

# Deep learning

## Assignment 5 Report

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**GitHub** link [https://github.com/Asif-Ejaz/MSDS19010\\_COVID19\\_DLSpring2020/](https://github.com/Asif-Ejaz/MSDS19010_COVID19_DLSpring2020/)

### Task-1

I have run 6 experiments for this task. I run both Vgg16 and Resnet18 for three different learning rates and constantly 10 number of epochs for each experiment.

#### Model 1- Vgg16

##### Parameters FC layers

```
(0): Linear(in_features=512, out_features=200, bias=True)
(1): ReLU(inplace=True)
(2): Dropout(p=0.5, inplace=False)
(3): Linear(in_features=200, out_features=2, bias=True)
```

**Epochs = 10**

##### Three different learning rates

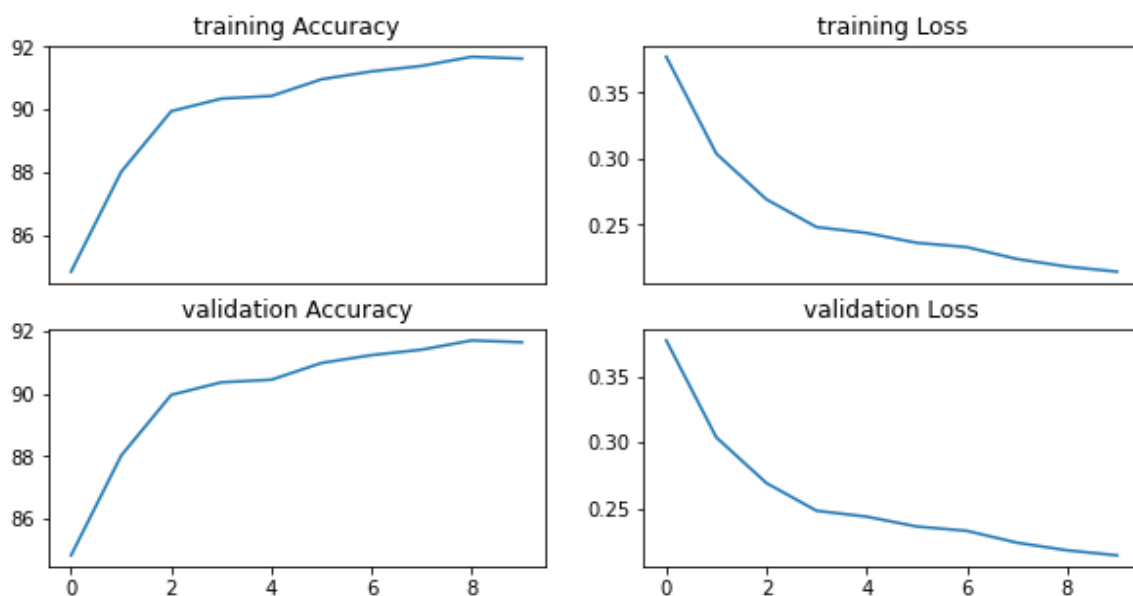
##### 1. 0.001 (best learning rate)

Epoch 10/10,train ==> Loss: 0.3439 , Acc: 91.67 %

Epoch 10/10,valid ==> Loss: 0.3350 , Acc: 91.80 %

Best Validation Accuracy: 91.933333 %

Testing accuracy : 97 %



## 2. 0.0001

Epoch 10/30,train ==> Loss: 0.3078 , Acc: 9.27 %

Epoch 10/30,valid ==> Loss: 0.3105 , Acc: 90.00 %

Best Validation Accuracy: 89.33333 %

Testing accuracy : 94 %



## 3. 0.00001

Epoch 10/10,train ==> Loss: 0.3236 , Acc: 86.72 %

Epoch 10/10,val ==> Loss: 0.2898 , Acc: 88.53 %

Best Validation Accuracy: 88.533333 %

Testing accuracy : 94 %



## Model 2- Resnet18

### Parameters FC layers

```
(0): Linear(in_features=512, out_features=200, bias=True)
(1): ReLU(inplace=True)
(2): Dropout(p=0.5, inplace=False)
(3): Linear(in_features=200, out_features=2, bias=True)
```

