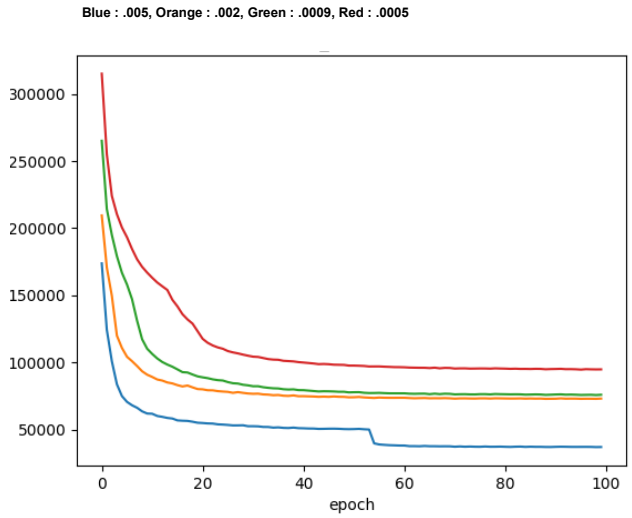
Machine Learning Assignment 3 Report

Ayesha Binte Mostofa(1805062)

Model 1



- Layers:
  - Dense Layer with 512 Node (optimizer: Xavier Initialization)
  - ReLU Layer
  - DropOut Layer with drop rate 0.8
  - Dense Layer with 128 Node (optimizer: Xavier Initialization)
  - ReLU Layer
  - DropOut Layer with drop rate 0.9
  - Dense Layer with 26 Node (optimizer: Xavier Initialization)
  - ReLU Layer
  - SoftMax
- Mini Batch Gradient Descent (size = 512)
- 100 Epochs
- Cross Entropy Loss Function
- Loss vs epoch in the figure

Performance measures: (Training)

Performance measure	**0.005**	**0.002**	**0.0009**	**0.0005**
Accuracy (%)	91.68	81.81	82.24	78.16
F1-macro	0.9017	0.7918	0.7976	0.7550
Loss	30493.08	65219.90	66287.7661	84460.69

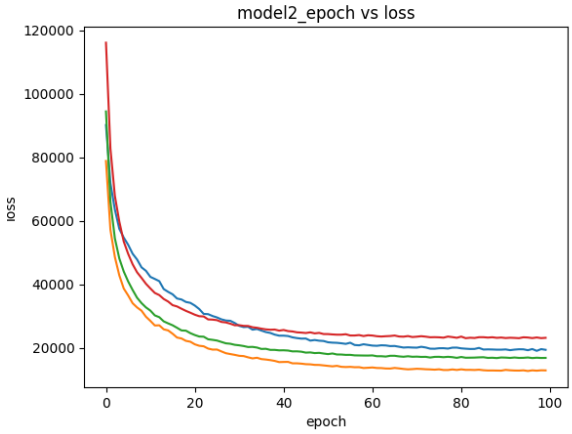
Performance measures: (Validation)

Performance measure	**0.005**	**0.001**	**0.0009**	**0.0005**
Accuracy (%)	88.45	79.893	81.15	77.55
F1-macro	0.8685	0.7728	0.7856	0.75
Loss	7217.29	12562.86	12222.0206	10211.11

Model 2

Blue : .005, Orange : .002, Green : .0009, Red : .0005

- Layers:
  - Dense Layer with 1024 Node (optimizer: ADAM, Xavier)
  - ReLU Layer
  - DropOut Layer with drop rate 0.8
  - Dense Layer with 128 Node (optimizer: ADAM,Xavier)
  - ReLU Layer
  - DropOut Layer with drop rate 0.5
  - Dense Layer with 26 Node (optimizer: ADAM,Xavier)
  - ReLU Layer
  - Softmax
- Mini Batch Gradient Descent (size = 512)
- 100 Epochs
- Cross Entropy Loss Function



Performance measures: (Training)

Performance measure	0.005	0.002	0.0009	0.0005
Accuracy (%)	96.971	97.781	97.061	95.807
F1-macro	0.96976	0.97784	0.97065	0.9581
Loss	12435.1019	8301.15	10736.016	15152.37

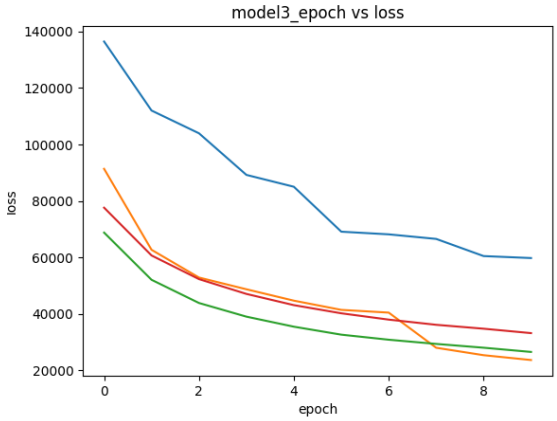
Performance measures: (Validation)

Performance measure	0.005	0.002	0.0009	0.0005
Accuracy (%)	92.02	92.59	92.66	92.339
F1-macro	0.9198	0.9256	92.639	0.92313
Loss	6231.74	5154.27	4611.49	4647.20

