```
longest string: 47
First dataset:
 [['scenarios-mature.ec', 'scenarios-mature.ec', 'nymaim'], ['statementsfocuses.yt', 'statementsfocuses.yt', 'nymaim'], ['trailer-de
Labels:
['tinba', 'gozi_rfc4343', 'gozi_gpl', 'kraken_v2', 'gozi_luther', 'sisron', 'ranbyus_v1', 'alureon', 'nymaim', 'murofet_v3', 'matsnu'
Labels to idx:
{'tinba': 0, 'gozi_rfc4343': 1, 'gozi_gpl': 2, 'kraken_v2': 3, 'gozi_luther': 4, 'sisron': 5, 'ranbyus_v1': 6, 'alureon': 7, 'nymaim'
Domain Name:
 000000000000000000000000000trailer-defense.com
second Domain Name:
 000000000000000000000000000trailer-defense.com
Class Label encoded:
8
Domain Bigram Name:
 ['00', '00', '00', '00', '00', '00', '00', '00', '00', '00', '00', '00', '00', '00', '00', '00', '00', '00', '00', '00', '00', '00', '00',
Domain Char Name:
 ['0', '0', '0', '0', '0', '0', '0', '0', '0', '0', '0', '0', '0', '0', '0', '0', '0', '0', '0', '0', '0', '0', '0', '0', '0', '0', '0', '
Class Label encoded:
8
Characters Vocabulary:
['r', 'd', '9', 'o', 'f', 'c', '-', '5', 'm', 's', 'k', '7', '6', '3', 'p', 'h', 'q', 'w', '4', 'z', '2', '0', 'j', 'i', 'b', 'y', 'a
Char Vocabulary len: 38
Bigrams Vocabulary:
['k6', '3r', '8y', 'wb', 'l4', 'ul', 'a9', 'rd', 'hf', 'et', '6c', '6m', 'is', '0.', 'bi', 'rt', 'ww', 'fl', '7r', '7.', 'o9', 'ji',
Vocabulary len: 1405
A Dataset Domain:
 Char encode:
[21, 21, 21, 21, 21, 21, 21, 21, 21, 21, 21, 21, 21, 21, 21, 21, 21, 21, 21, 21, 21, 21, 21, 21, 21, 21, 34, 0, 26, 23, 36, 2
 Bigram encode:
[686, 686, 686, 686, 686, 686, 686, 686, 686, 686, 686, 686, 686, 686, 686, 686, 686, 686, 686, 686, 686, 686, 686, 686, 686, 686, 68
 Label:
8
dataset len: 50898

Fold 1/5
epoch 1 / 6, step 300/1358, loss = 1.0291
epoch 1 / 6, step 600/1358, loss = 1.5417
epoch 1 / 6, step 900/1358, loss = 0.7735
epoch 1 / 6, step 1200/1358, loss = 1.0567
Epoch 1/6:
