A SUMMER INTERNSHIP REPORT

on

FAKE NEWS DETECTION USING MACHINE LEARNING AND NATURAL LANGUAGE PROCESSING

Submitted in partial fulfillment of the requirements for the award of the degree of

BACHELOR OF TECHNOLOGY

in

CSE (Artificial Intelligence & Machine Learning)

Submitted by

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DEPARTMENT OF CSE (ARTIFICIAL INTELLIGENCE & MACHINE LEARNING)

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2021-2025

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DEPARTMENT OF CSE(AI&ML)

CERTIFICATE

This is to certify that project work entitled "**FAKE NEWS DETECTION USING MACHINE LEARNING AN NATURAL LANGUAGE PROCESSING**" submitted by **S.Laxmi prasanna (21UP1A6655)** in the partial fulfilment of the requirements for the award of the degree of Bachelor of Technology in CSE(AI&ML) **VIGNAN'S INSTITUTE OF MANAGEMENT AND TECHNOLOGY FOR WOMEN** is a record of bonafide work carried by them under my guidance and supervision. The results embodied in this Summer Internship report have not been submitted to any other University or institute for the award of any degree.

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DECLARATION

We here by declare that the work reported in the present project entitled "**FAKE NEWS DETECTION USING MACHINE LEARNING AND NATURAL LAGUAGE PROCESSING**" is a record of bonafied work duly completed by us in the Department of CSE (AI&ML) from Vignan's Institute of Management and Technology for Women, affiliated to JNTU, Hyderabad. The reports are based on the summer internship work done entirely by us and not copied from any other source. All such materials that have been obtained from other sources have been duly acknowledged.

The result embodied in this summer internship report have not been submitted to any other University or Institute for the award of any degree to the best of our knowledge and belief.

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ACKOWLEDGEMENT

We would like to express our sincere gratitude and indebtedness to our project guide Guide Name, Designation for his valuable suggestions and interest throughout the course of this project.

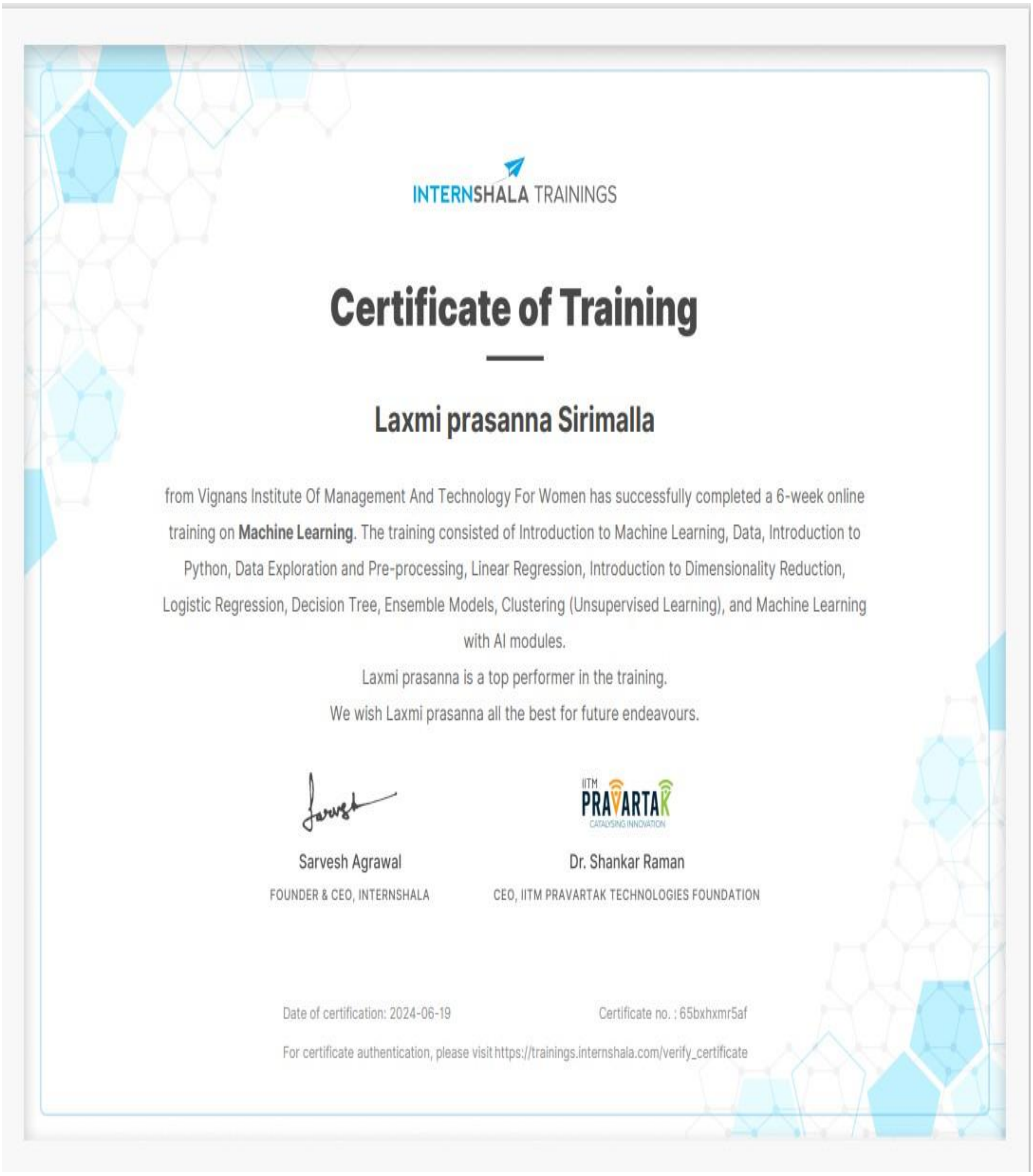
We would like to extend our gratitude to '**Dr. M. Thejovathi.,M.tech.,Ph.D**', Summer Internship Coordinator, Department of CSE- Artificial Intelligence and Machine Learning from Vignan's Institute of Management and Technology For Women, for his valuable suggestions and timely help while the project.

We are also thankful to **Dr. D. Shanthi.,Ph.D**, Head of the Department of CSE- Artificial Intelligence and Machine Learning from Vignan's Institute Of Management And Technology For Women, Hyderabad for providing excellent infrastructure and a nice atmosphere for completing this project successfully as a part of our B.Tech. Degree (CSM).

We convey our heartfelt thanks to the lab staff for allowing us to use the required equipment whenever needed.

Finally, we would like to take this opportunity to thank our family for their support through the work. We sincerely acknowledge and thank all those who gave directly or indirectly their support in the completion of this work.

