

# Machine Learning: Assignment 2

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## 1 Introduction

In the world today there are many methods that fall under the category of "Machine Learning", some being very similar and some very different. All of them share in common that they use data to produce a model that can be used on unseen data. When successful this is very appealing in today's society when we get lots of data on situations where there is likely to be an underlying pattern, another requirement for learning. There is broad agreement that machine learning is a good way to make prediction and classification models, and often the only computationally feasible way. This makes it a task to decide which method in machine learning to choose for a given problem. The answer is not always the same and several methods can be good, but for different reasons. In this task I will show several different machine learning algorithms and how they perform on classifying pictures of handwritten numbers.

## 2 Methods

### 2.1 Tree based methods

### 2.2 Random Forest

	0	1	2	3	4	5	6	7	8	9	Error	Rate
0	46	0	0	1	0	0	0	0	0	0	0.021	1/47
1	0	42	0	0	0	1	0	1	0	0	0.045	2/44
2	0	2	48	0	0	0	0	1	0	0	0.059	3/51
3	0	0	0	41	0	1	0	0	3	0	0.089	4/45
4	0	1	0	0	52	1	1	4	0	1	0.133	8/60
5	0	0	0	4	0	42	1	0	1	0	0.125	6/48
6	0	0	0	0	1	0	47	0	2	0	0.060	3/50
7	0	1	0	0	0	0	0	48	0	2	0.059	3/51
8	1	2	0	1	0	0	0	0	42	1	0.106	5/47
9	0	0	0	1	2	1	0	0	1	48	0.094	5/53
Total	0	0	0	0	0	0	0	0	0	0	0.081	40/496

### 2.3 Neural Networks

For Neural Networks I have decided to use a convolutional neural network because of its great performance in problems that can be represented as an "image". This is because convolutional neural networks (CNNs) work by recognizing patterns in images or represented as a matrix or tensor (multidimensional matrix) in the computer. It does so by using convolutional, pooling and voting layers. Multiple of these can be stacked to create a very precise recognising images.

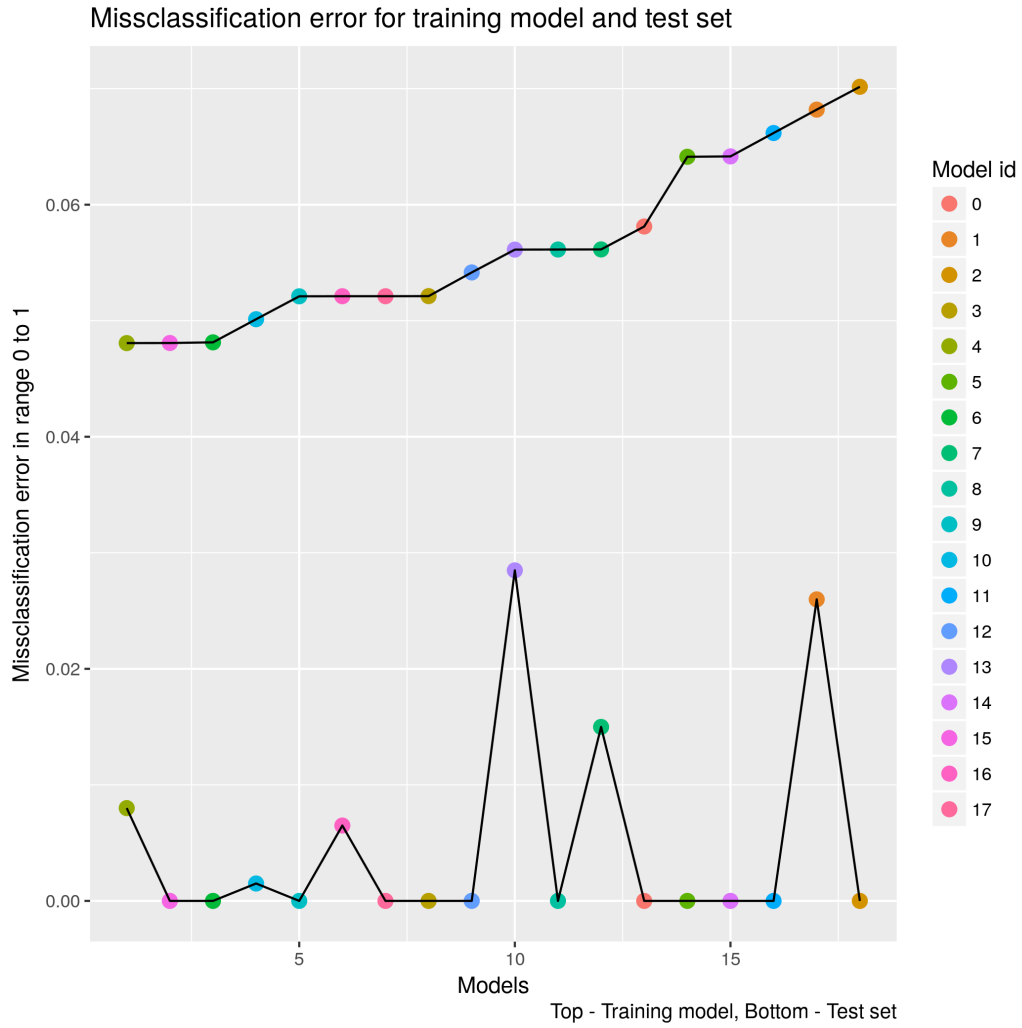


Figure 1: Error measures  $E_{out}$  and  $E_{val}$  are plotted for different sizes of training and validation sets.

## 2.4 Support vector machines

## 3 Results

## 4 Discussion

## 5 Acknowledgments

## 6 Appendices