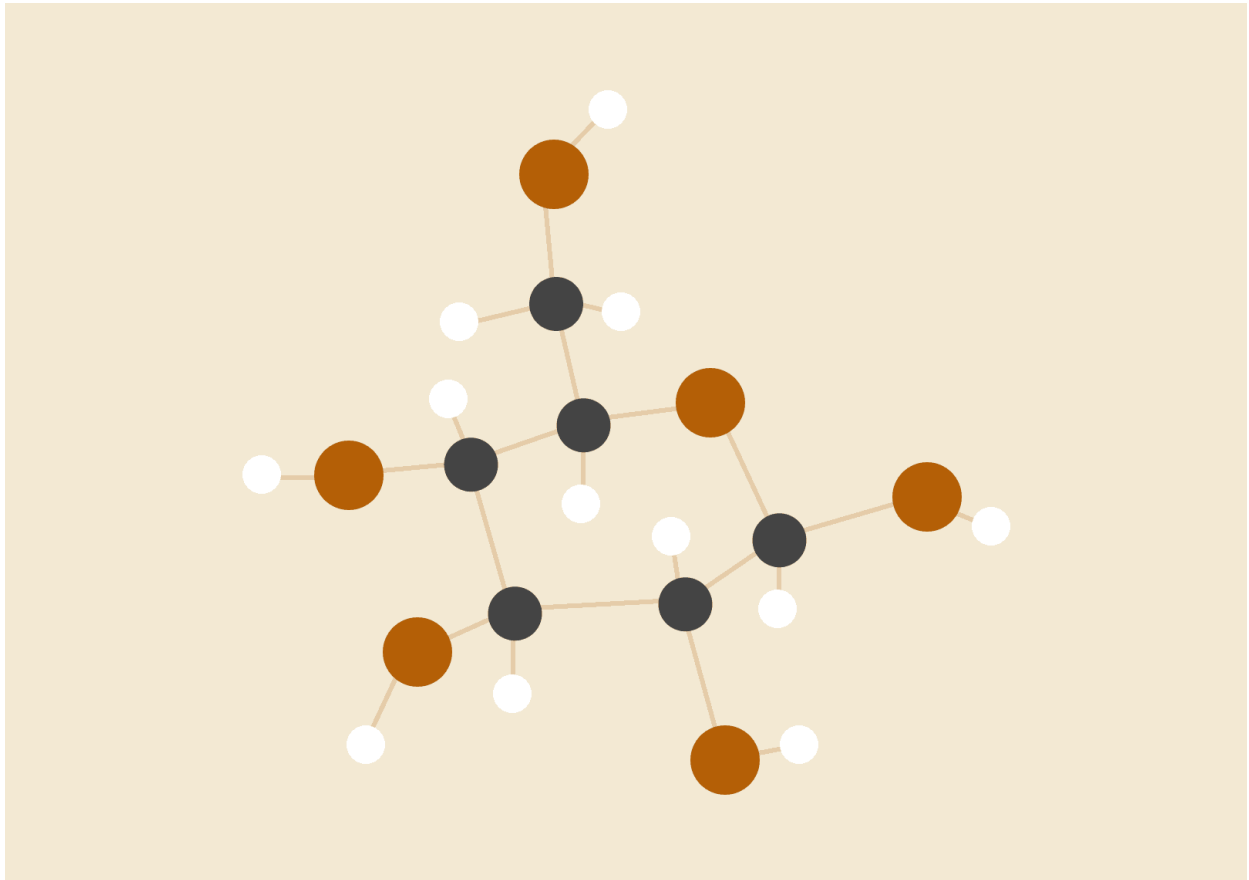


# Assignment 3: Feed Forward Neural Networks

*CSE472 (Machine Learning Sessional)*



**Fardin Anam Aungon**

1805087

Level 4 Term 2

## Instructions to run the code

### Training on EMNIST Dataset

Run the following command to train the model on the EMNIST dataset.

```
python emnist_model.py
```

The model will be trained for 15 epochs. The training and validation accuracy will be printed after each epoch. The final test accuracy will be printed after the training is complete.

### Testing on EMNIST Dataset

Run the following command to test the model on the EMNIST dataset.

```
python evaluate.py
```

The test accuracy and macro f1 score will be printed.

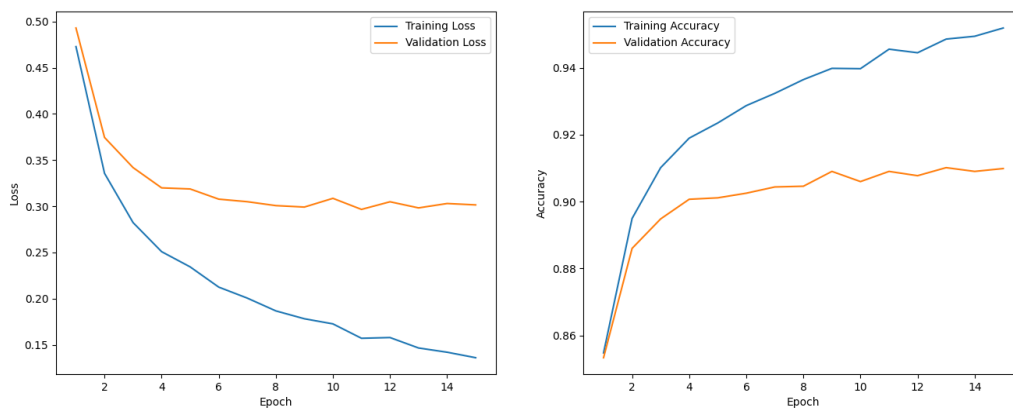
## Models

We have run three different models with **15** epochs, learning rates of **0.005**, **0.0035**, **0.002**, **0.001** and batch sizes of **1024** . The model specifications are as follows:

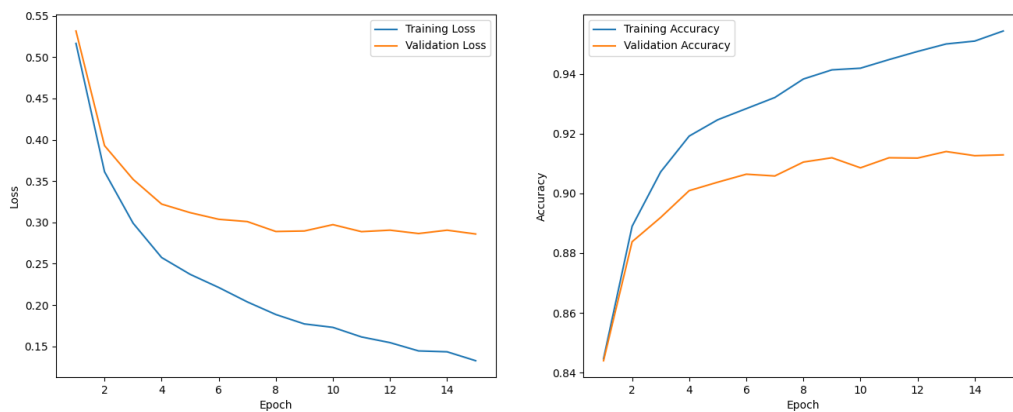
1. Dense layer (784, 512), ReLU, Dropout(0.3), Dense Layer(512, 26), Cross Entropy Loss with Softmax
2. Dense layer (784, 1024), ReLU, Dropout(0.3), Dense Layer(1024, 26), Cross Entropy Loss with Softmax
3. Dense layer (784, 1024), Sigmoid, Dropout(0.3), Dense Layer(1024, 26), Cross Entropy Loss with Softmax