S.Laxmi prasanna (21UP1A6655)


INTERNSHALA TRAININGS

Certificate of Training

Laxmi prasanna Sirimalla

from Vignans Institute Of Management And Technology For Women has successfully completed a 6-week online training on **Machine Learning**. The training consisted of Introduction to Machine Learning, Data, Introduction to Python, Data Exploration and Pre-processing, Linear Regression, Introduction to Dimensionality Reduction, Logistic Regression, Decision Tree, Ensemble Models, Clustering (Unsupervised Learning), and Machine Learning with AI modules.

Laxmi prasanna is a top performer in the training.

We wish Laxmi prasanna all the best for future endeavours.

[illegible]

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ABSTRACT

In an era dominated by digital information, the proliferation of fake news poses a significant threat to the integrity of news dissemination and public perception. This project focuses on the development and implementation of a robust Fake News Detection system leveraging the power of Machine Learning (ML) and Natural Language Processing (NLP) techniques.

The primary goal of the project is to design an intelligent model capable of distinguishing between genuine and fake news articles by analysing textual content. The methodology involves the collection and preprocessing of a diverse dataset encompassing both reliable and deceptive news sources. Feature engineering techniques, including TF-IDF (Term Frequency-Inverse Document Frequency) and word embeddings, are employed to extract meaningful representations from the textual data.

The core of the system comprises machine learning algorithms, such as Support Vector Machines (SVM), Random Forest, and Neural Networks, trained on labelled datasets to learn the underlying patterns indicative of fake news. Furthermore, the project integrates NLP techniques, including sentiment analysis and linguistic pattern recognition, to enhance the model's accuracy in discerning deceptive content.

The effectiveness of the developed system is evaluated through rigorous testing on various datasets, including real-world examples of fake news. The project aims to contribute to the ongoing efforts to mitigate the spread of misinformation, thereby promoting a more informed and discerning public. The outcomes of this research have the potential to be integrated into online platforms and social media networks as a tool for real-time fake news identification, ultimately fostering a more trustworthy information ecosystem.

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CHAPTER 1
INTRODUCTION

In response to the escalating challenge posed by the proliferation of fake news in the digital landscape, this project endeavors to develop an effective Fake News Detection System using advanced Machine Learning (ML) and Natural Language Processing (NLP) techniques. By leveraging these sophisticated tools, the system aims to automatically discern between authentic news sources and fabricated content, empowering users to make informed decisions about the credibility of online information. Through a multi-step approach encompassing data collection, preprocessing, feature engineering, model selection, and evaluation, this project seeks to deploy a robust solution capable of mitigating the harmful impacts of misinformation and fostering a more discerning online community.

By leveraging the combined power of ML and NLP techniques, the Fake News Detection System aims to provide users with a reliable tool for assessing the credibility of online news articles. The successful implementation of this system has the potential to mitigate the harmful effects of fake news dissemination, thereby promoting a more informed and discerning online community.

1.1. PROBLEM STATEMENT

In today's digital age, the proliferation of fake news poses a significant threat to the integrity of information dissemination, leading to misinformation, polarization, and societal distrust. The rapid spread of fabricated content across online platforms makes it increasingly challenging for users to distinguish between credible news sources and deceptive information. As a result, there is a critical need for automated systems capable of accurately detecting fake news articles in real-time, thereby empowering users to make informed decisions about the reliability of online content. This project aims to address this pressing challenge by developing a sophisticated Fake News Detection System using Machine Learning (ML) and Natural Language Processing (NLP) techniques. By leveraging advanced algorithms and linguistic analysis, the system seeks to differentiate between genuine and misleading news articles, thereby mitigating the detrimental effects of fake news dissemination and promoting a more discerning online community.

1.2. SCOPE OF THE PROJECT

- The project encompasses a comprehensive approach to develop a Fake News Detection System leveraging Machine Learning (ML) and Natural Language Processing (NLP) techniques. Beginning with data collection from diverse sources, including both real and fake news articles, the project entails thorough preprocessing to standardize and clean the text data.
- Feature engineering follows, extracting relevant linguistic and semantic features from the preprocessed text. Model selection involves choosing appropriate ML algorithms for classification, considering factors such as model complexity and performance.

1.3. OBJECTIVE

The primary objective of this project is to develop a robust Fake News Detection System using advanced Machine Learning (ML) and Natural Language Processing (NLP) techniques. The system aims to automatically differentiate between genuine news articles and fake or misleading content with high accuracy. By leveraging sophisticated algorithms and linguistic analysis, the objective is to provide users with a reliable tool to assess the credibility of online news sources. This system seeks to mitigate the harmful effects of fake news dissemination, thereby promoting a more informed and discerning online community. Through a multi-step approach encompassing data preprocessing, feature engineering, model training, evaluation, and deployment, the project aims to achieve its objective of creating an effective solution for combating misinformation in the digital age.

1.4. MOTIVATION

- The proliferation of fake news in today's digital landscape has become a pressing concern, with significant implications for societal trust, political discourse, and public safety. Misinformation spreads rapidly across online platforms, leading to widespread confusion, polarization, and mistrust in traditional media sources.
- The consequences of unchecked fake news dissemination are far-reaching, affecting individuals, communities, and democratic institutions. This project is motivated by the urgent need to address this challenge and develop effective solutions to combat the spread of misinformation.

1.5 EXISTING SYSTEM

Existing fake news detection systems encompass a diverse array of approaches and implementations aimed at mitigating the spread of misinformation. Foremost among these are fact-checking websites like Snopes, PolitiFact, and FactCheck.org, which employ teams of journalists and fact-checkers to manually verify the accuracy of news stories and claims. Social media platforms such as Facebook and Twitter have also taken steps to combat fake news, implementing algorithms that prioritize content from reputable sources and partnering with fact-checking organizations to flag suspicious content.

LIMITATIONS IN EXISTING SYSTEM

- Existing systems may not detect all types of fake news or content in different languages.
- They can sometimes make mistakes, flagging real news as fake or missing fake news altogether.
- There's a risk of infringing on privacy or free speech rights if detection methods are too aggressive.

1.6 PROPOSED SOLUTION

To address the limitations of existing fake news detection systems, we propose a multifaceted approach that encompasses several key strategies. First, we aim to enhance algorithmic models by developing more sophisticated machine learning algorithms and natural language processing techniques, leveraging advanced deep learning models and ensemble methods. Second, we advocate for the use of diverse training data to ensure comprehensive coverage across different content types, languages, and cultural contexts, thereby mitigating bias and improving accuracy. Third, we propose the implementation of adversarial defense mechanisms to safeguard against manipulation attempts by malicious actors, incorporating techniques such as adversarial training and anomaly detection. Additionally, we emphasize the importance of continuous monitoring and updating of fake news detection systems to adapt to evolving misinformation tactics and emerging threats. Interdisciplinary collaboration is essential, as we seek to engage experts from various fields to gain a deeper understanding of the socio-cultural dynamics driving misinformation.

