ECE209AS (Fall 2025)

Computational Robotics

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Problem set 7 | Kalman filtering and SLAM

Due Tue, Nov 11, 2025 @ 9am PT

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?