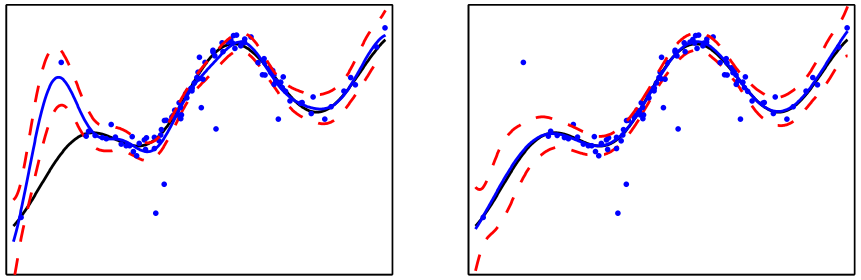
Gaussian process regression with Student-t likelihood

jarno.vanhatalo@tkk.fi pasi.jylanki@tkk.fi aki.vehtari@tkk.fi

HELSINKI UNIVERSITY OF TECHNOLOGY
Department of Biomedical Engineering and Computational Science

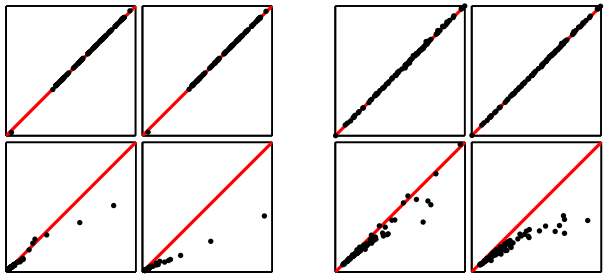
- A robust observation model, such as the Student-t distribution, reduces the influence of outlying observations and improves the predictions.
- The problem, however, is the analytically intractable inference.
- We utilize the Laplace approximation for approximate inference and compare our approach to VB and MCMC scheme



(a) Gaussian observation model. (b) Student-t observation model.

Figure 1. An example of regression with outliers by Neal (1997).

- All the methods (Laplace, VB, MCMC) are similar in predictive performance
- VB underestimates variance more than Laplace approximation
- The Laplace approximation is the fastest and MCMC the slowest



(c) Neal data (d) Friedman data

Figure 2. Scatter plot of the posterior mean (upper row) and variance (lower row) of the latent variables. In each figure, left plot is for MCMC (x-axis) vs the Laplace approximation (y-axis) and the right plot is MCMC vs. VB.