ADVANTAGES OVER EXISTING SYSTEM

- Improved Accuracy.
- It's more resilient against manipulation attempts and evolving tactics by malicious actors.
- Covers a wider range of content types, languages, and cultural contexts compared to existing systems.
- Ethical considerations like transparency and user privacy are given more importance.
- Involves experts from various fields for deeper insights and more effective strategies.
- Emphasizes ongoing monitoring and updates to adapt to changing misinformation tactics and threats.

CHAPTER 2
LITERATURE SURVEY

For a project on "Fake News Detection Using Machine Learning and Natural Language Processing," the literature survey would cover key studies, methodologies, and findings in the field. Here's a concise overview:

1. **Early Approaches to Fake News Detection:**
    - Explore early research that laid the foundation for fake news detection, including rule-based systems and traditional statistical methods.
2. **Machine Learning Techniques in Fake News Detection:**
    - Examine studies that applied machine learning algorithms for identifying patterns indicative of fake news.
    - Assess the strengths and limitations of various algorithms such as Support Vector Machines, Random Forest, and Neural Networks.
3. **Natural Language Processing (NLP) in Fake News Detection:**
    - Investigate how NLP techniques, such as sentiment analysis and linguistic pattern recognition, contribute to the accuracy of detection models.
    - Explore studies that utilize word embeddings and other NLP approaches for feature extraction.
4. **Hybrid Approaches:**
    - Review research that combines machine learning and NLP techniques for a more comprehensive fake news detection system.
    - Identify successful integration strategies and the impact on detection performance.
5. **Real-Time Detection Systems:**
    - Examine literature on systems designed for real-time identification of fake news, considering the challenges and online environments.

2.1. HISTORY OF FAKE NEWS CLASSIFICATION

- The history of fake news detection traces back to the earliest forms of journalism, where editorial standards and manual fact-checking were employed to uphold the integrity of news content.
- With the advent of digital media and the internet, the dissemination of misinformation became more pervasive, facilitated by the ease of publishing and sharing content online. Independent fact-checking organizations emerged to counteract the spread of fake news, scrutinizing viral stories and debunking false claims.
- Technological solutions for automated fake news detection began to emerge, initially relying on rule-based systems and keyword matching algorithms. However, the complexity of natural language and the evolving tactics of misinformation necessitated more advanced approaches.
- In recent years, Machine Learning (ML) and Natural Language Processing (NLP) techniques have revolutionized fake news detection, enabling the development of sophisticated algorithms capable of analyzing linguistic patterns associated with deception.

2.2. APPLICATION

2.2.1. Social Media Platforms: Social media companies can integrate fake news detection systems into their platforms to identify and flag misleading content. By providing users with warnings or context about potentially fake news articles, these systems help users make more informed decisions about the information they consume.

2.2.2. News Aggregator Websites: The Fake news detection systems can be integrated into news aggregator websites to filter out fake or unreliable sources. By prioritizing credible news sources and suppressing fake news articles, these systems improve the quality and reliability of news content delivered to users.

2.2.3. Fact Checking Organizations: Fact-checking organizations can leverage fake news detection systems to streamline their verification process. These systems can automatically flag suspicious claims or articles for further investigation, enabling fact-checkers to focus their efforts more efficiently.

2.2.4. Search Engines: Search engines can use fake news detection systems to prioritize credible sources in search results and suppress fake news websites.

CHAPTER 3
SYSTEM REQUIREMENT ANALYSIS

Software Requirements Specification plays an important role in creating quality software solutions. Specification is basically a representation process. Requirements are represented in a manner that ultimately leads to successful software implementation. Requirements may be specified in a variety of ways. However, there are some guidelines worth following:

• Representation format and content should be relevant to the problem.

• Information contained within the specification should be nested

• Diagrams and other notational forms should be restricted in number and consistent in use.

3.1 FUNCTIONAL REQUIREMENTS

Functional requirements are product features or functions that developers must implement to enable users to accomplish their tasks. So, it’s important to make them clear both for the development team and the stakeholders. Generally, functional requirements describe system behavior under specific conditions.

3.2 NON – FUNCTIONAL REQUIREMENTS

- **Usability**

  Usability is the case of use and learns ability of a human-made object. The object of use can be a software application, website, book, tool, machine, process, or anything a human interacts with. A usability study may be conducted as a primary job function by a usability analyst or as a secondary job function by designers, technical writers, marketing personnel, and others.

- **Reliability**

  The probability that a component part, equipment, or system will satisfactorily perform its intended function under given circumstances, such as environmental conditions, limitations as to operating time, and frequently and thoroughness of maintenance for a specified period of time.

- **Performance**

  Accomplishment of a given task measured against present standards of accuracy, completeness, cost, and speed.

- **Supportability**

  To which the design characteristics of a stand by or support system meet the operational requirements of an organization.

- **Implementation**

  Implementation is the realization of an application, or execution of a plan, idea, model, design, specification, standard, algorithm, or policy.

- **Interface**

  An interface refers to a point of interaction between components and is applicable at the level of both hardware and software. This allows a component whether a piece of hardware such as a graphics card or a piece of software such as an internet browser to function independently while using interfaces to communicate with other components via an input/output system and an associated protocol.

- **Legal**

  It is established by or founded upon law or official or accepted rules of or relating to jurisprudence: "legal loop hole". Having legal efficacy or force", "a sound title to the property" Relating to or characteristic of the profession of law, "the legal profession". Allowed by official rules; "a legal pass receiver".

3.3 HARDWARE REQUIREMENTS

3.3.1 CPU SPECIFICATIONS

3.3.1.1	CPU Type	Intel Core i5 or more
3.3.1.2	Clock Speed	2.4 GHz or more

3.3.2 MEMORY SPECIFICAITONS

3.3.2.1	Memory Type	DDR4 SDRAM
3.3.2.2	Memory Size	8GB or more
3.3.2.3	Secondary Memory	100GB

3.4 SOFTWARE REQUIREMENTS

3.4.1 OPERATING SYSTEM

3.4.1.1 OS Name Microsoft Windows 11 Home Single Language

3.4.1.2 OS Kernel Type Multiprocessor Free (x64 based PC)

3.4.2 PYTHON

Python is a high-level, interpreted, general-purpose programming language. Its design philosophy emphasizes code readability with the use of significant indentation. Python is dynamically-typed and garbage-collected. It supports multiple programming paradigms, including structured (particularly procedural), object-oriented and functional programming.