## Graphs

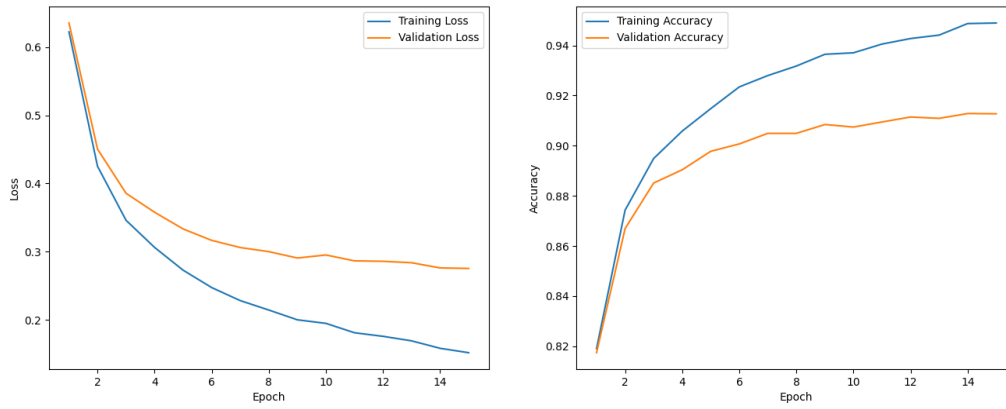
**Model 1 (lr = 0.005)**



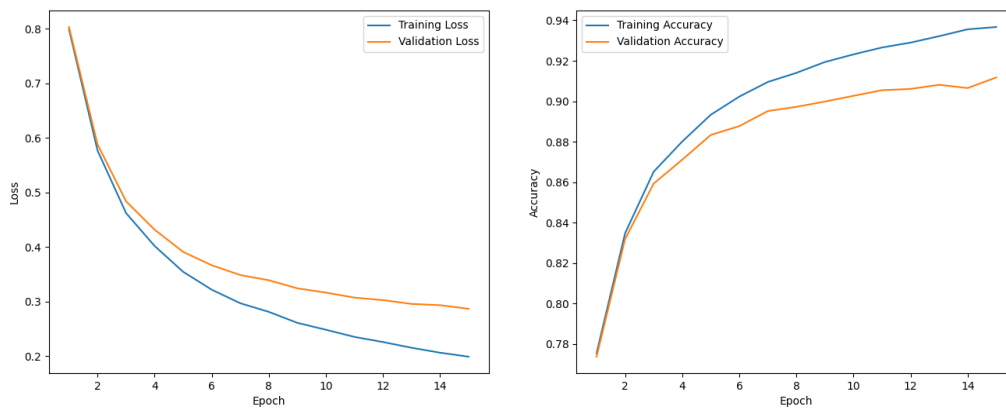
**Model 1 (lr = 0.0035)**



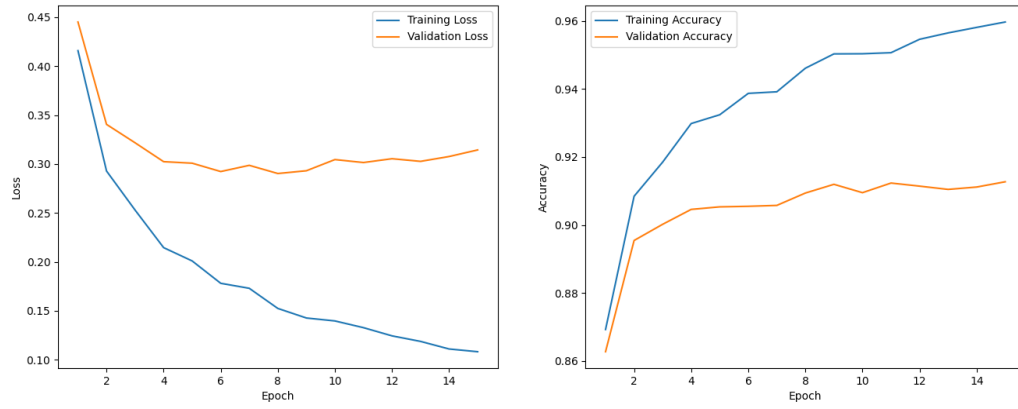
### Model 1 (lr = 0.002)



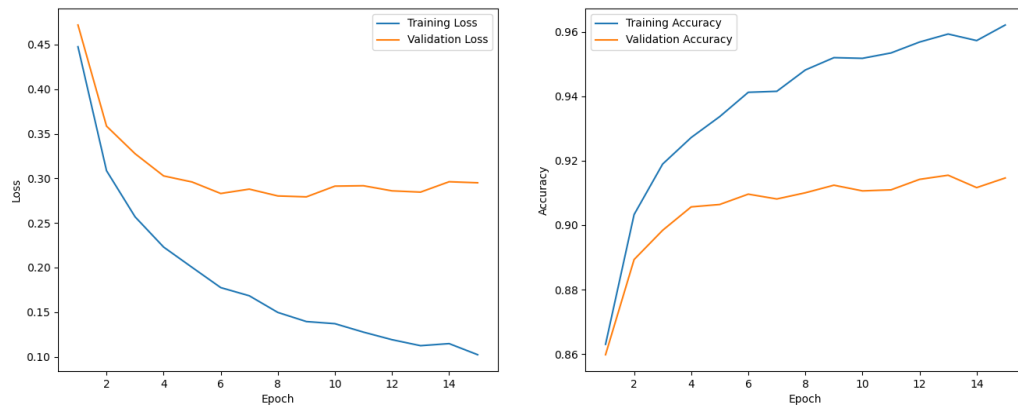
### Model 1 (lr = 0.001)



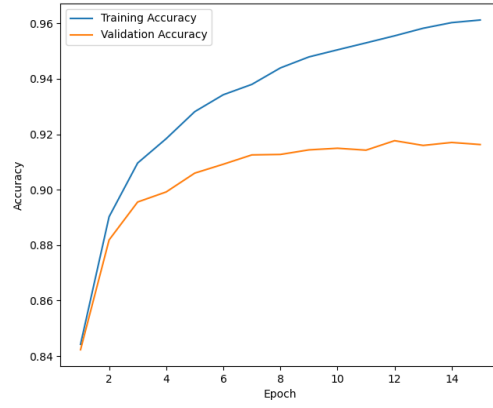
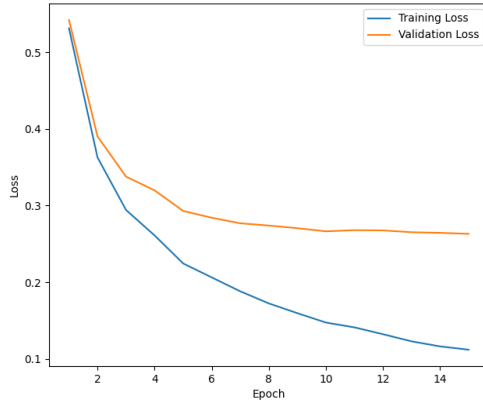
### Model 2 ( $lr = 0.005$ )



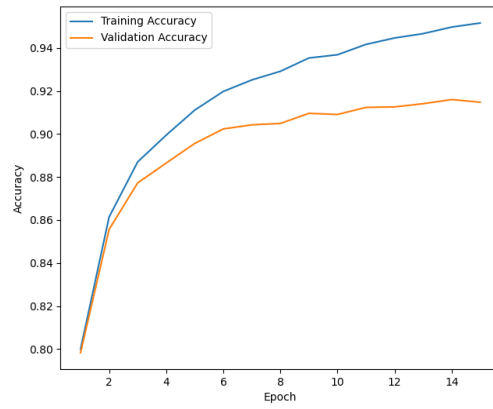
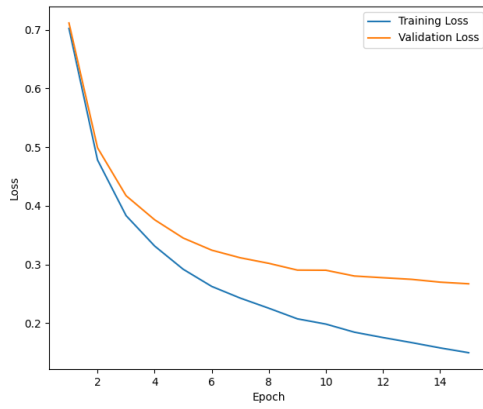
### Model 2 ( $lr = 0.0035$ )



