

CS3001-CS3606:

Autonomous vehicles

Please try to solve the following problems:

Problem 1

Calculate the value of $f(x)$ for mean=10; variance=4 and $x=8$

$$f(x) = \frac{1}{\sqrt{2\pi\sigma^2}} e^{-\frac{1}{2} \frac{(x-\mu)^2}{\sigma^2}}$$

Response:

Problem 2

Calculate the value of $f(x)$ for mean=0; variance=2 and $x=4$

$$f(x) = \frac{1}{\sqrt{2\pi\sigma^2}} e^{-\frac{1}{2} \frac{(x-\mu)^2}{\sigma^2}}$$

Response:

Problem 3

What is the maximum value of $f(x)$, where mean=3 and variance=0.5?

$$f(x) = \frac{1}{\sqrt{2\pi\sigma^2}} e^{-\frac{1}{2} \frac{(x-\mu)^2}{\sigma^2}}$$

Response:

Problem 4

We have a prior position of a car with a mean 10 and a variance 4, and we read a measurement probability with a mean of 12 and a variance of 4. Compute the new mean and variance after the measurement update.

Response:

Problem 5

We have a prior position of a car with a mean 10 and a variance 8, and we read a measurement probability with a mean of 13 and a variance of 2. Compute the new mean and variance after the measurement update.

Response:

Problem 6

We have a prior position of a car at position 8m from the origin with an uncertainty of 4. The car moves forward 10m, but the motion has its own uncertainty 6. What is the predicted position of the car?

Response:

Problem 7

A car is equipped with a radar sensor. We have a series of measurements [5, 6, 7, 9, 19] taken at five time steps. The uncertainty of the sensor (variance) is 4 for each measurement. The car also moves at each time step with the following distances [1, 1, 2, 1, 1]. The uncertainty of the movement (variance) is fixed at 2 for each movement. The initial position of the car is 0 with an uncertainty of 10.

Apply Kalman filter in order to predict the position of the car after the five time steps.

Hint: Apply iteratively the update and predict steps for the Kalman filter. There will be basically five iterations of update & predict.

Response: