

# Machine Learning Model Implementation Report

## 1. Introduction

In this project, we implemented a machine learning model for spam email detection. Spam detection is a classic text classification problem where the goal is to identify unwanted or malicious messages. This project was developed as part of CODTECH Internship Task 4.

## 2. Dataset

The dataset used is the SMS Spam Collection dataset from the UCI Machine Learning Repository. It contains over 5,000 SMS messages labeled as either 'spam' or 'ham' (not spam).

## 3. Methodology

1. Data Preprocessing: Removed unnecessary columns and encoded labels. 2. Feature Extraction: Used Bag of Words with CountVectorizer. 3. Model Selection: Trained a Multinomial Naive Bayes classifier. 4. Evaluation: Used Accuracy, Precision, Recall, F1-score, and Confusion Matrix.

## 4. Results

The trained model achieved an accuracy of 97.25%. The classification report shows high precision and recall for both spam and ham messages. The confusion matrix indicates that the model correctly identified most spam and ham messages.

## 5. Conclusion

The spam detection model performs well with over 97% accuracy. Future improvements could include using advanced NLP techniques such as TF-IDF, Word Embeddings, or deep learning models like LSTMs or Transformers for even better performance.

## 6. Tools & Libraries

Python, Pandas, NumPy, Scikit-learn, Matplotlib, Seaborn