

Probabilistic Robotics
BAIPR6, Fall 2008
Book Assignment 2.8.4
Assigned: Week 37, Due: Week 38
Monday September 14th, 15:00 in the afternoon

September 7, 2009

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 $\sigma_{\text{init}}^2 = 900m^2$,

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 $\sigma_{\text{init}}^2 = 100m^2$.

- (a) Write the probability 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 continuous 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, you will mail one file: `my_answer2.8.4.pdf` to Arnoud Visser (`a.visser@uva.nl`). If you have only partially solved the assignment, mail your partial solution.