3.4.3 JUPYTER – ANACONDA

The Jupyter Notebook application allows you to create and edit documents that display the input and output of a Python or R language script. Anaconda is a distribution of the Python and R programming languages for scientific computing (data science, machine learning applications, large-scale data processing, predictive analytics, etc.), that aims to simplify package management and deployment. The distribution includes data-science packages suitable for Windows, Linux, and macOS. It is developed and maintained by Anaconda, Inc., which was founded by Peter Wang and Travis Oliphant in 2012. As an Anaconda, Inc. product, it is also known as Anaconda Distribution or Anaconda Individual Edition, while other products from the company are Anaconda Team Edition and Anaconda Enterprise Edition, both of which are not free.

4.4.4 PYTHON PACKAGES

- tensorflow
- keras
- scikit-learn
- PIL
- numpy
- matplotlib
- opencv-python, flask
- flask_mail

CHAPTER 4
SYSTEM DESIGN

System design is the process of defining the elements of a system such as the architecture, modules and components, the different interfaces of those components and the data the goes through that system. It is meant to satisfy specific needs and requirements through the engineering of a coherent and well-running system.

4.1 HIGH LEVEL DESIGN

A high-level design provides an abstract overview of a system or software solution without delving into detailed implementation specifics. It focuses on defining the architecture, components, interactions, and major functionalities of the system at a conceptual level.

4.1.1 SYSTEM ARCHITECTURE

An architecture model is a partial abstraction of a system. It is an approximation, and it captures the different properties of the system. It is a scaled-down version and is built with all the essential details of the system. Architecture modeling involves identifying the characteristics of the system and expressing it as models so that the system can be understood. Architecture models allow visualization of information about the system represented by the model.

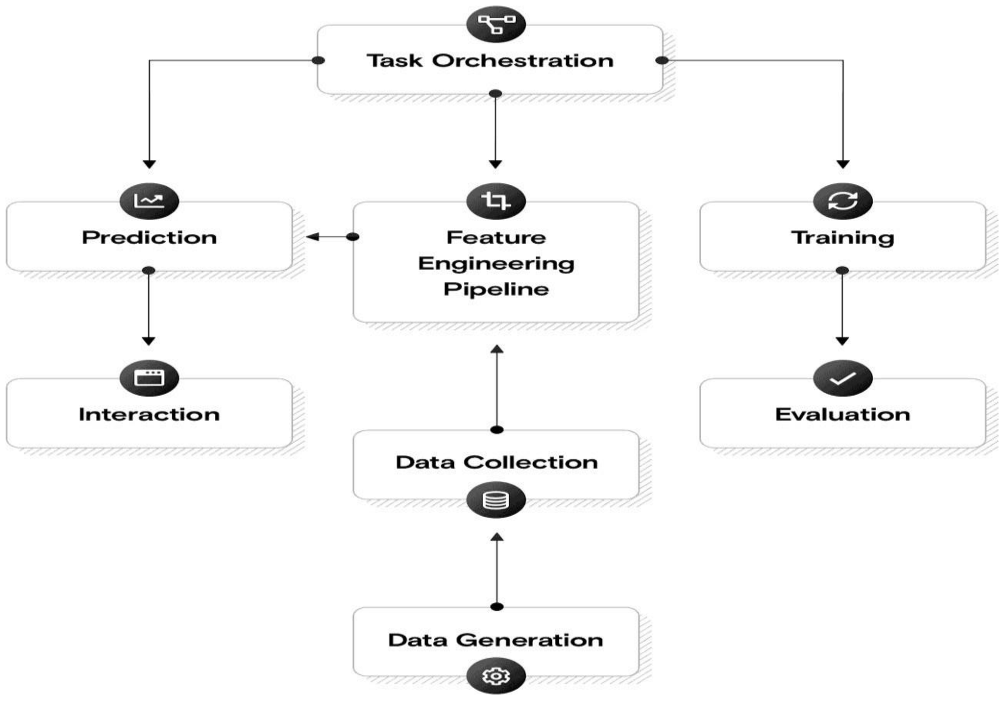


Fig 5.1.1.1 System Architecture

4.1.2 DATA FLOW DIAGRAM (DFD)

A Data Flow Diagram (DFD) is a visual representation that helps us understand how information moves within a system. It shows how data enters and exits the system, what processes oractions change the data, and where the data is stored. A well-designed DFD can provide a clear pictureof the system's requirements. It can be created manually, using pen and paper, or using software tools.The diagram helps define the scope and boundaries of the system. It can also be used as a communication tool between a systems analyst and anyone involved in the system. Additionally, it serves as a starting point for redesigning a system by identifying areas that need improvement.

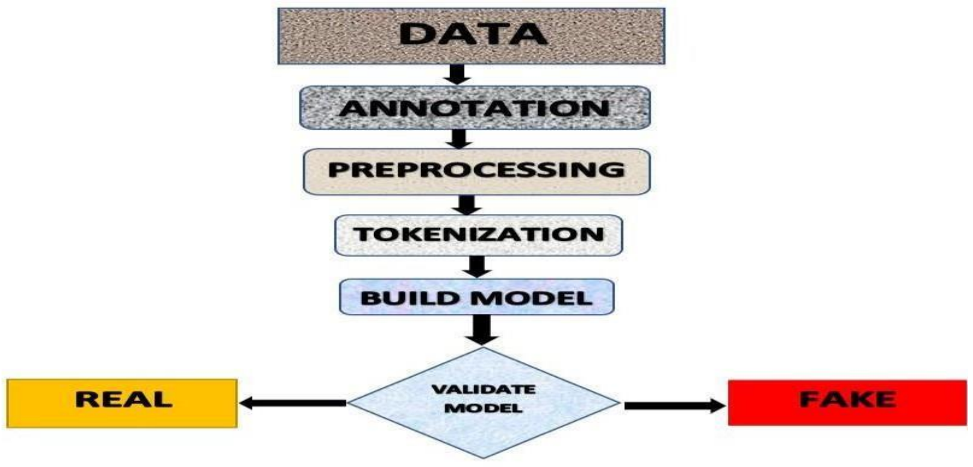


Fig 5.1.2.1 Data Flow Diagram

4.2 LOW LEVEL DESIGN

A low-level design (LLD) is a detailed design document that elaborates on the high-level design by specifying how the system or software solution will be implemented. It provides a granular view of the system's architecture, including individual components, modules, data structures, algorithms, and interfaces.

CONCEPT OF UML

UML is a standard language for specifying, visualizing, constructing, and documenting the artifacts of software systems. UML stands for Unified Modelling Language. UML is different from the other common programming languages such as C++, Java, COBOL, etc., UML is a pictorial language used to make software blueprints.

UML DIAGRAMS:

UML diagram is designed to let developers and customers view a software system from a different perspective and in varying degrees of abstraction. UML diagrams commonly created in visual modeling tools include. In its simplest form, a use case can be described as a specific way of using the system from a User's (actor's) perspective. A more detailed description might characterize a use case as:

- a pattern of behavior the system exhibits
- a sequence of related transactions performed by an actor and the system
- delivering something of value to the actor.

