Robot Localization with Kalman Filters: Milestone 2

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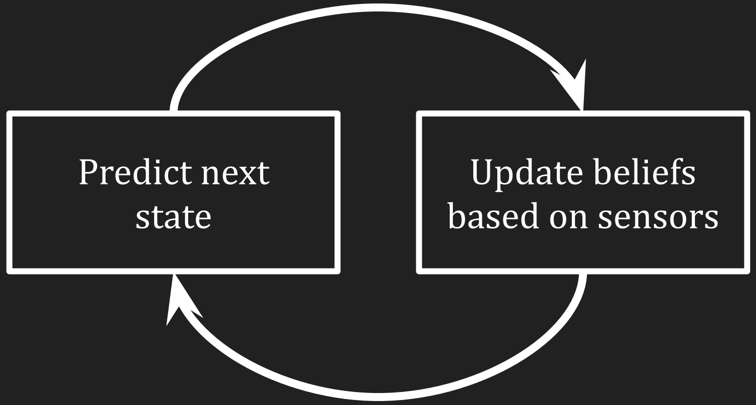
Project Objective

- Want to estimate a robot's position in the presence of uncertainty
- Want to integrate information from diverse sensors
  - GPS (low precision, slow)
  - Accelerometer (fast, drifts over time)
- How can we optimally update our beliefs in the presence of conflicting and uncertain sensor measurements?

Kalman Filters

1. Model robot (or other system) as a set of linear differential equations
2. Given probability distribution of initial states, predict next state based on dynamic model
3. Use sensors as evidence to update beliefs in Bayesian fashion
4. Repeat

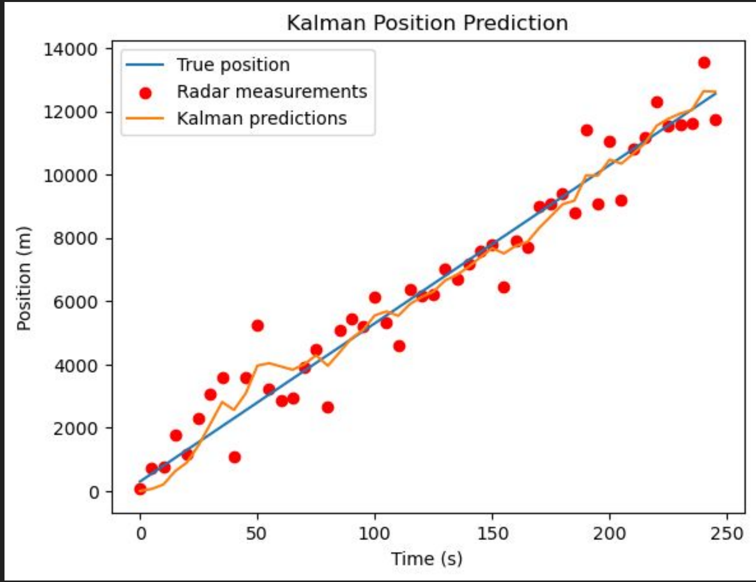


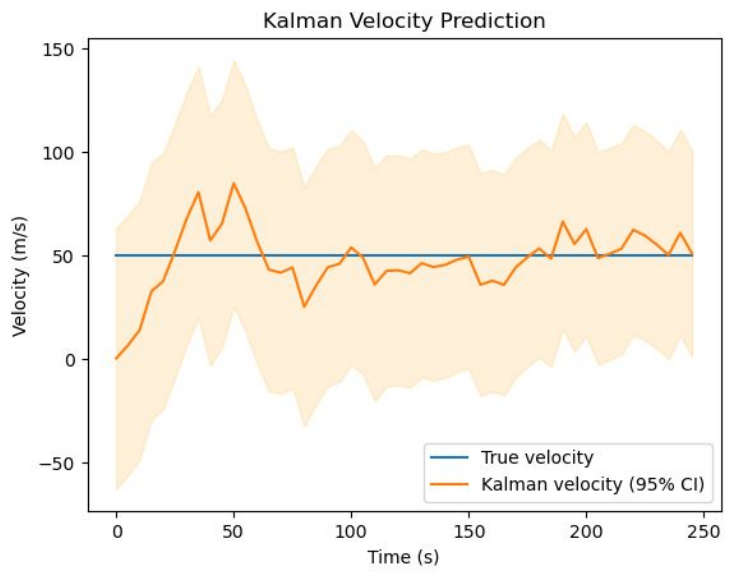
First Attempt

- Model position and velocity of aircraft in one dimensions
- Measure position with simulated radar (gaussian sampling)
- Track estimated position, estimated velocity, and the variance and covariance for each
- For each radar measurement:
  - Predict the new position of the aircraft based on the passage of time
  - Combine that prediction with the radar’s uncertain measurement

Results

- Position estimate is relatively accurate but velocity prediction is noisy





Next Steps

- Implement the Kalman filter with matrix equations
- Add more sensors with different types of measurements
- Introduce process noise (wind, changing acceleration, ect)