Applying Regression and Resampling Techniques to Norwegian Terrain Data with Franke's Function as Test Function

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Abstract

1 Introduction

2 Theory

2.1 Datasets

We will analyze the following datasets:

2.1.1 MNIST

The famous MNIST dataset is a collection of handwritten numbers, as 28×28 grayscale images. It comes in two sets, a training set with $60,000$ images, and a testing set with $10,000$ images. In this report, we will model the inputs as a $28 \times 28 = 784$-dimensional vector, and the output as a 10-dimensional state vector, with each dimension representing the corresponding digit.

2.2 Stochastic Gradient Descent

Gradient descent describes the process of finding a local minimum of a function (the cost function, in our case) by following the negative value of the gradient at each point, stepwise. *Stochastic gradient descent* or SDG is a way of increasing the numerical efficiency of this process, by doing this process stochastically.

This involves randomly dividing the training data into a given number of *mini batches*. For each mini batch, the gradient is found by averaging the gradient value each mini batch sample has. Then the weights and biases are updated (take a step down the "slope") and the process is repeated for the rest of the mini batches. The updating done at each mini batch is expressed mathematically as

$$w \to w' = w - \frac{\eta}{m} \sum_i^m \nabla C_{i,w}$$
$$b \to b' = b - \frac{\eta}{m} \sum_i^m \nabla C_{i,b},$$

where m is the number of datapoints in the mini batches and ∇C_i is the gradient at each individual data point. After exhausting all the training data, we have finished a so-called *epoch*, of which we can perform as many as necessary.

3 Method

4 Results

5 Discussion

6 Conclusion

A Appendix