

SMS Spam Detection Using Machine Learning

Advanced Version with Visualizations

This project identifies and filters out spam messages from SMS data using machine learning techniques.

It compares multiple algorithms to find the most accurate model and visualizes performance metrics.

Project Overview

Objective:

To classify SMS messages as either **Spam** or **Ham (Not Spam)** using natural language processing (NLP) and machine learning algorithms.

Motivation:

SMS spam messages can lead to scams, phishing, and poor user experience. This project aims to automatically detect such messages to improve safety and reliability in communication.

Technologies & Tools

- **Language:** Python
- **Libraries:** pandas, numpy, scikit-learn, nltk, seaborn, matplotlib, joblib
- **IDE / Environment:** Google Colab
- **Version Control:** Git & GitHub
- **Dataset Source:** [UCI Machine Learning Repository — SMS Spam Collection Dataset](#)

Methodology / Pipeline

Raw SMS → Text Cleaning & Preprocessing → TF-IDF Feature Extraction → Model Training → Evaluation → Prediction

Algorithms Used:

- Naive Bayes
- Logistic Regression
- Random Forest
- Support Vector Machine (SVM)

Evaluation Metrics:

- Accuracy
- Precision
- Recall
- F1-Score
- Confusion Matrix

Implementation Steps

1. Load dataset (from UCI Repository).
2. Preprocess text (lowercasing, removing punctuation, stemming, stopword removal).
3. Convert text to numerical features using **TF-IDF Vectorizer**.
4. Train multiple ML models.
5. Compare their performance.
6. Visualize results using **Matplotlib** and **Seaborn**.
7. Save the best model and TF-IDF vectorizer using **joblib**.
8. Test with new unseen messages.

Results & Visualizations

Model	Accuracy	Precision	Recall	F1-Score
Naive Bayes	0.97	0.96	0.95	0.96
Logistic Regression	0.98	0.97	0.97	0.97
Random Forest	0.96	0.95	0.94	0.94
SVM	0.99	0.98	0.98	0.98

✅ **Best Model:** Support Vector Machine (SVM)

Visualizations Included:

- Spam vs Ham Message Distribution
- Model Accuracy Comparison
- Confusion Matrix Heatmap
- Sample Predictions Output

Model Files

File	Description
models/best_spam_model.pkl	Trained ML model (best-performing SVM)
models/tfidf_vectorizer.pkl	TF-IDF vectorizer for text feature extraction

How to Run the Project

Option 1: In Google Colab

1. Open the .ipynb notebook file in Colab.

2. Run each cell from top to bottom.
3. View outputs (charts, confusion matrix, predictions).

Option 2: Locally (VS Code / Jupyter)

1. Clone the repository:

```
```bash git clone https://github.com/Keerthanadhanasekaran/SMS-spam-detection-ml cd sms-spam-detection-ml
```

## Links

- **GitHub Repository:** [Keerthanadhanasekaran/SMS-spam-detection-ml](https://github.com/Keerthanadhanasekaran/SMS-spam-detection-ml)
- Dataset: UCI SMS collection

## Conclusion

This project successfully implements an SMS Spam Detection system using multiple machine learning models.

It achieves high accuracy with the SVM model and demonstrates practical NLP applications for secure communications.

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