Machine Problem 5

2D Kalman Filter: An Application

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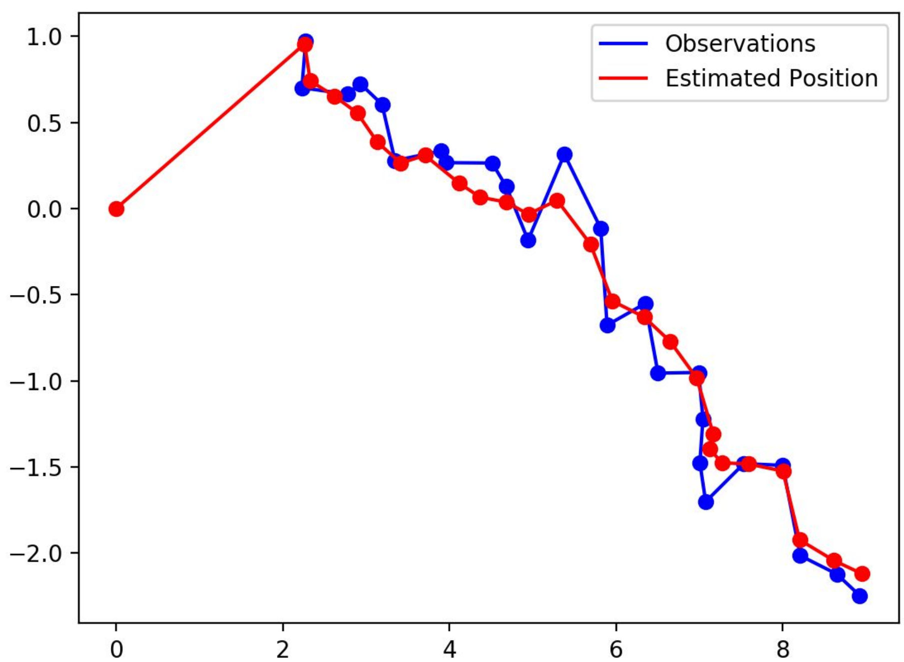
A1.

1. For calculating the updated equations we use the equations for iterative computation.
2. For the time update we use the equations:
   X'(k) = A*X'(k-1) + B*U(k-1)
   P'(k) = A*P(k-1)*transpose(A) + Q
3. For the measurement update we first calculate the kalman gain with the equation
   Kalman_gain = P'(k)*transpose(H) / (H*P'(k)*transpose(H) + R)
4. Now using the kalman gain we can calculate the updated measurements, ie:
   X(k) = X'(k) + Kalman_gain*(z(k) - H*X'(k)
   P(k) = (I - Kalman_gain*H)P'(K)

   Where A, B and H are identity matrices of size 2 and Q and R are the given covariance matrices. Our initial P is Lambda*Identity where lambda is 2.

A3. The plot asked in A4 is included below.



A4.

The value of P used is Lambda*Identity matrix where our lambda value is 2 so the P value we used is 2*I.

B2.

Since the Kalman Filter is a predictor-corrector type estimator, we shoot only when it is optimal, which is when it minimizes the **estimated error covariance**. This is when the estimated error in x is < 0.0015 and the estimated error in y < 0.014.

B3.

Not implemented.