

SSY345 Model Predictive Control

HA1 Implementation

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Discussions

I have discussed the assignment with Osvald Lindholm who usually is my LAB partner in other courses.

Code

The used matlab code for solving the problems can be found in the submitted files on Canvas.

1 Transformation of Gaussian random variables

(a)

As one would assume the approximated ellipse fit better to the analytically calculated ellipse with a larger number of samples. This can be seen in figure 1. With a much larger data size they should converge to the same mean.

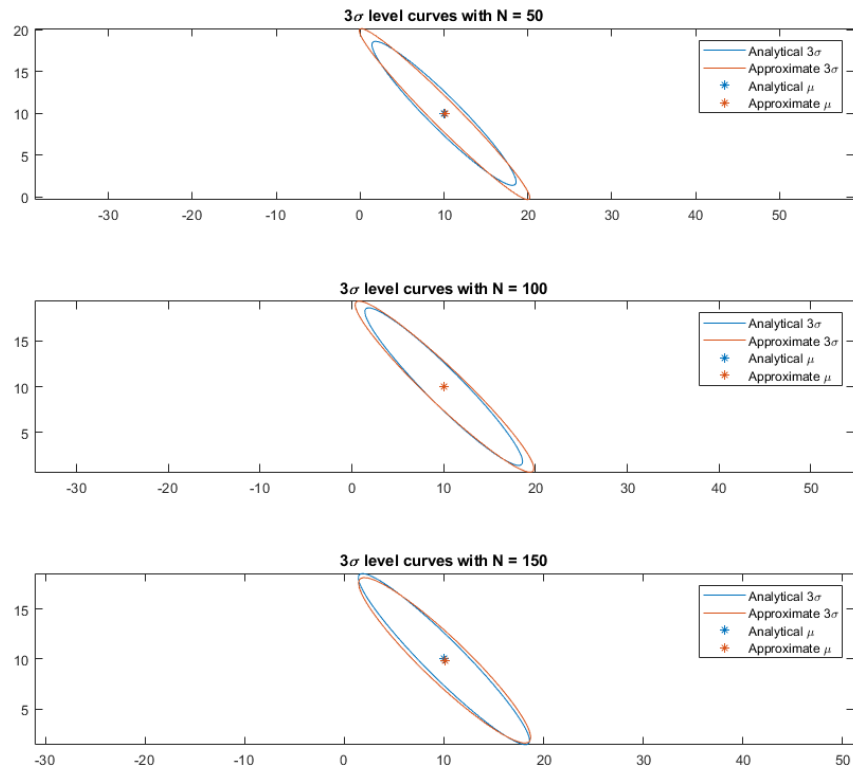


Figure 1: 3σ level curves for analytical and approximated.

(b)

The 3σ ellipse match well with the sample points for small N . When N tends to larger numbers we can see that the points have a tendency to be more on the right side of the mean than to the left which our 3σ level curves does not let us know.

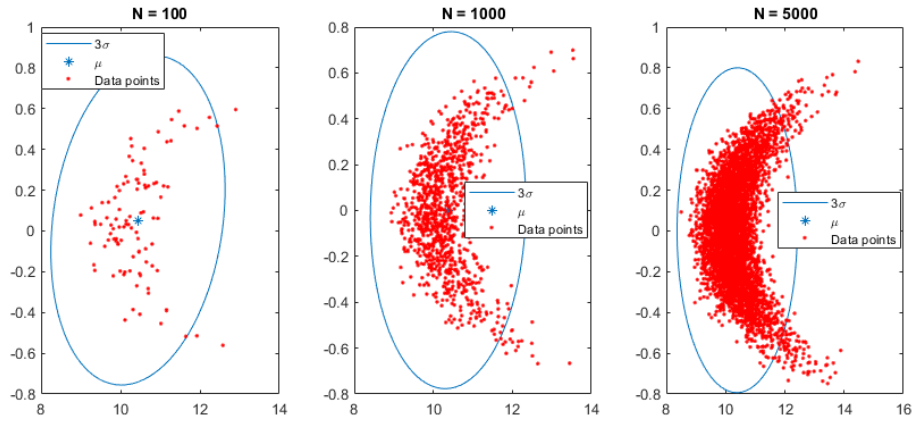


Figure 2: Radar observations with different number of points

2 Snow depth in Norway

(a)

The snow depth in Hafjell and Kvittfjell seem to correlate very well, since both distributions have almost the same slope. This means that if we measure a large snow depth (y) we would expect a true large snow depth (x) aswell.