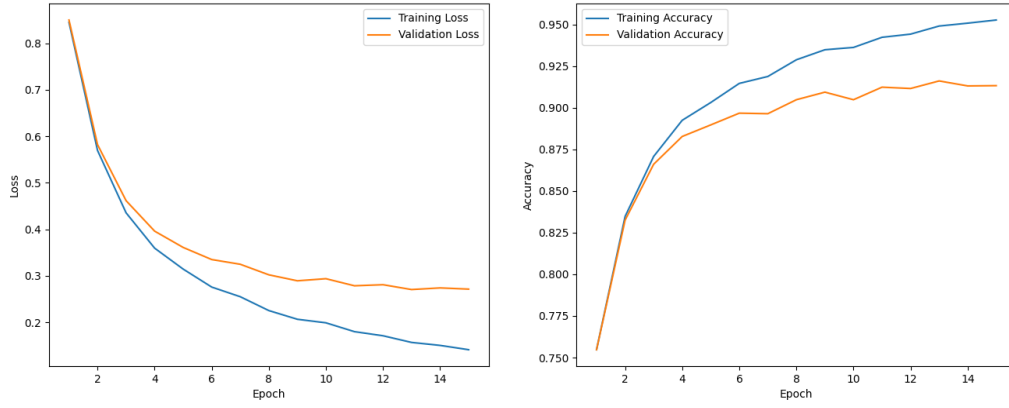
**Model 2 (lr = 0.002)**



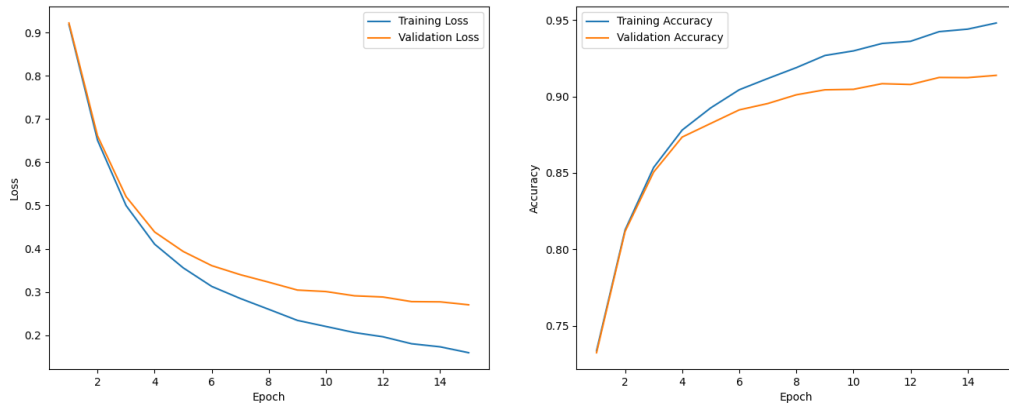
**Model 2 (lr = 0.001)**



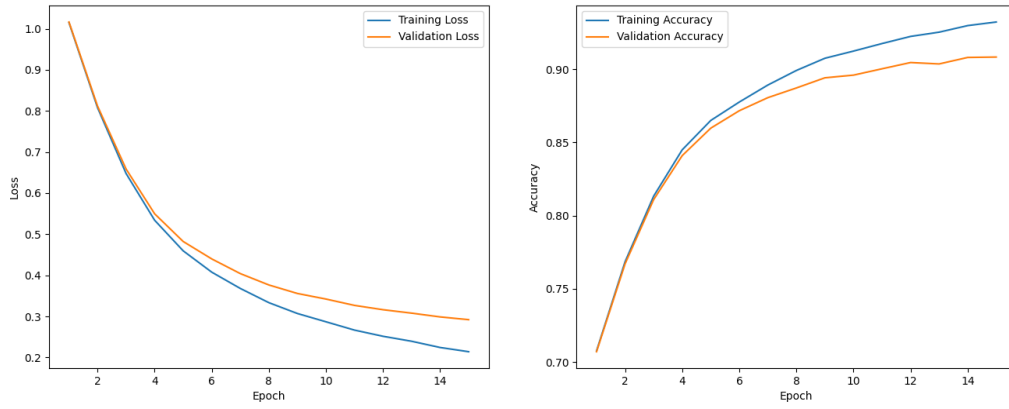
### Model 3 (lr = 0.005)



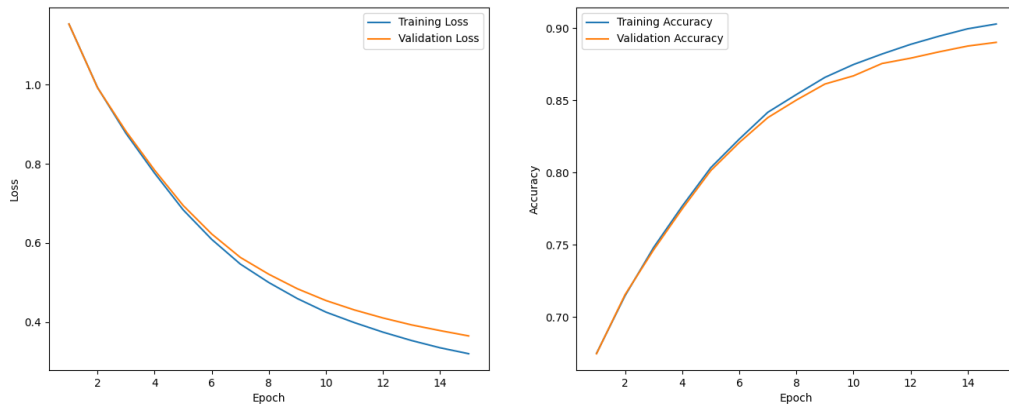
### Model 3 (lr = 0.0035)



### Model 2 ( $\text{lr} = 0.002$ )



### Model 2 ( $\text{lr} = 0.001$ )





## Confusion Matrices

Model 1 (lr = 0.005)

Confusion Matrix

0	706	9	2	11	4	1	6	10	0	0	1	0	2	7	10	5	13	0	1	2	3	0	0	1	0	6
1	3	759	0	3	3	0	3	7	2	1	1	4	0	1	3	1	1	3	0	0	0	0	0	0	0	5
2	2	2	751	1	21	0	1	0	0	0	0	8	0	0	6	1	0	2	1	1	2	0	1	0	0	0
3	6	9	1	722	0	0	0	3	0	4	0	0	1	4	40	5	1	1	1	1	1	0	0	0	1	0
4	5	3	22	0	753	2	1	0	1	0	0	2	0	0	1	1	0	3	0	3	1	0	1	0	0	1
5	1	0	0	2	5	743	2	0	2	0	0	4	0	0	0	18	1	4	2	14	0	0	0	1	1	0
6	25	22	6	2	5	6	608	0	0	2	0	1	0	2	4	0	101	1	9	0	0	0	0	1	5	0
7	6	8	0	1	0	0	0	733	3	0	4	8	7	16	0	0	0	0	0	1	6	0	2	3	2	0
8	0	1	1	0	1	1	1	1	565	11	1	206	0	1	0	1	1	0	2	0	0	1	0	0	0	5
9	0	2	0	9	0	0	3	0	27	736	0	5	0	0	0	0	2	0	5	5	1	1	0	0	3	1
10	2	3	0	0	3	1	0	13	1	0	745	5	0	2	0	0	0	2	0	1	2	1	0	16	1	2
11	0	2	4	0	0	0	0	3	142	1	0	642	0	0	1	0	2	0	0	0	0	0	0	0	3	0
12	0	0	0	0	0	0	0	7	0	0	2	0	771	15	0	1	0	1	0	1	0	0	2	0	0	0
13	7	0	0	1	0	0	0	14	0	3	4	0	7	752	0	0	0	0	0	0	1	3	8	0	0	0
14	1	2	2	9	1	0	2	0	0	0	0	0	0	2	773	3	1	0	0	0	3	0	1	0	0	0
15	0	0	0	4	1	4	1	0	0	0	0	1	0	3	0	782	0	4	0	0	0	0	0	0	0	0
16	34	2	2	4	3	1	88	0	4	0	0	0	0	1	16	3	626	2	3	2	3	1	0	0	4	1
17	15	3	6	1	10	5	0	0	1	0	7	2	2	1	0	6	1	708	1	7	0	8	0	7	5	4
18	5	0	0	0	2	3	15	1	1	11	0	0	0	1	0	0	0	1	760	0	0	0	0	0	0	0
19	1	2	1	1	3	3	1	3	3	3	4	4	0	1	1	0	0	3	0	752	0	0	0	5	8	1
20	3	0	1	3	0	0	0	5	0	0	4	1	1	3	1	0	1	0	1	0	734	33	4	0	5	0
21	0	0	0	2	0	0	0	0	1	2	1	0	0	2	0	0	0	8	0	1	29	730	2	1	21	0
22	0	0	0	3	0	0	0	1	0	0	1	0	4	9	0	0	0	0	0	0	9	1	772	0	0	0
23	2	0	0	1	0	0	1	0	1	1	13	1	1	2	0	0	2	3	0	2	0	4	0	749	14	3
24	0	1	0	1	0	0	1	4	0	4	0	1	0	1	0	1	2	3	0	4	1	10	0	4	762	0
25	0	1	1	3	4	0	4	1	3	1	0	3	0	0	0	0	2	1	0	2	0	0	0	3	0	771
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25

