ECE 421

Programming Assignment 3 Answers

Abhi Sharma: 1006700438
Rayyan Khan: 1006963742

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Experiment 1

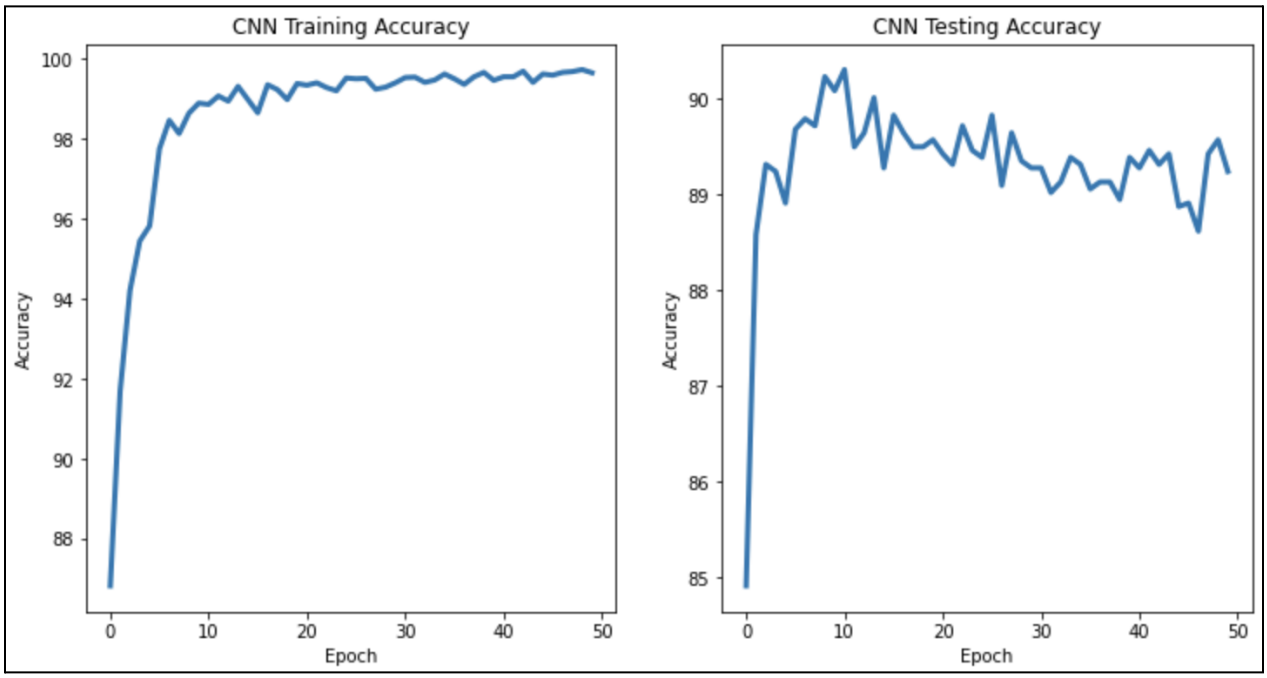


*Figure 1. Training and Testing accuracy for CNN model (no regularization or dropout rate)*