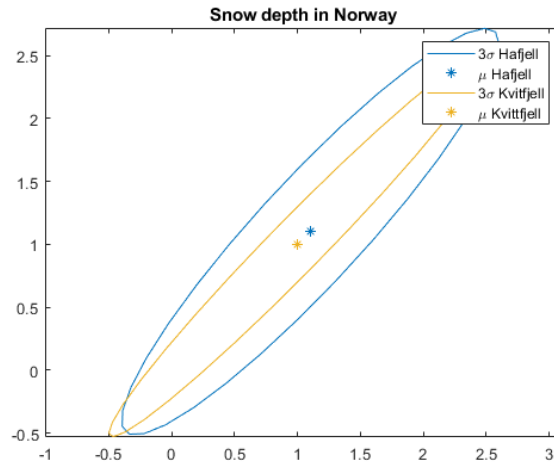


Figure 3: Joint Gaussian of snow depth

(b)

The 1-dimensional densities can be seen as taking a slice or plane from the joint distribution at the measured data. Since the joint dist. is a 3D surface the slice would become a plot in XY plane.

(c)

By examining figure 4 we can clearly see that Anders should go to Kvittfjell since the mean snow depth which is the expected snow depth is higher. Since the conditional distributions have close to 0 area overlapping it means that there is almost no way Hafjell would have more snow than Kvittfjell.

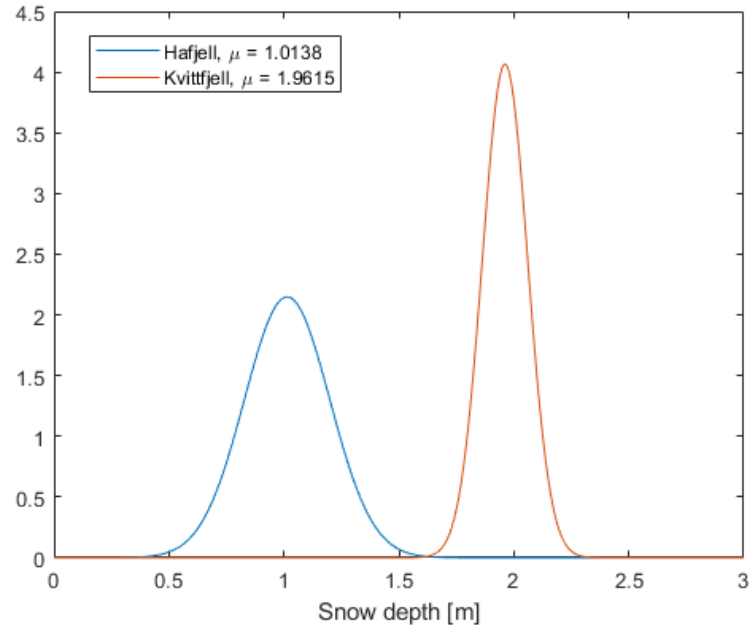


Figure 4: Posterior of the snow depths given a measurement.

3 MMSE and MAP estimates for Gaussian mixture posteriors

The MMSE tries to minimize the squared error which means both distribution in each posterior has an impact depending on the weight. which can be seen by the dashed lines in figure 5. The MAP is different since it tries to maximize the posterior and hence extracting the expected value.

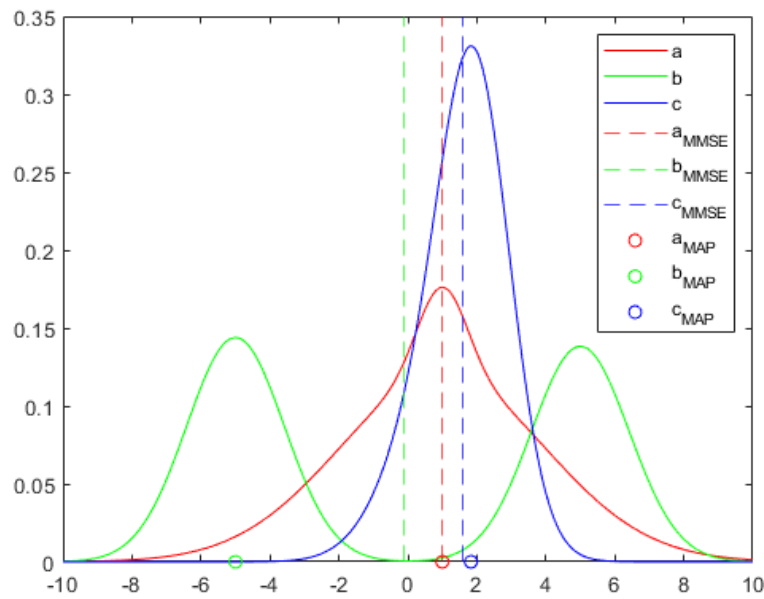


Figure 5: MMSE and MAP of the posteriors