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Assignment 3 Final Report

Our Approach

For the first portion of the project, which consists of Sentiment Prediction using RNN/LSTM, we decided to use the BERT classifier on the IMDB reviews dataset. Specifically, the BERT base Transformation encoder which consists of 12 layers, 12 attention heads, and 110 million parameters seemed most suitable for the dataset we are working with. BERT Large, the other deep learning model available, is better suited for a MUCH larger dataset. Our train test ratio was 80/20 for both portions of the project, and we used a seed = 42, to keep the train and test data splits consistent throughout the code. The training accuracy of the model was sometimes in the high 90's, which we believe may indicate a tendency to overfit the training data.

For the Naïve Bayes portion, we decided to use the Multinomial classifier from the Scikit-Learn library. In order to provide the 10 misclassified reviews, we used the original Multinomial classifier, with default settings. The only parameter tuning available for this classifier was adjusting the fit_prior parameter. After adjusting it to False, this produced a negligible decrease in model accuracy (difference less than 0.5%).

Due to the limitations in parameter tuning for the Multinomial classifier, we also experimented with the Gaussian classifier. We adjusted the var_smoothing parameter to see how it affected model accuracy. The var_smoothing parameter, according to the sk-learn documentation is the "portion of the largest variance of all features that is added to variances for calculation stability". In the code, we noted that as var_smoothing increases, the accuracy of the model suffers, but only to a baseline threshold of 50%, as evidenced by the Naïve Bayes Results table below.

Ultimately, the best model seemed to be the BERT model as it provided the highest model accuracy. This is due to the bidirectional encoding nature of the model, giving it a superior performance compared to Naïve Bayes methods. The cost of this accuracy is that the BERT model is more costly from a computing power perspective, and it takes longer to implement and run. In practice, the Naïve Bayes model would most likely suffice, considering we are just looking at movie reviews. However, in a more "higher stakes" setting, we would select the model with higher accuracy despite the limitations previously mentioned.

Keras Results

Classifier Type	Parameter Adjustment	Model Metrics (rounded 2 DP)
BERT base L12	Learning rate= .0001/10 epoch = 20 Optimizers = Adamax	Test: Loss: 0.25 Accuracy: 0.93
BERT base L12	Learning rate = .001/10 epoch = 3 Optimizers = Adamax	train: Loss: 0.002 Accuracy: 1.0 Test: Loss: 0.30 Accuracy: 0.93
BERT base L12	Learning rate = .0001/10 epoch = 10 Optimizers = Adam	test Loss: 0.68 Accuracy: 0.49 train Loss: 0.69 Accuracy: 0.48
BERT base L12	Learning rate = .0001/10 epoch = 10 Optimizers = Adamax	test Loss: 0.54 Accuracy: 0.74 train Loss: 0.39 Accuracy: 0.84
BERT base L12	Learning rate = .0001/10 epoch = 25 Optimizers = Adamax	test Loss: 0.26 Accuracy: 0.92 train Loss: 0.006 Accuracy: 1.0

Naïve Bayes Results

Classifier Type	Parameter Adjustment	Model Accuracy % (rounded 2 DP)
Multinomial	Default (fit_prior = True)	70.67
Multinomial	Fit_prior = False	69.33
Gaussian	Default (var_smoothing = 1e-9	70.67
Gaussian	Var_smoothing = 0.001	56.67
Gaussian	Var_smoothing = 0.01	50
Gaussian	Var_smoothing = 0.1	50

Ten Misclassified Reviews using Naïve Bayes

- The best scene in the movie was when Gerardo is trying to find a song that keeps running through his head.
- The movie showed a lot of Florida at it's best, made it look very appealing.
- It actually turned out to be pretty decent as far as B-list horror/suspense films go.
- There was NOTHING believable about it at all.
- I don't think you will be disappointed.
- I could not stand to even watch it for very long for fear of losing I.Q.
- Not a pleasant voyage of self-discovery.
- Nothing at all to recommend.
- There were too many close ups.
- But this movie is definitely a below average rent.

Ten Misclassified Reviews using Keras

- Jimmy Stewart is as ever a great hero for Hitchcock, the story rips along to its cool climax at an embassy function, but it lacks the brooding menace of Hitchcock's black and white, low-budget original. 1
- I struggle to find anything bad to say about it. 1
- Director Neil LaBute uses brutal violence to seperate dreams from reality, and along with the touching drama, and hilarious comedy, you can never tell what is going to happen next. 1
- " With great sound effects, and impressive special effects, I can't recommend this movie enough. 1
- If you do go see this movie, bring a pillow or a girlfriend/boyfriend to keep you occupied through out. 0
- And, FINALLY, after all that, we get to an ending that would've been great had it been handled by competent people and not Jerry Falwell. 0
- I would have casted her in that role after ready the script. 1
- The soundtrack wasn't terrible, either. 1
- If you see it, you should probably just leave it on the shelf. 0
- Easily, none other cartoon made me laugh in a tender way (before getting into dark sitcoms oriented for teenagers). 1