ETH zürich

Closed-loop multi-sensor SLAM using factor graphs for fixed-wing UAV.

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Master Thesis

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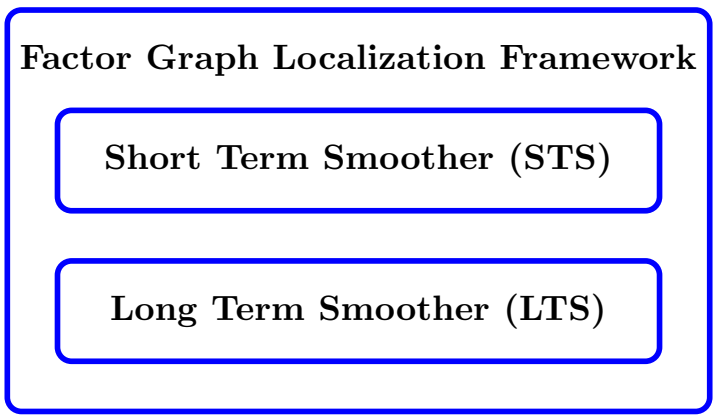
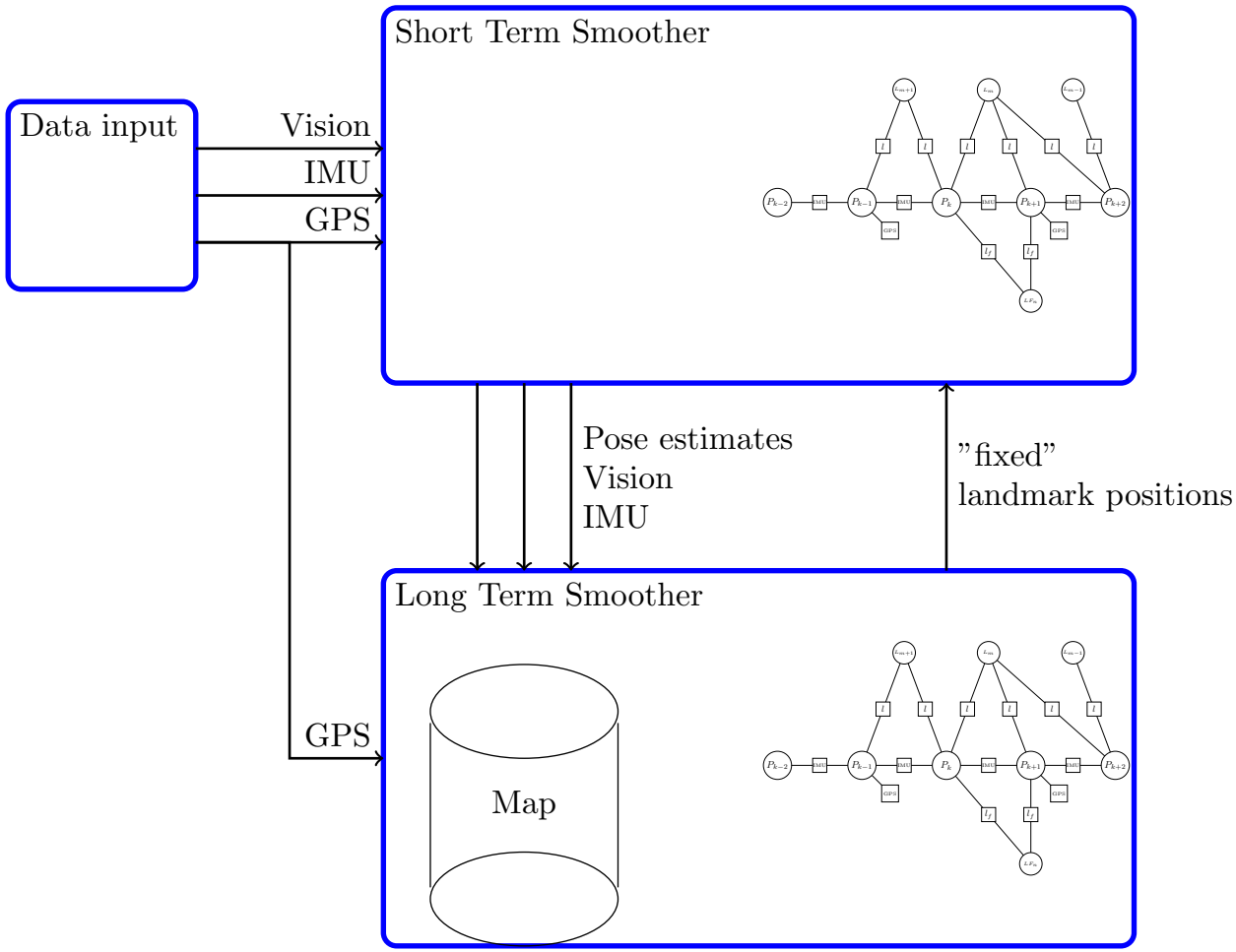
Motivation

