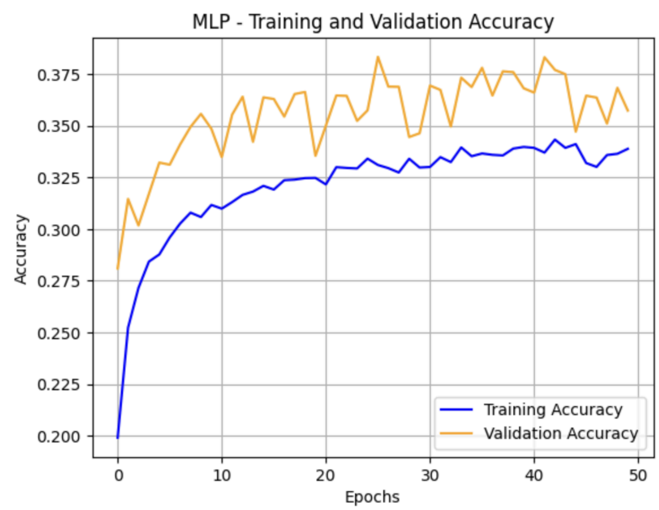
Sarah Groark
Generative Artificial Intelligence
Assignment 2 Report

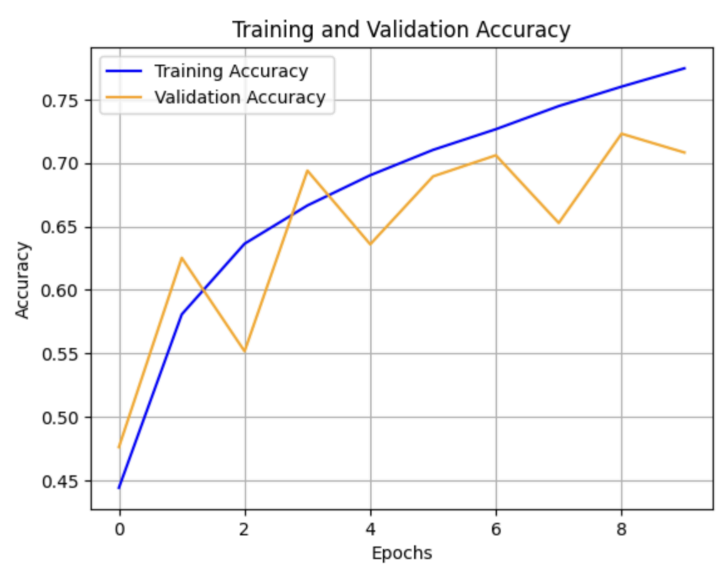
<u>Discussion Points</u>

1. Performance Comparison

The accuracy plot for the Multilayer Perceptron model (MLP), as seen to the right, displays the training accuracy converging to about 33% over the course of 50 epochs. The validation accuracy fluctuates substantially more, but also reaches an accuracy of around 36% in the same time frame.



The trained Convolutional Neural Network (CNN) displays accuracy calculations just over 75% in only 10 epochs, half that of what the MLP was trained in. The validation accuracy falls slightly under that, at around 71% (which could be a possible indication of overfitting, seeing that the training accuracy converges higher than the validation accuracy).



2. Model Complexity

CNNs are better suited for projects requiring image classification for a few reasons, with the largest being the convolution capabilities of the model. Given that a CNN utilizes kernels to step through each image at a given rate, this allows the model to recognize and learn the features of the image. The convolutional filters move across the dimensions of the image, in all channels, to extract features like edges, textures, and shapes. In comparison, a MLP flattens the image into a 1D vector, which prevents it from considering the spatial structure, something that is crucial to learning image features. Overall, a CNN is better equipped for image classification due to its ability to effectively manage spatial dependencies, allowing it to be more accurate than an MLP.

3. Training Time

Generally, a Convolutional Neural Network requires more time to train. This is due to the complexity of the model, which includes convolutional layers and more parameters. A MLP model takes less time to train, as it has a simpler structure and does not perform convolutional operations. Therefore, the MLP model does not require as many computational resources and utilizes less memory.

For example, when training the MLP on CPU (because of usage limits), it took 15 minutes to execute. Opposingly, the CNN required nearly 25 minutes to train over the course of only 10 epochs.

4. Overfitting and Regularization

Signs of overfitting found in a model can be analyzed through the comparison of the training accuracy and the validation accuracy. Ideally, the validation and training accuracies lay relatively close to each other. However, when they have a large gap between them – specifically when training accuracy is greater than validation accuracy – the model may be overfitted. Additionally, overfitting is possible when the validation accuracy begins to plateau or decline and the training accuracy continues to increase.

In efforts to reduce overfitting, regularization techniques can be used on the model. For example, adding dropout layers forces the model to learn more robustly and not rely on one neuron or pathway in the training set. Dropout layers specify a dropout rate, which indicates the percentage of outputs that will be set to zero in that training iteration. Dropout layers result in better generalization of the model, which increases its ability to classify unseen data.