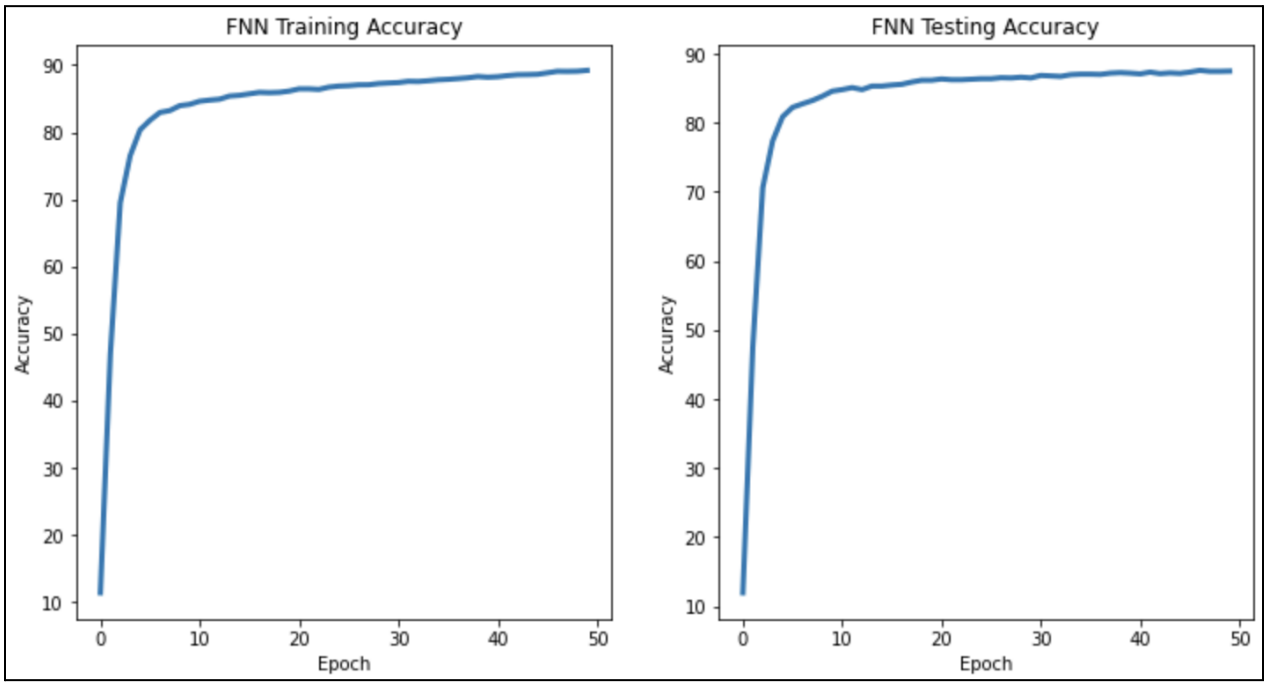


*Figure 2. Training and Testing accuracy for FNN model (no regularization or dropout rate)*

Comparing Figures 1 and 2 it can be deduced that for the training accuracy CNN performs better than FNN as at 50 epochs the CNN model graph is around 99% accurate while the FNN model is only 89%

accurate. In terms of the testing accuracy, both the CNN and FNN models resulted in a similar accuracy of 89.3% at 50 epochs. The only difference was that the CNN model was more unstable.

