A report on Bangla Character Recognition Challenge

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1 Performance Graphs for different learning rate

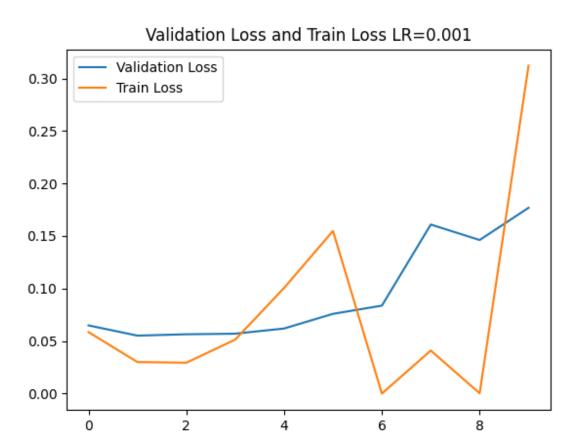


Figure 1: Train and validation loss for learning rate 0.001

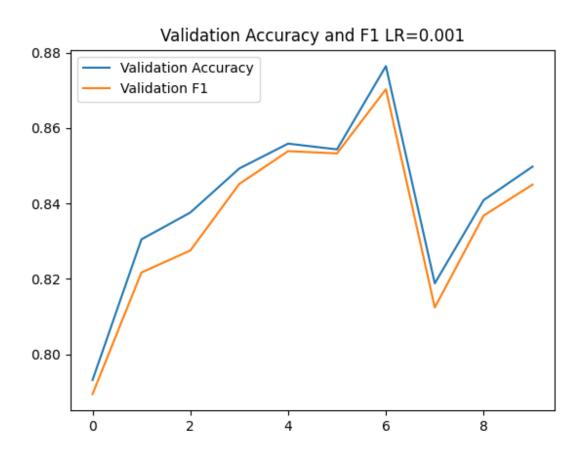


Figure 2: validation accuracy and macro-f1 score for learning rate 0.001

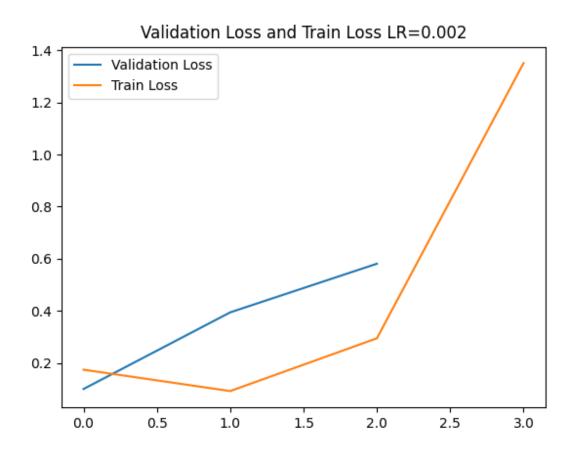


Figure 3: Train and validation loss for learning rate 0.002

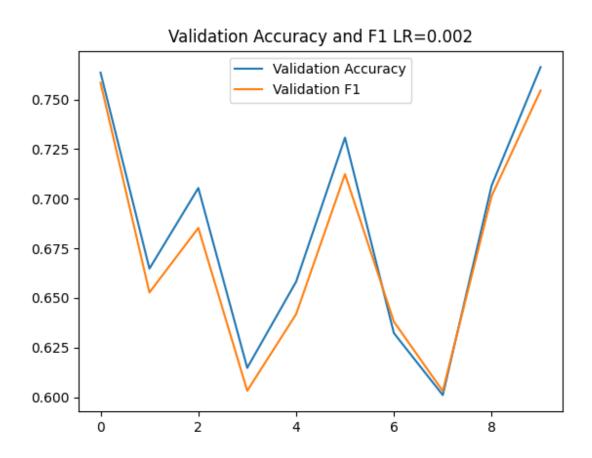


Figure 4: validation accuracy and macro-f1 score for learning rate 0.002

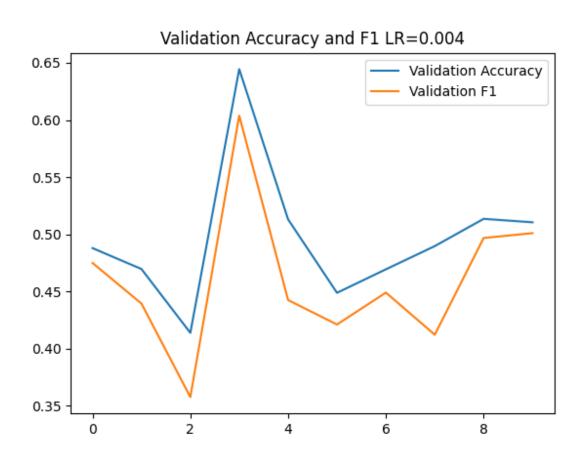