Use cases provide a means to :

- capture system requirements
- communicate with the end users and domain experts
- Test the system

Use cases are best discovered by examining the actors and defining what the actor will be able to do with the system. Since all the needs of a system typically cannot be covered in one use case, it is usual to have a collection of use cases. Together this use case collection specifies all the ways of using the system. A UML system is represented using five different views that describe the system from a distinctly different perspective. Each view is defined by a set of diagrams, which is as follows.

User Model View

- This view represents the system from the user's perspective.
- The analysis representation describes a usage scenario from the end-user's perspective.

Structural Model View

- In this model the data and functionality are arrived from inside the system.
- This model view models the static structures.

Behavioral Model View

- It represents the dynamic of behavior as parts of the system, depicting the interactions of collection between various structural elements described in the user model and structural model view.

Goals :

The Primary goals in the design of the UML are as follows:

1. Provide users a ready-to-use, expressive visual modeling Language so that they can develop and exchange meaningful models.
2. Provide extendibility and specialization mechanisms to extend the core concepts.
3. Be independent of particular programming languages and development process.
4. Provide a formal basis for understanding the modeling language.
5. Encourage the growth of OO tools market.
6. Support higher level development concepts such as collaborations, frameworks, patterns and components.
7. Integrate best practices.

4.2.1 USE CASE DIAGRAM

A use case diagram in the Unified Modeling language (UML) is a type of behavioral diagram defined by and created from a Use-case analysis. Its purpose is to present a graphical overview of the functionality provided by a system in terms of actors, their goals(represented as use case),and any dependencies between those cases. The main purpose of a use case diagram is to show system functions are performed for which actor. Roles of the actors in the system can be depicted.

