Employing supervised machine learning algorithms for fitting terrain data

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Abstract

1 Introduction

The use of machine learning for problem solving has risen in popularity as large data sets have become available for analysis. There now exists many different methods in varying complexity for both supervised and unsupervised learning. All of these methods have advantages and drawbacks, as well as many similarities. This means we can get familiar with some of the central themes in machine learning by studying simple algorithms. In this report, we will implement three different supervised learning algorithms with increasing complexity, as well as the k-fold resampling technique.

2 Theory

2.1 Ordinary least squares

2.2 Ridge regression

2.3 Lasso regression

2.4 Mean squared error

2.5 Score function

2.6 k-fold cross validation

There are several methods for estimating the skill of a machine learning model. One such method is the k-fold cross-validation procedure, which can be used when working with a limited data sample. The idea is to divide the data sample into k groups or folds, and then retain one of the folds to use as a test set after fitting a model to the remaining data. This is done for all folds. Algorithm 1 outlines the different steps in the procedure.

Shuffle the dataset randomly;
Divide the dataset into k folds;
foreach k **do**
    Take the kth fold out to use as test data set;
    Set the remaining folds as training data set;
    Fit a model to the training set;
    Evaluate the model on the test set;
    Retain the evaluation score and discard the model;
Calculate the mean of the evaluation scores;

Algorithm 1: The k-fold cross-validation algorithm.

This yields a statistical estimate for how well the model will preform on new data. The choice of k will however effect the bias and variance in the estimation of the evaluation scores.

It has been shown empirically that $k = 5$ or $k = 10$ gives neither a high bias nor variance (James et al., 2013). In this project, a value of 5 was chosen for k.

$$A = \begin{bmatrix} b_1 & c_1 & 0 & \dots & \dots & 0 \\ a_1 & b_2 & c_2 & 0 & \dots & 0 \\ 0 & a_2 & b_3 & c_3 & \dots & 0 \\ \vdots & \ddots & \ddots & \ddots & \ddots & \vdots \\ 0 & \dots & \ddots & a_{n-2} & b_{n-1} & c_{n-1} \\ 0 & \dots & \dots & 0 & a_{n-1} & b_n \end{bmatrix},$$

3 Results

Figure 1

4 Discussion

5 Conclusion

References

G. James, D. Witten, T. Hastie, and R. Tibshirani. *An Introduction to Statistical Learning: with Applications in R.* Springer Texts in Statistics. Springer New York, 2013. ISBN 9781461471387.