Figure 5: validation accuracy and macro-f1 score for learning rate 0.004

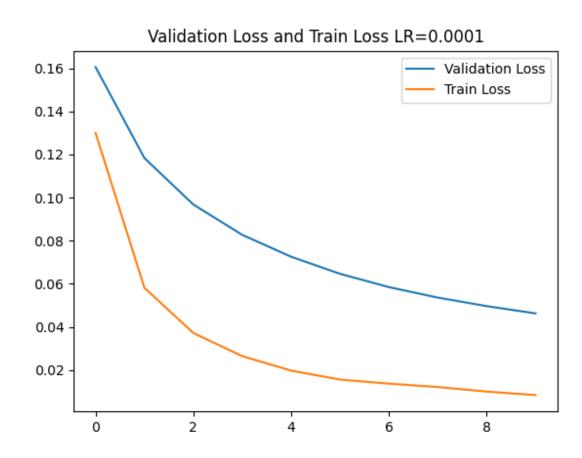


Figure 6: Train and validation loss for learning rate 0.0001

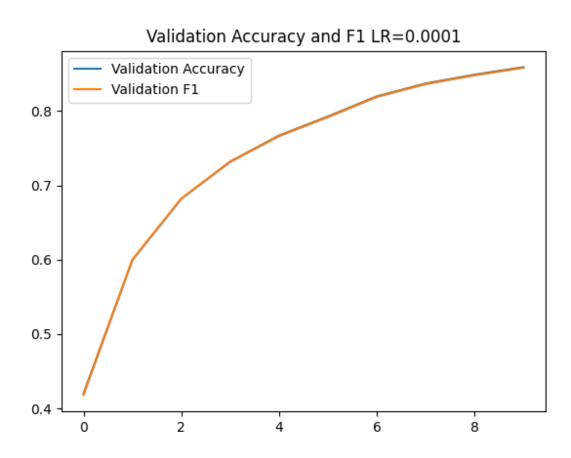


Figure 7: validation accuracy and macro-f1 score for learning rate 0.0001

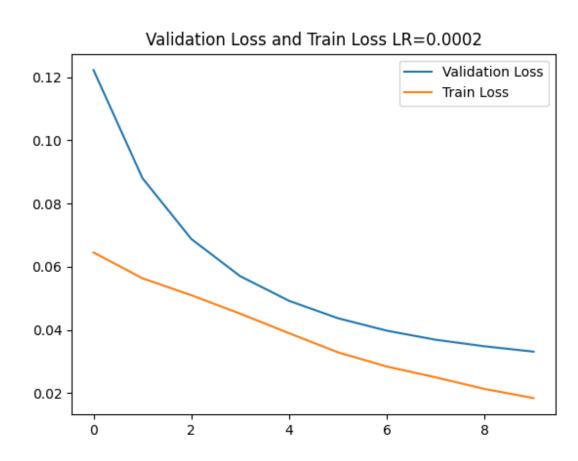


Figure 8: Train and validation loss for learning rate 0.0002

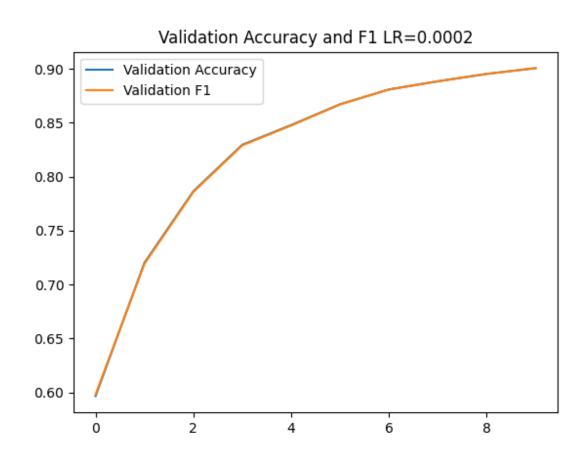


Figure 9: validation accuracy and macro-f1 score for learning rate 0.0002

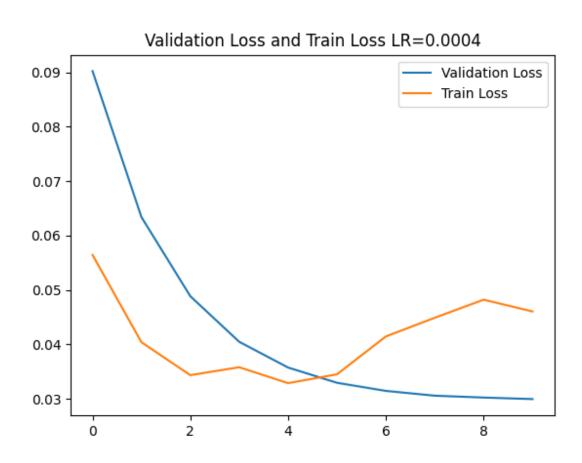


Figure 10: Train and validation loss for learning rate 0.0004

