Model Comparison Report – SMS Spam Classification

# 📊 Model Performance Comparison

The following table compares different Naive Bayes and SVM models tested on the SMS Spam dataset.   
All models were trained on 80% of the data and tested on the remaining 20%.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Model | Vectorizer | Accuracy | False Positives | False Negatives | Notes |
| MultinomialNB | CountVectorizer | 99.19% | 0 | 9 | Strong baseline |
| MultinomialNB | TF-IDF | 96.68% | 0 | 37 | TF-IDF hurt recall |
| BernoulliNB | Binary Count | 98.21% | 0 | 20 | Safe classifier, more cautious |
| SVM (RBF) | TF-IDF | 98.92% | 0 | 12 | Good non-linear separation |
| SVM (Linear) | TF-IDF | 99.37% | 0 | 7 | Best performance overall |

# 🧠 Interpretation

- SVM with Linear Kernel provided the best accuracy and lowest false negatives.  
- MultinomialNB with CountVectorizer was the best-performing Naive Bayes variant.  
- BernoulliNB was cautious and safe, misclassifying fewer ham messages.  
- TF-IDF reduced recall for Naive Bayes models but worked well with SVMs.  
- RBF kernel performed well but wasn’t necessary — Linear was faster and better here.