

## ECE 421 Programming Assignment Question

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### Part 3 Questions:

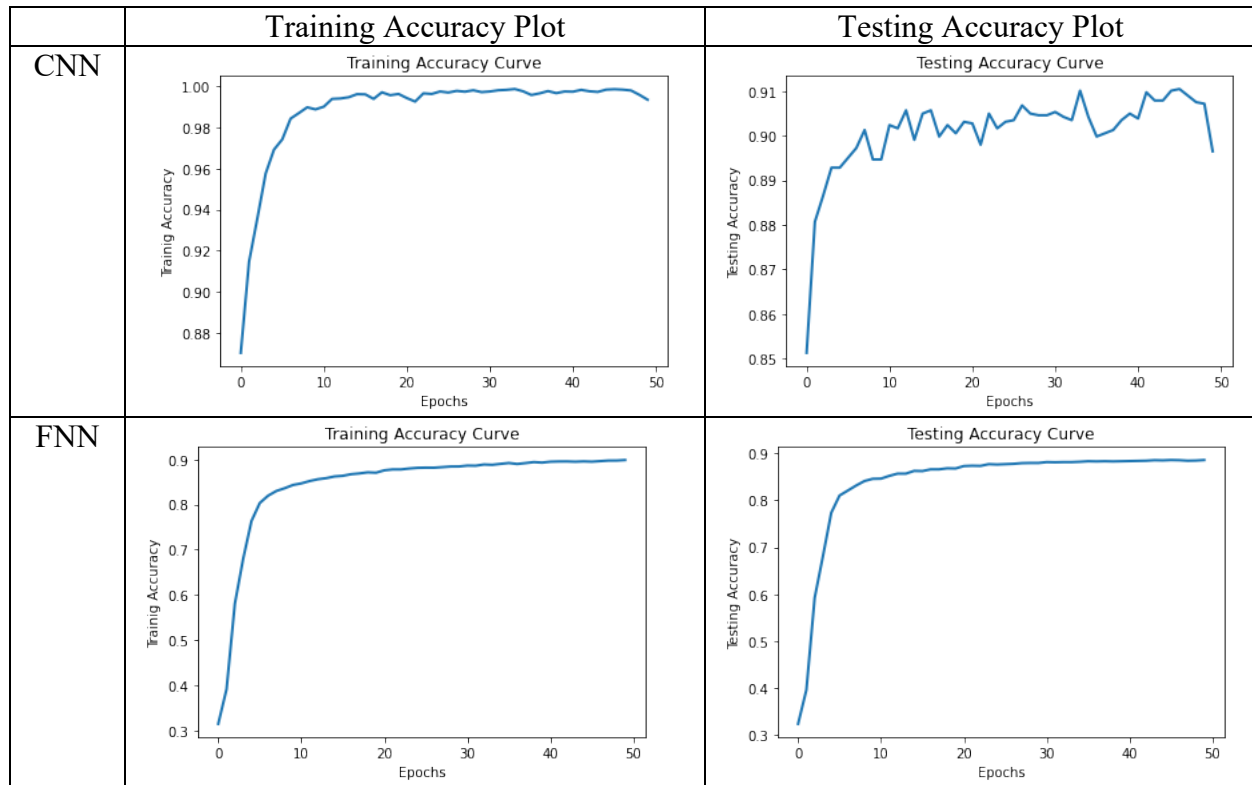
#### Experiment 1 Code

```
# Experiment 1
def compare_arch():
    # Train Model
    model_experiment_1_CNN, acc_hist_experiment_1_CNN = experiment(model_type = 'CNN',
learning_rate = 0.0001, dropout_rate = 0.0, weight_decay = 0.0, num_epochs = 50,
verbose = False)
    model_experiment_1_FNN, acc_hist_experiment_1_FNN = experiment(model_type = 'FNN',
learning_rate = 0.0001, dropout_rate = 0.0, weight_decay = 0.0, num_epochs = 50,
verbose = False)

    # Plot Result
    plot(acc_hist_experiment_1_CNN)
    plot(acc_hist_experiment_1_FNN)

    # Return Result
    return model_experiment_1_CNN, acc_hist_experiment_1_CNN, model_experiment_1_FNN,
acc_hist_experiment_1_FNN
```

## Experiment 1 Model Result



## Experiment 1 Conclusion

From the generate accuracy plots, we can observe that both training and testing accuracy plot for FNN were smoother than CNN. The training and testing accuracy for CNN model fluctuated a lot.