Actual

Predicted

## Model 1 (lr = 0.0035)

Confusion Matrix

0	729	5	3	10	3	2	7	5	0	0	2	0	0	6	8	2	11	0	1	1	3	0	0	0	0	2
1	4	747	0	10	3	0	6	10	2	0	0	6	0	1	3	0	2	1	0	0	1	0	0	0	1	3
2	1	1	751	1	17	0	1	0	0	0	0	12	0	0	4	1	2	3	0	1	2	0	1	0	1	1
3	5	5	0	730	0	1	3	0	0	5	1	1	1	2	37	2	3	1	0	0	0	0	0	0	2	1
4	2	4	15	0	755	3	2	0	2	1	0	2	0	0	0	2	2	3	1	4	2	0	0	0	0	0
5	0	0	0	2	3	751	3	0	2	0	0	1	0	0	0	16	0	3	3	15	0	0	0	0	1	0
6	17	17	4	1	5	5	618	0	1	3	0	2	0	2	1	1	110	1	8	1	0	0	0	0	3	0
7	3	8	0	3	0	1	1	741	0	0	2	14	3	13	0	0	0	0	0	1	2	0	2	3	3	0
8	1	1	1	0	1	2	1	0	583	12	1	183	0	0	1	0	0	0	2	3	0	1	1	2	0	4
9	0	2	0	8	0	1	2	0	22	744	0	3	0	0	0	0	1	1	7	6	1	1	0	1	0	0
10	3	3	0	1	2	3	0	16	1	1	732	8	0	1	0	0	0	5	0	1	2	1	0	17	2	1
11	0	0	3	0	0	0	0	1	161	4	0	626	0	0	1	0	2	1	0	0	0	0	0	0	1	0
12	2	0	0	1	0	0	0	7	0	0	1	0	772	8	0	0	0	1	0	1	2	0	4	1	0	0
13	0	0	6	0	0	0	14	0	2	2	1	9	739	0	0	0	3	0	0	3	3	3	1	1	1	0
14	2	0	3	12	0	0	1	0	0	0	0	0	1	775	1	1	0	0	0	2	1	0	0	1	0	0
15	1	0	0	8	1	9	2	0	0	0	1	0	0	1	0	765	4	6	0	2	0	0	0	0	0	0
16	27	1	2	3	2	5	68	1	3	0	1	0	0	1	10	5	659	2	0	2	1	0	0	2	5	0
17	12	1	4	0	4	3	0	0	2	0	4	1	1	1	0	3	3	733	0	7	0	6	1	3	6	5
18	5	0	1	1	1	2	9	1	0	12	0	1	0	1	0	0	2	0	764	0	0	0	0	0	0	0
19	1	3	1	1	3	5	0	0	3	5	3	3	0	0	1	0	0	2	1	757	0	0	0	4	5	2
20	2	0	1	3	0	0	1	2	0	2	1	1	2	3	1	0	1	0	1	0	751	24	3	0	1	0
21	0	0	0	2	0	0	0	0	1	2	0	0	0	2	0	0	0	8	0	1	27	734	1	2	20	0
22	0	0	0	1	0	0	0	1	0	1	0	0	3	9	0	0	0	0	0	0	7	5	772	0	1	0
23	1	0	0	0	0	2	1	1	0	2	15	2	0	3	0	0	3	1	0	0	1	4	0	750	12	2
24	0	0	0	2	0	0	4	3	0	6	0	0	0	1	0	0	4	3	1	3	5	7	0	3	758	0
25	2	1	2	3	4	0	4	2	5	1	0	4	0	0	0	0	2	2	0	0	0	0	0	4	0	764
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25

Actual

Predicted

## Model 1 (lr = 0.002)

Confusion Matrix

0	744	1	5	8	3	0	2	5	0	0	3	0	0	4	6	2	9	0	1	1	2	0	0	1	0	3
1	6	751	1	5	3	0	4	16	0	1	0	3	0	1	3	0	1	2	0	0	0	0	0	0	0	3
2	1	2	763	1	12	0	1	0	0	0	0	4	0	0	3	2	0	3	1	3	2	0	1	1	0	0
3	7	3	1	731	0	0	2	3	0	3	0	0	1	2	36	4	2	1	1	0	1	0	0	0	2	0
4	7	3	19	0	752	2	1	1	2	0	0	3	0	1	1	2	0	3	0	2	1	0	0	0	0	0
5	0	0	0	1	3	753	1	0	2	0	0	2	1	0	0	17	0	4	4	11	0	0	0	0	1	0
6	30	24	10	2	2	7	599	1	0	5	0	1	0	2	2	0	100	2	9	0	0	0	1	0	2	1
7	7	8	0	1	0	0	1	739	2	0	3	9	6	15	0	0	0	0	0	0	2	0	3	3	1	0
8	2	0	1	1	1	1	1	0	525	11	1	242	0	0	0	0	0	1	3	1	0	1	1	2	0	5
9	1	2	0	10	0	0	3	0	26	727	0	5	0	0	0	0	1	0	7	12	0	1	0	1	2	2
10	2	2	2	1	1	2	0	21	2	0	734	5	1	1	0	0	0	8	0	2	1	1	1	10	2	1
11	0	2	6	0	0	0	0	4	116	0	0	666	0	0	1	0	1	1	0	0	0	0	0	0	3	0
12	2	0	0	1	0	0	0	4	0	0	1	0	778	8	0	0	0	1	0	1	1	0	3	0	0	0
13	13	0	0	5	0	0	0	16	0	1	4	0	9	735	1	0	0	5	0	1	1	3	5	1	0	0
14	2	0	2	12	0	0	1	0	0	0	0	0	0	1	777	1	0	0	1	0	2	1	0	0	0	0
15	0	0	0	4	1	6	2	0	0	0	0	1	0	1	1	775	1	7	0	0	0	0	0	0	1	0
16	30	2	2	5	4	3	72	0	2	1	1	0	1	1	13	5	644	3	2	3	1	0	0	0	4	1
17	7	1	3	0	4	4	1	0	1	0	5	2	1	1	0	3	2	742	1	5	0	9	0	2	2	4
18	5	0	0	3	0	1	16	1	1	4	1	0	0	1	1	0	0	2	764	0	0	0	0	0	0	0
19	1	3	1	1	5	4	0	2	4	4	7	4	2	0	1	0	0	5	0	743	0	0	0	4	7	2
20	2	1	1	3	0	0	0	5	0	2	3	1	1	2	1	0	1	0	1	0	739	30	5	0	2	0
21	0	0	0	3	0	0	0	0	0	1	0	1	0	1	1	0	0	11	0	1	24	741	1	1	14	0
22	0	1	0	1	0	0	0	2	0	1	1	0	4	11	0	0	0	0	0	0	6	2	770	1	0	0
23	3	0	0	3	0	1	1	0	0	0	12	0	0	2	0	0	3	3	0	0	0	6	1	751	12	2
24	0	1	0	2	0	0	3	4	0	2	0	3	1	0	0	1	5	5	2	3	0	12	0	9	747	0
25	0	1	3	4	5	0	4	2	5	1	0	2	0	1	0	0	1	3	0	1	0	0	0	3	0	764
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25

Actual

Predicted

# Model 1 (lr = 0.001)

0	724	2	5	10	3	0	5	9	0	0	2	0	3	3	9	4	12	0	0	1	3	0	1	0	0	4	
1	3	741	0	7	4	0	5	18	1	1	0	3	1	3	2	0	3	1	0	0	0	0	0	0	1	6	
2	0	2	767	1	11	0	1	0	0	0	0	4	0	0	4	1	1	3	1	2	1	0	1	0	0	0	
3	4	5	1	725	0	0	0	2	0	5	2	1	0	4	35	4	2	1	2	0	3	0	0	0	2	2	
4	5	3	24	0	741	1	4	1	2	0	1	2	1	0	2	2	1	4	1	1	1	0	1	0	1	1	
5	1	0	1	2	3	735	4	0	2	1	0	1	0	0	0	21	0	6	3	18	0	0	0	1	1	0	
6	19	11	7	1	2	3	642	0	0	5	1	0	0	2	1	0	93	2	7	0	0	0	0	0	3	1	
7	5	6	0	3	0	1	1	739	2	0	2	9	4	16	0	0	0	0	0	0	1	4	0	3	2	1	1
8	0	1	1	0	1	1	1	576	13	1	190	0	0	0	0	0	1	2	0	0	1	1	2	0	7		
9	0	2	0	11	1	0	4	0	22	739	0	4	0	0	0	0	1	0	5	8	0	0	0	0	2	1	
10	2	3	3	1	1	2	0	16	2	1	734	3	1	3	0	0	0	8	0	3	0	1	4	10	1	1	
11	0	2	5	0	0	1	0	4	157	1	0	623	0	0	1	0	1	1	0	0	0	1	0	0	3	0	
12	2	0	0	0	0	0	1	4	0	0	1	0	774	8	0	1	0	0	0	1	0	0	4	1	3	0	
13	10	0	0	3	0	0	0	13	0	2	5	0	13	728	1	0	1	2	0	2	0	4	13	1	2	0	
14	1	0	1	8	0	0	2	0	0	0	0	0	0	1	779	1	3	0	0	0	4	0	0	0	0	0	
15	0	0	0	5	1	5	2	0	0	0	0	0	0	3	0	775	3	1	0	3	0	1	0	0	1	0	
16	27	1	1	5	3	2	101	1	2	2	1	0	0	1	9	4	626	2	2	1	1	0	1	0	6	1	
17	11	3	3	1	5	6	1	0	1	0	8	1	1	2	0	5	3	715	1	7	0	12	0	5	4	5	
18	4	0	1	1	0	1	14	1	2	10	0	0	0	1	2	0	1	1	760	0	0	0	1	0	0	0	
19	3	3	3	1	5	4	0	1	3	7	4	3	0	0	1	1	1	2	0	747	0	0	0	3	7	1	
20	4	0	1	4	0	0	1	3	0	2	3	1	2	1	1	0	2	0	1	0	730	34	6	0	4	0	
21	0	0	0	2	0	0	0	0	2	1	1	0	0	0	0	0	0	7	0	1	21	743	5	3	13	1	
22	1	0	0	3	0	0	0	1	0	0	1	0	3	9	0	0	0	0	0	0	8	3	771	0	0	0	
23	4	0	0	1	0	0	0	1	2	2	13	1	0	1	0	1	3	5	0	0	0	7	1	745	11	2	
24	0	2	0	3	0	1	4	2	0	9	0	1	0	0	0	2	4	3	3	3	0	19	1	4	738	1	
25	0	1	3	3	5	0	4	2	4	2	0	2	0	0	0	0	1	1	0	2	0	0	0	3	0	767	
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	