**Epochs = 10**

### Three different learning rates

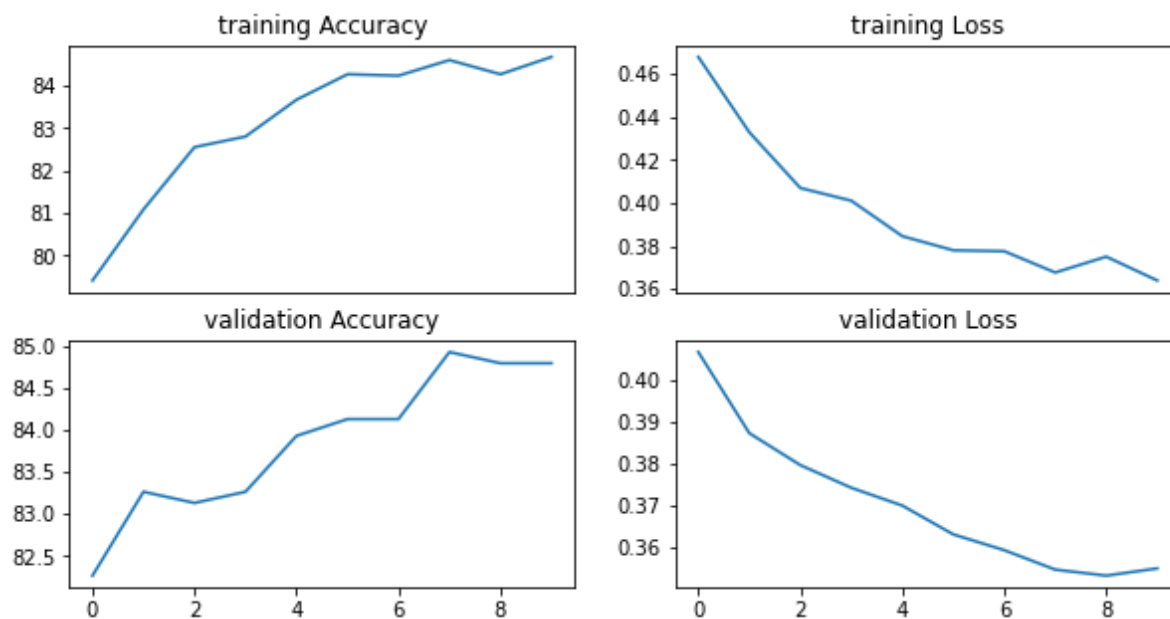
#### 1. 0.001 (best learning rate)

