SMS Spam Detection System Using NLP

A Project Report

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ABSTRACT

This project focuses on the development of an SMS Spam Detection System using Natural Language Processing (NLP) techniques. The problem of spam messages in mobile communication has been growing, leading to a need for effective filtering mechanisms. This project leverages text classification algorithms like Naive Bayes, Support Vector Machine (SVM), and Logistic Regression to classify messages as spam or non-spam based on their content. The dataset used consists of labeled SMS messages, which are pre-processed and tokenized to extract relevant features. By using NLP techniques, such as tokenization, stemming, and stop-word removal, we build a model capable of accurately detecting spam messages. The performance of the model is evaluated using accuracy, precision, recall, and F1-score, achieving an accuracy rate of [mention the accuracy]. This system has significant applications in reducing the impact of spam messages on mobile users and service providers.

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CHAPTER 1

Introduction

1.1Problem Statement:

Spam messages, often associated with unwanted advertisements, phishing attacks, and malicious content, are an increasing nuisance for mobile users. With billions of SMS messages sent daily, manually filtering spam is impractical, necessitating automated spam detection systems. This project aims to build an SMS spam detection system using Natural Language Processing (NLP) to effectively classify SMS messages as spam or non-spam, thus reducing the impact of spam messages on users.

1.2Motivation:

Spam messages contribute to a significant amount of wasted time and resources for both users and service providers. The automation of spam detection systems can help filter out irrelevant messages and improve the efficiency of communication platforms. The project's motivation lies in creating a solution that uses NLP to detect spam messages accurately, providing a practical tool for end-users and telecom providers.

1.3Objective:

The objectives of this project are as follows:

- To preprocess SMS data for feature extraction.
- To implement text classification algorithms such as Naive Bayes, SVM, and Logistic Regression.
- To evaluate the performance of the model using standard metrics such as accuracy, precision, recall, and F1-score.
- To deploy a model capable of distinguishing between spam and non-spam messages in real-time.

1.4Scope of the Project:

This project is limited to the classification of SMS messages into spam and non- spam categories. It leverages machine learning models trained on pre-processed SMS data. The project does not cover advanced features such as real-time SMS filtering or dynamic model updates. Furthermore, this system is focused on text-based SMS messages and does not extend to multimedia messages (MMS) or other forms of communication.

CHAPTER 2

Literature Survey

2.1 Review of Existing Literature:

Several studies have been conducted on spam message detection using machine learning. Traditional methods, such as rule-based systems and keyword matching, have proven ineffective in the face of sophisticated spam tactics. More recent studies have explored the use of NLP techniques combined with machine learning models to classify SMS messages accurately. Researchers have also employed deep learning algorithms for spam detection, though simpler models such as Naive Bayes and SVM have shown competitive performance.

2.2 Existing Models or Techniques:

Existing spam detection techniques include:

- **Naive Bayes**: A probabilistic classifier often used for text classification tasks.
- **Support Vector Machine (SVM)**: A robust classifier that works well for text data.
- **Logistic Regression**: A linear model suitable for binary classification tasks like spam detection.

2.3 Gaps in Existing Solutions:

Despite the effectiveness of machine learning models, there are still challenges in handling large-scale datasets and evolving spam patterns. This project seeks to address these gaps by experimenting with different classifiers and optimizing model performance through feature engineering and hyperparameter tuning.

CHAPTER 3

Proposed Methodology

3.1 System Design

Designing of system is the process in which it is used to define the interface, modules and data for a system to specify the demand to satisfy. System design is seen as the application of system theory. The main thing of the design of a system is to develop the system architecture by giving the data and information that is necessary for the implementation of a system.