## Model 2 (lr = 0.005)

Confusion Matrix

0	733	3	2	8	1	1	5	8	0	0	1	0	0	1	13	3	12	0	0	0	3	0	2	1	0	3
1	4	747	1	4	3	0	6	13	1	1	0	5	0	1	4	0	3	3	0	0	0	1	0	0	0	3
2	1	1	754	1	21	1	1	0	0	0	0	4	0	0	6	0	0	3	1	2	2	0	1	1	0	0
3	5	9	0	727	0	1	1	1	0	4	0	1	0	2	41	2	5	0	0	0	1	0	0	0	0	0
4	2	2	21	0	756	4	2	0	2	0	1	3	0	0	1	1	0	2	1	1	1	0	0	0	0	0
5	0	0	0	3	2	756	4	0	2	1	0	1	0	0	0	10	0	3	3	13	0	0	0	0	2	0
6	21	12	7	2	2	2	650	1	0	3	0	2	0	1	2	0	83	2	8	0	0	0	0	1	1	0
7	6	6	0	2	0	0	0	751	1	1	7	5	2	6	0	1	0	0	0	1	6	0	3	1	1	0
8	0	0	1	0	1	2	1	0	557	18	1	207	0	0	1	0	0	1	2	1	0	1	1	0	0	5
9	1	1	0	12	0	2	5	0	22	734	0	0	0	0	0	0	1	0	6	13	0	1	0	0	2	0
10	2	3	0	0	0	2	0	15	1	0	746	2	0	1	0	0	0	2	0	4	3	2	1	14	1	1
11	0	1	5	0	0	0	1	6	151	1	2	629	0	0	1	0	0	0	0	0	0	0	0	0	3	0
12	6	1	0	1	0	0	0	5	0	0	1	0	764	11	0	1	0	1	0	1	2	0	4	1	1	0
13	13	0	0	4	0	0	0	16	1	2	1	0	7	728	2	1	0	4	0	0	3	4	9	3	2	0
14	2	0	1	7	0	0	1	0	0	0	0	0	0	0	782	0	3	0	0	0	3	1	0	0	0	0
15	0	0	0	4	1	17	2	1	0	0	0	0	0	1	1	765	2	3	0	2	0	0	0	0	1	0
16	32	3	1	3	6	4	117	0	2	2	1	1	0	1	12	3	606	2	0	0	1	0	0	0	3	0
17	12	1	4	1	2	11	1	0	1	0	10	1	1	2	0	6	2	713	0	5	0	13	0	2	8	4
18	3	0	0	1	0	1	14	1	0	11	1	2	0	1	2	0	2	0	760	0	0	0	1	0	0	0
19	1	4	2	1	2	8	1	2	3	5	6	2	0	0	1	0	0	2	0	753	0	0	0	3	4	0
20	3	0	0	2	0	0	0	2	0	2	2	1	0	1	3	0	2	0	1	0	741	33	5	0	2	0
21	0	0	0	1	0	0	0	0	1	2	0	0	0	1	0	0	0	7	0	0	18	738	2	0	30	0
22	0	0	0	3	0	0	0	1	0	0	3	0	3	17	0	0	0	0	0	8	2	763	0	0	0	0
23	2	0	0	1	0	1	0	1	1	0	13	2	0	2	0	0	3	2	0	2	1	2	1	750	14	2
24	0	3	0	1	0	0	2	2	1	3	0	0	0	0	0	0	1	4	1	2	2	5	0	3	770	0
25	0	2	3	2	7	0	4	1	6	3	0	4	0	0	0	0	4	2	0	3	0	0	0	3	0	756
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25

Actual

Predicted

## Model 2 (lr = 0.0035)

0	725	1	3	6	4	0	8	4	0	0	2	0	1	6	5	2	20	1	0	1	3	0	1	4	0	3	
1	3	742	0	5	3	0	6	17	1	2	2	3	0	1	2	0	3	1	1	0	0	0	0	1	0	7	
2	1	0	762	2	16	1	1	0	1	0	0	6	0	0	2	0	1	2	1	1	1	1	1	0	0	0	
3	9	9	0	712	0	0	1	5	0	6	0	0	0	2	38	6	5	0	3	0	1	0	0	1	2	0	
4	6	3	28	0	748	1	2	1	1	0	1	2	0	0	0	2	0	1	2	1	1	0	0	0	0	0	
5	0	0	0	1	2	753	4	0	2	2	0	1	0	0	0	10	2	5	4	13	0	0	0	0	1	0	
6	20	13	8	1	7	5	653	0	0	2	1	1	0	2	1	0	74	1	10	0	0	0	0	0	1	0	
7	8	2	0	1	0	0	1	741	0	1	5	6	4	20	0	0	0	0	0	0	3	0	4	3	1	0	
8	0	0	1	0	1	1	1	579	10	1	192	0	1	0	0	0	0	0	1	0	0	1	1	0	1	8	
9	1	2	0	5	0	1	5	0	21	739	0	4	0	0	0	0	1	1	7	7	2	1	0	1	2	0	
10	1	2	0	0	2	3	0	20	1	1	729	3	2	3	0	0	0	3	0	1	2	1	2	22	1	1	
11	0	0	6	0	0	0	0	6	156	0	0	628	0	0	1	0	1	1	1	0	0	0	0	0	0	0	
12	4	0	0	1	0	0	0	3	0	0	0	0	0	768	17	0	0	0	2	0	1	0	0	3	1	0	0
13	9	0	0	2	0	0	0	10	1	1	1	0	7	755	0	0	0	3	0	1	1	1	4	4	0	0	
14	1	1	2	8	0	0	0	0	0	0	0	0	0	2	779	2	1	0	1	0	2	0	1	0	0	0	
15	0	0	0	4	1	9	2	0	0	0	0	0	0	2	0	770	8	3	0	1	0	0	0	0	0	0	
16	26	1	2	4	3	4	114	0	2	1	0	0	0	1	9	3	618	2	1	1	3	0	0	2	2	1	
17	7	4	3	0	2	9	1	0	1	0	6	0	1	2	0	4	3	726	1	5	0	10	0	6	7	2	
18	4	0	0	1	1	1	12	1	0	8	1	0	0	1	1	0	0	0	768	0	0	0	0	1	0	0	
19	1	3	3	1	1	7	1	1	3	2	2	2	0	0	1	0	1	4	0	756	0	0	0	5	5	1	
20	5	0	1	1	0	0	1	6	0	2	2	1	1	2	0	0	1	0	1	0	729	41	3	0	3	0	
21	0	0	0	2	0	0	0	0	1	1	0	0	0	1	0	0	0	5	0	0	19	735	3	5	28	0	
22	0	0	0	2	0	0	0	2	0	0	1	0	1	8	0	0	0	0	0	0	6	2	778	0	0	0	
23	1	0	0	1	0	0	0	2	1	0	10	1	0	2	1	0	1	1	0	3	1	2	0	759	11	3	
24	0	1	0	2	0	0	5	3	1	3	0	2	0	0	0	0	4	3	3	2	2	7	0	11	751	0	
25	2	1	1	0	6	0	5	2	2	1	0	2	0	0	0	0	1	2	0	3	0	0	0	3	0	769	
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	

