Solution to analysis in Home Assignment 1

Arshad Nowsath(nowsath)

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Contents

1 Analysis

In this report I will present my independent analysis of the questions related to home assignment 1. I have discussed the solution with Karthik Nagaraj and Oskar Begic Johansson but I swear that the analysis written here are my own.

2 Transformation of Gaussian random variables

2.1 Task (a)

By using both the approxGaussianTransform and the affineGaussianTransform the mean and covariance of the transformed density is calculated.

The plot of the transformed samples from approxGaussianTransform together with mean and 3sigma ellipse is given below:

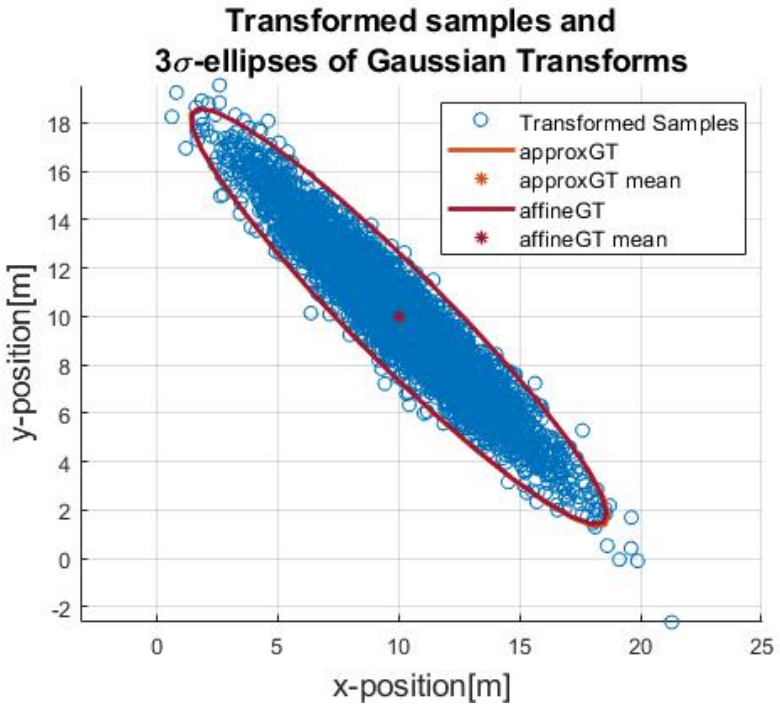

Figure 1: plot of the transformed samples with mean and 3sigma ellipse

yes, the ellipses match the sample points well because If X is the point set of an affine space, then every affine transformation on X can be represented as the composition of a linear transformation on X and a translation of X. Unlike a purely linear transformation, an affine transformation need not preserve the origin of the affine space.

The approximated ellipse's fit to the analytically calculated ellipse because both the mean and covariance of approxGaussianTransform and the affineGaussianTransform we got is perfectly match.

2.2 Task (b)

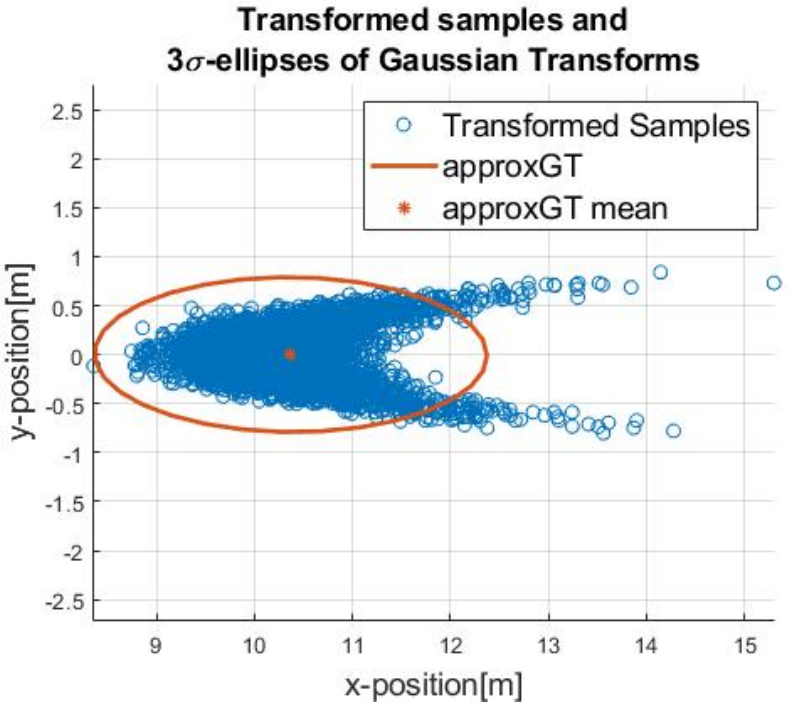

Figure 2: plot of the transformed samples with mean and 3sigma ellipse

yeah, the ellipse almost match with the sample points only some of the points are lying outside. The approximated ellipse's fit to true distribution change with number of samples because the approximated mean depends on the samples propagated through f.

