# 2019 2019 Fall EE5183 FinTech - Homework 2

Deep learning Model: Deep Neural Network

**Note: All the result shown in this report came from the jupyter lab IDE and the code has been format to .py in pycharm IDE later.**

1. Using grid search with the values in the picture below:

```
parameters ={
            'epochs':[10,20,30],
            'units':[16, 32, 48, 64],
            'batch_size': [16, 32, 64],
            'learn_rate': [0.001, 0.003, 0.01],
            'hidden_layers': [1, 2, 3]}
gridSearch = GridSearchCV(estimator=classifier,
                          param_grid=parameters,
                          n_jobs=-1)
```

The hyperparameter I got from the grid search:

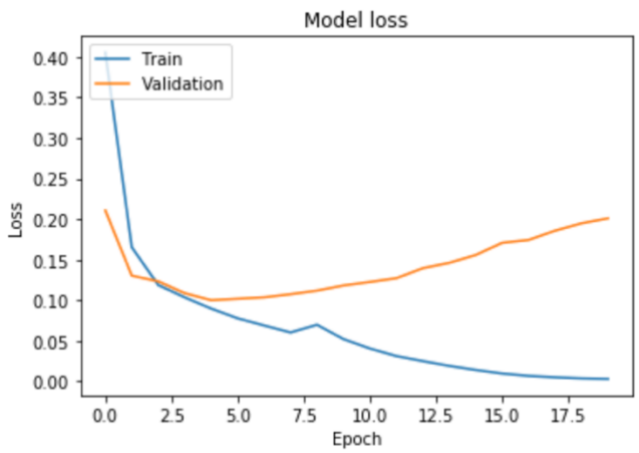
```
Best: 0.962857 using {'batch_size': 64, 'epochs': 20, 'hidden_layer
s': 2, 'learn_rate': 0.003, 'units': 64}
```

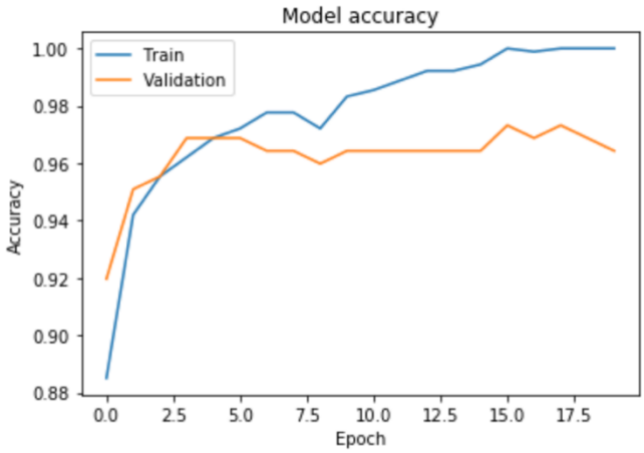
DNN training accuracy & training loss:

```
Trained Acc:  0.99285716
Trained Loss:  0.04204638173125984
```

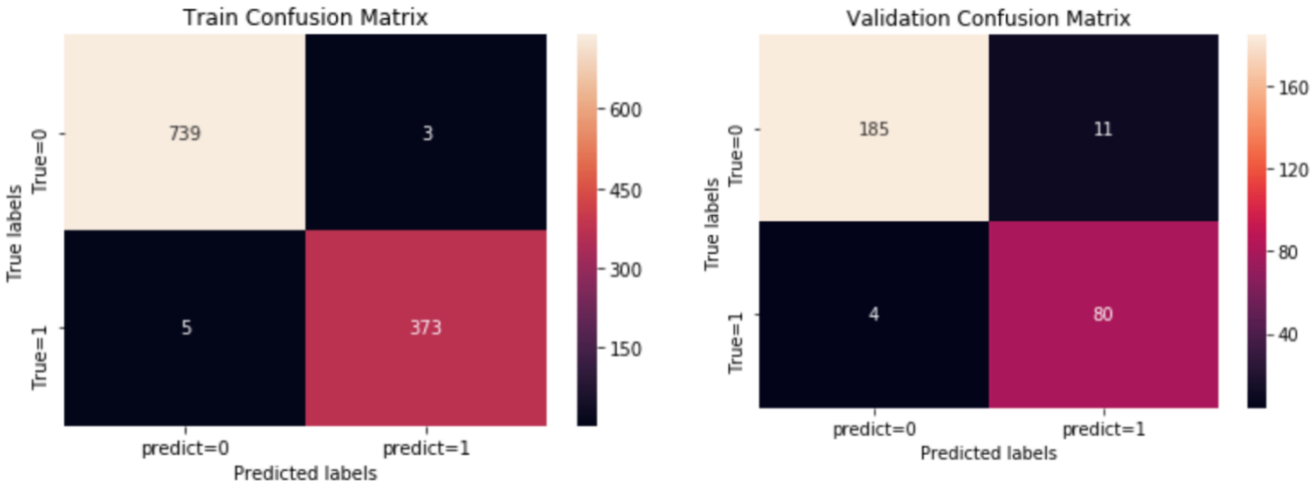
DNN testing accuracy & testing loss:

```
Tested Acc:  0.9464286
Tested Loss:  0.36126516674246106
```