3.1.1 ARCHITECTURE DIAGRAM:

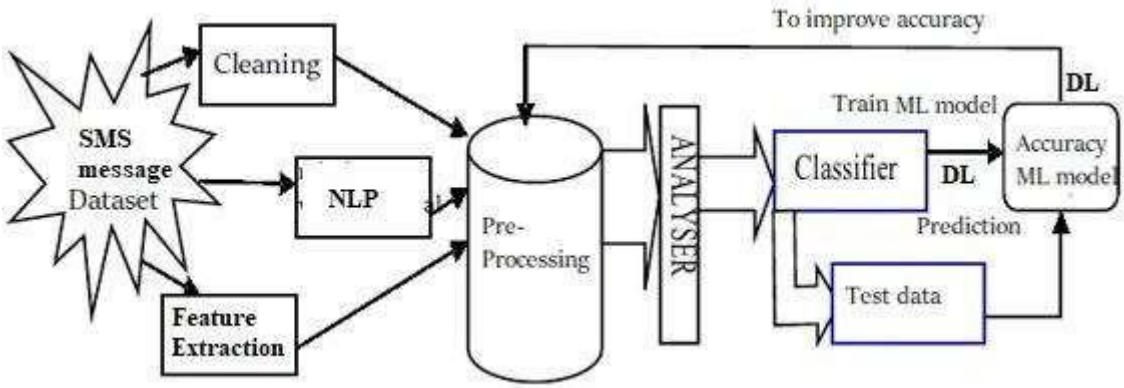

Fig-01

The system's architecture consists of the following stages:

1. **Data Collection**: A labeled SMS dataset is collected.
2. **Preprocessing**: Text data is cleaned by removing stop words, punctuation, and performing tokenization and stemming.
3. **Feature Extraction**: TF-IDF (Term Frequency-Inverse Document Frequency) is used for converting text into numerical features.
4. **Model Training**: Different machine learning models, such as Naive Bayes, SVM, and Logistic Regression, are trained on the dataset.
5. **Evaluation**: The performance of the models is evaluated using accuracy, precision, recall, and F1-score.

3.1.2 DATA FLOW DIAGRAM:

Data flow diagrams are used to graphically represent the flow of data in a business information system. DFD describes the processes that are involved in a system to transfer data from the input to the file storage and reports generation. Data flow diagrams can be divided into logical and physical. The logical data flow diagram describes the flow of data through a system to perform certain functionality of a business. The physical data flow diagram describes the implementation of the logical data flow

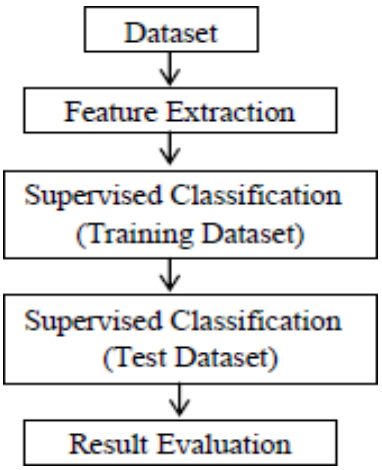

Fig-02

3.2 Requirement Specification

3.2.1 Hardware Requirements:

- Processor: Intel Core i3 or higher
- RAM: 4 GB or more
- Storage: Minimum 5 GB free space

3.2.2 Software Requirements:

- Python 3.x

- Libraries: scikit-learn, pandas, NumPy, nltk, matplotlib
- IDE: Jupyter Notebook or Visual Studio Code