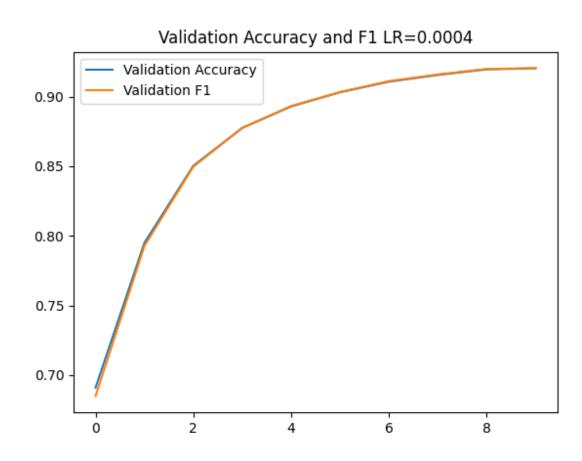


Figure 11: validation accuracy and macro-f1 score for learning rate 0.0004

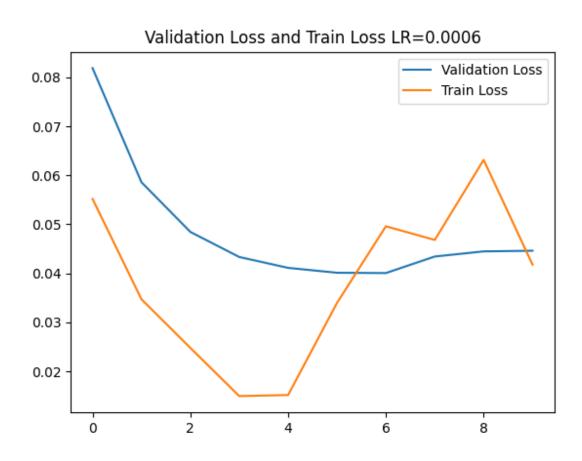


Figure 12: Train and validation loss for learning rate 0.0006

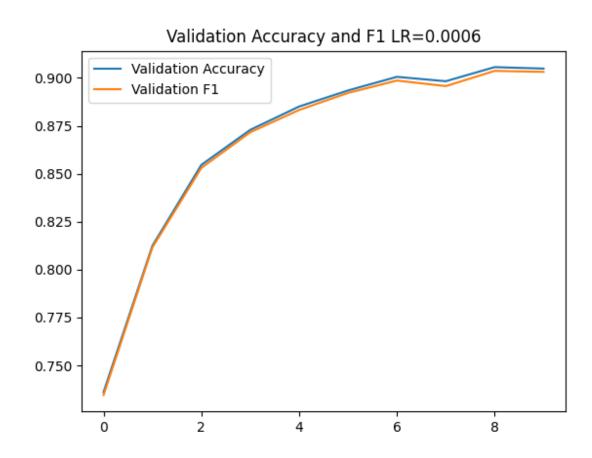


Figure 13: validation accuracy and macro-f1 score for learning rate 0.0006

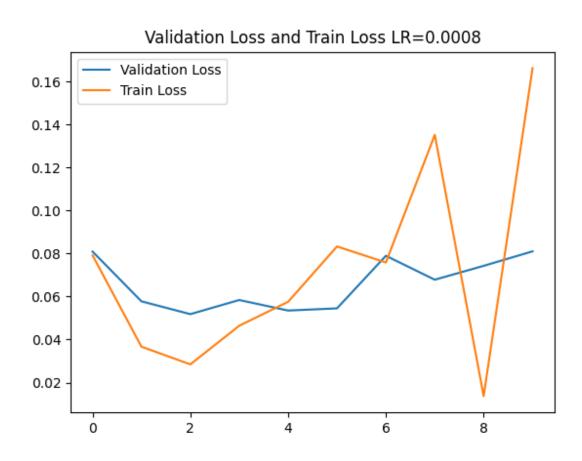


Figure 14: Train and validation loss for learning rate 0.0008

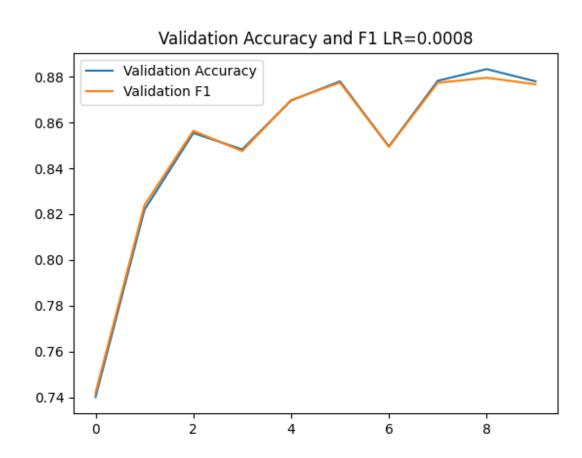


Figure 15: validation accuracy and macro-f1 score for learning rate 0.0008

2 Statistics of Best Learning rate

The model used in this CNN is:

- One Convolution Layer
- Two ReLU activation Layer
- One Max Pooling Layer
- Two Fully Connected Layer
- One Flattening Layer
- One SoftMax Layer

```
def __init__(self, learning_rate):
self.learning_rate = learning_rate
self.conv = Convolution(output_channels=6, filter_size=5, stride=1, padding=1)
self.relu = ReLUActivation()
self.maxpool = MaxPooling(pool_size=2, stride=2)
self.flatten = Flattening()
self.fc = FullyConnectedLayer(output_size=100, learning_rate=learning_rate)
self.relu2 = ReLUActivation()
self.fc2 = FullyConnectedLayer(output_size=10, learning_rate=learning_rate)
self.softmax = Softmax(output_size=10, learning_rate=learning_rate)
```

