

## Output of vanilla RNN model on test data (predictions and classification report)

Predictions: [2, 4, 2, 1, 1, 2, 1, 2, 3, 4, 1, 2, 3, 4, 3, 3, 4, 2, 1, 1, 2, 2, 2, 3, 2, 1, 3, 4, 2, 3, 2, 2, 3, 3, 2, 2, 2, 2, 2, 2, 1, 5, 2, 1, 1, 1, 1, 1, 1, 3, 2, 3, 5, 3, 2, 2, 1, 2, 3, 1, 2, 2, 1, 1, 1, 2, 1, 4, 2, 2, 1, 3, 1, 3, 3, 3, 3, 5, 1, 2, 2, 1, 1, 1, 2, 1, 3, 2, 1, 2, 4, 2, 4, 5, 1, 5, 1, 4, 2, 5, 3, 2, 2, 5, 2, 2, 1, 2, 2, 1, 5, 4, 5, 3, 5, 1, 1, 3, 1, 2, 3, 1, 1, 2, 4, 1, 4, 1, 2, 2, 1, 4, 1, 2, 3, 2, 2, 2, 1, 2, 1, 2, 2, 3, 2, 1, 1, 3, 1, 2, 2, 4, 3, 2, 4, 2, 1, 1, 3, 2, 2, 1, 2, 1, 1, 4, 4, 2, 2, 2, 1, 2, 4, 4, 1, 1, 3, 1, 1, 3, 1, 2, 5, 2, 2, 4, 2, 4, 4, 4, 5, 2, 1, 1, 4, 1, 1, 3, 1, 1, 1, 4, 3, 5, 5, 4, 2, 2, 2, 1, 4, 5, 4, 1, 1, 1, 1, 2, 4, 2, 2, 2, 2, 2, 3, 4, 3, 2, 1, 4, 3, 2, 2, 2, 2, 3, 3, 4, 1, 1, 2, 4, 2, 2, 4, 4, 1, 5, 1, 2, 5, 3, 4, 4, 1, 4, 4, 2, 2, 2, 2, 1, 2, 5, 2, 1, 5, 2, 1, 2, 2, 3, 2, 1, 2, 2, 2, 3, 2, 2, 2, 2, 2, 5, 4, 1, 2, 2, 5, 4, 1, 4, 1, 2, 2, 4, 4, 4, 1, 1, 2, 5, 2, 1, 4, 2, 3, 2, 1, 4, 2, 3, 2, 4, 4, 2, 2, 1, 2, 2, 2, 1, 2, 2, 2, 2, 3, 2, 3, 3, 1, 2, 5, 4, 2, 1, 2, 5, 1, 2, 3, 2, 1, 2, 2, 4, 1, 3, 1, 1, 1, 1, 1, 2, 1, 1, 5, 1, 3, 4, 2, 5, 2, 3, 1, 5, 3, 3, 1]

	precision	recall	f1-score	support
1	0.43	0.44	0.43	105
2	0.30	0.58	0.40	74
3	0.73	0.46	0.56	83
4	0.45	0.28	0.35	82
5	0.13	0.10	0.12	39
accuracy			0.40	383
macro avg	0.41	0.37	0.37	383
weighted avg	0.44	0.40	0.40	383