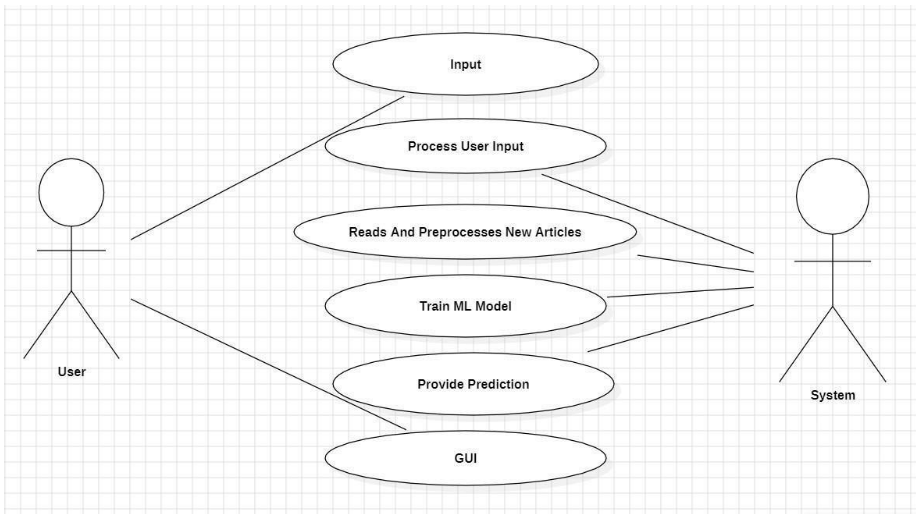


Fig 5.2.1.1 Model Development

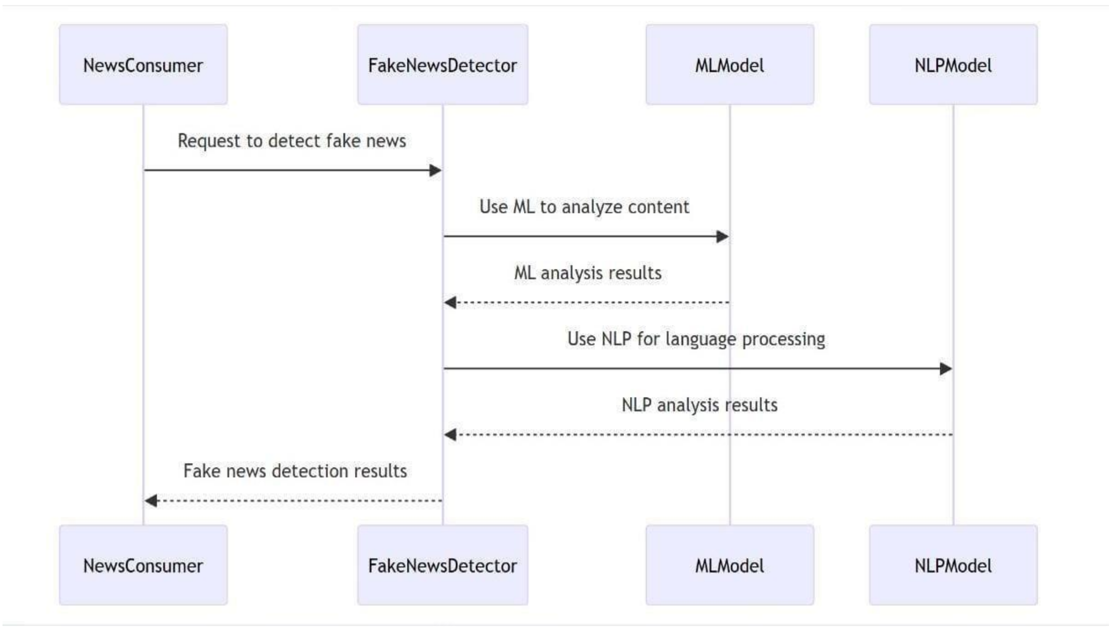


Fig 5.2.1.2 Sequence Diagram

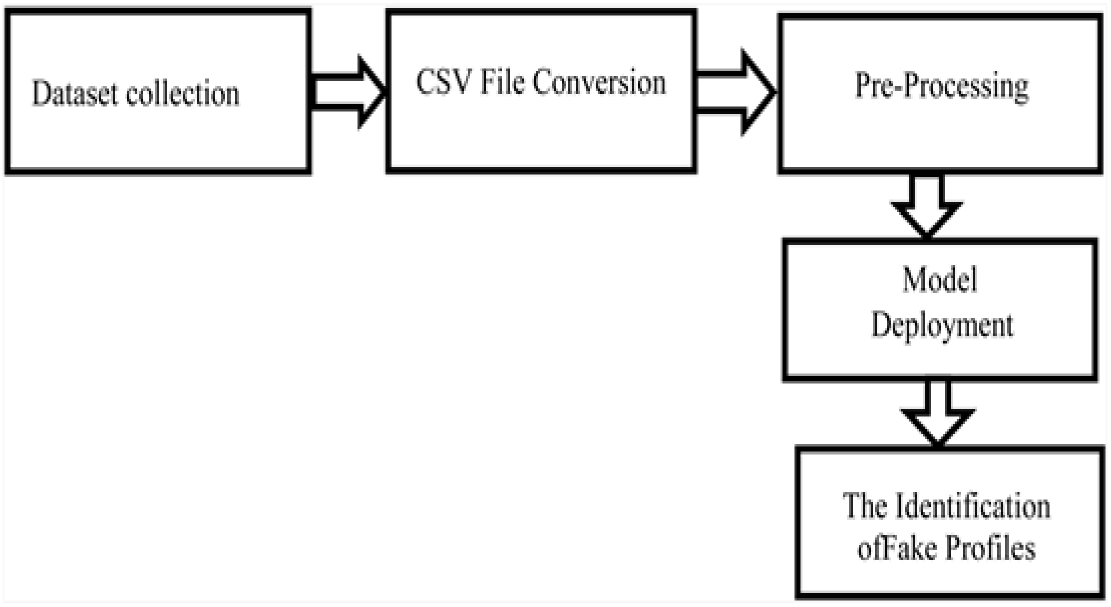


Fig 5.2.1.3 Web Application Module

4.2.2 ACTIVITY DIAGRAM

An activity diagram is a type of Unified Modeling Language (UML) diagram used to model workflows and business processes. It visually represents the sequential and parallel activities within a system, providing a high-level view of the dynamic aspects of the system.

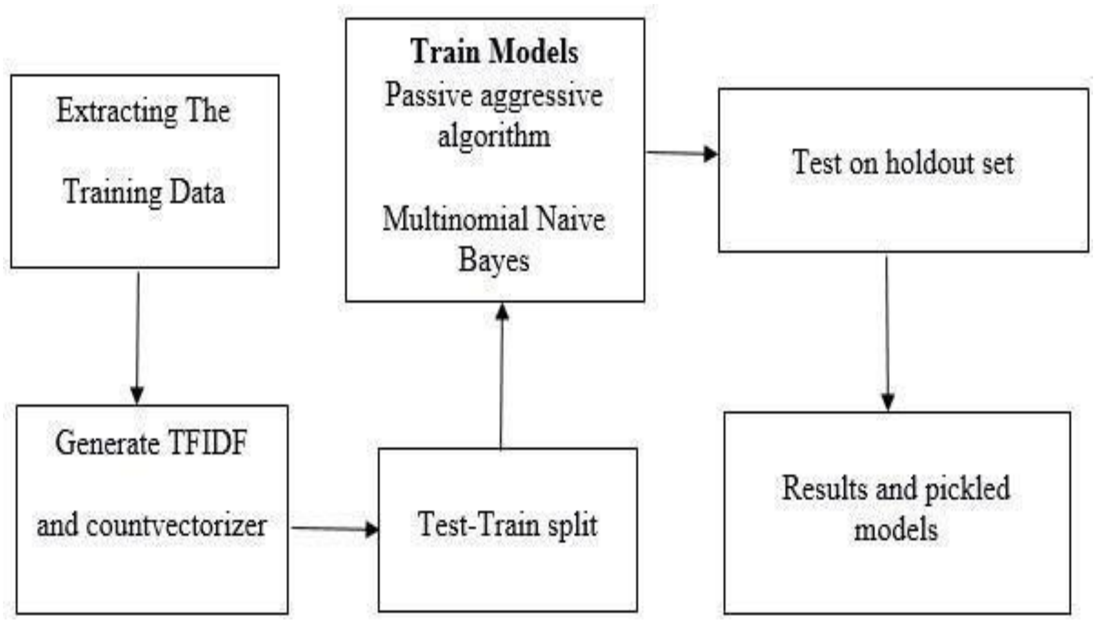

Extracting The Training Data
Generate TFIDF and countvectorizer
Test-Train split
Train Models
Passive aggressive algorithm
Multinomial Naive Bayes
Test on holdout set
Results and pickled models

Fig 5.2.2.1 Activity Diagram

4.2.3 CLASS DIAGRAM

A class diagram is a fundamental component of Unified Modeling Language (UML) used in software engineering to visualize the structure of a system in terms of classes, their attributes, and the relationships between classes in it. Associations between classes are represented by lines, showcasing relationships such as composition, aggregation, or simple associations. Inheritance, denoted by solid lines with hollow arrowheads, illustrates the "is-a" relationship between a superclass and its subclasses. Interfaces, circles adjacent to classes, specify a contract for implementing classes.

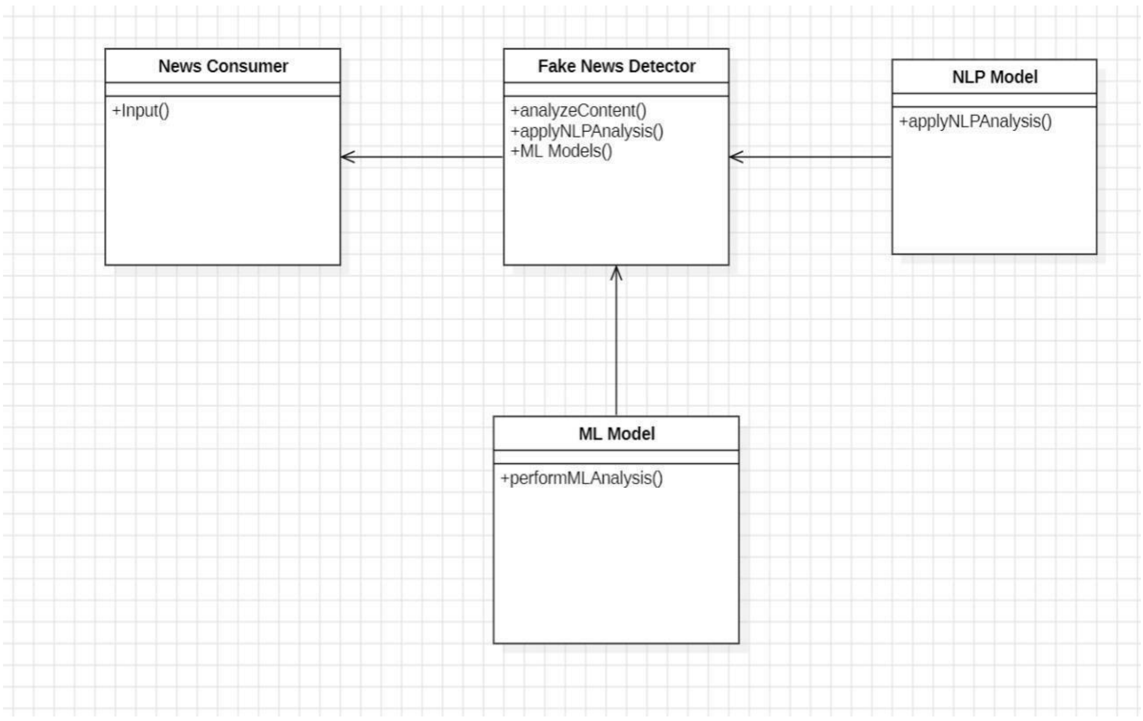


Fig 5.2.3.1 Class Diagram

CHAPTER 5
IMPLEMENTATION

5.1 WORKING DESCRIPTION

This project on fake news detection using Machine Learning (ML) and Natural Language Processing (NLP) aims to develop an advanced system to combat the proliferation of misinformation in online media platforms. By leveraging ML algorithms and NLP techniques, the system will be capable of accurately identifying and flagging fake news articles in real-time.