Experiment 2

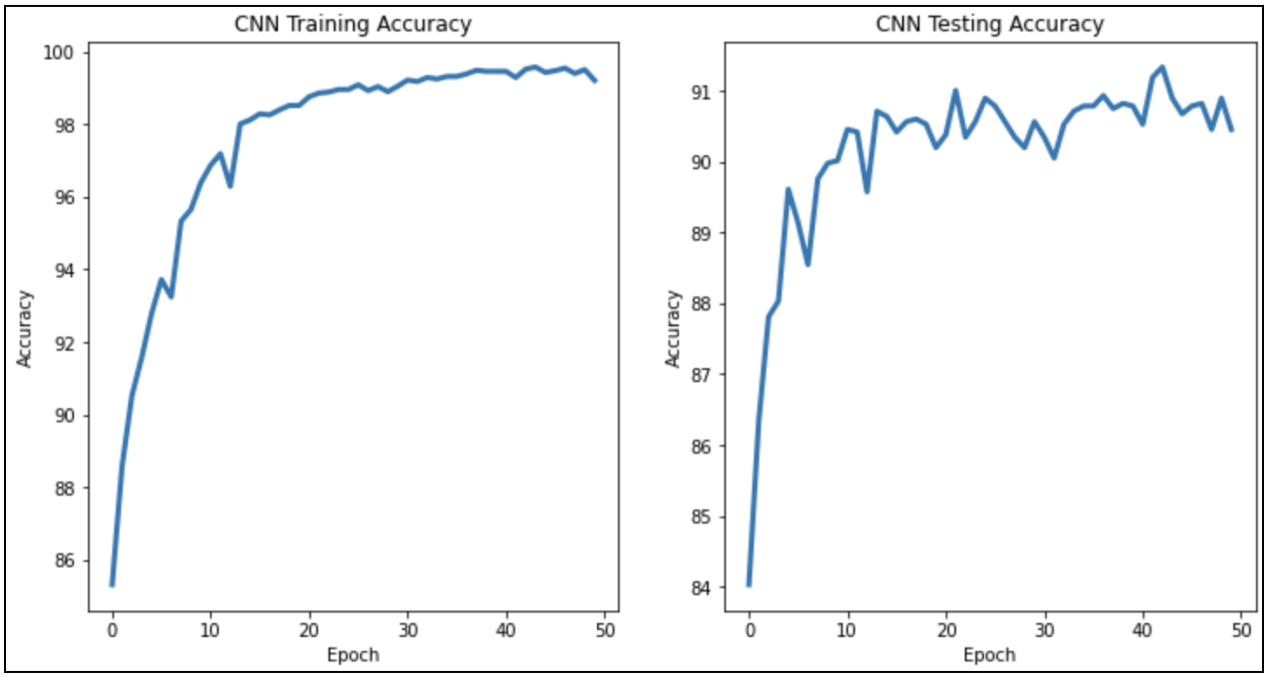


*Figure 3. Training and Testing accuracy for CNN model (dropout rate=0.5)*

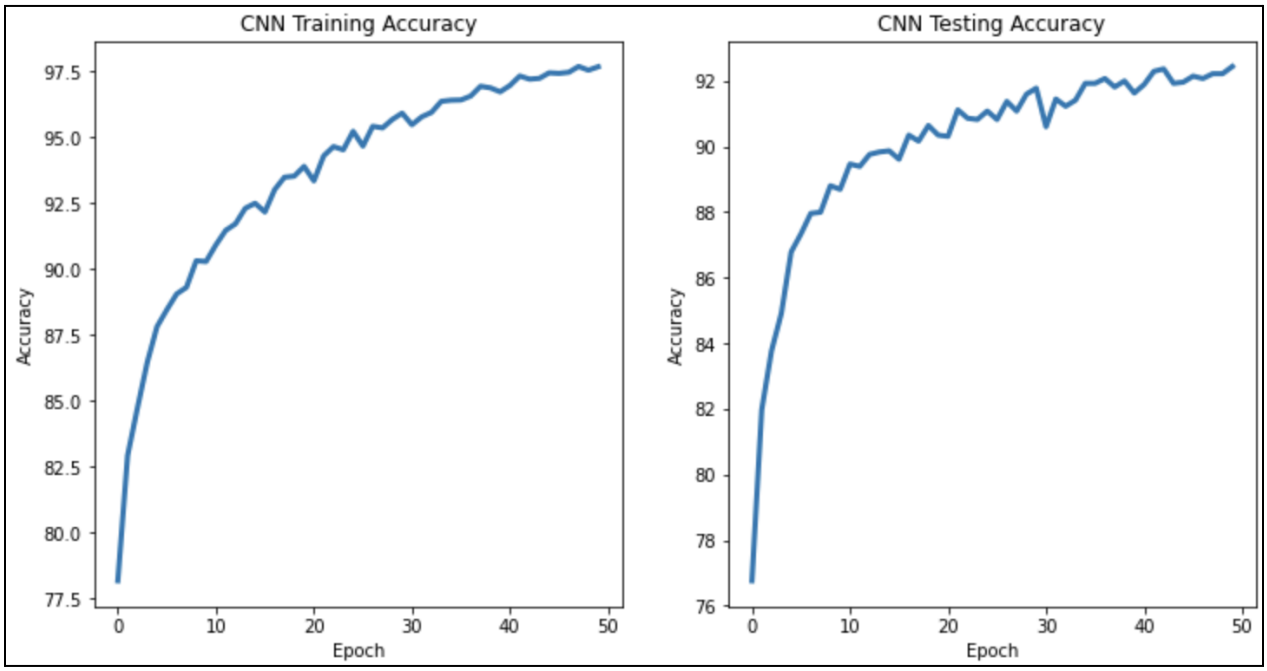


*Figure 4. Training and Testing accuracy for CNN model (dropout rate=0.8)*

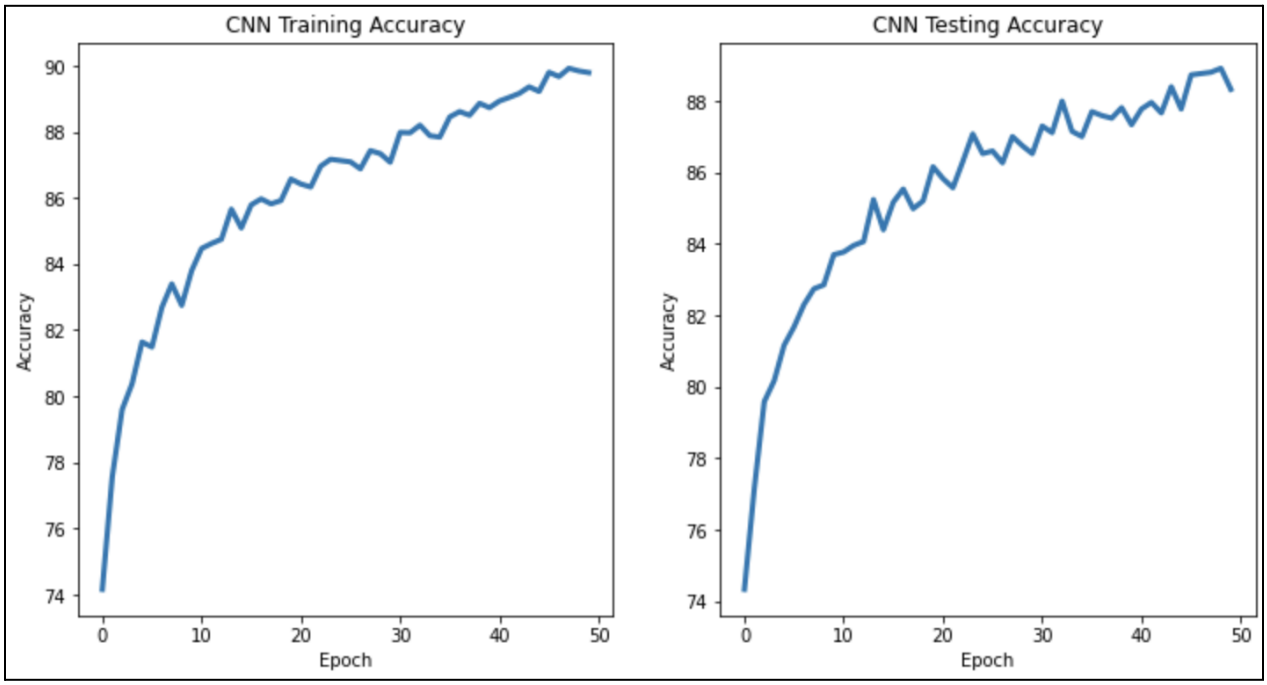


*Figure 5. Training and Testing accuracy for CNN model (dropout rate=0.95)*

A notable trend can be seen for the graphs of the training accuracy. It can be seen that as the dropout rate increases the training accuracy decreases. This can be seen by comparing the accuracies at 50 epochs: 99% (0.5 dropout rate), 97.5% (0.8 dropout rate) and 90% (0.95 dropout rate). A similar observation can be seen for the testing accuracy, however, there is an anomaly when the dropout rate is 0.8. A result testing accuracy of 92% is produced at 50 epochs which is greater than the testing accuracy at a 0.5 dropout rate (90%). As a final observation, as the dropout rate increases so does the instability (noise) of both the training and testing accuracies.