Epoch 10/10,train ==> Loss: 0.3639 , Acc: 84.67 %

Epoch 10/10,valid ==> Loss: 0.3550 , Acc: 84.80 %

Best Validation Accuracy: 84.933333 %

Testing accuracy : 92 %



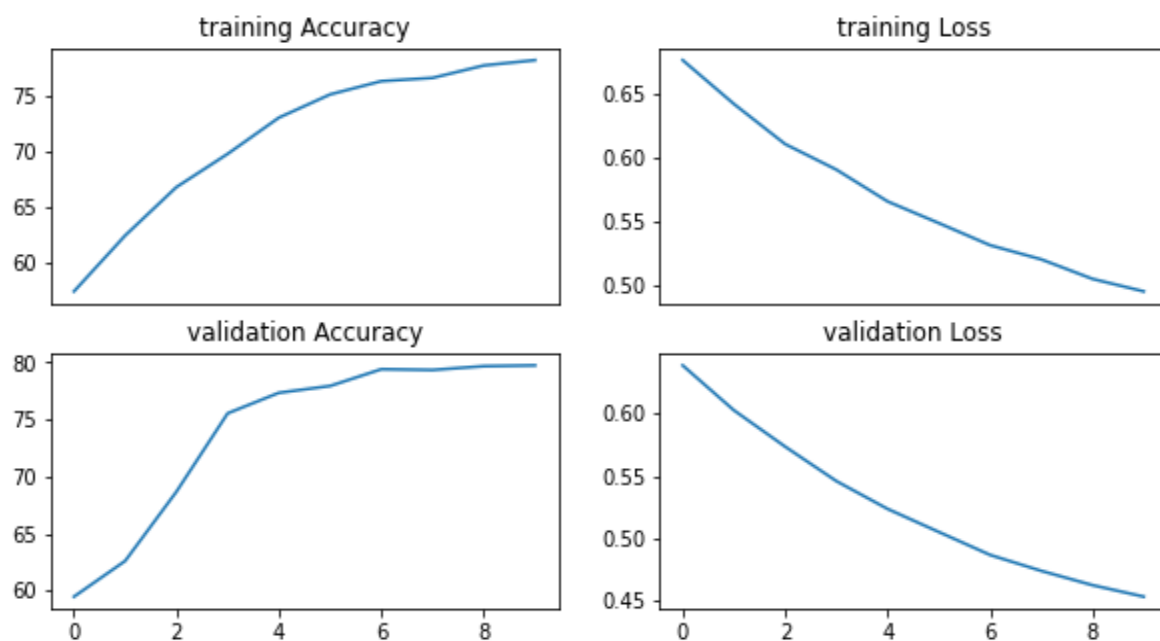
**2. 0.0001**

Epoch 10/10,train ==> Loss: 0.4944 , Acc: 78.21 %

Epoch 10/10,valid ==> Loss: 0.4535 , Acc: 79.73 %

Testing accuracy : 87 %

Best Validation Accuracy: 79.733333 %



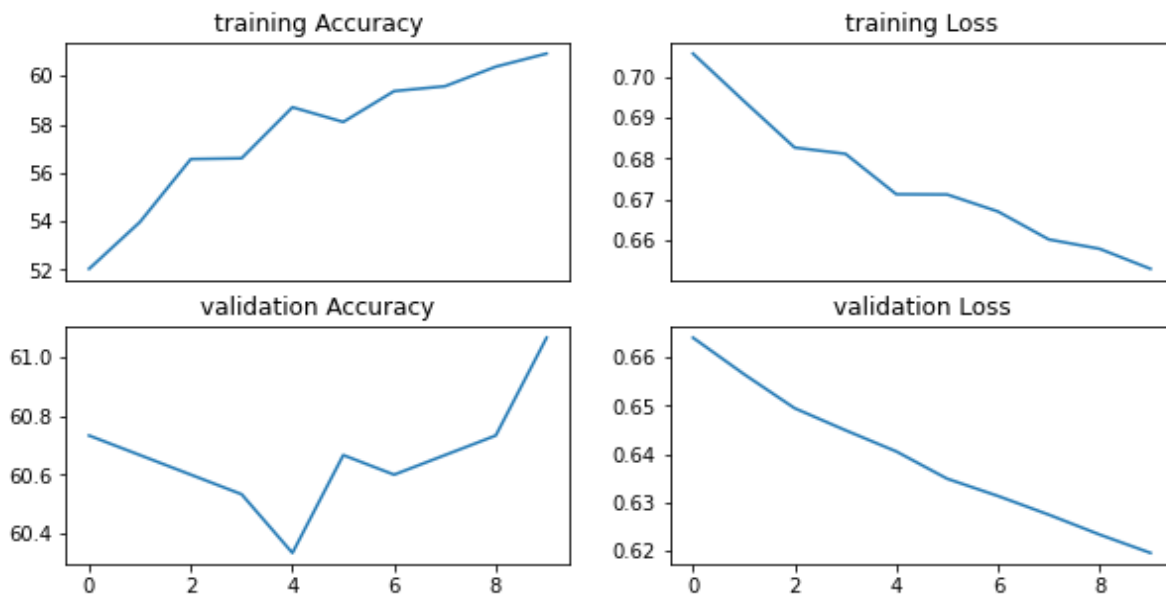
### 3. 0.00001

Epoch 10/10,train ==> Loss: 0.6529 , Acc: 60.92 %

Epoch 10/10,valid ==> Loss: 0.6196 , Acc: 61.07 %

Best Validation Accuracy: 61.066667 %

Testing accuracy : 61 %



## Task-2

### Model 1. Vgg16

In this task learning rate (0.0001) and epochs are constant while tune able parameters varies.