Key components of the project include acquiring a diverse dataset of news articles, preprocessing the text data to extract relevant features, and training ML models using various algorithms such as logistic regression, support vector machines, and deep learning models like recurrent neural networks (RNNs) and convolutional neural networks (CNNs).

The trained models will be evaluated and validated using standard metrics on separate datasets to assess their performance. Additionally, the project will focus on developing a user-friendly interface for the system, enabling users to submit news articles for analysis and view results in real-time.

By deploying the system on scalable infrastructure and integrating it with existing media platforms, the project aims to empower users with tools to make informed decisions about the credibility of online content, ultimately mitigating the harmful effects of fake news on society.

5.2. IMPLEMENTATION

This The implementation of the fake news detection system involves a systematic approach encompassing data acquisition, preprocessing, model training, evaluation, and deployment stages. Initially, a diverse dataset of news articles is gathered from reputable sources and fact-checking organizations, ensuring coverage across various topics and sources.

Subsequently, the collected data undergoes preprocessing, where noise is removed, and the text is standardized and tokenized. Feature engineering techniques are then applied to extract relevant features, such as word frequency, sentiment analysis, and semantic similarities. Machine learning models, including logistic regression, support vector machines, and deep learning architectures like recurrent and convolutional neural networks, are trained on the preprocessed data using techniques like cross-validation and hyperparameter tuning.

The trained models are evaluated using standard metrics on separate validation datasets to assess their performance. Finally, the developed system is deployed on scalable infrastructure, with a user-friendly interface allowing users to submit news articles for real-time analysis. Iterative testing and feedback collection ensure continuous improvement of the system's performance and user experience.

Through this implementation process, the fake news detection system aims to provide a robust and effective solution for identifying and mitigating the spread of misinformation in online media platforms.

5.3.SAMPLE CODE

#Train the model

```
import re
import nltk
nltk.download('stopwords')

input_str = open("fake_or_real_news_test.csv")

# Remove all new lines
noNewLines = re.sub("\n", "", input_str.read())

# re-add new line at end of each row
noNewLines = re.sub("title,text", "title,text\n", noNewLines)


noNewLines = re.sub(",FAKE", ",FAKE\n", noNewLines)


noNewLines = re.sub(",REAL", ",REAL\n", noNewLines)

lines = noNewLines.split('\n')

def removeComma(g):
  t = g.groups()
  t = [t[0], t[1].replace(',', ' |'), t[2], t[3]]
  return "".join(t)

betweenQuotes = lambda line: re.sub(r'(.*,")(.*)(",)(.*)', lambda x: removeComma(x),
line)

secondCol = lambda line: re.sub(r'^([0-9]+,)(.*,.*)(,\")(.*)$', lambda x:
removeComma(x), line, 1)

lines = [betweenQuotes(l) for l in lines]
lines = [secondCol(l) for l in lines]

finalString = '\n'.join(lines)

file = open('fake_or_real_news_test_CLEANED.csv', 'w')
file.write(finalString)
file.close()
```

