Project 1 FYS-STK4155

(Dated: September 15, 2023)

I. INTRODUCTION

Write a paragraph about why it is useful with machine learning, in this setting.

The aim of this report is to study three different regression methods, ordinary least squares (OLS), Ridge and LASSO and see how these method compare to each other when applied to different data sets. First we are going to look at the Franke function. When plotted between 0 and 1 this function looks like a mountain and a valley, which is a perfect starting point when we later want to apply these methods on digital terrain data taken from https://earthexplorer.usgs.gov/.

II. THEORY

A. Ordinary least squares (OLS)

B. Ridge

C. LASSO

D. Bias-variance trade-off and resampling techniques

III. METHOD

In the first part of this project a function called Franke function was used as the data analysed. The Franke function is given by the following equation:

$$
\begin{aligned}
f(x,y) = &\frac{3}{4}\,exp\left(-\frac{(9x-2)^2}{4}-\frac{(9y-2)^2}{4}\right)\\
&+\frac{3}{4}\,exp\left(-\frac{(9x+1)^2}{49}-\frac{(9y+1)}{10}\right)\\
&+\frac{1}{2}\,exp\left(-\frac{(9x-7)^2}{4}-\frac{(9y-3)^2}{4}\right)\\
&-\frac{1}{5}exp\left(-(9x-4)^2-(9y-7)^2\right)
\end{aligned}
$$

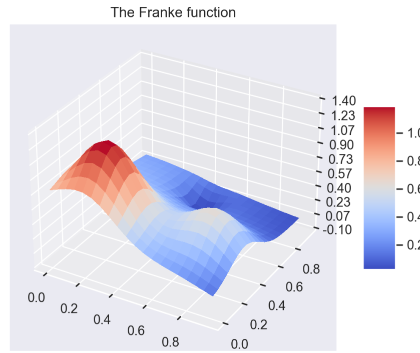

Figure 1. A plot of the Franke function

This function was fitted with the OLS method, were a polynomial with degree 5 was used to create the design matrix. Since the design matrix in this case was noninvertible, singular value decomposition was used to create the β-values needed to create a model of the dataset. The mean square error and the R2 score was calculated for both the testing and training datasets.

Next Ridge regression was used on the Franke function, to see if this method have a better fit than what was obtained with OLS. Diffrent values for λ was used to obtain the best fit as possible.

IV. RESULTS

V. DISCUSSION

VI. CONCLUSION

REFERENCES

- Reference 1
- Reference 2

Appendix A: Name of appendix

This will be the body of the appendix.

Appendix B: This is another appendix