Accuracy: 0.7638
Precision: 0.7616
Recall: 0.7638
F1 Score: 0.7546
==================================================
epoch 2 / 6, step 300/1358, loss = 0.5696
epoch 2 / 6, step 600/1358, loss = 0.4813
epoch 2 / 6, step 900/1358, loss = 0.8984
epoch 2 / 6, step 1200/1358, loss = 0.8890
Epoch 2/6:
Accuracy: 0.7960
Precision: 0.7995
Recall: 0.7960
F1 Score: 0.7891
==================================================
epoch 3 / 6, step 300/1358, loss = 0.6545
epoch 3 / 6, step 600/1358, loss = 0.9390
epoch 3 / 6, step 900/1358, loss = 0.6177
epoch 3 / 6, step 1200/1358, loss = 0.6108
Epoch 3/6:
Accuracy: 0.8057
Precision: 0.8162
Recall: 0.8057
F1 Score: 0.8014
==================================================
epoch 4 / 6, step 300/1358, loss = 0.5426
epoch 4 / 6, step 600/1358, loss = 0.3816
epoch 4 / 6, step 900/1358, loss = 0.3470
epoch 4 / 6, step 1200/1358, loss = 0.6445
Epoch 4/6:
Accuracy: 0.8087
Precision: 0.8128
Recall: 0.8087
F1 Score: 0.8026
==================================================
epoch 5 / 6, step 300/1358, loss = 0.7627
epoch 5 / 6, step 600/1358, loss = 0.2701
epoch 5 / 6, step 900/1358, loss = 0.5171
epoch 5 / 6, step 1200/1358, loss = 0.4733
Epoch 5/6:
Accuracy: 0.8078
Precision: 0.8130
Recall: 0.8078
F1 Score: 0.8028
==================================================
epoch 6 / 6, step 300/1358, loss = 0.2153
```

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epoch 6 / 6, step 600/1358, loss = 0.2010
epoch 6 / 6, step 900/1358, loss = 0.7421
epoch 6 / 6, step 1200/1358, loss = 0.4346
Epoch 6/6:
Accuracy: 0.7952
Precision: 0.8088
Recall: 0.7952
F1 Score: 0.7953
================================================

Fold 2/5
epoch 1 / 6, step 300/1358, loss = 1.1340
epoch 1 / 6, step 600/1358, loss = 0.6688
epoch 1 / 6, step 900/1358, loss = 0.7340
epoch 1 / 6, step 1200/1358, loss = 0.8216
