ECE183DA (Winter 2022)
Design of Robotic Systems I

Prof. Ankur Mehta ⟨`mehtank@ucla.edu`⟩

Problem set 7 | Kalman filtering and SLAM

Key takeaways

After this lecture, you should understand:

- How Kalman filtering results from an optimization problem as well as Bayesian filtering on continuous spaces;

- Specific challenges and solutions when applying state estimation to localization and mapping problems; and

- Why it might be valuable for planning to be integrated alongside state estimation into a single computational problem, and ways this problem is being tackled.

Assignment

7(a). Come up with a system for which, even though the state dynamics and sensor models are both linear, a Kalman filter (KF) would be a particularly poor state estimator. What would be a negative consequence of using a KF for state estimation on this system?

7(b). Is it possible to start from high uncertainty in both localization and map, then build a very accurate map while maintaining a very uncertain localization estimate? Why or why not?

7(c). Can you come up with a spatial planning problem that is solvable despite no knowledge of either localization or map?

  - *Optional:* What is the potential improvement to be had by including SLAM to get an integrated active SLAM / SPLAM problem?

7(d). Would you be willing to let us use your correct responses as (anonymized) examples for the class?