CHAPTER 4

Implementation and Result

4.1 Snap Shots of Result:

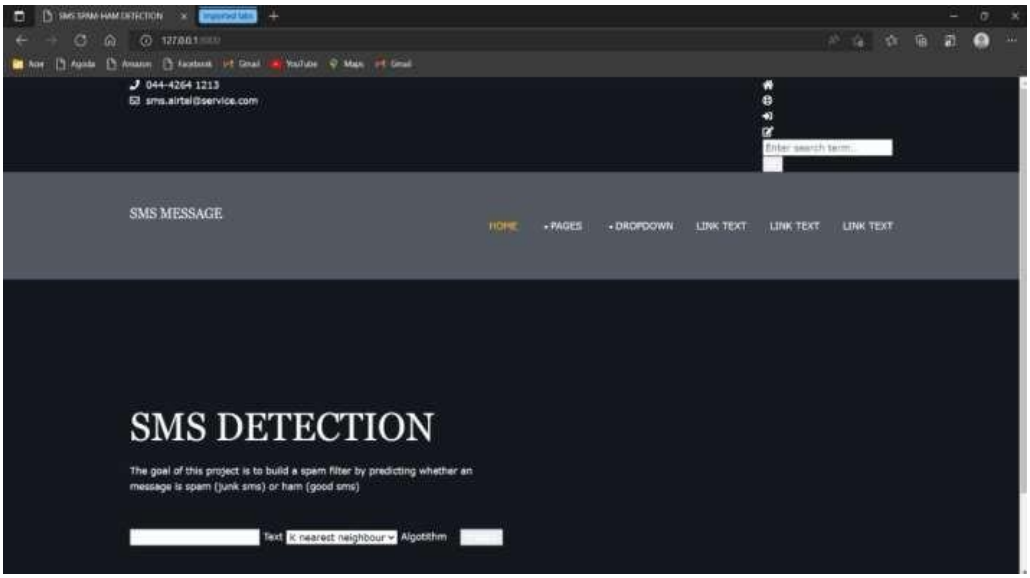

Fig-03

4.2 Snap Shots of Result:

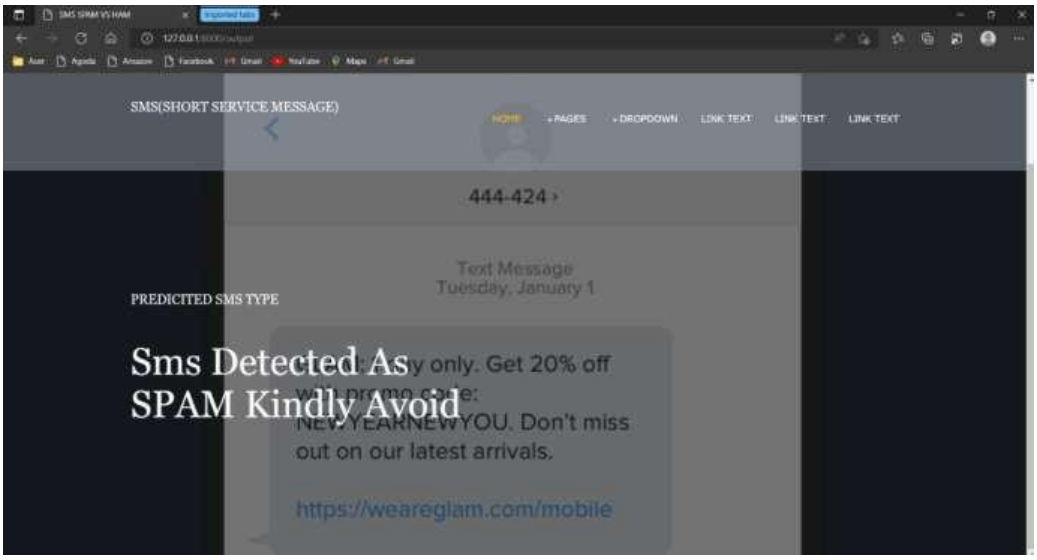

Fig-04

GitHub Link for Code:

CHAPTER 5

Discussion and Conclusion

5.1 Future Work:

Future work may involve incorporating more advanced machine learning models, such as deep learning techniques, for better accuracy. Real-time detection and continuous model retraining could be explored to adapt to new spam patterns.

5.2 Conclusion:

The SMS Spam Detection System using NLP has proven to be an effective tool for classifying SMS messages as spam or non-spam. Through the use of machine learning models and text preprocessing techniques, the system achieves high accuracy in identifying spam messages. This project can help reduce the impact of spam messages and improve communication efficiency

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