## Experiment 2 Code

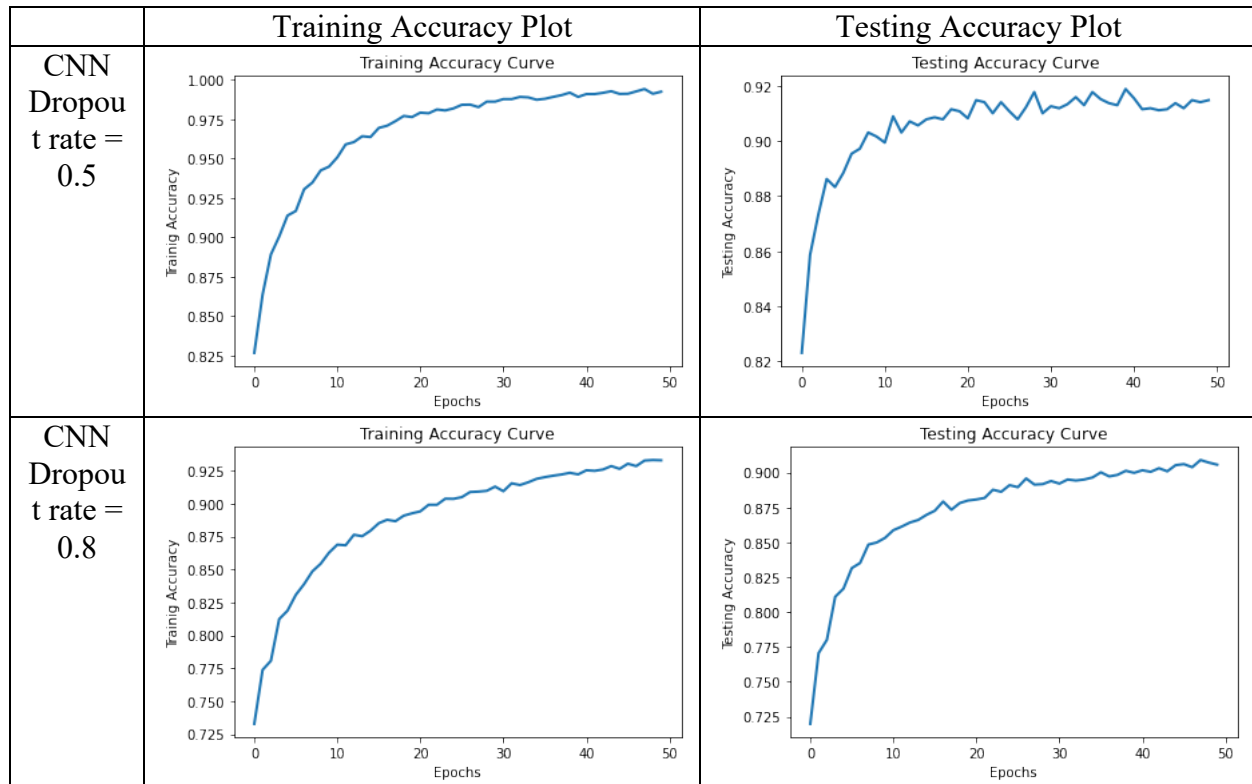
```
# Experiment 2
def compare_dropout():
    # Variable Declaration
    dropout_list = [0.5, 0.8, 0.95]
    model_list = []
    acc_hist_list = []

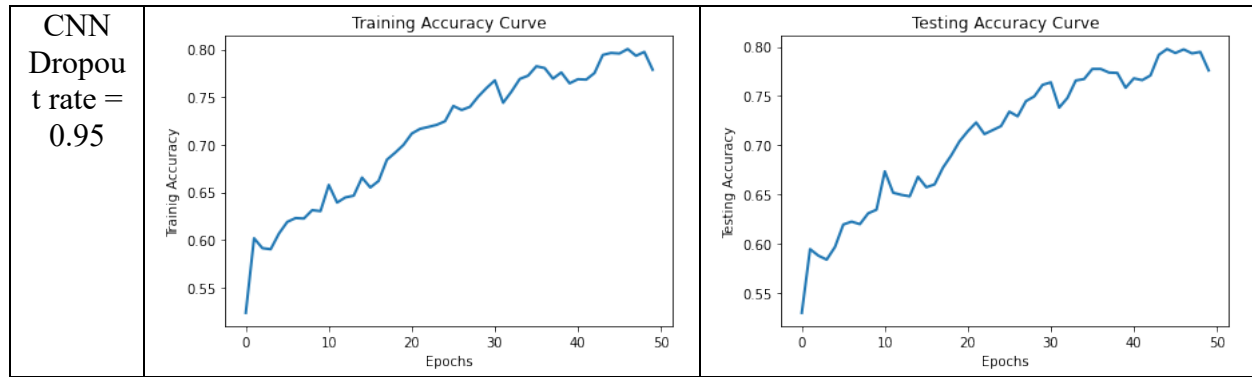
    # Train Model
    for dropout_rates in dropout_list:
        model, acc_hist = experiment(model_type = 'CNN', learning_rate = 0.0001,
        dropout_rate = dropout_rates, weight_decay = 0.0, num_epochs = 50, verbose = False)
        model_list.append(model)
        acc_hist_list.append(acc_hist)

    # Plot Result
    for acc_hist in acc_hist_list:
        plot(acc_hist)

    # Return Result
    return model_list, acc_hist_list
```