#### 1. Parameters last 1 CONV layers + FC layers

features.28.weight

features.28.bias

classifier.0.weight

classifier.0.bias

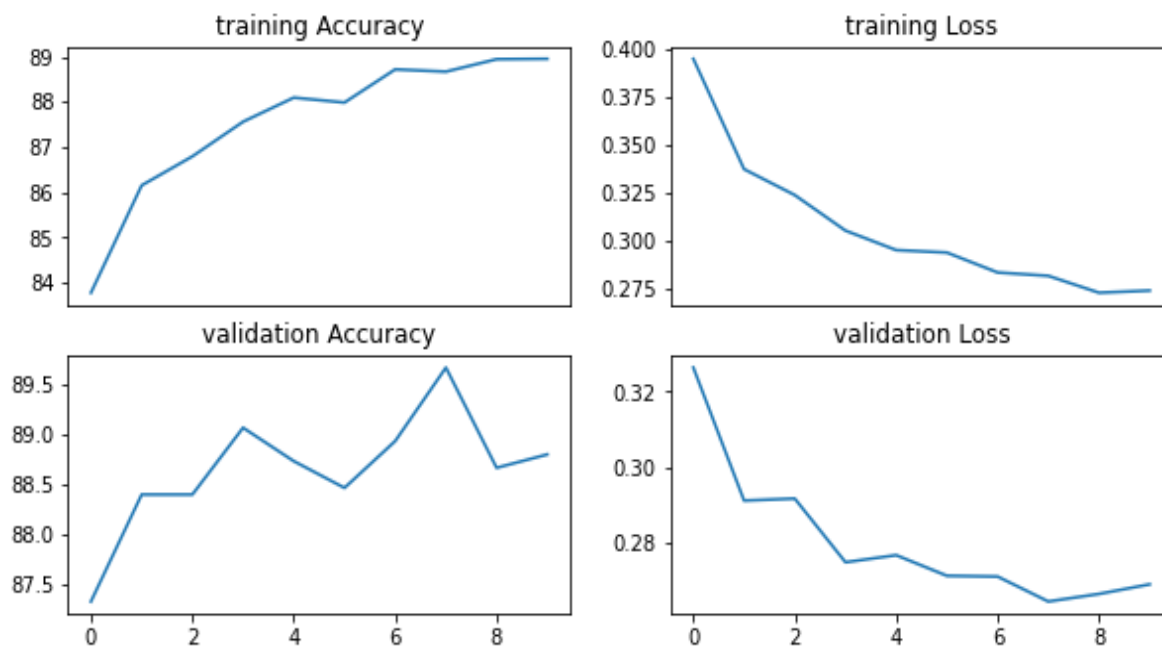
classifier.3.weight

classifier.3.bias

Epoch 10/10,train ==> Loss: 0.2741 , Acc: 88.95 %

Epoch 10/10,val ==> Loss: 0.2691 , Acc: 88.80 %

Best Validation Accuracy: 89.666667 %  
Testing accuracy : 95 %



## 2. Parameters last 3 CONV layers + FC layers

Epoch 10/10,train ==> Loss: 0.2093 , Acc: 90.97 %  
Epoch 10/10,valid ==> Loss: 0.2034 , Acc: 90.73 %