Develop localization framework which can simultaneously:

- Estimate local navigation solution with minimal latency
- Find optimal solution given all the measurements



Approach


Short Term Smoother
Data input
Vision
IMU
GPS
Pose estimates
Vision
IMU
"fixed"
landmark positions
Long Term Smoother
GPS
Map

Work done so far

Backbone of the localization framework

- Short Term Smoother
  - building a full factor graph given sensor data
  - estimating position and passing data to LTS
- Long Term Smoother
  - building a map with the input data
  - "translating" the map to a factor graph
  - optimizing the factor graph and updating data in the map

Current challenges

- Reading landmarks from the map and translating them into a factor graph
- Inserting fixed landmarks into STS

Future work

- 3-stage landmark initialization
  - Stage 1: compute 3D landmark coordinate and initialize the feature as binary factor (state x_k and x_{k+1}).
  - Stage 2: formulate the feature re-projection factors connecting the 3D landmark state and pose.
  - Stage 3: once uncertainty converges marginalize landmark state and switch back to binary factor formulation.
- Sliding-Window STS
  - Reduce the STS problem to a sliding-window factor graph

Overview

Adding a video

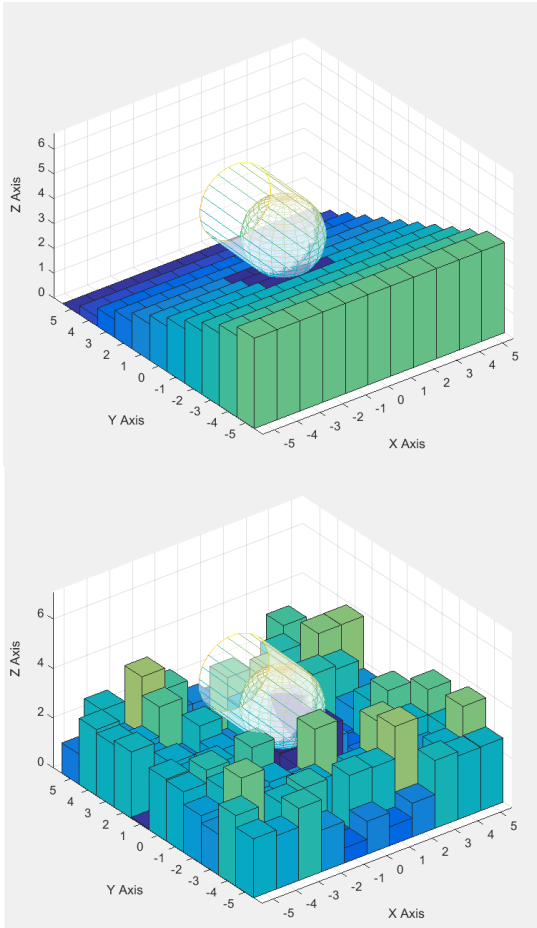
Example Slide

Adding a video

LittleDog walking over rough terrain (S. Schaal, “The latest version of the LittleDog Robot,” 2010. https://www.youtube.com/watch?v=nUQsRPJ1dYw)

Adding a video - Example Slide

- Point 1
- Point 2
  - Point 1.1
  - Point 1.2



Caption