Epoch 1/6:
Accuracy: 0.7732
Precision: 0.7766
Recall: 0.7732
F1 Score: 0.7565
================================================
epoch 2 / 6, step 300/1358, loss = 0.6858
epoch 2 / 6, step 600/1358, loss = 1.0095
epoch 2 / 6, step 900/1358, loss = 0.9784
epoch 2 / 6, step 1200/1358, loss = 0.3445
Epoch 2/6:
Accuracy: 0.7925
Precision: 0.7983
Recall: 0.7925
F1 Score: 0.7820
================================================
epoch 3 / 6, step 300/1358, loss = 0.6743
epoch 3 / 6, step 600/1358, loss = 0.5840
epoch 3 / 6, step 900/1358, loss = 0.2483
epoch 3 / 6, step 1200/1358, loss = 0.4968
Epoch 3/6:
Accuracy: 0.8084
Precision: 0.8166
Recall: 0.8084
F1 Score: 0.8024
================================================
epoch 4 / 6, step 300/1358, loss = 0.1656
epoch 4 / 6, step 600/1358, loss = 0.2520
epoch 4 / 6, step 900/1358, loss = 0.2251
epoch 4 / 6, step 1200/1358, loss = 0.6621
Epoch 4/6:
Accuracy: 0.7989
Precision: 0.8020
Recall: 0.7989
F1 Score: 0.7919
================================================
epoch 5 / 6, step 300/1358, loss = 0.7353
epoch 5 / 6, step 600/1358, loss = 0.3480
epoch 5 / 6, step 900/1358, loss = 0.4766
epoch 5 / 6, step 1200/1358, loss = 0.4602
Epoch 5/6:
Accuracy: 0.8098
Precision: 0.8128
Recall: 0.8098
F1 Score: 0.8058
================================================
epoch 6 / 6, step 300/1358, loss = 0.4396
epoch 6 / 6, step 600/1358, loss = 0.5442
epoch 6 / 6, step 900/1358, loss = 0.2224
epoch 6 / 6, step 1200/1358, loss = 0.5591
Epoch 6/6:
Accuracy: 0.8072
Precision: 0.8119
Recall: 0.8072
F1 Score: 0.8051
================================================

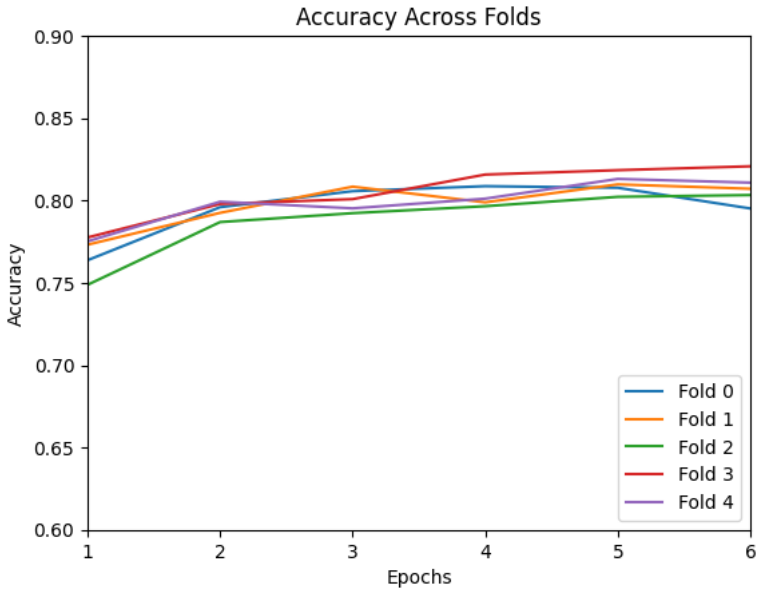
Fold 3/5
epoch 1 / 6, step 300/1358, loss = 1.1576
epoch 1 / 6, step 600/1358, loss = 0.8506
epoch 1 / 6, step 900/1358, loss = 0.7802
epoch 1 / 6, step 1200/1358, loss = 0.9144