Best Validation Accuracy: 89.733333 %  
Testing accuracy : 96 %



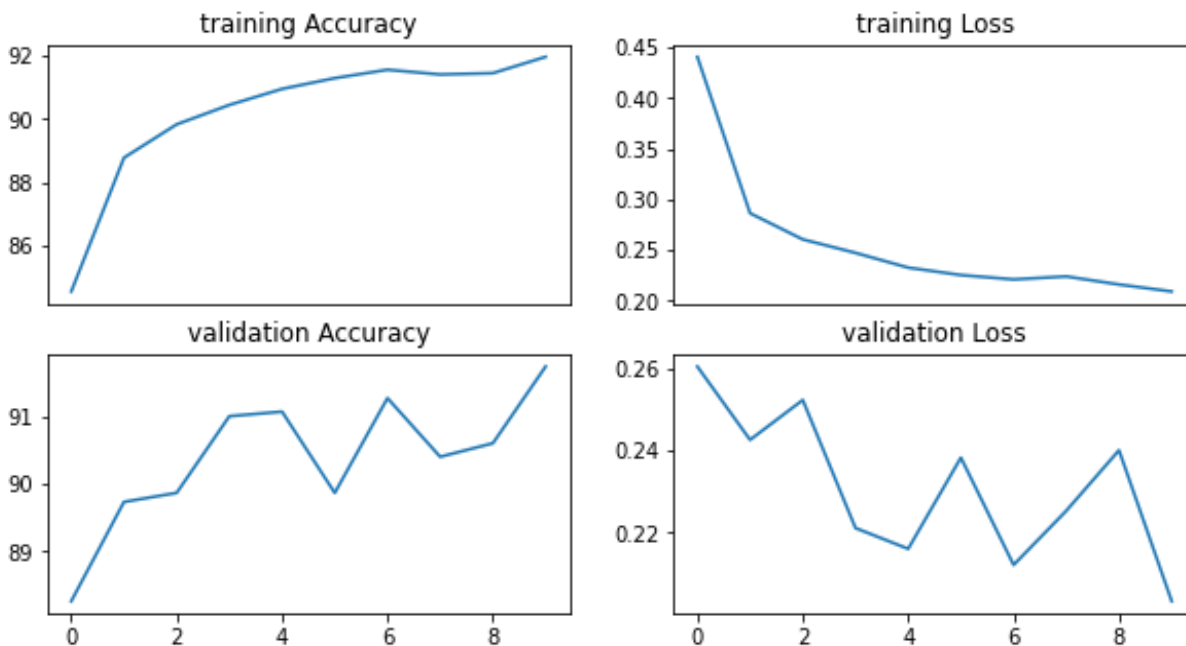
### 3 Parameters : All parameters

Epoch 10/10,train ==> Loss: 0.2093 , Acc: 91.97 %

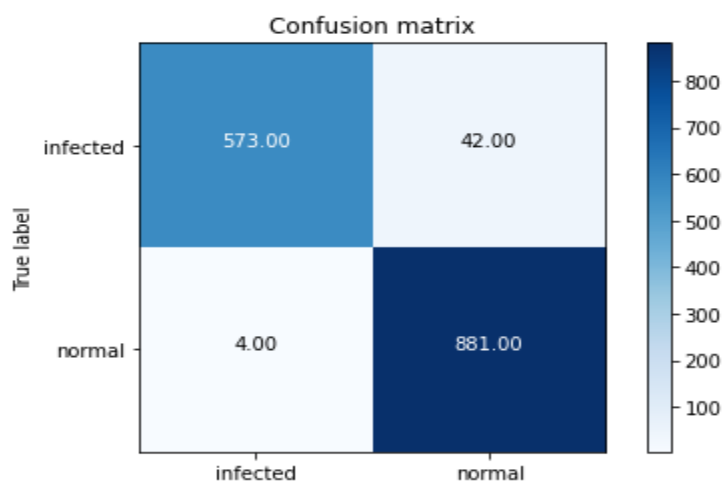
Epoch 10/10,valid ==> Loss: 0.2034 , Acc: 91.73 %

Best Validation Accuracy: 91.733333 %

Testing accuracy : 96 %



```
precision = 0.9544962079139224
Recall    = 0.995480225876217
F1 score  = 0.9745574720381786
```



## Model 2. Resnet18

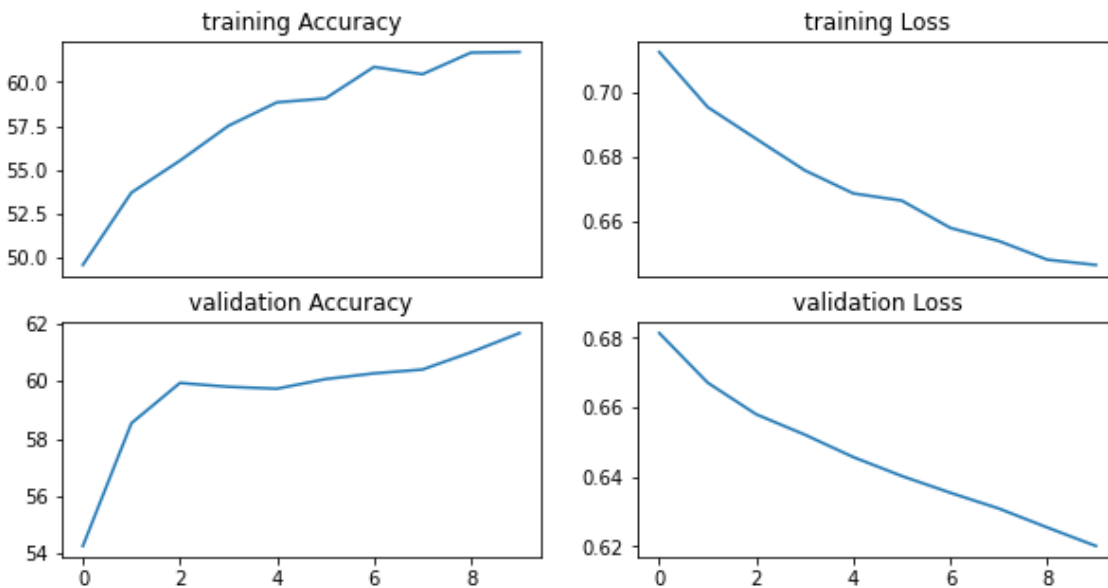
### 1. Parameters (Layer 4+ FC layers)