3 Snow depth in Norway

3.1 Task (a)

The plot of 3σ -ellipsoid of p(x; y) for the snow depth at Hafjell and Kvitfjell.

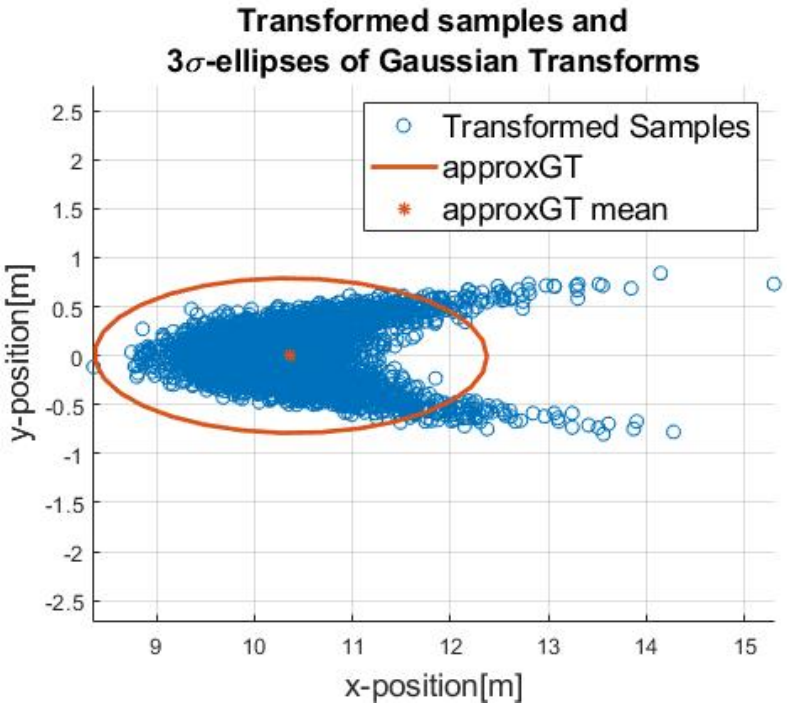

Figure 3: plot of $3\sigma ellipsoid for Hafjell$

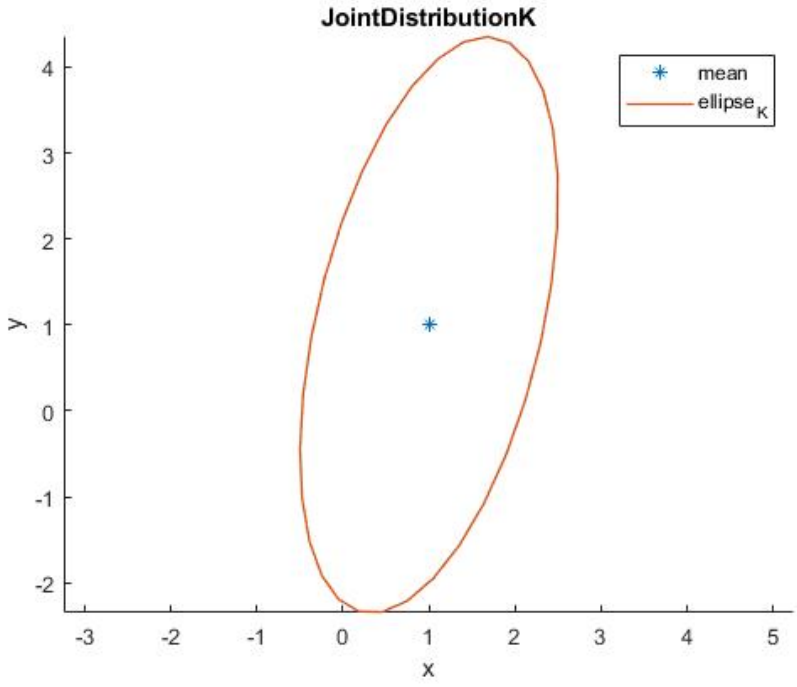

Figure 4: plot of $3\sigma ellipsoid for Kvitfjell$

The slope is randomly picked x = 2,2.5. The major axis in Hafjell is high because the depth of hafjell is 1.1 which is high compared to Kvitfjell

