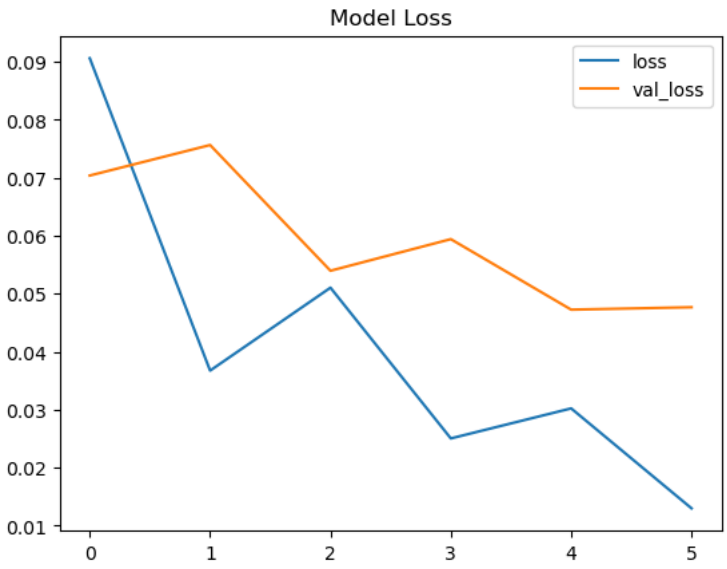
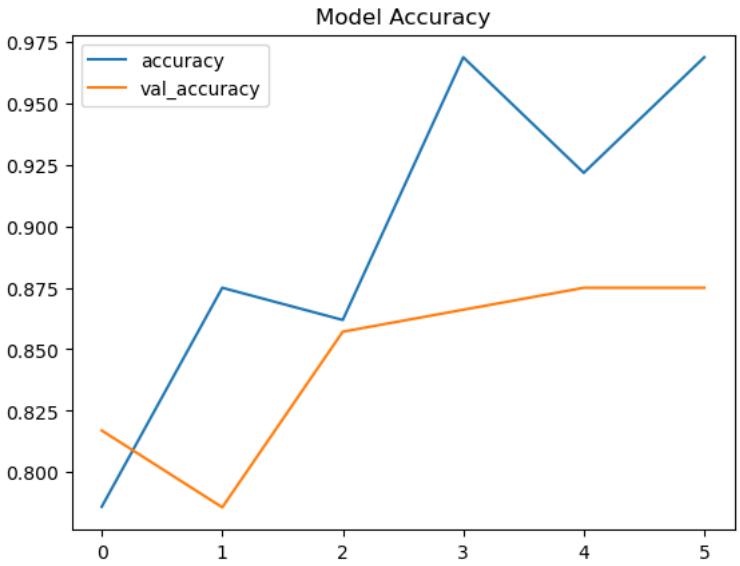
Visual Applications of Machine Learning

Part I: Radar Recognition

** NOTE: After opening the notebook and running the script on a separate occasion, the training of the same model produced different results. The graphs here are shown on the most accurate result, and the current state of outputs from my script does not reflect those results.

Epoch = 6

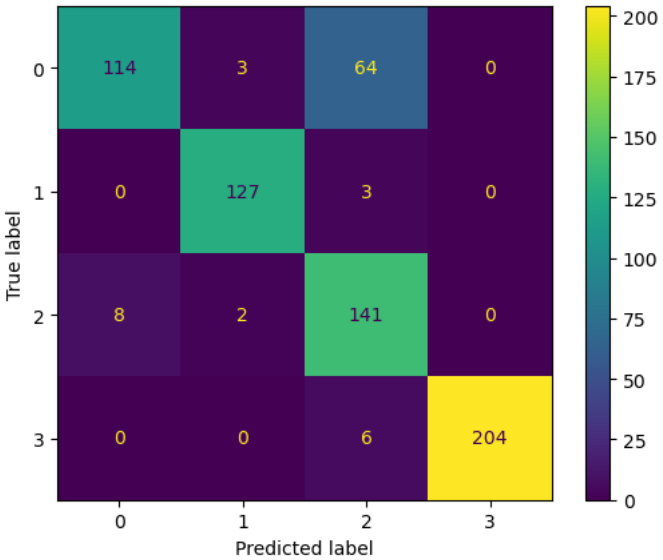





```
Accuracy: 0.96875, Val_Accuracy: 0.875
Loss: 0.012993456795811653, Val_Loss: 0.047676049172878265
```

After testing for 3, 6, and 10 epochs, and rerunning some of them, 6 epochs is the best result. At 3 epochs, there is a clear direction, but more epochs were needed to determine if the accuracy could improve. At 10 epochs, the accuracy and loss start to fluctuate wildly after the 4th epoch, ultimately ending with higher losses and lower accuracy. The second trial with 6 epochs has delivered the highest accuracy at 0.969 and lowest loss at 0.013.

Confusion Matrix on 20 Batches



The confusion matrix shows high accuracy, with the most error when on predicting cloudy weather (it predicts it as shine). I did view the images that it predicted and can see the confusion, as sometimes there are bright blue skies with clouds, and the algorithm can easily classify that as shine due to the brightness. I would even say humans may disagree on that picture whether it is cloudy or shine.

Incorrect Prediction - class: Cloudy - predicted: Shine[1.8191760e-02 5.8038924e-05 9.7

Part II: GANs

Three ideas for use of GANs in weather prediction:

Outline at least three ideas you have using a few sentences each.

1. **Rain Radar:** We can use GANs on radar images of rain clouds. It will help simulate and predict cloud and rain movement over geographical areas. In the case of severe storms, the GANs can help predict more accurately and quickly where the critical areas will be.
2. **Glacier Melts:** Images of glaciers can be put through GANs and help understand the rate that glaciers are melting or breaking apart. Melting glaciers affect how water level rises and overall temperatures globally.
3. **River imagery:** Using GANs, we can work on satellite imagery of major rivers to see the conditions of the riverbeds, whether they are diminishing or growing. It may be combined with weather forecasting, for instance rain prediction, to foresee the risk of flooding or drought.

Ideas researched by another person or institution (links):

1. **Rain Radar:** https://www.deeplearning.ai/the-batch/weather-forecast-by-gan/

2. **Glacier Melts:** https://www.sciencedirect.com/science/article/abs/pii/S0952197623011041

3. **River imagery:** https://www.sciencedirect.com/science/article/abs/pii/S0022169424008837 (It doesn't touch on river images, but does mention flood risk mapping)