CS564 ML

Assignment-4

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Task: Implementation of a Feed Forward Neural Network for the document classification of the BBC News Dataset into five categories, business, entertainment, politics, sport and tech.

For **Pre-processing of data**, I have:

1. removed all stopwords,
2. considered 50 words/article,
3. converted text to lower case,
4. removed punctuation, and finally
5. performed stemming on each word

The BBC News Dataset was split in the ratio of **70:10:20 for training, validation and testing**

Variation in Activation Functions:

Scenario 1:
Activation Function = **ReLU**
Optimizer = **Adam**

Evaluation:
Overall Accuracy = **54.83%**

Accuracy on fold number 1 is:
47.25848563968668

	precision	recall	f1-score	support
business	0.57	0.30	0.40	79
entertainment	0.73	0.43	0.55	69
politics	0.50	0.61	0.55	93
sport	0.26	0.62	0.37	47
tech	0.53	0.43	0.48	95
accuracy			0.47	383
macro avg	0.52	0.48	0.47	383
weighted avg	0.54	0.47	0.48	383

Accuracy on fold number 2 is:
57.96344647519582

	precision	recall	f1-score	support
business	0.71	0.41	0.52	79
entertainment	0.76	0.57	0.65	69
politics	0.50	0.87	0.64	93
sport	0.61	0.30	0.40	47
tech	0.54	0.59	0.57	95
accuracy			0.58	383
macro avg	0.63	0.55	0.55	383
weighted avg	0.62	0.58	0.57	383

Accuracy on fold number 3 is:
59.268929503916446

	precision	recall	f1-score	support
business	0.77	0.42	0.54	79
entertainment	0.83	0.43	0.57	69
politics	0.53	0.86	0.66	93
sport	0.57	0.53	0.55	47
tech	0.54	0.62	0.58	95
accuracy			0.59	383
macro avg	0.65	0.57	0.58	383
weighted avg	0.64	0.59	0.58	383

Overall Accuracy is: 54.83028720626632

Scenario 2:
Activation Function = **tanh**
Optimizer = **Adam**

Evaluation:
Overall Accuracy = **57.01%**

Accuracy on fold number 1 is:
48.825065274151434

	precision	recall	f1-score	support
business	0.39	0.59	0.47	79
entertainment	0.38	0.43	0.41	69
politics	0.57	0.49	0.53	93
sport	0.87	0.28	0.42	47
tech	0.59	0.54	0.56	95
accuracy			0.49	383
macro avg	0.56	0.47	0.48	383
weighted avg	0.54	0.49	0.49	383

Accuracy on fold number 2 is:
60.313315926892955

	precision	recall	f1-score	support
business	0.62	0.62	0.62	79
entertainment	0.54	0.62	0.58	69
politics	0.60	0.65	0.62	93
sport	0.47	0.64	0.54	47
tech	0.82	0.52	0.63	95
accuracy			0.60	383
macro avg	0.61	0.61	0.60	383
weighted avg	0.63	0.60	0.61	383

Accuracy on fold number 3 is:
61.8798955613577

	precision	recall	f1-score	support
business	0.64	0.61	0.62	79
entertainment	0.56	0.65	0.60	69
politics	0.63	0.69	0.66	93
sport	0.46	0.68	0.55	47
tech	0.86	0.51	0.64	95
accuracy			0.62	383
macro avg	0.63	0.63	0.61	383
weighted avg	0.65	0.62	0.62	383

Overall Accuracy is: 57.006092254134025

Conclusion:

tanh is a better activation function than ReLU. Reason: In Scenarios 1 and 2, we can notice that tanh achieves an accuracy of 57.01% which is better than ReLU's (54.83%), with the same optimizer.

Variation in Optimizers:

Scenario 3:
Activation Function = **ReLU**
Optimizer = **SGD**

Evaluation:
Overall Accuracy = **20.63%**

Accuracy on fold number 1 is:
20.626631853785902

	precision	recall	f1-score	support
business	0.21	1.00	0.34	79
entertainment	0.00	0.00	0.00	69
politics	0.00	0.00	0.00	93
sport	0.00	0.00	0.00	47
tech	0.00	0.00	0.00	95
accuracy			0.21	383
macro avg	0.04	0.20	0.07	383
weighted avg	0.04	0.21	0.07	383

Accuracy on fold number 2 is:
20.626631853785902

	precision	recall	f1-score	support
business	0.21	1.00	0.34	79
entertainment	0.00	0.00	0.00	69
politics	0.00	0.00	0.00	93
sport	0.00	0.00	0.00	47
tech	0.00	0.00	0.00	95
accuracy			0.21	383
macro avg	0.04	0.20	0.07	383
weighted avg	0.04	0.21	0.07	383

Accuracy on fold number 3 is:
20.626631853785902

	precision	recall	f1-score	support
business	0.21	1.00	0.34	79
entertainment	0.00	0.00	0.00	69
politics	0.00	0.00	0.00	93
sport	0.00	0.00	0.00	47
tech	0.00	0.00	0.00	95
accuracy			0.21	383
macro avg	0.04	0.20	0.07	383
weighted avg	0.04	0.21	0.07	383

Overall Accuracy is: 20.626631853785902

Conclusion:

Adam is a better optimizer than SGD. Reason: In Scenarios 2 and 3, we can notice that Adam achieves an accuracy of 54.83% which is better than SGD's (20.63%), with the same activation function.