Epoch 10/10,train ==> Loss: 0.6462 , Acc: 61.72 %

Epoch 10/10,val ==> Loss: 0.6202 , Acc: 61.67 %

Best Validation Accuracy: 61.666667 %

Testing accuracy : 61 %



### 2. Parameters (Layer 3, 4+ FC layers)

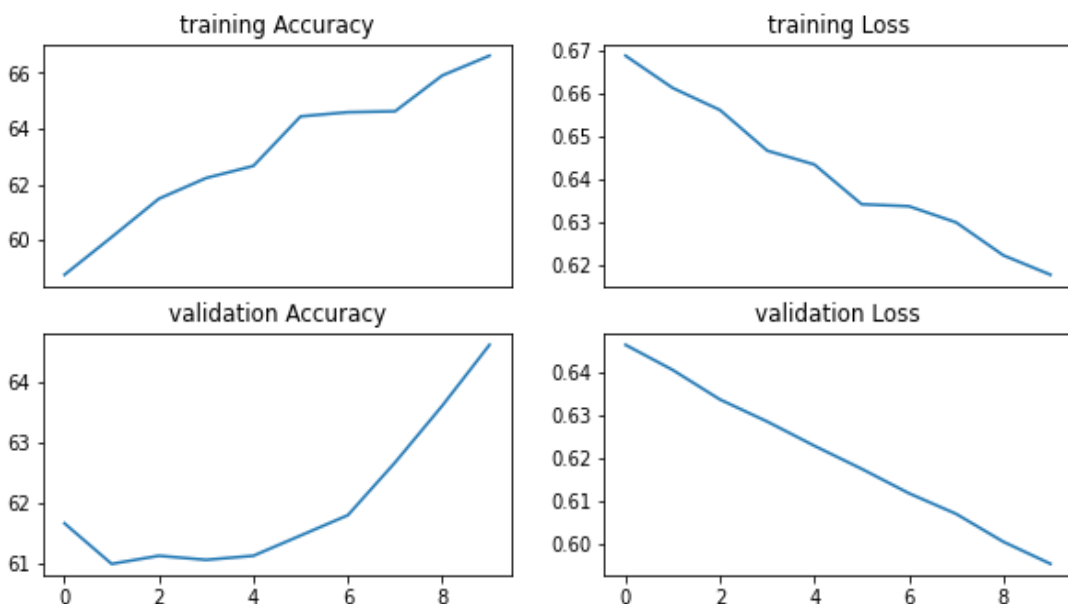
Epoch 10/10,train ==> Loss: 0.6179 , Acc: 66.61 %

