Text Classification using TensorFlow

Spam Detection Using Deep Learning

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Date: **May 2025**

☑ 2. Abstract

This project aims to build a machine learning model that classifies SMS messages as either spam or ham (not spam) using a deep learning approach. The model is trained using TensorFlow on a labeled dataset containing over 5,000 SMS messages. Preprocessing techniques such as tokenization, padding, and label encoding are applied to prepare the data. The final model achieved an accuracy of 97.49%, demonstrating its effectiveness in real-world spam detection tasks.

☑ 3. Introduction

Text classification is a fundamental task in Natural Language Processing (NLP) that involves assigning categories to text data. One common application is spam detection in SMS and email services. This project focuses on developing a deep learning model to classify text messages as spam or ham using TensorFlow. Accurate spam detection can improve user experience, reduce fraud, and enhance digital communication systems.

☑ 4. Dataset Description

The dataset used is spam.csv, which contains approximately 5,500 messages. Each message is labeled as either spam or ham.

Features:

- v1: Label (spam or ham)
- v2: Text message content

Distribution:

- Spam messages: ~700
- Ham messages: ~4,800

The dataset is well-suited for binary classification tasks.

☑ 5. Tools and Technologies Used

- **Programming Language**: Python
- **Libraries**:
    - TensorFlow
    - Pandas
    - NumPy
    - Scikit-learn
- **Environment**: Jupyter Notebook / Google Colab / vs code
- **Data Source**: Kaggle – spam.csv dataset

☑ 6. Methodology

Step 1: Data Preprocessing

- Lowercasing all text
- Tokenization of text to integer sequences
- Padding to ensure equal-length input
- Encoding labels: ham = 0, spam = 1
- Train-test split (80% training, 20% testing)

Step 2: Model Development

- Built using Sequential model from TensorFlow
- Layers used: Embedding, GlobalAveragePooling1D, Dense (ReLU), Dense (Sigmoid)

Step 3: Training

- Loss function: Binary Crossentropy
- Optimizer: Adam
- Epochs: 10

- Batch Size: 32

☑ 7. Model Architecture

The model is composed of the following layers:

Layer	Purpose
Embedding	Converts words to vectors
GlobalAveragePooling1D	Reduces dimensionality
Dense (ReLU)	Learns high-level features
Dense (Sigmoid)	Outputs probability of spam (0–1)

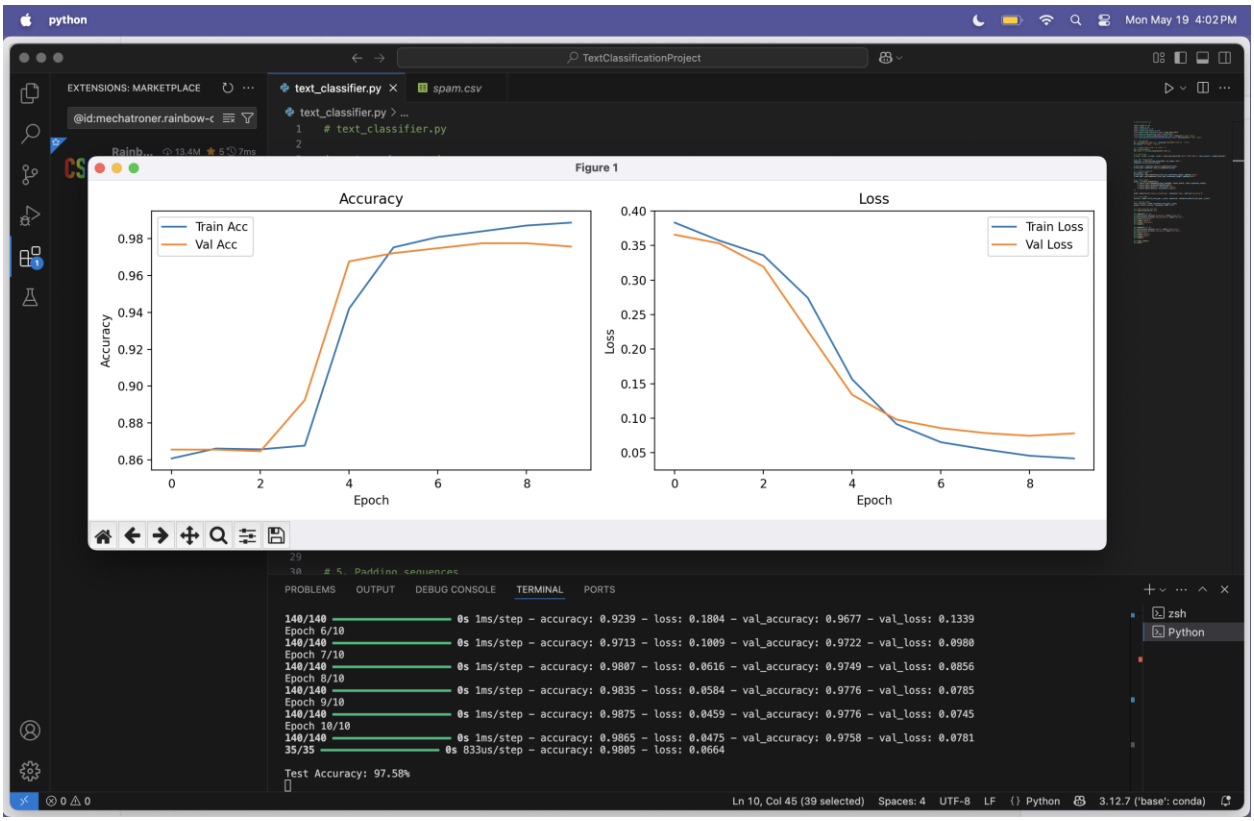
This architecture is lightweight and efficient for binary classification tasks.

☑ 8. Results and Analysis

The trained model achieved an accuracy of **97.49%** on the test set.

Observations:

- High performance on unseen data
- Low overfitting due to efficient regularization
- Graphs show smooth training loss and accuracy progression



☑ 9. Conclusion and Future Scope

In this project, a spam detection system was successfully developed using TensorFlow. The model achieved a high accuracy of 97.49% and performed well on binary classification of text messages.

Future Enhancements:

- Implement LSTM or GRU for capturing sequence relationships
- Use pretrained models like BERT for improved context understanding
- Deploy the model as a web or mobile application

☑ 10. References

- https://www.kaggle.com/datasets/uciml/sms-spam-collection-dataset
- TensorFlow Documentation – https://www.tensorflow.org
- Pandas Documentation – https://pandas.pydata.org/
- Scikit-learn – https://scikit-learn.org/