## Model 2 (lr = 0.002)

Confusion Matrix

Actual \ Predicted	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
	712	5	3	6	3	0	6	3	0	0	4	0	0	6	4	3	33	1	0	3	3	0	0	1	0	4
	2	757	0	2	2	0	4	9	1	1	1	4	0	1	7	0	4	1	0	0	1	0	0	0	0	3
	0	0	763	1	15	0	1	0	0	0	0	6	0	0	5	0	1	2	1	1	2	0	1	0	0	1
	4	6	1	720	0	0	0	1	0	6	1	0	0	3	44	3	3	2	2	1	1	0	1	0	1	0
	3	3	16	0	757	0	4	0	1	0	2	2	0	0	1	2	3	1	0	3	1	0	0	0	0	1
	0	0	0	1	3	727	6	0	1	0	0	2	0	0	0	20	2	5	3	28	0	0	0	0	1	1
	12	16	9	1	1	3	589	1	0	5	0	1	0	1	2	0	149	2	5	0	0	0	1	0	1	1
	4	6	0	3	0	0	0	735	1	1	8	8	8	18	0	0	1	2	0	0	2	0	2	1	0	0
	0	0	1	0	1	1	1	1	663	15	1	104	0	0	1	0	0	0	2	1	1	0	1	1	0	5
	1	2	0	6	0	0	5	0	24	745	0	1	0	0	0	0	1	0	3	9	2	0	0	0	0	1
	1	3	1	1	1	0	0	13	3	1	747	3	0	1	0	0	0	4	0	4	0	2	0	14	1	0
	0	1	4	0	0	0	0	6	264	1	0	518	0	0	1	0	1	1	0	1	0	0	0	0	2	0
	1	0	0	1	0	0	0	2	0	0	1	0	783	6	0	0	0	1	0	0	1	0	3	0	1	0
	10	1	0	6	0	0	0	8	0	1	3	1	9	741	1	0	1	2	0	1	2	3	7	2	0	1
	1	0	3	3	0	0	1	0	0	0	0	0	0	0	786	0	3	1	0	0	2	0	0	0	0	0
	0	0	0	6	1	3	1	0	0	0	0	0	0	1	0	766	9	7	0	5	0	0	0	0	1	0
	17	1	2	1	4	1	48	0	5	3	0	0	0	0	5	2	701	4	0	1	1	0	0	1	3	0
	5	1	1	0	4	3	1	0	1	0	7	1	1	1	0	2	2	743	1	8	0	8	0	3	2	5
	4	2	0	1	1	1	12	1	0	10	0	0	0	1	1	0	2	0	763	0	0	0	0	0	0	1
	1	3	2	1	2	3	0	1	2	2	5	2	0	0	1	0	0	1	0	765	0	0	0	2	6	1
	0	0	1	3	0	0	1	2	0	2	3	1	3	2	2	0	3	0	1	0	750	18	4	0	4	0
	0	0	0	3	0	0	0	0	1	1	0	0	0	0	0	0	0	6	0	2	41	728	2	3	13	0
	0	0	0	2	1	0	0	2	0	0	1	0	3	5	0	0	2	0	0	1	10	1	772	0	0	0
	2	0	0	0	0	0	0	2	1	1	12	1	0	1	0	0	3	2	0	1	0	3	0	759	9	3
	0	0	0	2	0	0	5	2	0	7	0	2	0	0	0	1	5	4	1	3	0	10	0	7	751	0
	0	2	0	1	3	0	2	2	7	0	0	1	0	0	0	0	2	2	0	2	0	0	0	2	0	774
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25

## Model 2 (lr = 0.001)

Confusion Matrix

0	723	2	6	9	3	0	6	9	0	0	1	0	2	3	7	3	15	0	1	3	3	0	1	2	0	1
1	0	757	1	4	3	0	7	11	1	0	0	3	1	1	3	1	2	1	0	0	0	0	0	0	0	4
2	0	2	765	1	13	0	1	0	0	0	0	4	0	0	4	1	1	2	1	2	2	0	1	0	0	0
3	4	5	1	738	0	0	0	3	0	4	0	1	1	2	30	4	2	0	1	0	1	0	0	0	3	0
4	2	4	20	0	751	1	3	0	1	0	1	3	0	0	3	3	1	3	0	3	1	0	0	0	0	0
5	0	0	0	1	4	736	3	0	2	0	0	2	0	0	0	24	0	4	4	18	0	0	0	0	2	0
6	21	16	7	1	2	5	646	1	0	3	0	1	0	1	1	0	77	1	9	0	0	0	1	0	7	0
7	3	9	0	2	0	0	0	737	3	1	6	10	5	15	0	1	0	0	0	2	2	0	2	2	0	0
8	1	1	1	0	1	1	1	1	525	16	1	240	0	0	0	0	0	0	2	0	0	1	1	2	0	5
9	0	2	0	9	0	0	4	0	23	740	0	4	0	0	0	0	1	0	6	8	0	1	0	0	1	1
10	3	3	1	1	1	2	0	16	1	1	742	4	2	2	0	0	0	5	0	2	0	1	1	11	1	0
11	0	0	5	1	0	0	0	4	115	1	0	668	0	0	1	0	1	1	0	0	0	0	0	0	3	0
12	1	0	0	1	0	0	0	3	0	0	1	0	780	7	0	0	0	1	0	1	0	0	3	2	0	0
13	10	0	0	4	0	0	0	13	0	2	3	0	14	737	0	0	1	2	0	2	0	3	7	1	1	0
14	2	1	4	9	0	0	1	0	0	0	0	0	0	1	777	1	2	0	0	0	2	0	0	0	0	0
15	1	0	0	5	1	4	1	0	0	0	0	0	0	2	0	780	3	2	0	0	0	0	0	0	1	0
16	22	2	4	7	3	2	100	0	3	1	0	0	0	1	6	4	635	3	0	1	1	0	0	0	4	1
17	11	2	4	0	5	4	1	0	2	0	7	2	1	2	0	5	1	719	1	8	0	10	0	6	4	5
18	4	1	0	1	0	0	14	1	1	7	1	0	0	1	2	0	0	0	767	0	0	0	0	0	0	0
19	2	3	1	2	3	4	0	0	3	3	5	2	0	0	1	0	0	1	1	759	0	0	0	3	5	2
20	1	1	1	6	0	0	1	4	0	2	2	1	2	2	2	0	2	0	1	0	740	25	4	0	3	0
21	0	0	0	2	0	0	0	0	0	2	0	1	0	0	0	0	1	5	0	1	23	747	4	2	12	0
22	0	0	0	3	0	0	0	2	0	0	1	0	5	6	0	0	0	0	2	9	2	770	0	0	0	0
23	2	0	0	2	0	1	1	1	1	1	7	1	1	2	0	0	2	2	0	2	0	5	1	757	9	2
24	0	2	0	2	0	0	3	3	0	3	0	2	0	0	0	1	3	3	1	3	0	12	0	5	757	0
25	2	1	1	2	6	0	5	1	3	2	1	2	1	0	0	0	2	2	0	1	0	0	0	1	0	767
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25

Actual

Predicted



### Model 3 (lr = 0.005)

Confusion Matrix

0	736	1	5	4	3	0	8	7	0	1	1	0	3	6	5	2	7	0	0	0	4	0	0	4	0	3
1	5	750	1	4	3	0	7	16	0	1	0	3	0	3	4	0	0	1	0	0	0	0	0	0	0	2
2	2	2	760	2	13	0	3	0	0	0	0	5	0	0	4	1	0	3	0	2	2	0	1	0	0	0
3	7	6	1	718	0	1	0	2	0	6	0	1	1	3	42	5	2	1	0	0	2	0	0	0	2	0
4	5	3	19	0	756	0	2	0	2	0	0	3	0	0	3	2	0	3	0	0	1	0	0	0	1	0
5	1	0	0	1	3	748	3	1	3	1	0	1	0	0	0	15	0	3	4	14	0	0	0	0	2	0
6	20	14	5	1	5	5	676	1	0	4	0	1	0	1	2	0	48	1	8	0	0	0	1	1	6	0
7	4	6	0	2	0	0	1	745	0	0	2	10	3	18	0	0	0	2	0	1	1	0	3	2	0	0
8	1	1	1	0	1	1	1	2	580	14	0	188	0	0	0	0	0	1	1	1	0	1	1	2	0	3
9	1	1	0	6	0	1	4	0	18	749	0	4	0	0	0	0	1	0	3	9	0	1	0	0	1	1
10	4	2	3	0	2	3	0	20	1	1	726	4	2	2	0	0	0	4	0	1	0	1	2	21	1	0
11	0	0	6	0	0	1	0	6	152	3	0	627	0	0	1	0	1	1	0	0	0	0	0	0	2	0
12	1	0	0	1	0	0	0	5	0	0	1	0	769	14	0	1	0	1	0	1	2	0	1	2	1	0
13	12	0	0	3	0	0	0	11	0	1	1	0	6	751	1	0	0	2	0	0	1	3	6	1	1	0
14	3	1	2	5	0	0	1	0	0	0	0	0	0	2	783	0	1	0	0	0	2	0	0	0	0	0
15	0	0	0	4	1	6	2	0	0	0	1	0	0	3	0	778	1	2	0	0	0	0	0	0	2	0
16	29	1	2	6	4	1	148	0	4	1	2	0	0	1	10	4	574	2	2	1	1	0	1	0	6	0
17	10	2	4	0	9	4	1	0	1	0	4	2	1	2	0	3	2	719	1	8	0	9	1	6	7	4
18	3	2	0	1	0	1	13	1	1	9	0	0	0	1	2	0	0	1	764	0	0	0	1	0	0	0
19	2	4	1	1	3	4	0	0	4	4	3	2	1	0	1	0	0	2	0	757	0	0	1	3	6	1
20	4	0	1	3	0	0	0	4	0	2	1	1	1	2	3	0	1	0	1	0	753	18	4	0	1	0
21	0	0	0	3	0	0	0	0	1	2	0	0	0	0	0	0	1	6	0	1	30	735	0	3	18	0
22	0	0	0	3	0	0	0	1	0	0	0	1	4	13	0	0	0	0	0	0	8	2	767	1	0	0
23	3	0	0	1	0	1	1	2	1	1	7	1	0	3	0	1	0	2	0	1	0	5	0	759	9	2
24	0	1	0	1	0	0	6	1	0	3	0	0	0	1	0	1	2	3	1	2	1	11	1	10	755	0
25	0	1	3	3	5	0	4	2	4	4	0	1	1	0	0	0	2	2	0	0	0	0	0	2	0	766
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25