Epoch 10/10,valid ==> Loss: 0.5955 , Acc: 64.60 %

Best Validation Accuracy: 64.600000 %

Testing accuracy : 67 %





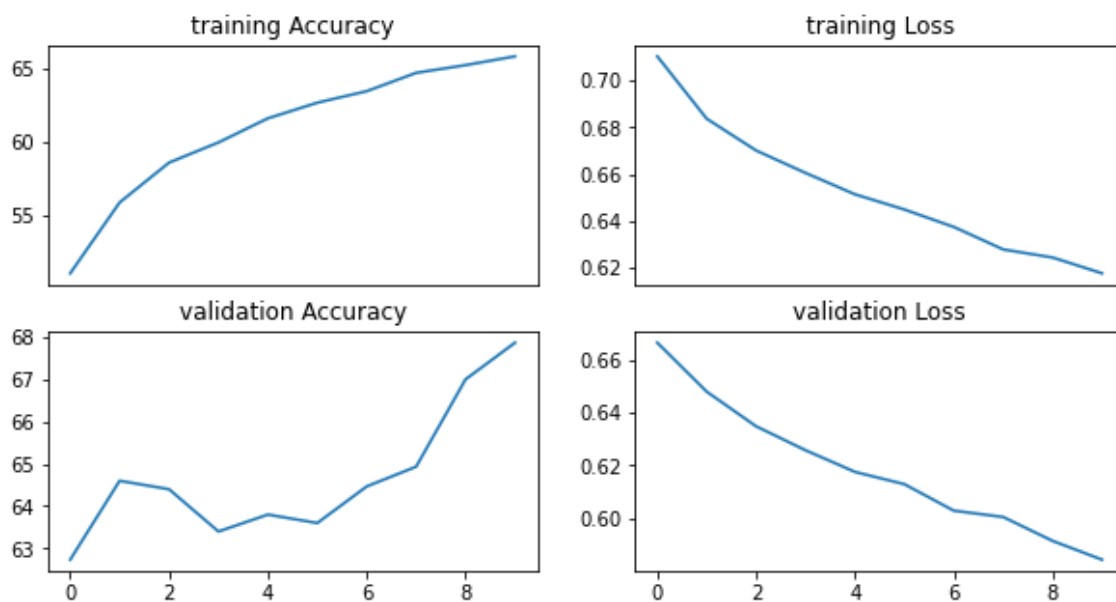
### 3. Parameters (All layers)

Epoch 10/10,train ==> Loss: 0.6177 , Acc: 65.78 %

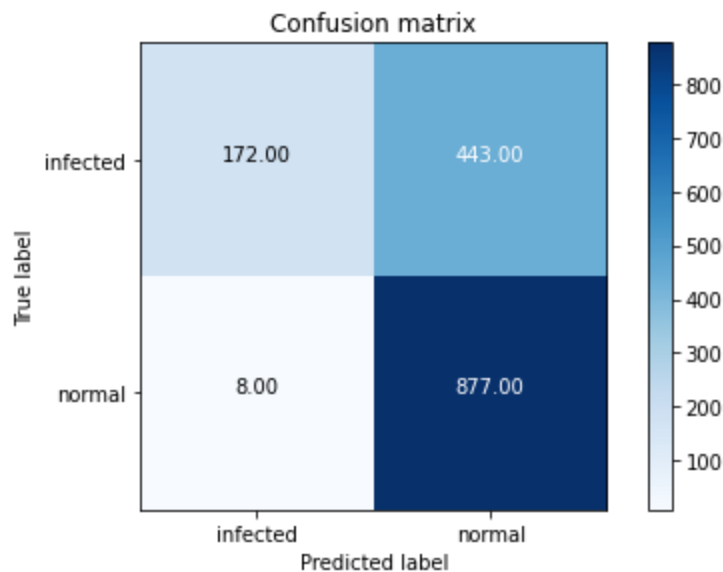
Epoch 10/10,val ==> Loss: 0.5842 , Acc: 67.87 %

Best Validation Accuracy: 67.866667 %

Testing accuracy : 67 %



```
precision = 0.6643939393436065
Recall     = 0.9909604518654282
F1 score  = 0.7954648044815101
```



## Comparison

### Accuracies and F1 Score

VGG16			ResNet18		
Only 2 FC Layer					
LR	validation	test	LR	validation	test
0.001	91	97	0.001	84	92
0.0001	89	94	0.0001	87	79
0.00001	88	94	0.00001	61	61
One last layer + FC layer					
Train = 88			Train = 61		
Test = 89			Test = 61		
Valid = 95			Valid = 61		
All layers					
Train = 91			Train = 67		
Test = 91			Test = 67		
Valid = 96			Valid = 67		
F1 score					
0.97			0.80		

**Discussion :**

VGG gives more accuracy than Resnet but it requires more training time than Resnet. It is costly in terms of parameters so it provides that much high accuracy easily.

Resnet requires less training time than VGG but due to less parameters it is not able to provide that high accuracy in comparison to vgg. But setting optimal parameters like learning rate we can tune this to work better