Experiment 3

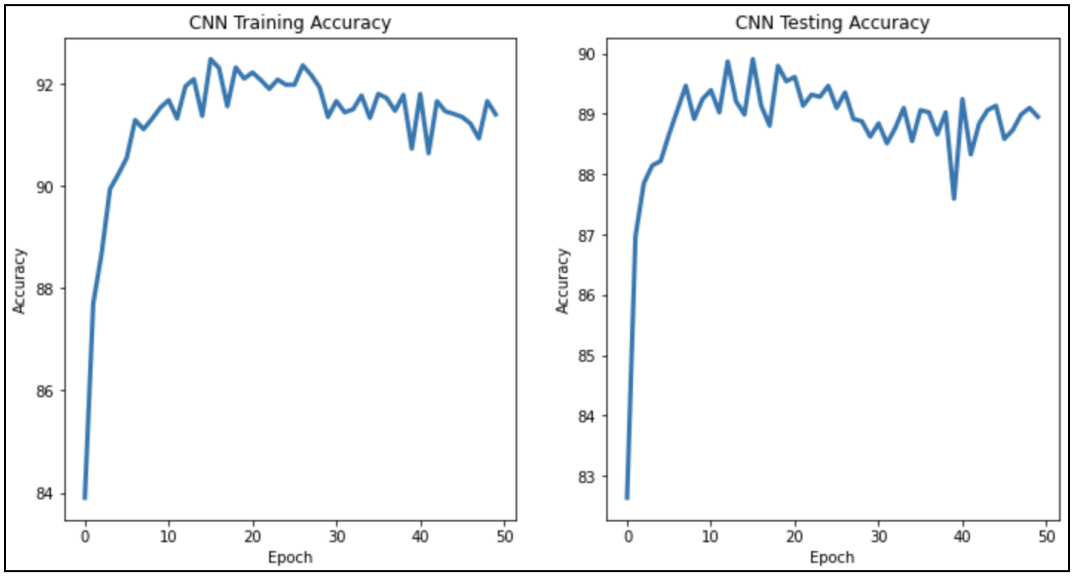


*Figure 6. Training and Testing accuracy for CNN model (regularization = 0.1)*

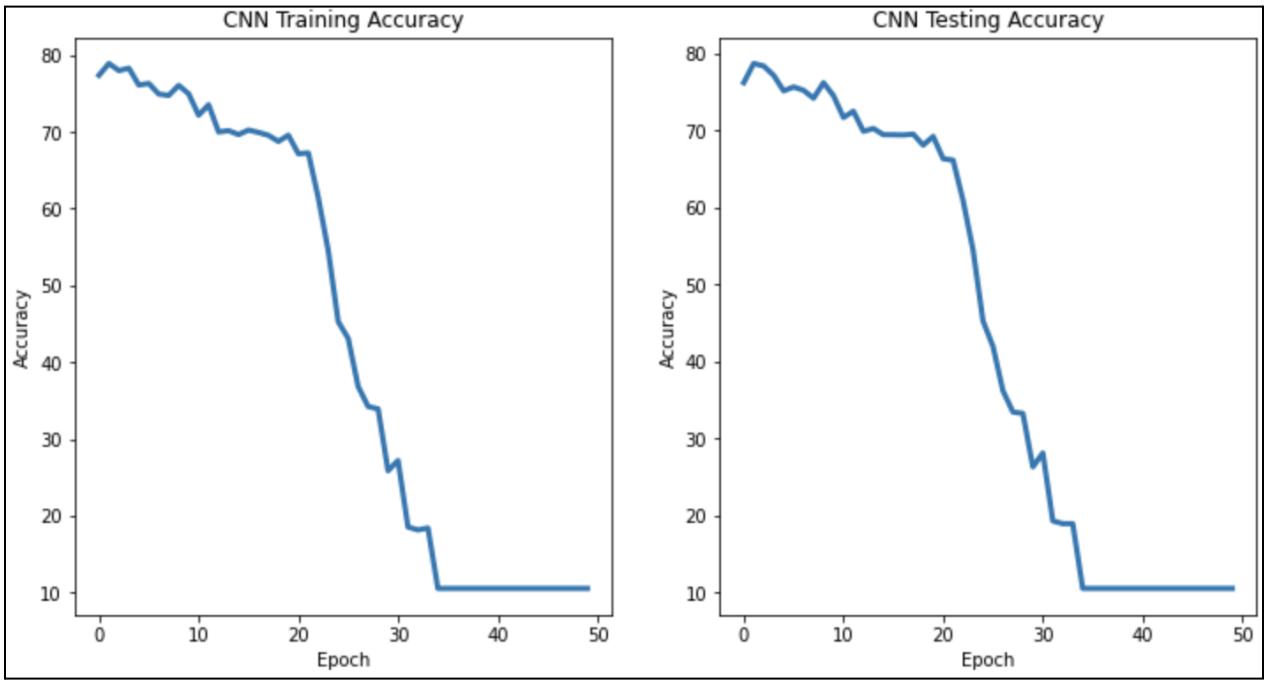


*Figure 7. Training and Testing accuracy for CNN model (regularization = 1)*

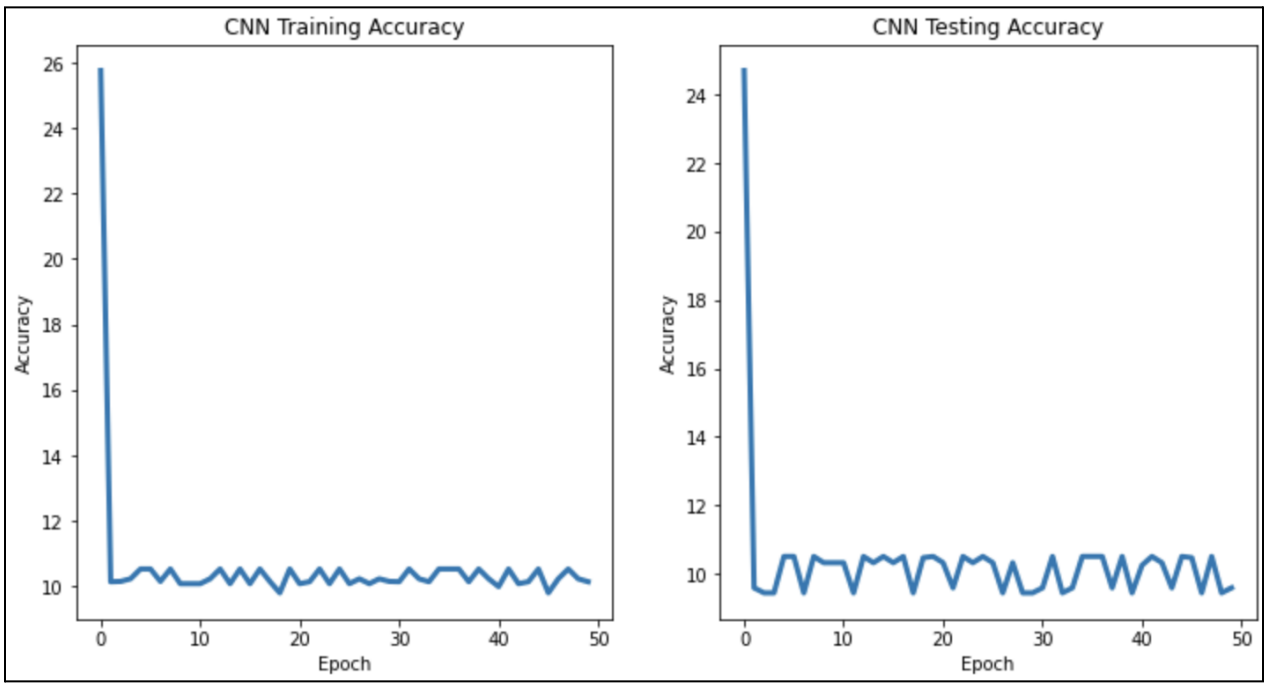


*Figure 8. Training and Testing accuracy for CNN model (regularization = 10)*

A contrast from the first two experiments is seen in this case in regards to weight decay. It's clear that as the weight decay was increased, both the training and testing accuracies drastically fell. The purpose of weight decay is to prevent overfitting but if it's too large it can have a negative effect as shown wherein

the model doesn’t learn anything and produces accuracies of 10% in this case (1 and 10 weight decay). Thus, the weight decay mustn’t be too small as the regularization effect would be too weak and shouldn’t be too large. The optimal value depends on the problem and should be chosen through iterating through various values.