CS 547: Sensing and Planning in Robotics

SLAM

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Summary

- True simultaneous localization and mapping - *i.e.* estimate robot state and state of landmarks in the world simultaneously
- Online, incremental
- Formal proofs
  - map certainty increases with observations,
  - landmark locations are known precisely relative to each
  - uncertainty in landmark location is due to initial uncertainty in vehicle pose
- Practical implementation

Key Limitations

- Complexity increases as N^2 where N is the number of landmarks
- For a dense map, N could be in the thousands (or more)
- Unsuitable for environments where (range,bearing) feature detection is hard

The Basic Idea

- Use a Kalman filter to recursively update the state of the robot *and* the landmarks
- Over time, the entire state vector converges to the correct locations of the robot (*i.e.* localization) and the landmarks (*i.e.* mapping)