## Output of old FFN model on test data (predictions and classification report)

Predictions: [1, 1, 3, 3, 4, 4, 2, 1, 4, 4, 5, 5, 1, 5, 4, 3, 4, 3, 5, 1, 2, 3, 3, 3, 3, 2, 3, 3, 3, 3, 1, 1, 3, 1, 3, 2, 2, 1, 3, 4, 1, 1, 1, 2, 1, 1, 2, 5, 3, 3, 2, 3, 4, 3, 5, 4, 4, 1, 1, 4, 1, 3, 2, 5, 4, 2, 1, 5, 2, 3, 4, 4, 1, 1, 3, 3, 3, 3, 2, 1, 1, 1, 4, 1, 2, 1, 3, 1, 5, 3, 3, 3, 4, 1, 1, 3, 4, 2, 4, 4, 3, 1, 4, 3, 1, 3, 4, 1, 3, 1, 1, 2, 1, 3, 1, 1, 2, 3, 1, 4, 1, 1, 1, 3, 4, 1, 4, 5, 2, 1, 4, 3, 1, 5, 1, 1, 4, 2, 1, 4, 1, 5, 5, 3, 1, 1, 1, 3, 4, 2, 4, 5, 3, 4, 4, 4, 4, 1, 3, 2, 2, 4, 4, 5, 4, 4, 2, 2, 3, 2, 2, 1, 3, 4, 1, 1, 4, 1, 2, 3, 3, 1, 5, 1, 1, 4, 4, 3, 4, 4, 4, 1, 1, 1, 1, 1, 3, 3, 1, 1, 4, 3, 3, 4, 5, 4, 1, 3, 3, 1, 2, 3, 5, 1, 1, 1, 1, 2, 2, 2, 4, 2, 2, 4, 3, 4, 3, 1, 2, 2, 3, 5, 2, 5, 4, 3, 3, 1, 4, 4, 3, 4, 1, 1, 2, 4, 1, 5, 4, 4, 2, 4, 3, 5, 1, 3, 5, 3, 2, 4, 2, 4, 4, 4, 1, 3, 4, 2, 2, 3, 3, 5, 3, 3, 1, 2, 4, 1, 5, 3, 1, 1, 2, 1, 2, 2, 5, 1, 4, 4, 2, 1, 3, 4, 2, 3, 2, 2, 2, 4, 5, 4, 1, 2, 5, 4, 1, 2, 4, 2, 5, 1, 2, 1, 3, 4, 2, 3, 3, 3, 2, 1, 3, 3, 2, 3, 5, 3, 1, 3, 4, 3, 4, 1, 1, 1, 1, 1, 2, 5, 2, 5, 3, 4, 1, 4, 4, 5, 3, 2, 1, 3, 2, 3, 4, 2, 1, 1, 4, 4, 3, 1, 2, 1, 1, 1, 2, 4, 1, 4, 2, 1, 3, 5, 5, 1, 3, 5, 5, 4, 1, 1]

	precision	recall	f1-score	support
1	0.87	0.91	0.89	105
2	0.91	0.80	0.85	74
3	0.85	0.92	0.88	83
4	0.90	0.89	0.90	82
5	0.95	0.92	0.94	39
accuracy			0.89	383
macro avg	0.90	0.89	0.89	383
weighted avg	0.89	0.89	0.89	383

## Output of new FFN model on test data (predictions and classification report)

Predictions: [1, 1, 3, 3, 4, 4, 2, 1, 2, 4, 5, 5, 1, 5, 4, 3, 4, 3, 4, 1, 2, 3, 3, 3, 3, 3, 3, 3, 3, 3, 3, 1, 3, 3, 1, 3, 2, 2, 1, 3, 4, 1, 1, 1, 2, 1, 1, 2, 5, 3, 3, 2, 3, 4, 3, 5, 4, 4, 1, 1, 4, 1, 3, 2, 5, 5, 2, 1, 5, 2, 3, 4, 4, 1, 1, 3, 3, 3, 3, 2, 1, 1, 1, 4, 1, 2, 1, 3, 1, 5, 3, 3, 3, 4, 1, 1, 3, 4, 2, 4, 4, 3, 1, 4, 3, 1, 3, 4, 1, 3, 1, 1, 2, 1, 3, 1, 1, 2, 3, 1, 4, 1, 1, 1, 3, 4, 1, 4, 5, 2, 1, 4, 3, 1, 5, 1, 1, 4, 2, 1, 4, 1, 5, 5, 3, 1, 1, 1, 3, 4, 2, 4, 5, 3, 4, 4, 4, 4, 1, 3, 2, 2, 4, 4, 5, 4, 4, 2, 2, 3, 2, 2, 1, 3, 4, 1, 1, 4, 1, 2, 3, 3, 1, 5, 1, 1, 4, 4, 3, 4, 4, 4, 1, 1, 2, 1, 1, 3, 3, 1, 1, 4, 3, 3, 4, 5, 4, 1, 3, 3, 1, 2, 3, 5, 3, 1, 1, 1, 2, 2, 2, 4, 1, 2, 4, 3, 4, 3, 1, 2, 2, 3, 5, 2, 4, 4, 3, 3, 1, 4, 4, 3, 4, 1, 1, 2, 4, 1, 5, 4, 4, 2, 4, 3, 5, 1, 3, 5, 3, 2, 4, 2, 4, 4, 4, 1, 3, 4, 2, 2, 3, 3, 5, 3, 3, 1, 2, 2, 1, 5, 3, 1, 2, 2, 1, 4, 2, 5, 1, 4, 4, 2, 1, 3, 4, 4, 3, 2, 2, 2, 4, 5, 4, 1, 2, 5, 4, 1, 2, 4, 2, 5, 1, 3, 1, 3, 4, 2, 3, 3, 3, 2, 1, 3, 3, 2, 3, 5, 3, 1, 3, 4, 3, 4, 1,

