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**HW\_2 MNB and SVM for Fake Review Detection**

In this Fake review detection prediction, we built two classification models – one for sentiment and another for lie. Two machine learning models were built – Support Vector Machine and Multinomial Naïve Bayes. Along with them, multiple vectorization methods were used in this combination using TF-IDF Vectorizer, CountVectorizer Binary, CountVectorizer, and CountVectorizer Bigram.

For sentiment classification, the best-performing model was the Multinomial Naive Bayes with TF-IDF Vectorization, achieving an accuracy of 79% and an F1 Score of 0.83.

We extracted the top 10 features for sentiment and Lie for each vectorization and classifier combination. These features are based on the importance assigned to words by the models.The top features:

great  
best  
amazing  
delicious  
quality  
need  
friendly  
nice  
fresh  
favorite

These features reflect positive sentiment, suggesting that the model correctly identified words associated with positive reviews.

For lie classification, the SVM with TF-IDF Vectorization performed the best, with an accuracy of 45% and an F1 Score of 0.51. Top 10 Features:  
environment  
people  
cheese  
worst  
waitress  
menu  
lunch  
good  
overall  
time

These features do not show a clear pattern related to Lie, indicating that the model struggled to identify features distinguishing between true and fake reviews.

**COMPARISON OF PERFORMANCE METRICS:**

Each Model's Performance in Accuracy, Precision, Recall, and F-Measure The performance metrics for each model vary:  
  
**Multinomial Naive Bayes with TF-IDF Vectorization (Sentiment):**  
Accuracy: 79%  
Precision: 74%  
Recall: 94%  
F1 Score: 83%

**Multinomial Naive Bayes with TF-IDF Vectorization (Lie):**  
Accuracy: 45%  
Precision: 47%  
Recall: 55%  
F1 Score: 51%

**Support Vector Machine with TF-IDF Vectorization (Sentiment):**  
Accuracy: 78%  
Precision: 76%  
Recall: 85%  
F1 Score: 81%

**Support Vector Machine with TF-IDF Vectorization (Lie):**  
Accuracy: 45%  
Precision: 48%  
Recall: 64%  
F1 Score: 55%

**ERROR ANALYSIS TO IDENTIFY AREAS OF IMPROVEMENT:**

Based on the confusion matrices, both Multinomial Naive Bayes and SVM models struggled with Lie classification, as indicated by the low accuracy and F1 scores. For sentiment classification, while the Multinomial Naive Bayes model performed well, the SVM model showed slightly lower performance. Areas for improvement may include refining feature selection and engineering, exploring more complex models, or collecting additional data to better distinguish between authentic and fake reviews.

**COMPARISON OF DIFFICULTY:**

Sentiment classification proved to be relatively easier, with both Multinomial Naive Bayes and SVM models achieving higher accuracy and F1 scores. On the other hand, Lie (lie) classification was more challenging, as the models struggled to identify features that clearly distinguish true reviews from fake ones.