Epoch 1/6:
Accuracy: 0.7488
Precision: 0.7886
Recall: 0.7488
F1 Score: 0.7351
================================================
epoch 2 / 6, step 300/1358, loss = 0.7740
epoch 2 / 6, step 600/1358, loss = 0.6905
epoch 2 / 6, step 900/1358, loss = 0.5143
```

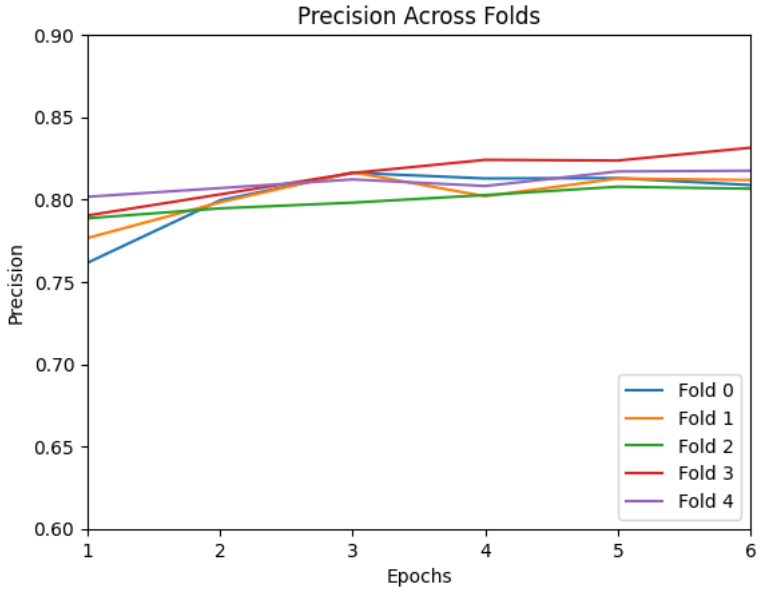
```
epoch 2 / 6, step 1200/1358, loss = 0.7511
Epoch 2/6:
Accuracy: 0.7869
Precision: 0.7946
Recall: 0.7869
F1 Score: 0.7752
================================================
epoch 3 / 6, step 300/1358, loss = 0.9887
epoch 3 / 6, step 600/1358, loss = 0.2705
epoch 3 / 6, step 900/1358, loss = 0.5143
epoch 3 / 6, step 1200/1358, loss = 1.0015
Epoch 3/6:
Accuracy: 0.7923
Precision: 0.7981
Recall: 0.7923
F1 Score: 0.7897
================================================
epoch 4 / 6, step 300/1358, loss = 0.5013
epoch 4 / 6, step 600/1358, loss = 0.3351
epoch 4 / 6, step 900/1358, loss = 0.5391
epoch 4 / 6, step 1200/1358, loss = 0.5010
Epoch 4/6:
Accuracy: 0.7966
Precision: 0.8027
Recall: 0.7966
F1 Score: 0.7936
================================================
epoch 5 / 6, step 300/1358, loss = 0.4296
epoch 5 / 6, step 600/1358, loss = 0.3587
epoch 5 / 6, step 900/1358, loss = 0.6629
epoch 5 / 6, step 1200/1358, loss = 0.6947
Epoch 5/6:
Accuracy: 0.8023
Precision: 0.8078
Recall: 0.8023
F1 Score: 0.7954
================================================
epoch 6 / 6, step 300/1358, loss = 0.3780
epoch 6 / 6, step 600/1358, loss = 0.3201
epoch 6 / 6, step 900/1358, loss = 0.5098
epoch 6 / 6, step 1200/1358, loss = 0.5371
Epoch 6/6:
Accuracy: 0.8033
Precision: 0.8066
Recall: 0.8033
F1 Score: 0.7997
================================================

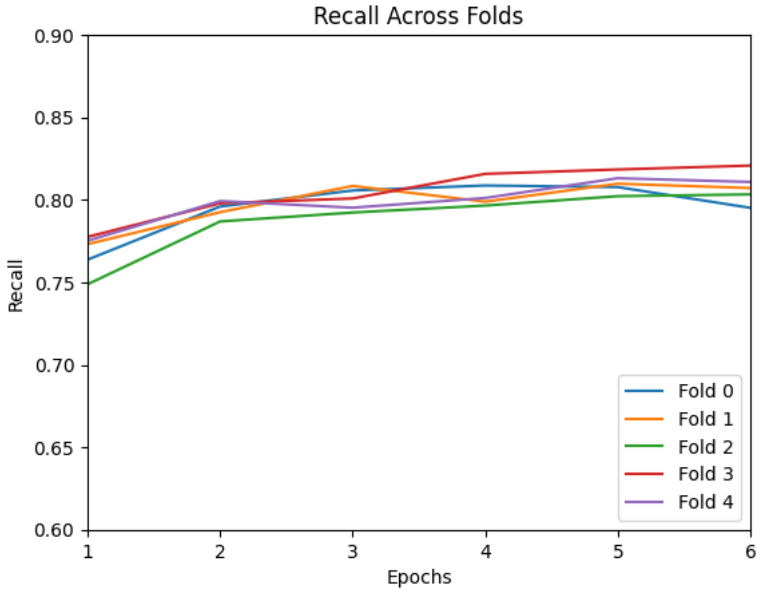
Fold 4/5
epoch 1 / 6, step 300/1358, loss = 1.1127
epoch 1 / 6, step 600/1358, loss = 1.2496
epoch 1 / 6, step 900/1358, loss = 0.9581
