

Exercise: 2.5 Visual Applications of Machine Learning
Timothy Aluko

Part 1

| Number | result |
|--------|--------|
| 0 | 0 |
| 1 | 1 |
| 2 | 2 |
| 3 | 3 |
| 4 | 4 |
| 5 | 5 |
| 6 | 6 |
| 7 | 7 |
| 8 | 8 |
| 9 | 2 |

After training the model had an accuracy of 99.19%. On the pictures used it only failed to recognise the digit once, where it classified a 9 as a 2. This indicates that the model was 90% accurate.

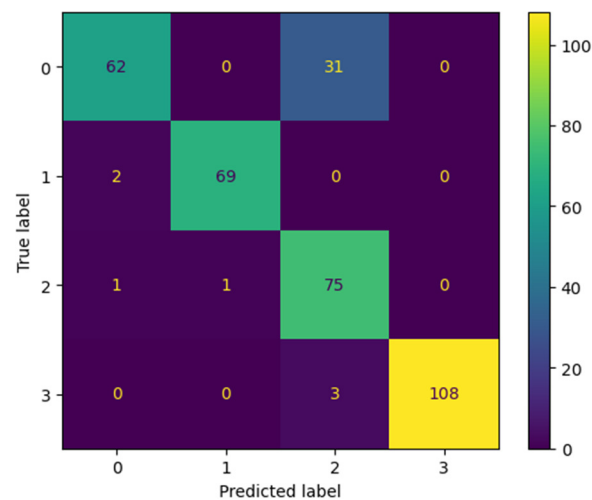
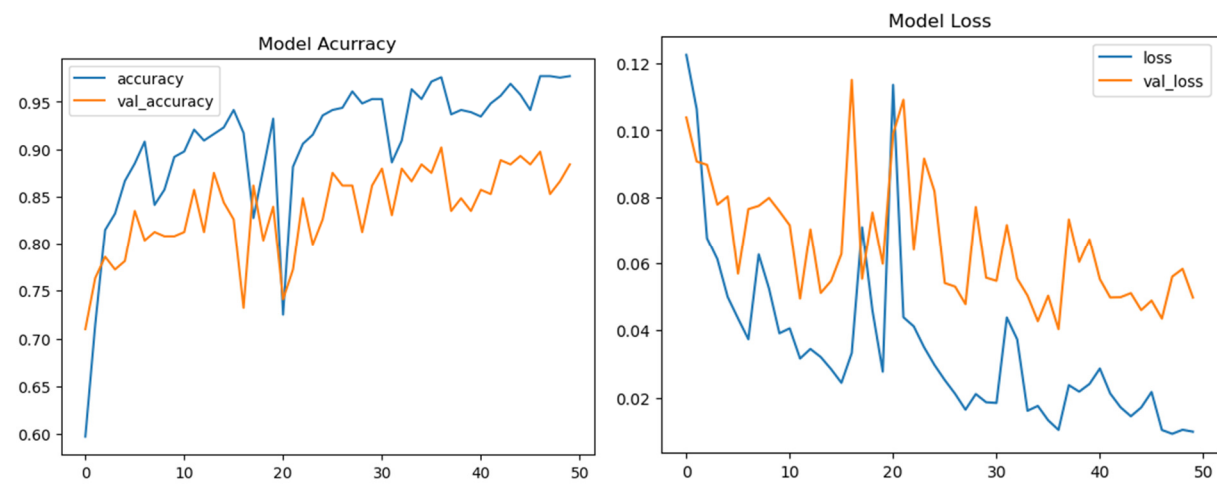
Part 2

At 50 epochs the results are as follows

| | |
|----------------------------|---------------|
| Validation Accuracy | 88.39% |
| Accuracy | 97.70% |
| Validation loss | 4.98% |
| Loss | 0.98% |

The model requires 30 epochs to reach an accuracy of 95%, and requires another 20 epochs to reach an accuracy of 97.7%. At the end of the 50 epochs, there is a 10% difference in accuracy between the training set and validation set implying poor generalisation of the model. The confusion matrix shows that the poor

performance is mostly due to false predictions of weather in class 0 (classifying cloudy as shine); this might be due to lack of sufficient data in the training data set for this class.



Some proposals for using GANs in weather prediction are as follows

- Improving the resolution of forecast for regions without enough data, by using GANs to improve weather predictions based on training using high-resolution data. Source - <https://pmc.ncbi.nlm.nih.gov/articles/PMC9788314/>
- Forecasting the change in weather at a location in the short-term (hours) based on current weather data <https://www.nature.com/articles/s41598-024-60253-w>
- Using GANs to predict the occurrence of extreme, often sudden, weather events such as tornadoes and storms. Source - <https://journals.ametsoc.org/view/journals/aies/3/2/AIES-D-23-0094.1.xml>