Actual

Predicted

### Model 3 (lr = 0.0035)

Confusion Matrix

Actual	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
	725	4	3	9	6	1	8	8	0	1	1	0	2	3	7	4	10	0	0	0	3	0	0	1	0	4
	5	744	1	5	4	0	6	17	1	3	0	3	0	1	3	0	0	2	1	0	0	0	0	0	0	4
	1	2	759	1	16	0	2	0	1	0	0	5	0	0	4	2	0	3	0	1	2	0	1	0	0	0
	4	7	2	726	0	1	1	2	0	5	1	1	1	1	38	4	1	2	0	0	0	0	0	0	2	1
	5	4	23	0	745	1	3	1	1	0	0	3	0	0	4	2	2	4	0	0	1	0	0	1	0	0
	1	0	0	1	2	753	2	0	2	1	0	1	0	0	0	15	0	4	3	13	0	0	0	0	1	1
	21	17	6	1	2	6	649	1	0	3	0	1	0	1	4	0	74	2	7	0	1	0	1	0	3	0
	4	9	0	4	0	0	0	738	0	0	4	11	2	17	0	0	0	0	0	1	2	2	4	2	0	0
	2	1	1	0	1	1	2	0	547	19	1	211	0	1	0	0	0	2	1	0	0	1	1	1	1	6
	0	1	0	6	1	1	4	0	21	744	0	5	0	0	0	0	1	0	3	10	0	1	0	0	2	0
	3	3	2	0	1	3	0	18	1	1	736	5	1	2	0	0	0	6	0	3	0	1	2	11	1	0
	0	1	7	0	0	2	0	4	140	2	0	638	0	0	1	0	1	1	0	1	0	0	0	0	2	0
	1	0	0	1	0	0	0	6	0	0	1	0	774	9	0	0	0	1	0	1	1	0	3	2	0	0
	9	0	1	5	0	1	0	13	0	2	4	0	9	746	0	0	0	3	0	0	0	2	3	1	1	0
	3	0	3	7	0	0	2	0	0	0	0	0	0	0	781	0	1	1	0	0	2	0	0	0	0	0
	0	1	0	5	1	7	0	0	0	0	0	0	0	2	1	772	1	5	0	3	0	0	0	0	2	0
	29	1	0	6	5	3	112	0	3	2	0	0	0	1	6	3	617	2	1	1	1	1	1	0	4	1
	8	2	4	0	2	2	0	0	1	0	6	2	1	2	0	2	2	740	1	6	0	6	0	5	4	4
	3	2	0	1	1	1	18	1	1	10	0	0	0	1	2	0	0	1	757	0	0	0	1	0	0	0
	2	3	2	1	2	3	1	0	4	3	6	3	0	0	1	0	0	6	0	754	0	0	0	3	5	1
	3	1	2	2	0	0	1	4	0	1	2	1	1	2	4	0	1	0	1	0	743	25	4	0	2	0
	0	0	0	3	0	0	0	0	0	2	1	1	0	1	0	0	1	10	0	1	24	737	2	1	15	1
	0	1	1	2	0	0	0	1	0	0	3	0	4	9	0	0	0	0	0	0	9	2	768	0	0	0
	3	0	0	1	0	1	1	1	2	2	15	1	1	2	0	0	2	2	0	0	0	6	1	748	9	2
	0	1	0	1	0	1	8	1	0	2	0	1	0	0	0	1	3	6	0	4	1	15	0	5	750	0
	1	2	3	3	5	0	5	1	3	1	0	3	1	0	0	0	2	3	0	2	0	0	0	1	0	764
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
	Predicted																									

### Model 3 (lr = 0.002)

Confusion Matrix

Actual	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
	737	3	3	9	4	0	3	7	0	0	2	0	1	4	5	3	13	0	0	1	2	0	0	1	0	2
	3	745	0	6	4	0	5	19	1	1	0	4	0	2	4	0	1	1	0	0	1	0	0	0	0	3
	1	1	752	2	20	0	1	0	1	0	0	4	0	0	7	2	2	2	0	2	1	0	1	1	0	0
	7	8	2	718	0	1	1	1	0	2	1	1	1	3	44	3	1	1	1	0	1	0	1	0	2	0
	3	3	24	0	743	1	2	0	1	0	0	2	0	0	4	3	2	6	0	3	1	0	0	1	0	1
	2	1	0	2	3	735	4	0	2	0	1	3	0	0	0	20	0	8	3	14	0	0	0	1	0	1
	25	21	9	2	3	5	579	1	0	4	0	1	0	1	6	0	126	1	7	0	0	0	1	0	8	0
	4	10	0	4	0	1	0	734	1	0	2	14	4	14	0	0	0	1	0	1	3	0	4	2	1	0
	2	1	1	1	1	1	1	0	539	14	0	224	0	0	0	0	0	2	3	0	0	1	1	2	0	6
	0	2	0	17	1	0	4	0	22	715	0	9	0	0	0	0	1	0	6	14	1	1	0	0	4	3
	1	2	3	1	1	4	0	16	1	1	732	4	1	2	0	0	0	8	0	2	1	1	3	12	3	1
	0	2	6	0	0	1	0	5	134	2	0	644	0	0	1	0	2	1	0	0	0	0	0	0	2	0
	0	0	0	1	0	0	0	6	0	0	1	0	773	11	0	1	0	0	0	1	2	0	2	2	0	0
	14	0	0	6	0	0	0	11	0	1	8	0	13	733	0	0	1	2	0	0	0	3	6	1	1	0
	1	1	2	6	0	0	1	0	0	0	0	0	0	2	783	1	1	0	0	0	2	0	0	0	0	0
	0	0	0	5	1	5	1	0	0	0	1	0	1	2	0	771	2	6	0	2	0	0	0	0	3	0
	27	2	3	6	3	4	45	1	3	1	0	0	0	1	9	4	676	2	2	2	2	0	1	0	5	1
	10	2	5	0	5	4	0	0	1	0	4	2	2	1	0	4	3	730	1	6	0	6	0	5	6	3
	4	3	0	3	1	1	15	1	2	5	0	0	0	1	4	0	1	1	757	0	0	0	0	0	1	0
	1	5	1	2	4	4	1	0	4	1	6	3	2	0	1	0	0	4	2	751	0	0	0	2	6	0
	4	1	1	5	0	0	1	3	0	1	1	1	1	2	2	0	1	0	1	0	743	26	4	0	2	0
	0	0	0	4	0	0	0	0	0	1	0	1	0	3	1	1	0	9	0	1	26	739	0	0	14	0
	0	1	0	3	0	0	0	0	0	0	2	0	4	9	0	0	0	0	0	1	9	1	769	1	0	0
	5	1	0	2	0	0	1	1	0	0	12	2	0	3	0	0	2	1	0	0	0	8	1	747	12	2
	0	1	0	2	0	0	4	1	0	3	1	1	0	0	0	1	6	4	2	6	1	17	1	7	742	0
	1	2	3	4	6	0	4	1	2	2	1	2	1	0	0	0	2	2	1	0	0	0	0	2	1	763
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
	Predicted																									

