Project 2 – DCNNs, Bryan Kikuta

https://github.com/kikutabryan/aer850-project-2.git

Discussions

The goal of this project was to accurately predict different kinds of imperfections and faults in aircraft skin surfaces. The classes which were being predicted consisted of cracks, missing heads, and paint-off. Each of these classes had a provided set of training, validation, and test images.

During the preprocessing phase, the images were decreased in resolution down to 96x96 pixels. This was conducted to reduce the computational power required for training and running the model, as there would be fewer connections in the dense matrices, and fewer elements for each convolutional layer. Moreover, the images were converted to gray scale, reducing the colour channels from 3 down to 1. This was done as upon observation of the images, there was no usage of RGB colours, rather they all appeared to be gray scale. Colour would also not have much impact on such classifications as they are mostly feature based (lines, contours, regions) instead of colours.

During the creation of the model architecture, inspiration was taken from models like VGG16, where the convolutional filter numbers continuously increase (double) with each layer, and 2 dense layers are utilized afterwards. Before passing the data into the networks and convolutional filters, the values were scaled to be within 0 to 1, and this was conducted after the convolutional layers and before passing the values into the dense network. Another feature in the model was the data augmentation. This was added to add some variety to the training images allowing the model to be exposed to "more" data through basic transformations. It is important to note that these were not applied during testing, only training.

To prevent overfitting, early stopping was used on the model fitting. This would check to see if the validation accuracy stopped increasing after a certain number of epochs, and if so, revert to the best performing model.

Results

The accuracy that was observed for the model was 90.81% on the testing dataset.

The predicted classes of the provided test images are shown below with the associated probabilities. Each of the predictions was correct with the probabilities depicting strong confidence in the predicted classes.