3.2 Task (b)

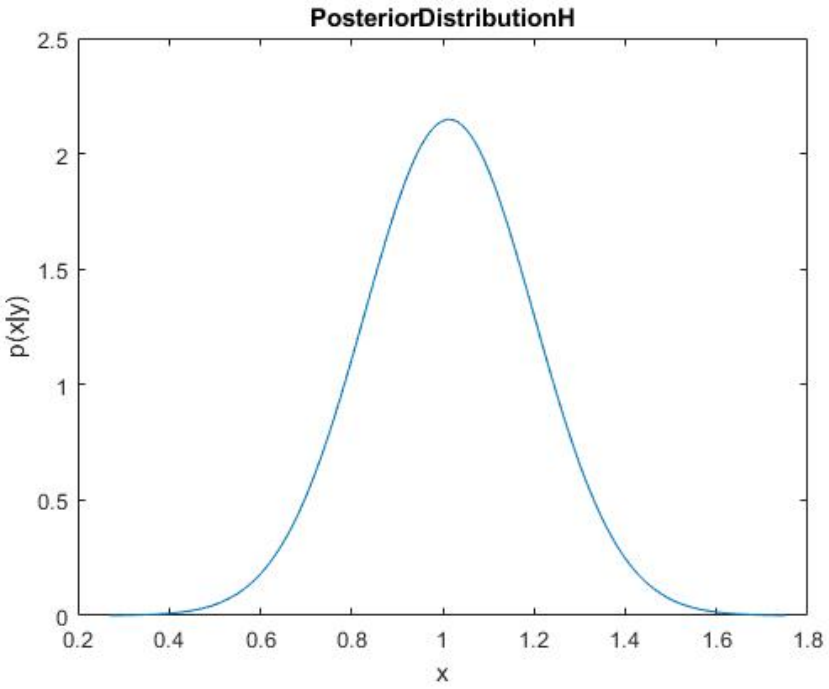

Figure 5: plot of Posterior distribution for hafjell

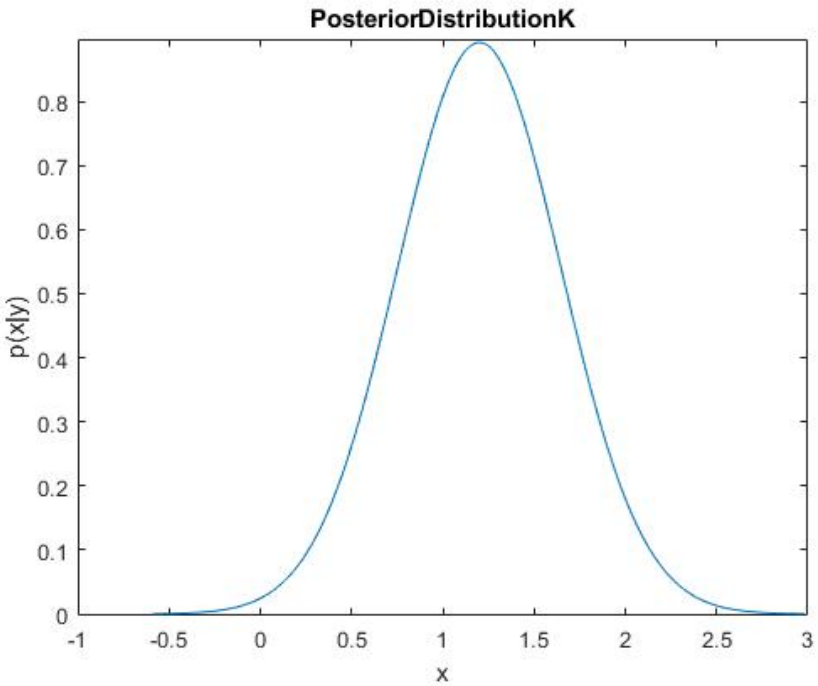

Figure 6: plot of Posterior distribution for Kvitfjell

since the mean of both the distribution is equal to the mean of both case of ellipse. we can easily identify in the posterior distribution.

3.3 task (c)

Based on his decision by maximizing expected snow depth he will choose Hafjell since the chances of getting snow in Hafjell is low comapred to Kvitfjell.

