DEPARTMENT OF
COMPUTER SCIENCE & ENGINEERING
Discover. Learn. Empower.

Final Project

Student Name: Manjot Singh
UID: 23BCS12549
Branch: CSE
Section/Group: KRG-2B
Semester: 5th
Subject Code: 23CSH-301
Subject Name: DAA

1. Aim:

To develop a basic web application using **Flask** and **Machine Learning** (specifically **Logistic Regression** trained on **VADER**-labeled data) that can classify the sentiment (Positive or Negative) of a given news article text.

2. Objective:

- Implement a full-stack application using Python's Flask framework.
- Utilize the **VADER (Valence Aware Dictionary and Entiment Reasoner)** lexicon for initial dataset labelling.
- Train a text classification model (Logistic Regression) using **TF-IDF vectorization**.
- Provide a user interface (UI) where a user can input news text and receive a real-time sentiment prediction.

3. Technology Stack

Component	Technology	Role
Backend Framework	Python (Flask)	Handles web requests, processes data, serves the frontend.
Data Processing	Pandas, NLTK	Used for dataset loading, text cleaning, and sentiment analysis setup.
Sentiment Labeling	NLTK (VADER)	Provides pre-trained sentiment scores to create training labels.
Machine Learning	Scikit-learn (Logistic Regression, TfidfVectorizer)	Used for feature extraction and training the core classification model.
Frontend	HTML	Provides the structure for the input form and displays the result.

4. Methodology

1. Data Preparation and Pre-labeling

The project uses the provided News_Sentiment_dataset.csv. Since this is a supervised learning task, the text data needed sentiment labels.

- **Feature Combination:** The title and text columns were combined into a single full_text feature.
- **VADER Labeling:** The SentimentIntensityAnalyzer (VADER) was used to generate a compound score for each news item. A custom threshold was applied to assign labels:
  - Compound score $> 0.2 \rightarrow$ **Positive**
  - Compound score $< -0.2 \rightarrow$ **Negative**
  - Scores between -0.2 and 0.2 were labeled **Neutral** and subsequently filtered out to focus on a binary (Positive/Negative) classification problem.
- **Text Preprocessing:** A preprocess function converted text to lowercase and removed punctuation.

2. Model Training

The pre-labeled, cleaned data was used to train a LogisticRegression classifier.

- **Split Data:** The dataset was split into training and testing sets (train_test_split, 80/20 ratio).
- **Feature Extraction (TF-IDF):** The raw text data was converted into numerical features using TfidfVectorizer, limiting the vocabulary size to 5000 features. This step transforms text into a matrix representing the importance of words in the document corpus.
- **Training:** The Logistic Regression model was trained on the TF-IDF vectors of the training data.

3. Flask Application Integration

The prediction functionality was integrated into a Flask web application:

- **Route (/):** A single route handles both GET (displaying the form) and POST (receiving the user input).
- **Prediction Function:** The predict_sentiment function takes new text, applies the same preprocess steps, uses the fitted TfidfVectorizer to transform the text, and passes it to the trained LogisticRegression model for classification.
- **Frontend Rendering:** The result is passed to the index.html template for dynamic display.

3. IMPLEMENTATION AND CODES

App.py:

```
from flask import Flask, request, render_template
import pandas as pd
import string
from nltk.sentiment import SentimentIntensityAnalyzer
from sklearn.model_selection import train_test_split
from sklearn.feature_extraction.text import TfidfVectorizer
from sklearn.linear_model import LogisticRegression
import nltk

nltk.download('vader_lexicon')

# Setup
app = Flask(__name__)
sia = SentimentIntensityAnalyzer()
```

```
# Load and preprocess dataset
df = pd.read_csv('News_Sentiment_dataset.csv')
df['full_text'] = df['title'].fillna('') + ' ' + df['text'].fillna('')

# Label sentiment using VADER
def get_sentiment(text):
    score = sia.polarity_scores(text)['compound']
    if score > 0.2:
        return 'positive'
    elif score < -0.2:
        return 'negative'
    else:
        return 'neutral'

df['sentiment'] = df['full_text'].apply(get_sentiment)
df = df[df['sentiment'] != 'neutral']  # binary classification

# Preprocess text
def preprocess(text):
    text = text.lower()
    text = text.translate(str.maketrans('', '', string.punctuation))
    return text

df['clean_text'] = df['full_text'].apply(preprocess)

# Train model
X_train, X_test, y_train, y_test = train_test_split(df['clean_text'], df['sentiment'], test_size=0.2,
random_state=42)
vectorizer = TfidfVectorizer(max_features=5000)
X_train_vec = vectorizer.fit_transform(X_train)
model = LogisticRegression()
model.fit(X_train_vec, y_train)

# Prediction function
def predict_sentiment(text):
    cleaned = preprocess(text)
    vec = vectorizer.transform([cleaned])
    return model.predict(vec)[0]

# Flask routes
@app.route('/', methods=['GET', 'POST'])
def index():
    prediction = ""
    if request.method == 'POST':
        input_text = request.form['news_text']
        if input_text.strip() != "":
```