Model 3

- Layers:
  - Batch Normalization
  - Dense Layer with 600 Node (optimizer : Xavier)
  - ReLU Layer
  - DropOut Layer with drop rate 0.8
  - Dense Layer with 26 Node (optimizer : Xavier)
  - ReLU Layer
  - Softmax
- Mini Batch Gradient Descent (size = 512)
- 10 Epochs
- Cross Entropy Loss Function

Blue : .005, Orange : .002, Green : .0009, Red : .0005



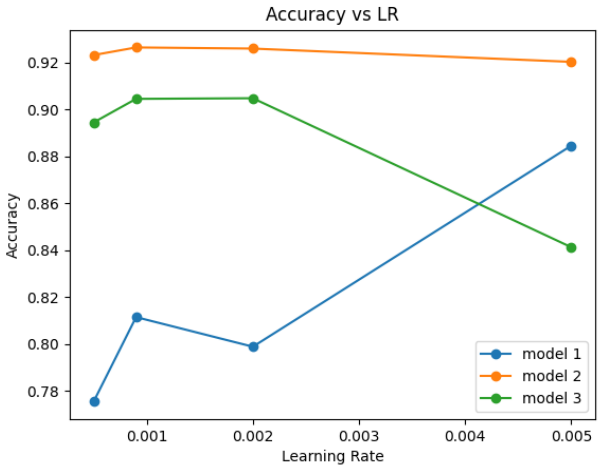
Performance measures: (Training)

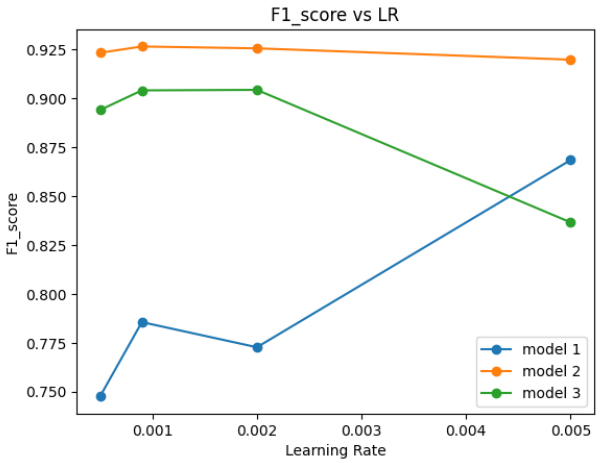
Performance measure	0.005	0.002	0.0009	0.0005
Accuracy (%)	87.86	94.96	94.39	93.03
F1-macro	0.8720	0.9497	0.9440	0.9303
Loss	52891.51	19575.337	22130.69	27603.908

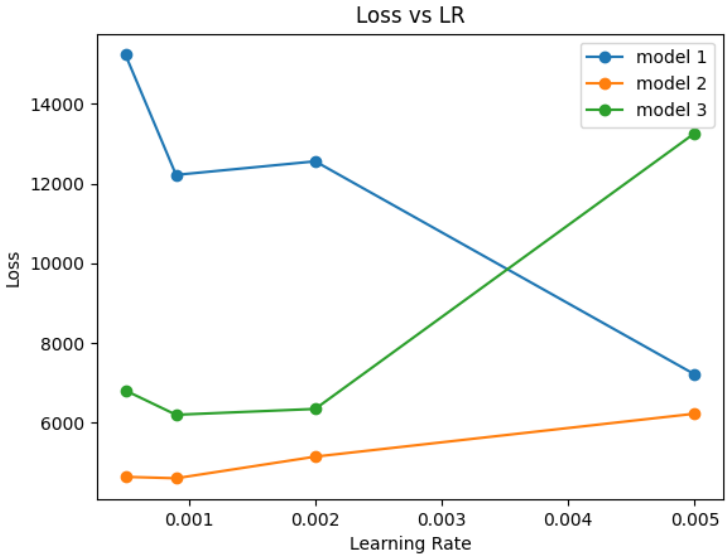
Performance measures: (Validation)

Performance measure	0.005	0.002	0.0009	0.0005
Accuracy (%)	84.123	90.47	90.445	89.45
F1-macro	0.8366	0.9044	0.9042	0.8941
Loss	13268.923	6351.43	6204.328	6813.68

Model Comparison







To see all models confusion matrix :

https://drive.google.com/drive/folders/1llXuWTRlnqUKMVPh1_3Ex_rSDwH8m_ah?usp=sharing

Best Model

Model 2 with learning rate 0.0009 (Epoch 100)

Independent Test Performance:

- Loss: 5525.317
- Accuracy: 92.32%
- F1-macro: 0.923183

Confusion Matrix:

LABELS	TP	FP	FN	TN
A	738	75	62	19925
B	757	33	43	19967
C	765	40	35	19960
D	732	54	68	19946
E	762	46	38	19954
F	741	25	59	19975
G	638	118	162	19882
H	748	64	52	19936
I	613	218	187	19782
J	744	37	56	19963
K	751	36	49	19964
L	599	190	201	19810
M	774	21	26	19979
N	753	57	47	19943
O	779	60	21	19940
P	781	38	19	19962
Q	674	141	126	19859
R	749	45	51	19955
S	772	21	28	19979
T	768	54	32	19946
U	753	52	47	19948
V	743	51	57	19949
W	773	15	27	19985
X	760	34	40	19966
Y	759	50	41	19950
Z	776	23	24	19977