2. Confusion matrices of DNN:




3. precision, recall, F1-score, average:

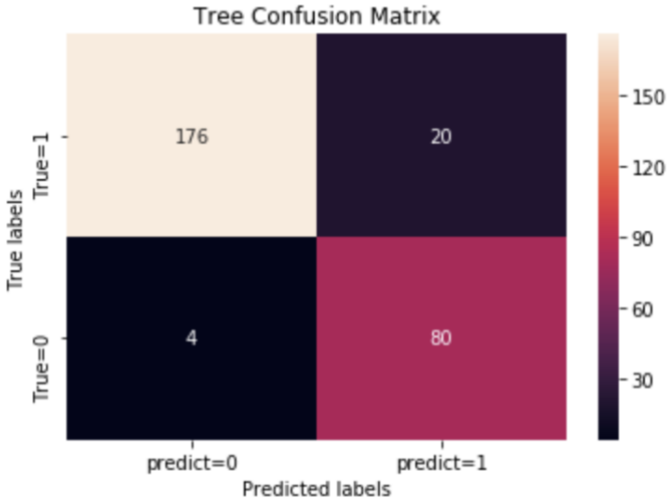
**Class 0**
Precision: 0.9788359788359788
Recall: 0.9438775510204082
F-score: 0.9610389610389609
**Class 1**
Precision: 0.8791208791208791
Recall: 0.9523809523809523
F-score: 0.9142857142857143
**Average**
Precision: 0.928978428978429
Recall: 0.9481292517006803
F-score: 0.9376623376623376

4. What is difference between decision tree and random forest

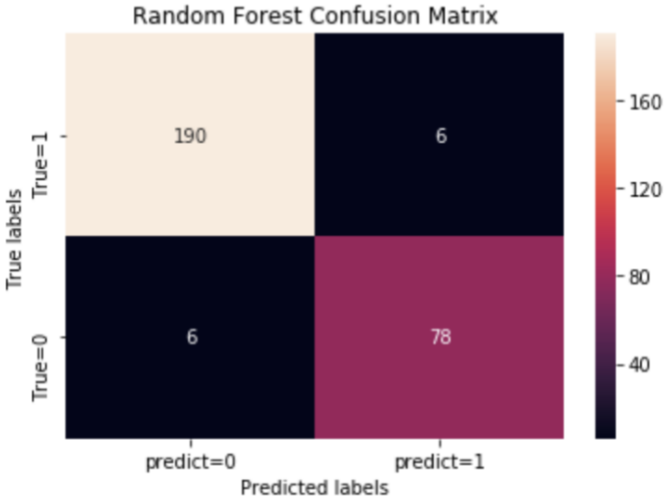
- Random forest builds multiple decision trees and merges them together to get a more accurate and stable prediction. It uses to solve the decision tree's habit of over-fitting to the training set

5. Decision Tree result & Random Forest result:

```
Accuracy: 0.9142857142857143
Precision: 0.9777777777777777
Recall: 0.8979591836734694
F1_score: 0.9361702127659575
```




```
Accuracy: 0.9571428571428572
Precision: 0.9693877551020408
Recall: 0.9693877551020408
F1_score: 0.9693877551020408
```




6. Plot ROC, PRC