Figure 16: Implemented Model

From the figures in previous section, based on macro-f1 score, it can be said that for this model best learning rate is **0.0004** Here are the performance statistics for this learning rate:

Epoch 1/10: Training loss: 0.06807739241725286

Epoch 1/10: Validation Accuracy: 0.6637909160111647

Epoch 1/10: Validation F1: 0.6622416941088508

Epoch 1/10: Validation Loss: 0.09894671074549356

Epoch 2/10: Training loss: 0.03109822706368471

Epoch 2/10: Validation Accuracy: 0.787617356001015

Epoch 2/10: Validation F1: 0.7863681775816329

Epoch 2/10: Validation Loss: 0.06717655381787037

Epoch 3/10: Training loss: 0.017570996243445207

Epoch 3/10: Validation Accuracy: 0.8403958386196397

Epoch 3/10: Validation F1: 0.8401023989385307

Epoch 3/10: Validation Loss: 0.050990185419675906

Epoch 4/10: Training loss: 0.013237911530970472

Epoch 4/10: Validation Accuracy: 0.8726211621415885

Epoch 4/10: Validation F1: 0.8722914232129695

Epoch 4/10: Validation Loss: 0.04208553752103421

Epoch 5/10: Training loss: 0.011403324093217678

Epoch 5/10: Validation Accuracy: 0.8842933265668612

Epoch 5/10: Validation F1: 0.884471813840913

Epoch 5/10: Validation Loss: 0.03719446099830459

Epoch 6/10: Training loss: 0.010776360011481754

Epoch 6/10: Validation Accuracy: 0.8941892920578534

Epoch 6/10: Validation F1: 0.8946205119647532

Epoch 6/10: Validation Loss: 0.03419912530951273

Epoch 7/10: Training loss: 0.010099455642152233

Epoch 7/10: Validation Accuracy: 0.9023090586145648

Epoch 7/10: Validation F1: 0.9028213838833858

Epoch 7/10: Validation Loss: 0.03238768962527914

Epoch 8/10: Training loss: 0.009518659989070038Epoch 8/10: Validation Accuracy: 0.9081451408272012Epoch 8/10: Validation F1: 0.9084283410122909

Epoch 8/10: Validation Loss: 0.030826391298623152

Epoch 9/10: Training loss: 0.010261415564723144 Epoch 9/10: Validation Accuracy: 0.9083988835320984 Epoch 9/10: Validation F1: 0.9087126018977572

Epoch 9/10: Validation Loss: 0.030397808280495882

Epoch 10/10: Training loss: 0.009081869762167271 Epoch 10/10: Validation Accuracy: 0.9124587668104542

Epoch 10/10: Validation F1: 0.9125343364721894 Epoch 10/10: Validation Loss: 0.0298242578930939

3 Independent Test Performance

3.1 Confusion Matrix

This the confusion matrix for the best model(learning rate=0.0004)

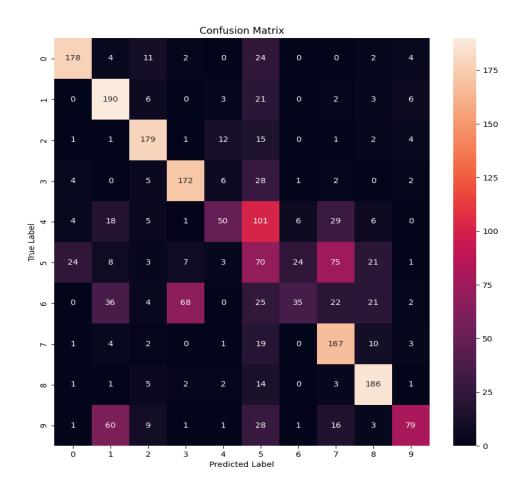


Figure 17: Confusion matrix

3.2 Performance Metrics

Independent Test Accuracy: 0.5985334555453712 Independent Test F1 Score: 0.5810360480922989