4 MMSE and MAP estimates for Gaussian mix- ture posteriors

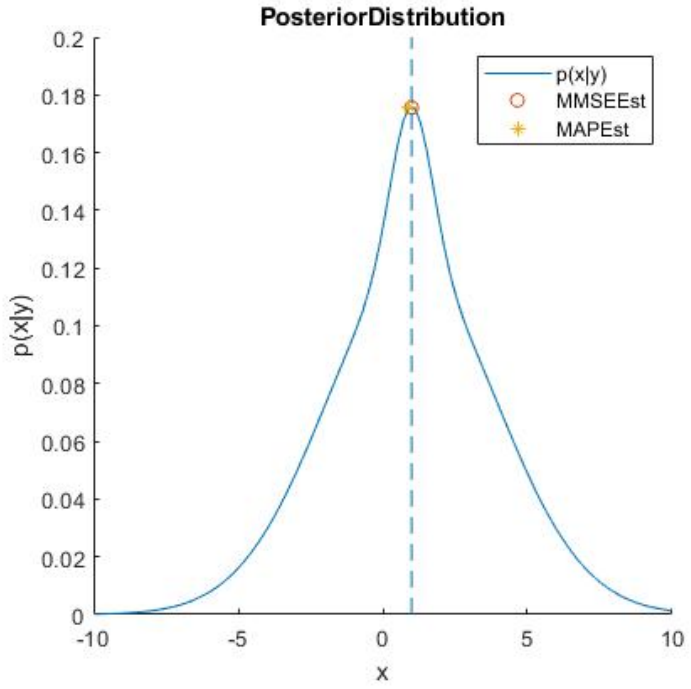

Figure 7: plot a)

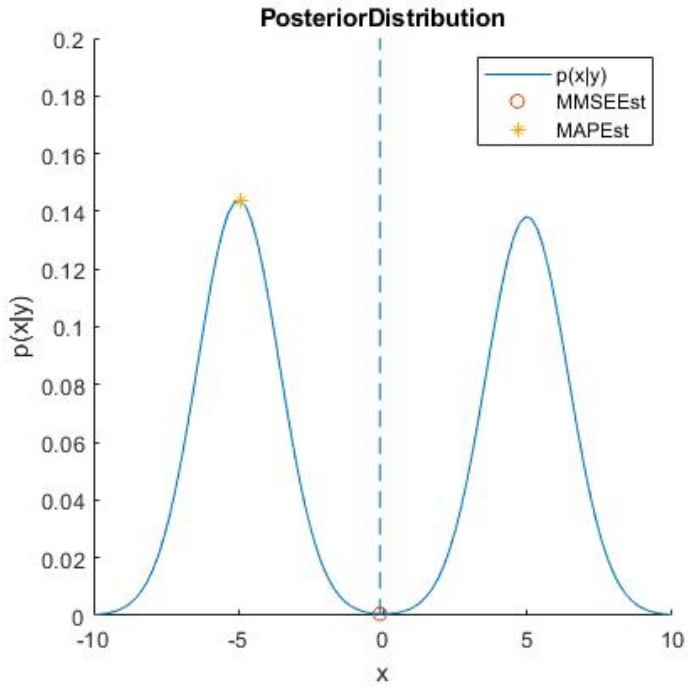

Figure 8: plot b)

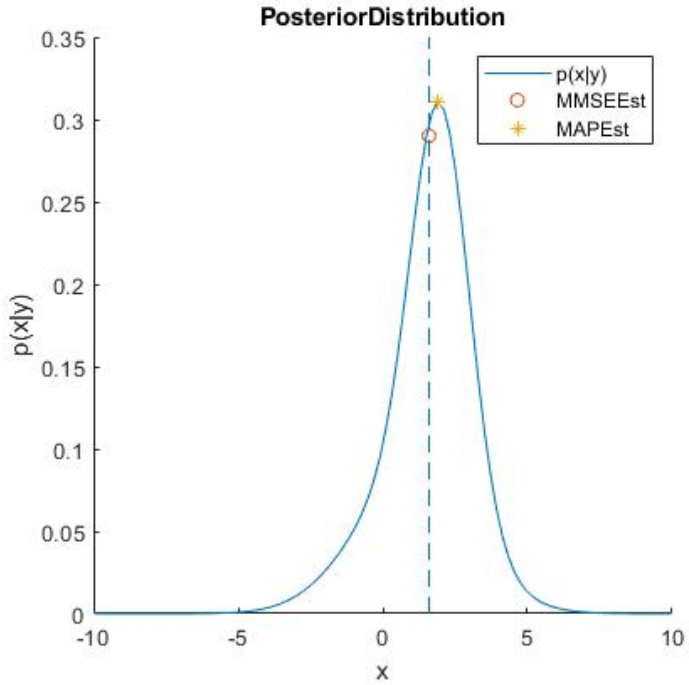

Figure 9: plot c)

(MAP) estimator aims to find and use the sparsest representation, the minimum mean-squared-error (MMSE) estimator a common measure of estimator quality, of the fitted values

of a dependent variable. In some case, the MMSE estimator is given by the posterior mean of the parameter to be estimated. yes if the MAP estimate is ambigious, it is enough to mark one MAP estimate.