epoch 1 / 6, step 1200/1358, loss = 1.2636
Epoch 1/6:
Accuracy: 0.7776
Precision: 0.7903
Recall: 0.7776
F1 Score: 0.7700
================================================
epoch 2 / 6, step 300/1358, loss = 1.0829
epoch 2 / 6, step 600/1358, loss = 0.5345
epoch 2 / 6, step 900/1358, loss = 1.2021
epoch 2 / 6, step 1200/1358, loss = 0.6078
Epoch 2/6:
Accuracy: 0.7979
Precision: 0.8031
Recall: 0.7979
F1 Score: 0.7852
================================================
epoch 3 / 6, step 300/1358, loss = 1.0251
epoch 3 / 6, step 600/1358, loss = 0.2280
epoch 3 / 6, step 900/1358, loss = 0.5116
epoch 3 / 6, step 1200/1358, loss = 0.3711
Epoch 3/6:
Accuracy: 0.8009
Precision: 0.8161
Recall: 0.8009
F1 Score: 0.7956
================================================
epoch 4 / 6, step 300/1358, loss = 0.8419
epoch 4 / 6, step 600/1358, loss = 0.7741
epoch 4 / 6, step 900/1358, loss = 0.6802
epoch 4 / 6, step 1200/1358, loss = 0.2833
Epoch 4/6:
Accuracy: 0.8158
Precision: 0.8241
```

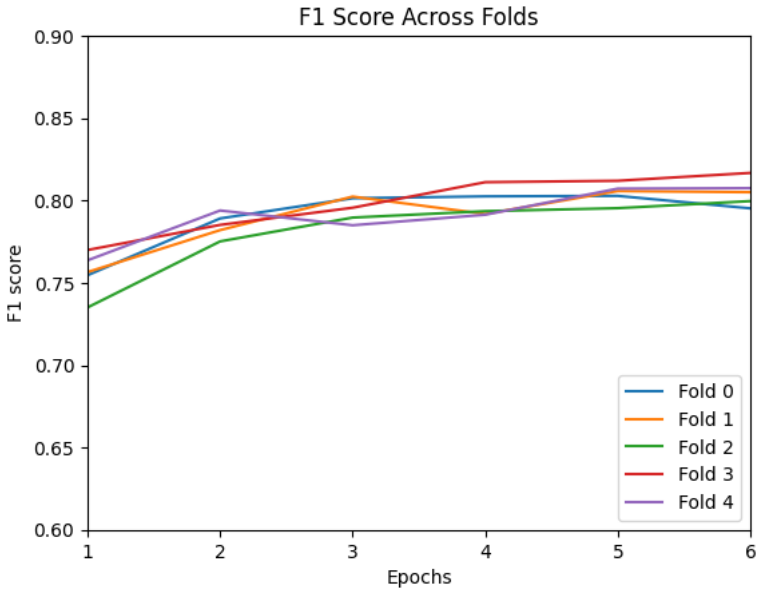
```
Recall: 0.8158
F1 Score: 0.8112
================================================
epoch 5 / 6, step 300/1358, loss = 0.2523
epoch 5 / 6, step 600/1358, loss = 0.3239
epoch 5 / 6, step 900/1358, loss = 0.8572
epoch 5 / 6, step 1200/1358, loss = 0.2112
Epoch 5/6:
Accuracy: 0.8184
Precision: 0.8237
Recall: 0.8184
F1 Score: 0.8120
================================================
epoch 6 / 6, step 300/1358, loss = 0.2034
epoch 6 / 6, step 600/1358, loss = 0.4206
epoch 6 / 6, step 900/1358, loss = 0.2489
epoch 6 / 6, step 1200/1358, loss = 0.3127
Epoch 6/6:
Accuracy: 0.8208
Precision: 0.8314
Recall: 0.8208
F1 Score: 0.8168
================================================

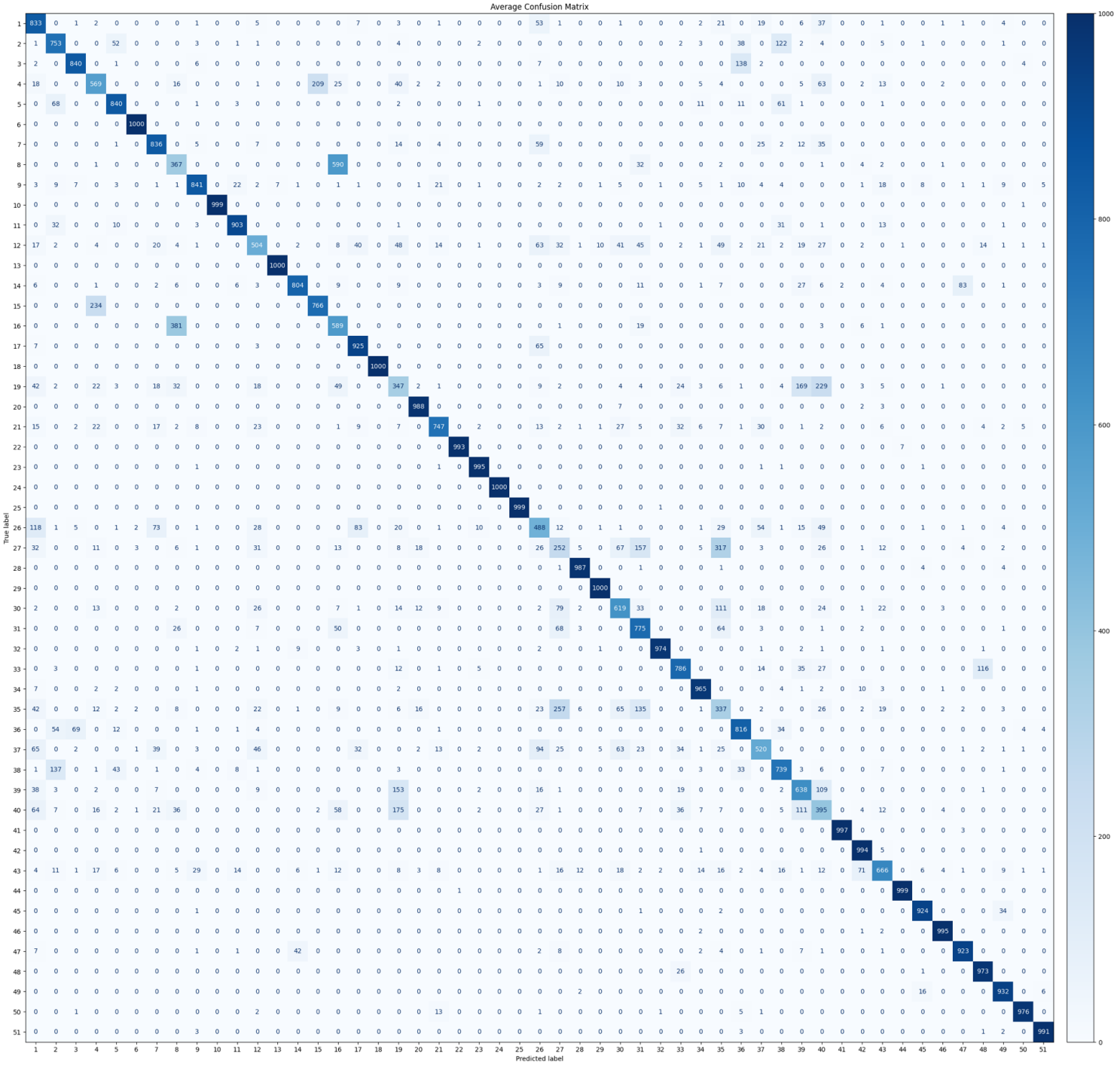
Fold 5/5
epoch 1 / 6, step 300/1358, loss = 1.2142
epoch 1 / 6, step 600/1358, loss = 1.2098
