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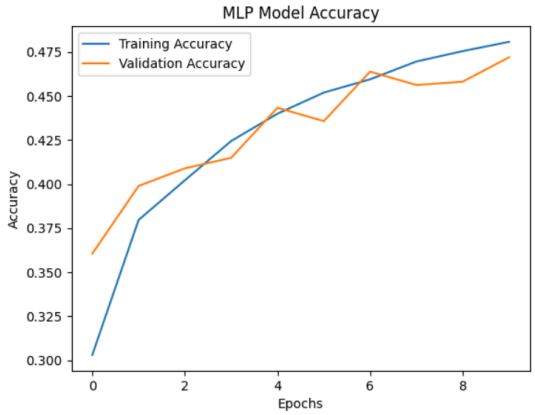
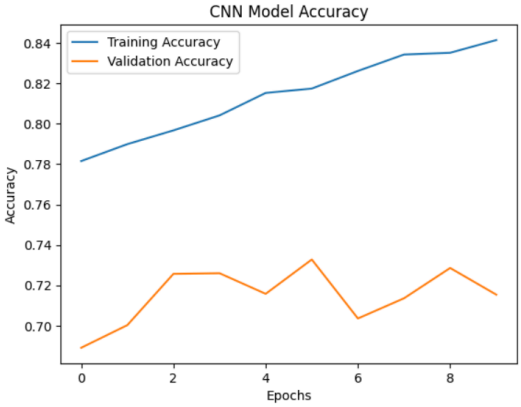
GenAI Assignment 2
9/26/2024



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accuracy: 0.4742 - loss: 1.4807
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loss: 0.8460 - accuracy: 0.7122
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1. Performance Comparison: Discuss the test accuracy and loss of both models.

For the MLP model, when evaluated with images the model has not seen before, the accuracy was 48% which is a good accuracy for how simple the model is. However, it is a low accuracy compared to the CNN model whose accuracy was 71%. The loss was also lower with the CNN model. Additionally, the MLP model starts the first epoch with 30% accuracy compared to the CNN which starts with 77% accuracy without the additional cycles. A major factor that results in the low accuracy of the MLP model is its lack of ability to extract high-level features.

2. Model Complexity: Explain why CNNs are generally better suited for image classification tasks compared to MLPs, focusing on the spatial hierarchies learned by CNNs.

The CNN model has a similar structure to an MLP model because of its use of dense layers and backpropagation. However, a CNN is more accurate for image classification because it includes a collection of filters that can extract high-level features from the data. This is done by using kernels to define the features and using strides to determine resolution. Strides are used to compress the image while increasing channels, making the model better suited for image classification. Additionally, a CNN can consider the distance between local and global features and has the added benefit of translation invariance. The MLP model in comparison uses flat pixels that cannot find edges and cannot assess spatial invariance making accuracy low.

3. Training Time: Compare the training time and resource usage of both models.

The training time for the MLP model on average was around 16 seconds for each epoch. The CNN model was double this with an average of 33 seconds for each epoch. The CNN's model requires more training time and power to compute. This is because of the convolutional and pooling layers that the CNN model has in addition to its fully connected and flatten layers. Also, due to CNN's use of feature maps, the convolution computed by multiplying the filter multiple times with sections of the image adds to training time.

4. Overfitting and Regularization: Discuss any signs of overfitting and how regularization techniques like dropout help mitigate it.

Regularization techniques can help with overfitting as it penalizes the model if it starts to overfit such as dropout layers and validation split. Both of these techniques help avoid an overreliance on the data. Although the CNN had the addition of dropout layers and validation split, the model was overfitting the data. The validation data accuracy was lower and not aligned with the training accuracy during any of the epochs. This could be due to model complexity or the chosen values for regularization techniques. For the MLP model, the training and validation accuracy were aligned, however, because the accuracy was under 50% this model was affected by underfitting. It was not able to accurately classify the data which could be due to the model being too simple.