Probabilistic Robotics
PRRO6, Fall 2017
Book Assignment 2.8.4
Assigned: Tuesday September 5;
Due: Thursday September 7, 13:00 in the afternoon

September 2, 2017

In this exercise we will apply Bayes rules to Gaussians. Suppose we are a mobile robot who lives on a long straight road. Our location x will simply be the position on this road. Now suppose that initially, we believe to be at location $x_{\text{init}} = 1000m$, but we happen to know that this estimate is uncertain. Based on this uncertainty, we model our initial belief by a Gaussian with variance $\sigma^2_{\text{init}} = 900m^2$,

To find out more about our location, we query a GPS receiver. The GPS tells us our location is $z_{\text{GPS}} = 1100m$. This GPS receiver is known to have an error variance of $\sigma^2_{\text{init}} = 100m^2$.

(a) Write the probabibility density functions of the prior $p(x)$ and the measurement $p(z|x)$.

(b) Using Bayes rule, what is the posterior $p(x|z)$? Can you prove it be a Gaussian?

(c) How likely is the measurement $z_{\text{GPS}} = 1100m$ given our prior, and the knowledge of the error probability of our GPS receiver?

Hint: The measurement density function can be written as $\mathcal{N}(z - x)$. Note that this exercise involves the continues case. Mathematica can easily solve $p(z) = \int_{-\infty}^{\infty} p(z|x)p(x)dx$ for you.

Hand-In

When you have completed the assignment, upload your solution to Blackboard. This should be a PDF, with your Matlab scripts as pseudo-code (for example with the matlab-prettifier package). If you have only partially solved the assignment, upload your partial solution.