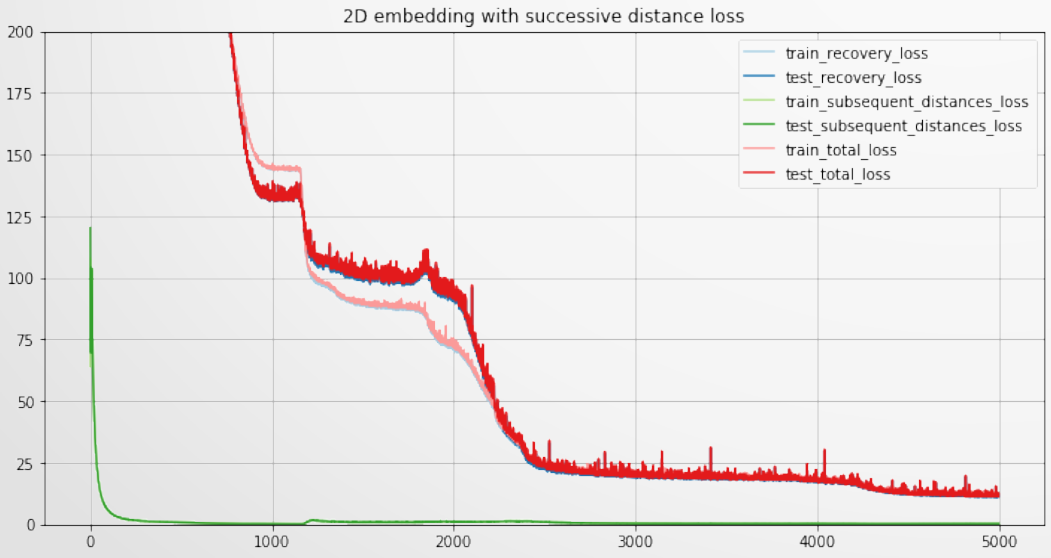


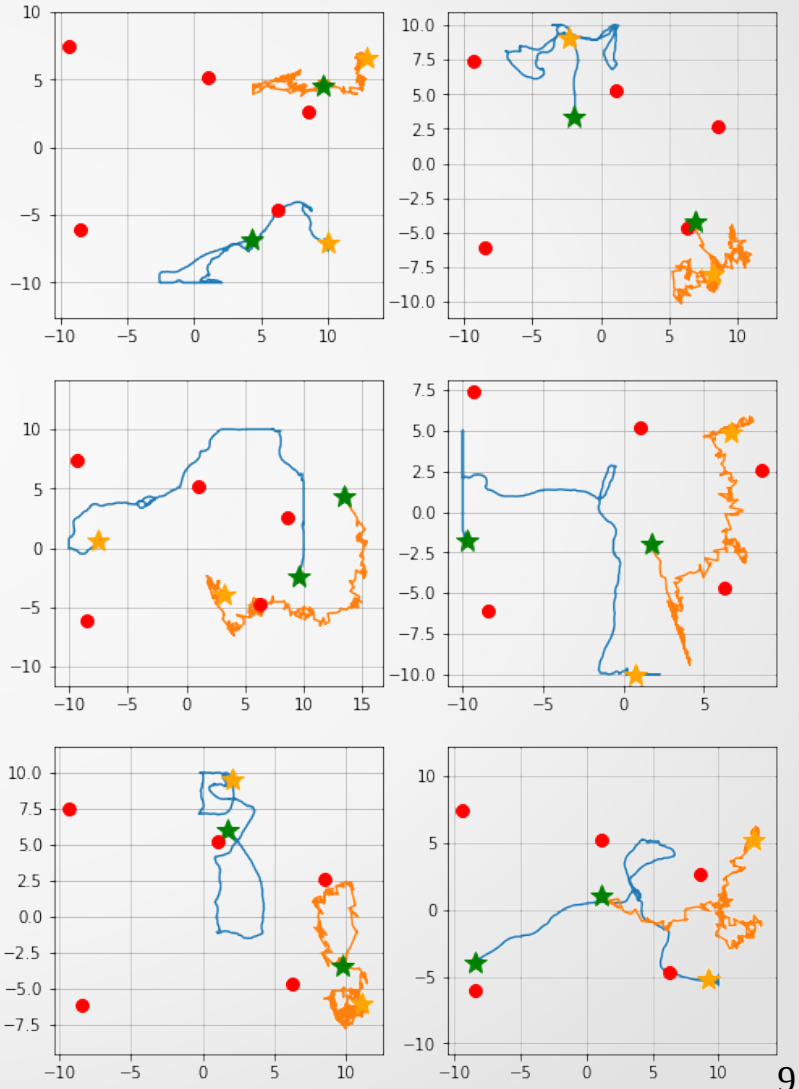


Adding constraints: Small steps

Assumption: two successive points are close together.

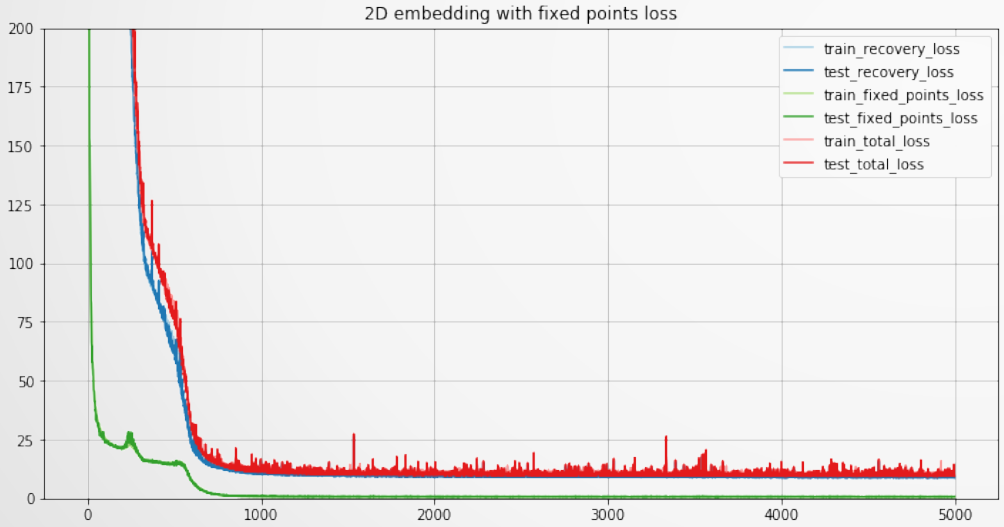
→ Penalize big successive distances

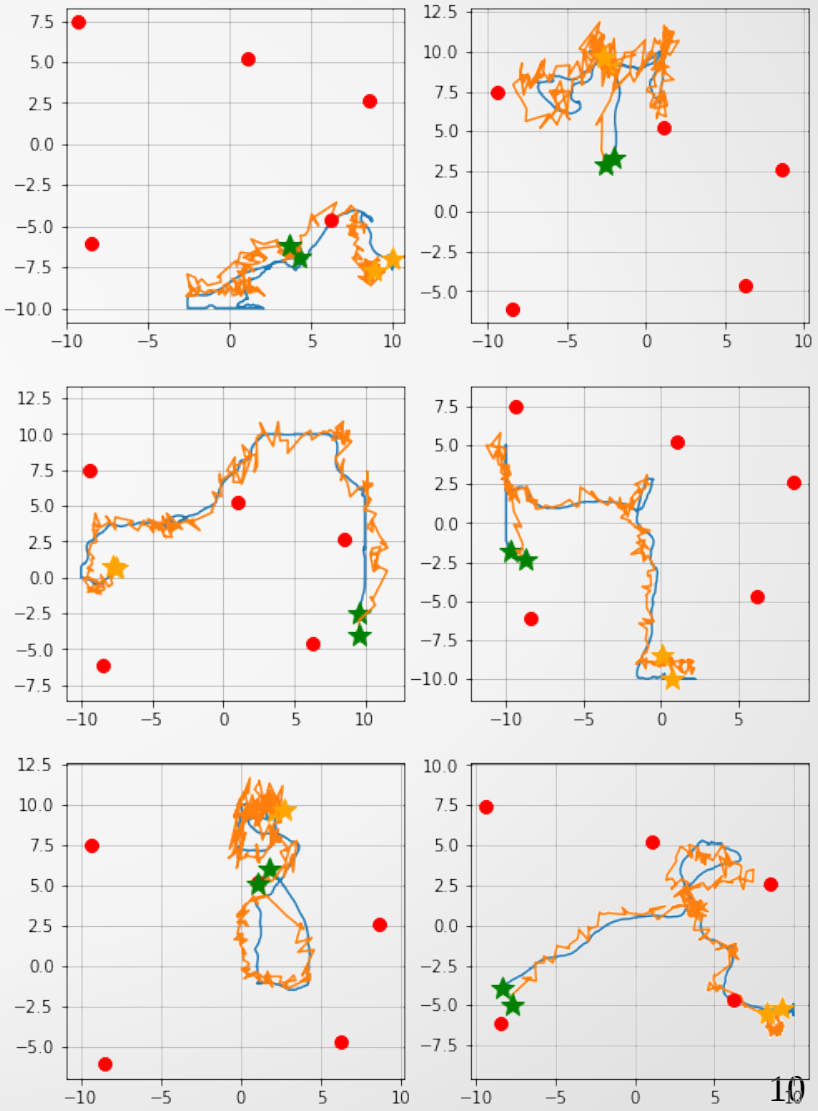




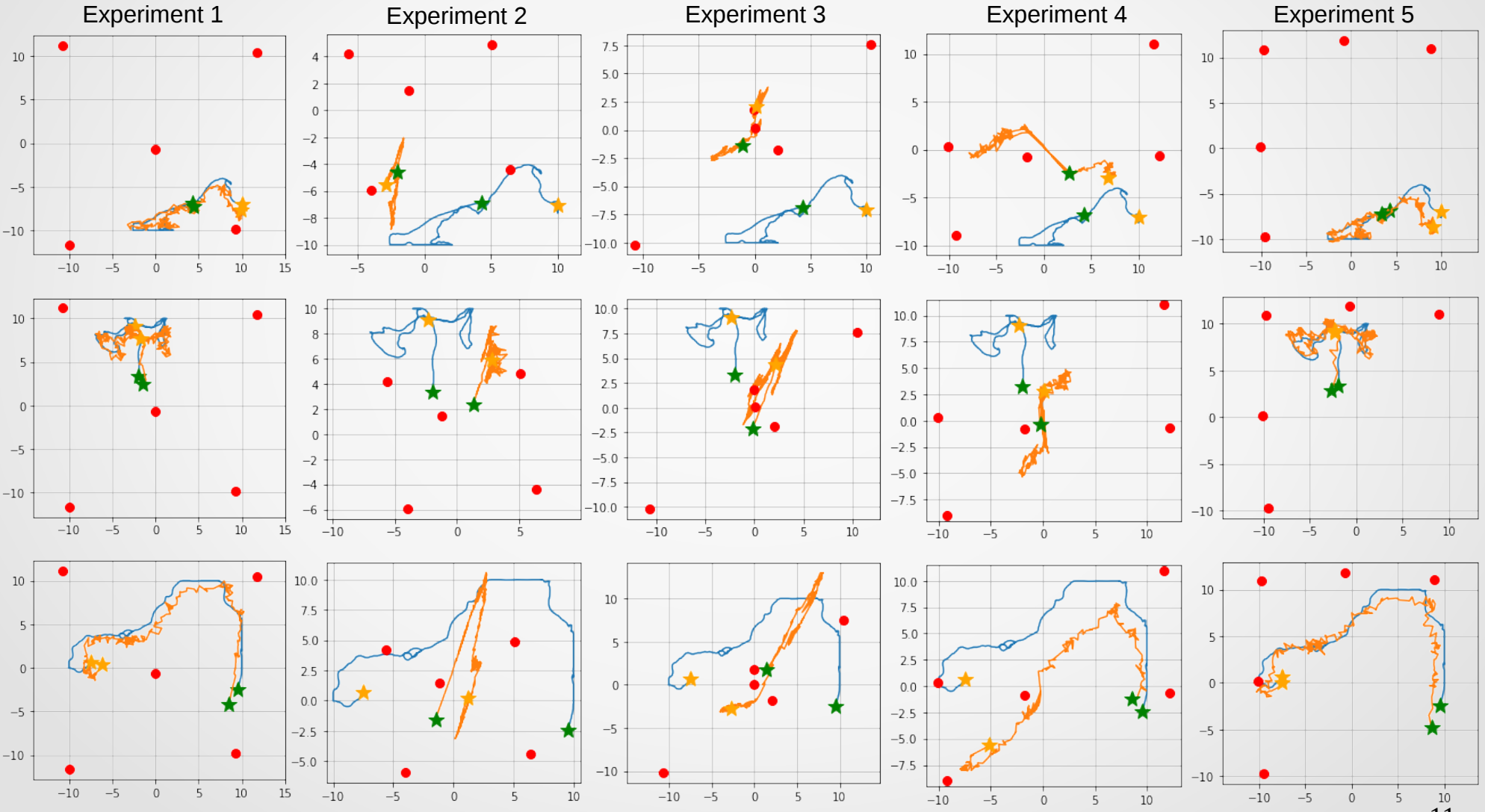
Adding constraints: Align the prediction shape

Correct the simulation shape with some known positions





Performance in specific configurations



What’s next

- Experiment on real data
  - Adapt solution to take multiple modalities
- Experiment with more complex autoencoder architectures
  - Might embed more information
  - Add more constraints
- Experiment with time-dependent architectures