

## Progress in Week 11

In week 11 the HMC was used instead of MAP. The advantage of HMC is that the ability to take distributions in parameter-space. The code introduces a joint distribution of the three parameters Noise Variance, Length Scale and Amplitude and creates a GP model using that. Using the unnormalized log posterior the chain tries to adjust the parameters. The chain has 500 burn-in steps to prevent the unreliable initial data to affect the mean. It also has 3 frog-leap steps between each step to minimize the correlation between steps that is inherent in the HMC. Finally, 200 results for each parameter are returned by the HMC. The mean is used in the GP. The data used is labelled 'Data 1' on github.

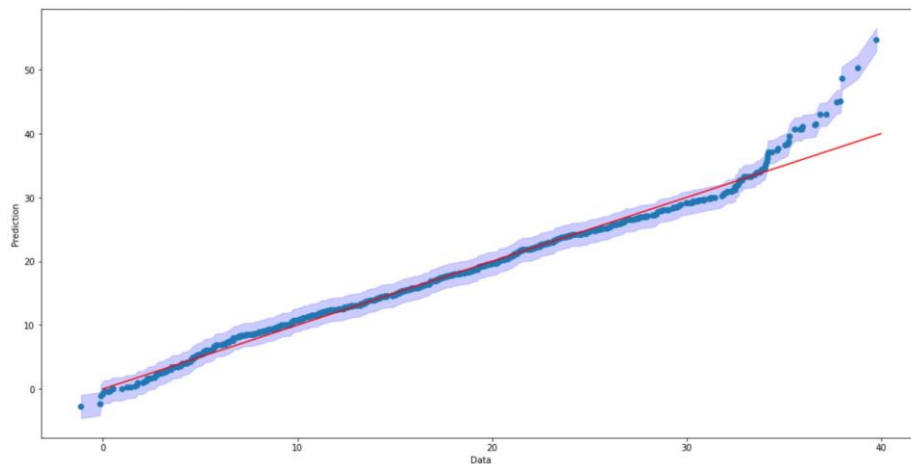


Figure 1: Residual plot for model in Days

Figure 1 shows the results of the HMC, which are satisfactory for up to 30 Days rotation period. As the trailing off in the end is a result of the GP not having enough data in the region. Figure 2 shows the z-statistic compared to a normal  $N(0,1)$ . Although there's some bias to the negative side, it is expected as the prediction is significantly larger for  $t > 30$  Days.

### Conclusion:

- Overall the implementation of the HMC was successful

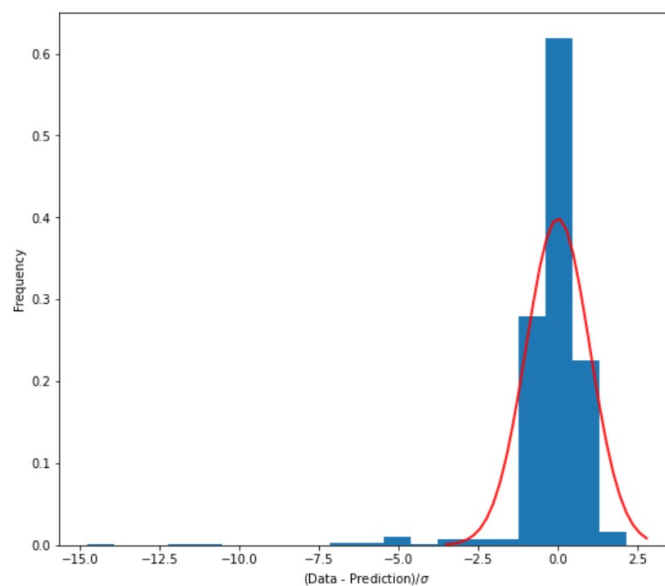


Figure 2: Z-statistic for model