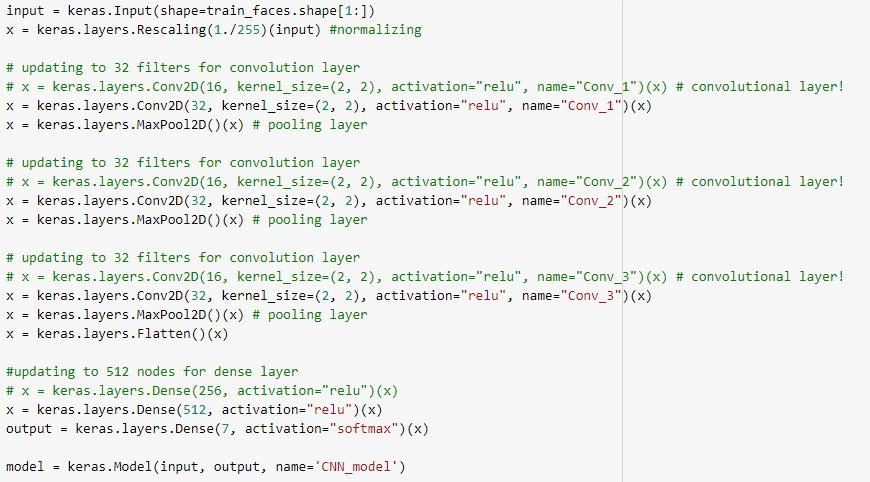
Tim Miller

15.S04.SP22

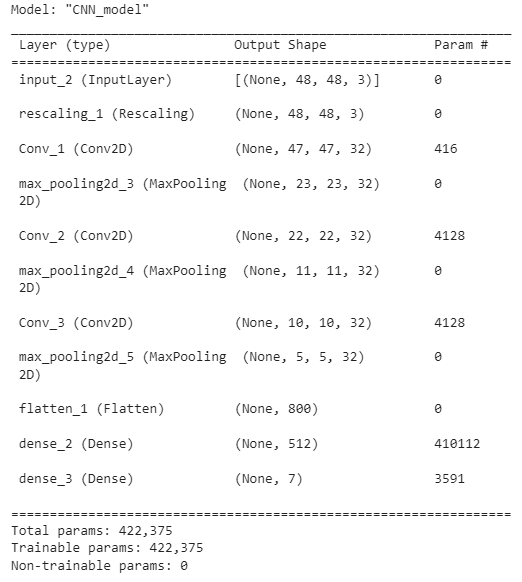
Homework #1

**PROBLEM 1A**

Updating to 32 filters for convolution layers and 512 nodes:

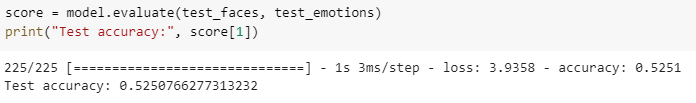


After these updates, we get **422,375 parameters**.

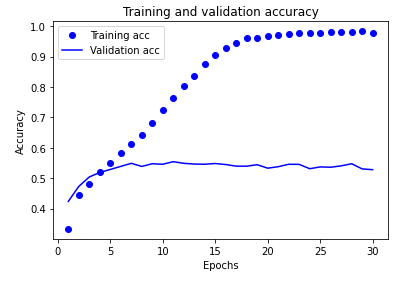


**PROBLEM 1B**

We find a model accuracy of ~52.51%



**PROBLEM 1C**



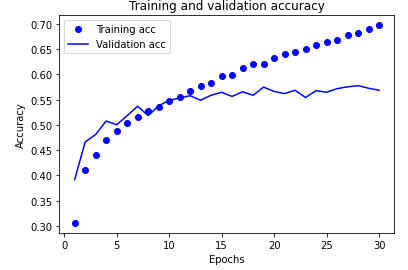
We can see the training accuracy approaches 100% as the number of epochs increases. However, validation accuracy reaches an asymptote of ~55%. Likely the model is overfitting on noise in the training set, which is why the accuracy is not replicated in the validation set.

**PROBLEM 2A**

Deep learning models require a lot of data to be trained. Data augmentation is useful because it helps us create a larger data set to train our models without necessarily having to go out and find additional images of faces (or whatever we are training our models). In this case we flipped the image and zoomed in / out providing additional data for training. But we did it with the data we already had.

**PROBLEM 2B**

Below is a graph for accuracy vs. epochs for the CNN augmented model.



**PROBLEM 2C**

Compared to problem 1C, we see two things

* The training accuracy in 2B does not increase in accuracy as rapidly as 1C
* The difference between the training and validation accuracy lines is small

The likely explanation for this that data augmentation helps reduce overfitting. As we said in 1C, the reason the training accuracy approaches 100% is because the model is likely overfitting. That is why it does not perform as well on the validation set. But in 2B, overfitting is reduced, so the model does not increase in accuracy as rapidly. Then accordingly the accuracy for the training and validation models is closer.

**PROBLEM 3A**