1, 1, 1, 1, 2, 5, 2, 5, 3, 4, 1, 5, 4, 5, 3, 2, 1, 3, 2, 3, 4, 2, 1, 1, 4, 4, 3, 1, 2, 1, 1, 1, 3, 4, 1, 4, 2, 1, 3, 3, 5, 1, 3, 5, 5, 4, 1, 1]

	precision	recall	f1-score	support
1	0.91	0.91	0.91	105
2	0.92	0.78	0.85	74
3	0.82	0.94	0.88	83
4	0.87	0.88	0.87	82
5	0.97	0.90	0.93	39
accuracy			0.89	383
macro avg	0.90	0.88	0.89	383
weighted avg	0.89	0.89	0.88	383

## Output of majority voting ensemble model on test data (predictions and classification report)

Predictions: [1, 1, 3, 3, 4, 4, 2, 1, 4, 4, 5, 5, 1, 5, 4, 3, 4, 3, 5, 1, 2, 3, 3, 3, 3, 2, 3, 3, 3, 3, 1, 1, 3, 1, 3, 2, 2, 1, 3, 4, 1, 1, 1, 2, 1, 1, 2, 5, 3, 3, 2, 3, 4, 3, 5, 4, 4, 1, 1, 2, 1, 3, 2, 5, 4, 2, 1, 5, 2, 3, 4, 4, 1, 1, 3, 3, 3, 3, 3, 2, 1, 1, 1, 4, 1, 2, 1, 3, 1, 5, 3, 3, 3, 4, 1, 1, 3, 4, 1, 4, 4, 3, 1, 5, 3, 1, 3, 4, 1, 3, 1, 1, 2, 1, 3, 1, 1, 2, 3, 1, 4, 1, 1, 1, 3, 4, 1, 4, 5, 2, 1, 4, 3, 1, 5, 1, 1, 4, 2, 1, 4, 1, 5, 5, 3, 1, 1, 1, 3, 4, 2, 4, 5, 3, 4, 4, 4, 4, 1, 3, 2, 2, 4, 5, 4, 4, 2, 3, 2, 2, 1, 3, 4, 1, 1, 4, 1, 2, 3, 3, 1, 5, 1, 1, 4, 4, 3, 4, 4, 4, 1, 1, 1, 1, 1, 3, 3, 4, 4, 2, 2, 3, 3, 4, 5, 4, 1, 3, 3, 1, 2, 3, 5, 1, 1, 1, 1, 1, 4, 3, 4, 5, 4, 1, 3, 3, 1, 2, 3, 5, 1, 1, 1, 1, 2, 2, 4, 2, 2, 4, 3, 4, 3, 1, 2, 2, 3, 5, 2, 5, 4, 3, 3, 1, 4, 4, 3, 4, 1, 1, 2, 4, 1, 5, 4, 4, 2, 4, 3, 5, 1, 3, 5, 3, 2, 4, 2, 4, 4, 4, 1, 3, 4, 2, 2, 3, 3, 5, 3, 3, 1, 2, 2, 1, 5, 3, 1, 2, 2, 1, 2, 2, 5, 1, 4, 4, 2, 1, 3, 4, 2, 3, 2, 2, 2, 4, 5, 4, 1, 2, 5, 4, 1, 2, 4, 2, 5, 1, 3, 1, 3, 4, 2, 3, 3, 3, 2, 1, 3, 3, 2, 3, 5, 3, 1, 3, 4, 3, 4, 1, 1, 1, 1, 1, 2, 5, 2, 5, 3, 4, 1, 5, 4, 5, 3, 2, 1, 3, 2, 3, 4, 2, 1, 1, 4, 4, 3, 1, 2, 1, 1, 1, 2, 4, 1, 4, 2, 1, 3, 5, 5, 1, 3, 5, 5, 4, 1, 1]

	precision	recall	f1-score	support
1	0.87	0.90	0.89	105
2	0.89	0.80	0.84	74
3	0.86	0.93	0.89	83
4	0.90	0.87	0.88	82
5	0.92	0.92	0.92	39
accuracy			0.88	383
macro avg	0.89	0.88	0.89	383
weighted avg	0.88	0.88	0.88	383