### Model 3 (lr = 0.001)

Confusion Matrix

Actual	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
	706	4	4	10	7	4	9	11	0	1	2	0	3	6	6	2	12	0	0	1	3	0	1	2	0	6
	7	727	0	6	4	1	6	18	1	4	0	3	1	3	4	2	2	2	0	0	1	0	0	0	0	8
	2	1	746	2	18	1	1	0	1	0	1	6	0	1	8	2	1	3	0	1	2	0	1	1	0	1
	7	10	2	711	1	1	1	3	0	2	1	1	1	1	41	3	3	2	2	0	2	0	2	0	2	1
	6	3	37	0	720	0	3	0	1	0	1	2	1	1	5	3	2	8	1	2	1	0	0	1	1	1
	1	1	1	2	3	714	4	1	3	0	1	3	1	0	0	28	2	10	4	18	0	0	0	1	1	1
	21	20	7	1	5	7	591	2	0	9	0	1	0	1	4	0	109	1	9	0	0	1	2	0	8	1
	10	15	0	5	0	2	2	695	1	0	9	12	9	23	1	1	0	0	0	1	5	0	2	3	4	0
	1	2	1	1	1	1	2	0	543	20	0	211	0	0	0	0	0	1	2	1	0	1	1	2	0	9
	0	3	0	15	1	1	5	0	23	714	0	9	0	0	0	0	2	0	4	13	0	1	0	0	6	3
	2	2	4	3	1	4	0	18	0	1	718	5	3	2	0	0	1	6	0	0	3	2	3	20	2	0
	0	3	7	0	0	3	0	3	129	3	0	645	0	0	1	0	2	2	0	0	0	0	0	0	2	0
	2	0	0	1	0	0	0	6	0	0	1	0	766	11	0	1	0	0	0	2	2	0	4	2	2	0
	23	1	0	6	0	1	1	16	0	1	8	0	17	702	1	0	1	2	0	2	1	3	11	2	1	0
	2	1	2	11	0	0	1	0	0	0	0	0	0	1	775	1	2	1	0	0	2	0	1	0	0	0
	0	0	0	5	1	11	2	0	0	0	0	0	1	2	0	761	3	4	0	3	0	2	0	0	5	0
	37	2	3	6	4	10	80	1	2	1	1	0	0	1	10	7	617	2	2	3	3	0	1	0	7	0
	13	1	5	1	10	12	0	0	2	0	12	1	4	0	0	6	4	688	1	9	0	8	0	9	9	5
	5	3	0	1	1	1	20	1	3	11	0	0	0	1	3	0	2	2	743	1	1	0	0	0	1	0
	2	3	2	2	6	5	1	2	3	7	7	5	1	0	1	0	1	5	1	730	0	0	0	4	11	1
	5	1	2	5	0	0	2	5	0	3	3	1	1	3	4	0	2	0	1	0	725	29	6	0	2	0
	0	0	0	2	0	0	0	1	0	1	3	1	0	5	1	0	1	7	0	1	22	733	3	2	17	0
	0	0	0	2	0	0	1	1	0	1	3	1	3	10	0	0	0	0	0	1	10	2	765	0	0	0
	5	0	0	2	0	3	1	2	1	0	21	0	0	2	0	1	1	3	0	2	0	6	0	730	18	2
	0	2	0	2	0	3	8	3	1	9	1	4	0	1	0	1	4	3	2	8	0	24	2	8	714	0
	3	2	4	4	8	0	5	2	4	5	1	3	1	0	0	0	3	1	1	0	1	1	0	4	1	746
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
	Predicted																									

## Chosen model and its average loss, accuracy and f1 score table

We have chosen **model 2** with learning rate of **0.002** because it gave the best f1 score on validation set among all the models. The table below shows the loss, accuracy and f1 score of each iteration of training phase:

**Table: Model 1 (lr = 0.002)**

Training iteration	Training loss	Training accuracy	Training f1 score	Validation loss	Validation accuracy	Validation f1 score
1	0.5311094	0.8442496	0.8445378	0.5420008	0.8423076	0.8418906
2	0.3627421	0.8902526	0.8900932	0.3902003	0.8818910	0.8809783
3	0.2942428	0.9096248	0.9097739	0.3377496	0.8955662	0.8951053
4	0.2610664	0.9184012	0.9184362	0.3198539	0.8991987	0.8989188
5	0.2245800	0.9281485	0.9282140	0.2930378	0.9059829	0.9055063
6	0.2063747	0.9342477	0.9342167	0.2841865	0.9091880	0.9084742
7	0.1882441	0.9379807	0.9378674	0.2769177	0.9125534	0.9117962
8	0.1724917	0.9439196	0.9440005	0.2739925	0.9127136	0.9123656
9	0.1597508	0.9478883	0.9479142	0.2705217	0.9143696	0.9139760
10	0.1475016	0.9504430	0.9504351	0.2664737	0.9149572	0.9144179
11	0.1412097	0.9529506	0.9529584	0.2679567	0.9142628	0.9136846
12	0.1323009	0.9554958	0.9554904	0.2676521	0.9176816	0.9172224
13	0.1229999	0.9582202	0.9583478	0.2652894	0.9159722	0.9158111
14	0.1164158	0.9602564	0.9603794	0.2644993	0.9170405	0.9166890
15	0.1121037	0.9611990	0.9610653	0.2631585	0.9162927	0.9157543

## Independent test performance of the best model

Loss: 0.27539495871174535

Accuracy: 0.9141826923076923

F1 score: 0.9141845423701032

Confusion Matrix:

		Confusion Matrix																											
Actual	0	712	5	3	6	3	0	6	3	0	0	4	0	0	6	4	3	33	1	0	3	3	0	0	1	0	0	4	
	1	2	757	0	2	2	0	4	9	1	1	1	4	0	1	7	0	4	1	0	0	1	0	0	0	0	0	3	
	2	0	0	763	1	15	0	1	0	0	0	0	6	0	0	5	0	1	2	1	1	2	0	1	0	0	1		
	3	4	6	1	720	0	0	0	1	0	6	1	0	0	3	44	3	3	2	2	1	1	0	1	0	1	0		
	4	3	3	16	0	757	0	4	0	1	0	2	2	0	0	1	2	3	1	0	3	1	0	0	0	0	1		
	5	0	0	0	1	3	727	6	0	1	0	0	2	0	0	0	20	2	5	3	28	0	0	0	0	1	1		
	6	12	16	9	1	1	3	589	1	0	5	0	1	0	1	2	0	149	2	5	0	0	0	1	0	1	1		
	7	4	6	0	3	0	0	0	735	1	1	8	8	8	18	0	0	1	2	0	0	2	0	2	1	0	0		
	8	0	0	1	0	1	1	1	1	663	15	1	104	0	0	1	0	0	0	2	1	1	0	1	1	0	5		
	9	1	2	0	6	0	0	5	0	24	745	0	1	0	0	0	0	1	0	3	9	2	0	0	0	0	1		
	10	1	3	1	1	1	0	0	13	3	1	747	3	0	1	0	0	0	4	0	4	0	2	0	14	1	0		
	11	0	1	4	0	0	0	0	6	264	1	0	518	0	0	1	0	1	1	0	1	0	0	0	0	2	0		
	12	1	0	0	1	0	0	0	2	0	0	1	0	783	6	0	0	0	1	0	0	1	0	3	0	1	0		
	13	10	1	0	6	0	0	0	8	0	1	3	1	9	741	1	0	1	2	0	1	2	3	7	2	0	1		
	14	1	0	3	3	0	0	1	0	0	0	0	0	0	0	786	0	3	1	0	0	2	0	0	0	0	0		
	15	0	0	0	6	1	3	1	0	0	0	0	0	0	1	0	766	9	7	0	5	0	0	0	0	1	0		
	16	17	1	2	1	4	1	48	0	5	3	0	0	0	0	5	2	701	4	0	1	1	0	0	1	3	0		
	17	5	1	1	0	4	3	1	0	1	0	7	1	1	1	0	2	2	743	1	8	0	8	0	3	2	5		
	18	4	2	0	1	1	1	12	1	0	10	0	0	0	1	1	0	2	0	763	0	0	0	0	0	0	1		
	19	1	3	2	1	2	3	0	1	2	2	5	2	0	0	1	0	0	1	0	0	765	0	0	0	2	6	1	
	20	0	0	1	3	0	0	1	2	0	2	3	1	3	2	2	0	3	0	1	0	750	18	4	0	4	0		
	21	0	0	0	3	0	0	0	0	1	1	0	0	0	0	0	0	0	6	0	2	41	728	2	3	13	0		
	22	0	0	0	2	1	0	0	2	0	0	1	0	3	5	0	0	2	0	0	1	10	1	772	0	0	0		
	23	2	0	0	0	0	0	0	2	1	1	12	1	0	1	0	0	3	2	0	1	0	3	0	759	9	3		
	24	0	0	0	2	0	0	5	2	0	7	0	2	0	0	0	1	5	4	1	3	0	10	0	7	751	0		
	25	0	2	0	1	3	0	2	2	7	0	0	1	0	0	0	0	2	2	0	2	0	0	0	2	0	774		
		0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25		
		Predicted																											