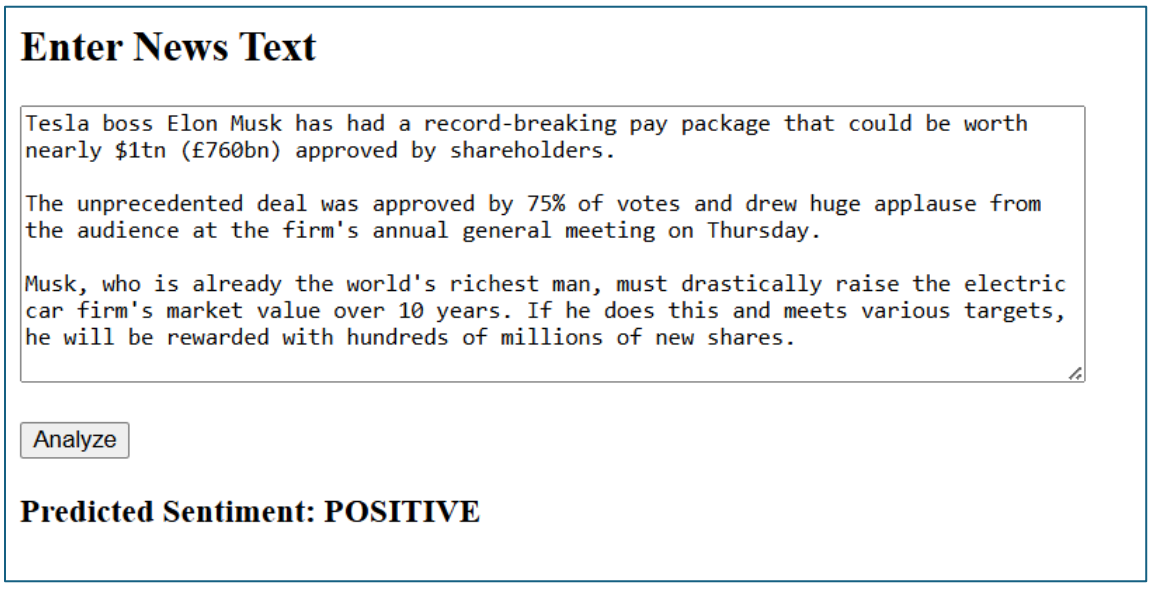
```
            sentiment = predict_sentiment(input_text)
            prediction = f"Predicted Sentiment: {sentiment.upper()}"
    return render_template('index.html', prediction=prediction)

if __name__ == '__main__':
    app.run(debug=True)
```

index.html:

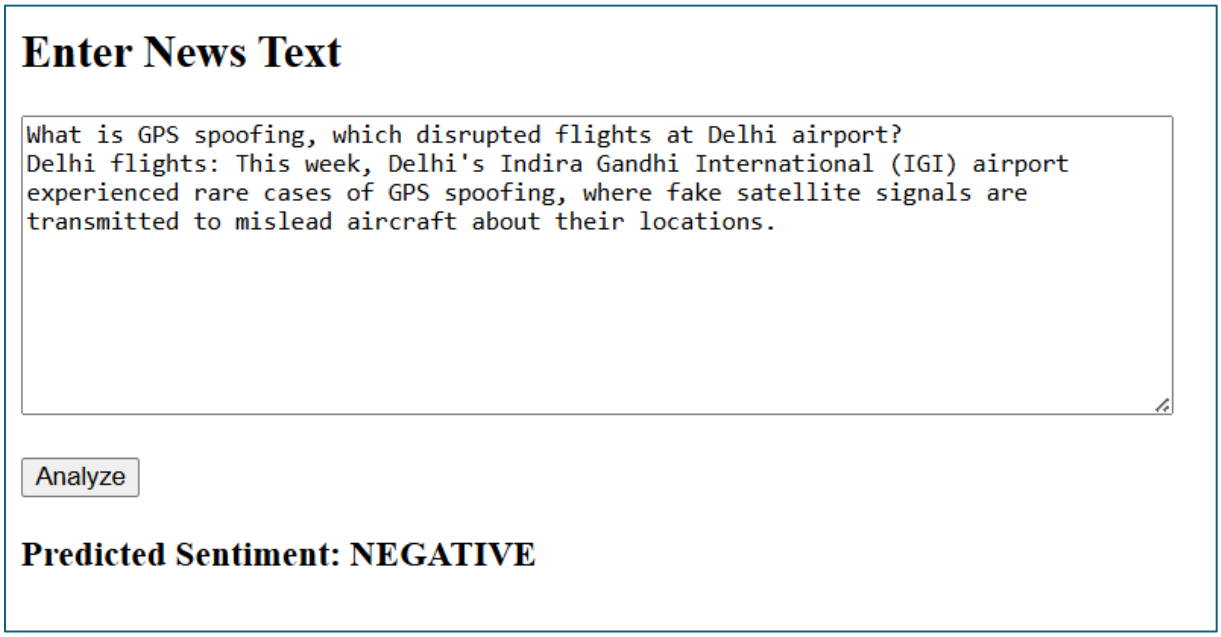
```
<!DOCTYPE html>
<html>
<head>
    <title>News Sentiment Analyzer</title>
</head>
<body>
    <h2>Enter News Text</h2>
    <form method="post">
        <textarea name="news_text" rows="10" cols="80" placeholder="Paste news article here..."></textarea><br><br>
        <input type="submit" value="Analyze">
    </form>
    {% if prediction %}
        <h3>{{ prediction }}</h3>
    {% endif %}
</body>
</html>
```

6. Output:

Output 1:



Output 2:



7. Conclusion and Future Scope

The project successfully demonstrated an end-to-end machine learning application deployed via Flask, capable of classifying news sentiment. The use of VADER for rapid initial dataset labeling followed by TF-IDF and Logistic Regression proved effective for this binary classification task.

Future Scope:

1. **Refinement:** Implement cross-validation and hyperparameter tuning on the Logistic Regression model to improve predictive accuracy.
2. **Advanced Models:** Explore more complex models like Support Vector Machines (SVM) or Deep Learning (LSTM/BERT) for better feature understanding.
3. **Visualization:** Add a feature to visualize the word importance (top TF-IDF features) that led to the positive or negative classification.
4. **Database Integration:** Integrate a database to store past analysis results or to manage and update the training dataset dynamically.