epoch 1 / 6, step 900/1358, loss = 1.0318
epoch 1 / 6, step 1200/1358, loss = 0.7513
Epoch 1/6:
Accuracy: 0.7752
Precision: 0.8017
Recall: 0.7752
F1 Score: 0.7637
================================================
epoch 2 / 6, step 300/1358, loss = 0.6484
epoch 2 / 6, step 600/1358, loss = 0.7430
epoch 2 / 6, step 900/1358, loss = 0.4216
epoch 2 / 6, step 1200/1358, loss = 0.4822
Epoch 2/6:
Accuracy: 0.7993
Precision: 0.8070
Recall: 0.7993
F1 Score: 0.7940
================================================
epoch 3 / 6, step 300/1358, loss = 0.3817
epoch 3 / 6, step 600/1358, loss = 0.6204
epoch 3 / 6, step 900/1358, loss = 0.3339
epoch 3 / 6, step 1200/1358, loss = 0.5134
Epoch 3/6:
Accuracy: 0.7953
Precision: 0.8122
Recall: 0.7953
F1 Score: 0.7850
================================================
epoch 4 / 6, step 300/1358, loss = 0.4488
epoch 4 / 6, step 600/1358, loss = 0.7671
epoch 4 / 6, step 900/1358, loss = 0.7149
epoch 4 / 6, step 1200/1358, loss = 0.5418
Epoch 4/6:
Accuracy: 0.8012
Precision: 0.8082
Recall: 0.8012
F1 Score: 0.7914
================================================
epoch 5 / 6, step 300/1358, loss = 0.2215
epoch 5 / 6, step 600/1358, loss = 0.4730
epoch 5 / 6, step 900/1358, loss = 0.3005
epoch 5 / 6, step 1200/1358, loss = 0.3017
Epoch 5/6:
Accuracy: 0.8131
Precision: 0.8171
Recall: 0.8131
F1 Score: 0.8072
================================================
epoch 6 / 6, step 300/1358, loss = 0.5650
epoch 6 / 6, step 600/1358, loss = 0.2939
epoch 6 / 6, step 900/1358, loss = 0.5209
epoch 6 / 6, step 1200/1358, loss = 0.1188
Epoch 6/6:
Accuracy: 0.8109
Precision: 0.8175
Recall: 0.8109
F1 Score: 0.8075
================================================
```


Accuracy Across Folds
Accuracy
Epochs
Fold 0
Fold 1
Fold 2
Fold 3
Fold 4


Precision Across Folds
Precision
Epochs
Fold 0
Fold 1