## Output of weighted voting ensemble model on test data (predictions and classification report)

Predictions: [1, 2, 3, 3, 3, 4, 2, 1, 3, 4, 4, 4, 1, 5, 4, 3, 4, 3, 4, 1, 2, 3, 3, 3, 3, 2, 3, 3, 3, 3, 1, 2, 3, 1, 3, 2, 2, 1, 3, 4, 1, 2, 1, 2, 1, 1, 2, 4, 3, 3, 2, 3, 4, 3, 4, 4, 3, 1, 1, 3, 1, 3, 2, 4, 4, 2, 1, 4, 2, 3, 4, 3, 1, 1, 3, 3, 3, 3, 3, 2, 1, 1, 1, 3, 1, 2, 1, 3, 1, 4, 3, 3, 3, 4, 2, 1, 3, 3, 2, 4, 4, 3, 1, 4, 3, 1, 3, 3, 1, 3, 1, 2, 2, 2, 3, 2, 1, 2, 3, 1, 4, 1, 1, 1, 3, 4, 1, 4, 4, 2, 1, 3, 3, 1, 4, 1, 1, 4, 2, 1, 4, 1, 4, 4, 3, 1, 1, 1, 3, 3, 2, 4, 5, 3, 4, 4, 4, 3, 1, 3, 2, 2, 3, 4, 4, 3, 4, 2, 2, 3, 2, 2, 1, 3, 4, 1, 1, 4, 1, 2, 3, 3, 1, 5, 1, 1, 4, 4, 3, 4, 4, 4, 1, 1, 2, 2, 1, 3, 3, 1, 1, 3, 3, 3, 4, 5, 4, 1, 3, 3, 1, 2, 3, 5, 2, 1, 1, 1, 2, 2, 2, 4, 1, 2, 4, 3, 4, 3, 1, 2, 2, 3, 4, 2, 4, 4, 3, 3, 1, 4, 3, 3, 4, 2, 1, 2, 4, 2, 4, 4, 3, 2, 4, 3, 5, 2, 3, 5, 3, 2, 4, 2, 4, 3, 4, 2, 3, 3, 3, 2, 3, 3, 4, 3, 3, 1, 2, 2, 1, 4, 3, 1, 2, 2, 1, 3, 3, 4, 2, 4, 3, 2, 1, 3, 4, 3, 3, 2, 2, 2, 4, 5, 4, 1, 2, 4, 4, 1, 3, 4, 2, 5, 1, 3, 1, 3, 4, 2, 3, 3, 3, 2, 1, 3, 3, 2, 3, 4, 3, 1, 3, 4, 3, 4, 1, 1, 1, 1, 1, 2, 5, 2, 5, 3, 3, 1, 5, 4, 4, 3, 2, 2, 3, 2, 3, 4, 2, 1, 1, 4, 3, 3, 1, 2, 1, 1, 1, 3, 3, 1, 4, 2, 1, 3, 3, 5, 1, 3, 4, 5, 4, 1, 1]

	precision	recall	f1-score	support
1	0.90	0.80	0.85	105
2	0.75	0.76	0.75	74
3	0.65	0.93	0.76	83
4	0.65	0.65	0.65	82
5	0.93	0.33	0.49	39
accuracy			0.74	383
macro avg	0.77	0.69	0.70	383
weighted avg	0.77	0.74	0.73	383

- Overall accuracy of vanilla RNN on test data is : 38.2088772845953  
Class-wise accuracy of vanilla RNN is: [0.42809524 0.58108108 0.43783133 0.2804878 0.1025641 ]

- Overall accuracy of old FFN on test data is : 87.77284595300262  
Class-wise accuracy of old FFN is: [0.91428571 0.7972973 0.91566265 0.8902439 0.92307692]

- Overall accuracy of new FFN on test data is : 85.51174934725849  
Class-wise accuracy of new FFN is: [0.91428571 0.78378378 0.93975904 0.87804878 0.8974359 ]

- Overall accuracy of majority voting ensemble on test data is : 83.25065274151436  
Class-wise accuracy of majority voting ensemble is: [0.9047619 0.7972973 0.92771084 0.86585366 0.92307692]

- Overall accuracy of weighted voting ensemble on test data is : 73.89033942558747  
Class-wise accuracy of weighted voting ensemble is: [0.8 0.75675676 0.92771084 0.64634146 0.33333333]

- Number of instances misclassified in vanilla RNN model but correctly classified in the ensemble model: 121
- Number of instances misclassified in old FFN model but correctly classified in the ensemble model: 1
- Number of instances misclassified in new FFN model but correctly classified in the ensemble model: 3
- Number of instances wrongly classified by all three models but correctly classified by the ensemble: 1