## Experiment 2 Model Result





### Experiment 2 Conclusion

CNN with dropout rate of 0.5 and 0.8 performed both resulted in smooth training and testing accuracy plot, while CNN with dropout rate of 0.95 resulted in fluctuating training and testing accuracy plot.

CNN with dropout rate of 0.5 had a slightly higher training and testing accuracy rate than CNN with dropout rate of 0.8.

Thus, we conclude that CNN with dropout rate of 0.5 is the best model and the higher the dropout rate, the more fluctuation in accuracy and lower final accuracy.

## Experiment 3 Code

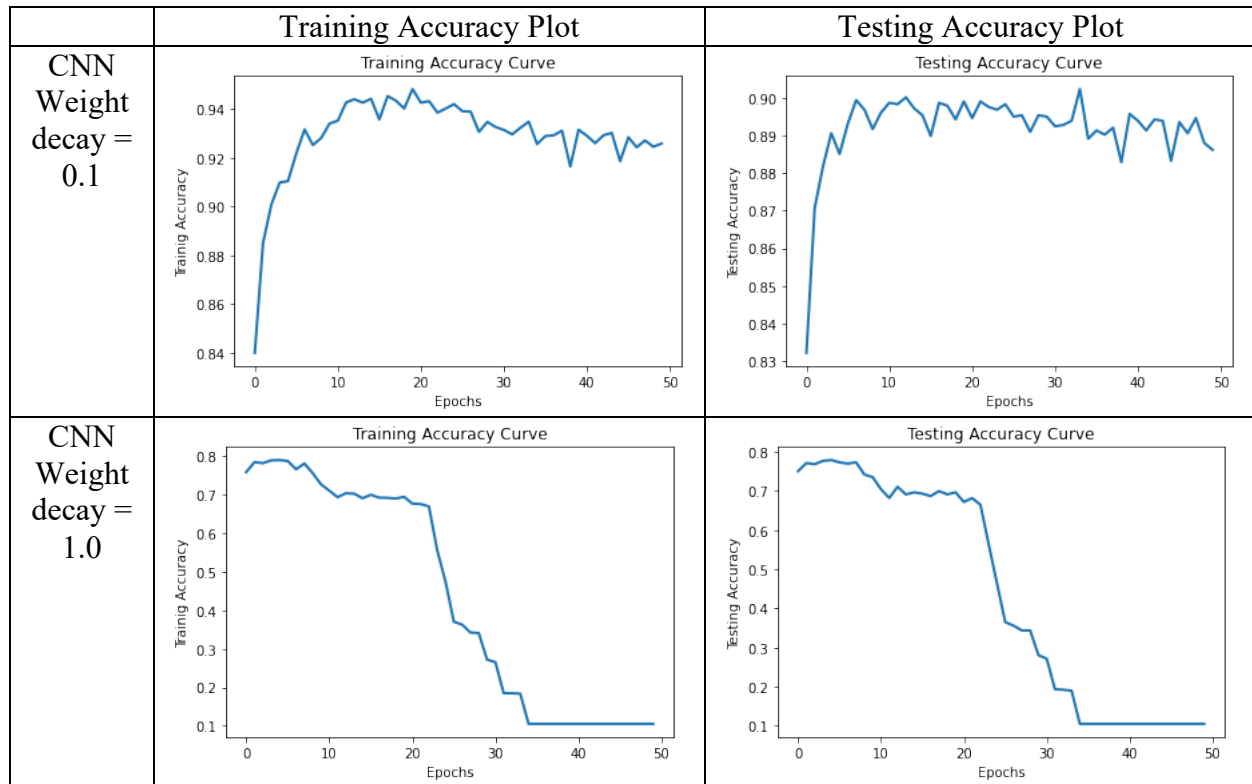
```
# Experiment 3
def compare_l2():
    # Variable Declaration
    weight_decay_list = [0.1, 1.0, 10.0]
    model_list = []
    acc_hist_list = []

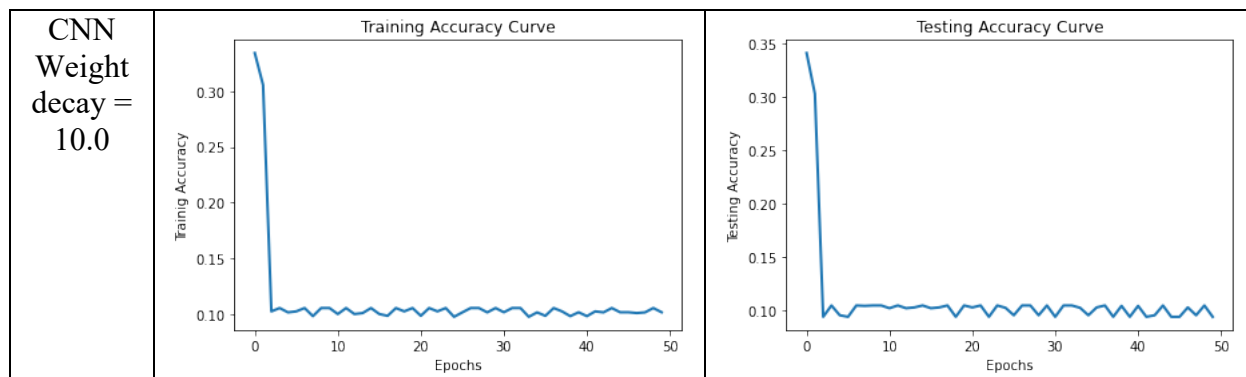
    # Train Model
    for weight_decays in weight_decay_list:
        model, acc_hist = experiment(model_type = 'CNN', learning_rate = 0.0001,
        dropout_rate = 0.0, weight_decay = weight_decays, num_epochs = 50, verbose = False)
        model_list.append(model)
        acc_hist_list.append(acc_hist)

    # Plot Result
    for acc_hist in acc_hist_list:
        plot(acc_hist)

    # Return Result
    return model_list, acc_hist_list
```

## Experiment 3 Model Result





### Experiment 3 Conclusion

CNN with weight decay of 0.1 performed both resulted in smooth training and testing accuracy plot, while CNN with weight decay of 1.0 and 10.0 resulted in much lower training and testing accuracy plot. The accuracy plummeted to 0.10 which is the same as random guesses.

Thus, we conclude that CNN with weight decay of 0.1 is the best model and the higher the weight decay, the accuracy will get worse.