Fold 2
Fold 3
Fold 4


Recall Across Folds
Recall
Epochs
Fold 0
Fold 1
Fold 2
Fold 3
Fold 4


F1 Score Across Folds
F1 score
Epochs
0.90
0.85
0.80
0.75
0.70
0.65
0.60
1
2
3
4
5
6
Fold 0
Fold 1
Fold 2
Fold 3
Fold 4



Classification report:

	precision	recall	f1-score	support
tinba	0.63	0.83	0.72	1000
gozi_rfc4343	0.70	0.76	0.73	995
gozi_gpl	0.91	0.84	0.87	1000
kraken_v2	0.61	0.57	0.59	1000
gozi_luther	0.86	0.84	0.85	1000
sisron	0.99	1.00	1.00	1000
ranbyus_v1	0.81	0.84	0.82	1000
alureon	0.41	0.37	0.39	1000
nymaim	0.92	0.84	0.88	1000
murofet_v3	1.00	1.00	1.00	1000
matsnu	0.94	0.91	0.92	996
qakbot	0.68	0.50	0.58	1000
vawtrak_v1	0.99	1.00	1.00	1000
shiotob	0.93	0.80	0.86	1000
kraken_v1	0.78	0.77	0.77	1000
fobber_v2	0.41	0.59	0.49	1000
murofet_v2	0.84	0.93	0.88	1000
dyre	1.00	1.00	1.00	1000
dircrypt	0.40	0.35	0.37	1000
simda	0.95	0.99	0.97	1000

necurs	0.89	0.75	0.81	1000
corebot	1.00	0.99	1.00	1000
padcrypt	0.97	0.99	0.98	1000
banjori	1.00	1.00	1.00	1000
zeus-newgoz	1.00	1.00	1.00	1000
cryptolocker	0.51	0.49	0.50	1000
pykspa	0.32	0.25	0.28	1000
suppobox_2	0.97	0.99	0.98	998
ramdo	0.98	1.00	0.99	1000
proslikefan	0.67	0.62	0.64	1000
tempedreve	0.62	0.78	0.69	1000
chinad	0.99	0.97	0.98	1000
ranbyus_v2	0.82	0.79	0.80	1000
pushdo	0.93	0.96	0.95	1000
pykspa_noise	0.33	0.34	0.34	1000
rovnix	0.77	0.82	0.79	1000
locky	0.72	0.52	0.60	1000
gozi_nasa	0.72	0.75	0.73	991
bedep	0.60	0.64	0.62	1000
ramnit	0.36	0.40	0.38	1000
ccleaner	1.00	1.00	1.00	1000
vawtrak_v3	0.90	0.99	0.94	1000
legit	0.81	0.67	0.73	1000
symmi	0.99	1.00	1.00	1000
suppobox_1	0.96	0.96	0.96	962
vawtrak_v2	0.98	0.99	0.99	1000
qadars	0.90	0.92	0.91	1000
fobber_v1	0.87	0.97	0.92	1000
pizd	0.92	0.97	0.95	956
murofet_v1	0.98	0.98	0.98	1000
suppobox_3	0.98	0.99	0.99	1000
accuracy			0.81	50898
macro avg	0.81	0.81	0.81	50898
weighted avg	0.81	0.81	0.81	50898