#Prediction Model

```
from # preprocessing
import timeit
from nltk.stem import WordNetLemmatizer
from nltk import pos_tag
from nltk.corpus import stopwords
from nltk.corpus import wordnet
import _pickle as pickle
import pickle
import  string
import nltk
nltk.data.path.append('./nltk_data')

start = timeit.default_timer()

with open("pickle/pipeline.pkl", 'rb') as f:
        pipeline = pickle.load(f)
        stop = timeit.default_timer()
        print('=> Pickle Loaded in: ', stop - start)


class PredictionModel:
    output = {}

    # constructor
    def _init_(self, text):
        self.output['original'] = text

    def predict(self):

        self.preprocess()
        self.pos_tag_words()

        # Merge text
        clean_and_pos_tagged_text = self.output['preprocessed'] + \
            ' ' + self.output['pos_tagged']

        self.output['prediction'] = 'FAKE' if pipeline.predict(
            [clean_and_pos_tagged_text])[0] == 0 else 'REAL'
        return self.output
    # Helper methods
    def preprocess(self):
        # lowercase the text
        text = self.output['original'].lower()

        # remove the words counting just one letter
        text = [t for t in text.split(" ") if len(t) > 1]

        # remove the words that contain numbers
        text = [word for word in text if not any(c.isdigit() for c in word)]

        # tokenize the text and remove puncutation
        text = [word.strip(string.punctuation) for word in text]

        # remove all stop words
        stop = stopwords.words('english')
        text = [x for x in text if x not in stop]

        # remove tokens that are empty
        text = [t for t in text if len(t) > 0]

        # pos tag the text
        pos_tags = pos_tag(text)

        # lemmatize the text
        text = [WordNetLemmatizer().lemmatize(t[0], self.get_wordnet_pos(t[1]))
                for t in pos_tags]

        # join all
        self.output['preprocessed'] = " ".join(text)

    def get_wordnet_pos(self, pos_tag):
        if pos_tag.startswith('J'):
            return wordnet.ADJ
        elif pos_tag.startswith('V'):
            return wordnet.VERB
        elif pos_tag.startswith('N'):
            return wordnet.NOUN
        elif pos_tag.startswith('R'):
            return wordnet.ADV
        else:
            return wordnet.NOUN

    def pos_tag_words(self):
        pos_text = nltk.pos_tag(
            nltk.word_tokenize(self.output['preprocessed']))
        self.output['pos_tagged'] = " ".join(
            [pos + "-" + word for word, pos in pos_text])
# import numpy as np # linear algebra
```

```
import pandas as pd # data processing, CSV file I/O (e.g. pd.read_csv)
import nltk
from sklearn.model_selection import GridSearchCV
from sklearn.linear_model import LogisticRegression
from sklearn.feature_extraction.text import CountVectorizer
from sklearn.naive_bayes import MultinomialNB
from sklearn.feature_extraction.text import TfidfTransformer
from sklearn.feature_extraction.text import TfidfVectorizer
from sklearn.model_selection import ShuffleSplit
import matplotlib.pyplot as plt
from nltk.corpus import stopwords
import os
import warnings
import seaborn as sns
import re
import string
from termcolor import colored
from nltk import word_tokenize
import string
from nltk import pos_tag
from nltk.corpus import stopwords
from nltk.tokenize import WhitespaceTokenizer
from nltk.stem import WordNetLemmatizer
import nltk
nltk.download('averaged_perceptron_tagger')

from sklearn.model_selection import GridSearchCV
from sklearn.model_selection import cross_val_score

warnings.filterwarnings('ignore')
from matplotlib.pyplot import *

from sklearn.pipeline import Pipeline
from sklearn.feature_extraction.text import TfidfVectorizer
from sklearn.naive_bayes import MultinomialNB
from sklearn.svm import LinearSVC
from sklearn.tree import DecisionTreeRegressor
from sklearn.linear_model import LogisticRegression
from sklearn.svm import SVC

from sklearn.model_selection import train_test_split

from sklearn import preprocessing

from sklearn.metrics import classification_report, accuracy_score
from sklearn.metrics import confusion_matrix

from nltk.corpus import wordnet
from sklearn.feature_extraction.text import TfidfTransformer
#####################################################
```

```
#################### Globals
######################################################

seed = 12345
cv = ShuffleSplit(n_splits=5, test_size=0.2, random_state=seed)
encoder = preprocessing.LabelEncoder()

######################################################
#################### Helper Functions
######################################################
def get_wordnet_pos(pos_tag):
   if pos_tag.startswith('J'):
      return wordnet.ADJ
   elif pos_tag.startswith('V'):
      return wordnet.VERB
   elif pos_tag.startswith('N'):
      return wordnet.NOUN
   elif pos_tag.startswith('R'):
      return wordnet.ADV
   else:
      return wordnet.NOUN

def preprocess(text):

   # lowercase the text
   text = text.lower()
   # remove the words counting just one letter
   text = [t for t in text.split(" ") if len(t) > 1]

   # remove the words that contain numbers
   text = [word for word in text if not any(c.isdigit() for c in word)]
   # tokenize the text and remove puncutation

   text = [word.strip(string.punctuation) for word in text]
   # remove all stop words
   stop = stopwords.words('english')
   text = [x for x in text if x not in stop]
   # remove tokens that are empty
   text = [t for t in text if len(t) > 0]
   # pos tag the text
   pos_tags = pos_tag(text)
   # lemmatize the text
     text = [WordNetLemmatizer().lemmatize(t[0], get_wordnet_pos(t[1])) for t in
pos_tags]

   # join all
   text = " ".join(text)
   return (text)

def split_train_holdout_test(encoder, df, verbose=True):
 # Resplit original train and test
 train = df[df["label"] != "None"]
 test = df[df["label"] == "None"]

 # Encode Target
 train["encoded_label"] = encoder.fit_transform(train.label.values)

 # Take holdout from train
  train_cv, train_holdout, train_cv_label, train_holdout_label = train_test_split(train,
train.encoded_label, test_size=0.33, random_state=seed)

 if(verbose):
   print("\nTrain dataset (Full)")
   print(train.shape)
   print("Train dataset cols")
   print(list(train.columns))

   print("\nTrain CV dataset (subset)")
   print(train_cv.shape)
   print("Train Holdout dataset (subset)")
   print(train_holdout.shape)

   print("\nTest dataset")
   print(test.shape)
   print("Test dataset cols")
   print(list(test.columns))

 return encoder, train, test, train_cv, train_holdout, train_cv_label, train_holdout_label

def runModel(encoder, train_vector, train_label, holdout_vector, holdout_label, type,
name):
 global cv
 global seed

 ## Classifier types
 if (type == "svc"):
   classifier = SVC()
   grid = [
     {'C': [1, 10, 50, 100], 'kernel': ['linear']},
     {'C': [10, 100, 500, 1000], 'gamma': [0.0001], 'kernel': ['rbf']},
   ]
 if (type == "nb"):
   classifier = MultinomialNB()
   grid = {}
 if (type == "maxEnt"):
     classifier = LogisticRegression()
     grid = {'penalty': ['l1','l2'], 'C': [0.001,0.01,0.1,1,10,100,1000]}
 # Model
 print(colored(name, 'red'))
 model = GridSearchCV(estimator=classifier, cv=cv, param_grid=grid)
 print(colored(model.fit(train_vector, train_label), "yellow"))
 # Score
 print(colored("\nCV-scores",  'blue'))
 means = model.cv_results_['mean_test_score']
 stds = model.cv_results_['std_test_score']
   for mean, std, params in sorted(zip(means, stds, model.cv_results_['params']),
key=lambda x: -x[0]):
     print("Accuracy: %0.3f (+/-%0.03f) for params: %r" % (mean, std * 2, params))
 print()

 print(colored("\nBest Estimator Params", 'blue'))
 print(colored(model.best_estimator_, "yellow"))

 # Predictions
 print(colored("\nPredictions:", 'blue'))
 model_train_pred = encoder.inverse_transform( model.predict(holdout_vector) )
 print(model_train_pred)

 # Confusion Matrix
 cm = confusion_matrix(holdout_label, model_train_pred)

 # Transform to df for easier plotting
 cm_df = pd.DataFrame(cm,
                 index = ['FAKE','REAL'],
                 columns = ['FAKE','REAL'])

 plt.figure(figsize=(5.5,4))
 sns.heatmap(cm_df, annot=True, fmt='g')
 plt.ylabel('True label')
 plt.xlabel('Predicted label')
 plt.show()

 # Accuracy
 acc = accuracy_score(holdout_label, model_train_pred)
 print(colored("\nAccuracy:", 'blue'))
 print(colored(acc, 'green'))
 return [name, model, acc]

def pos_tag_words(text):
   pos_text = nltk.pos_tag(nltk.word_tokenize(text))
   return " ".join([pos + "-" + word for word, pos in pos_text])
```

# Testing

```
X = 92
img_size = 256
img_single = x_test[X]
img_single = cv2.resize(img_single, (img_size, img_size))
img_single = (np.expand_dims(img_single, 0))
img_single = img_single.reshape(img_single.shape[0], 256, 256, 1)
predictions_single = model.predict(img_single)
```

```
plt.subplot(1, 2, 1)
plt.xticks([])
plt.yticks([])
plt.grid(False)
plt.imshow(np.squeeze(img_single))
plt.xlabel(categories[np.argmax(predictions_single)])
plt.ylabel("Tested Data")
plt.subplot(1, 2, 2)
plt.xticks([])
plt.yticks([])
plt.grid(False)
plt.imshow(np.squeeze(x_test[X]))
plt.xlabel(categories[np.argmax(y_test[X])])
plt.ylabel("Actual Data")
plt.show()
print('Predicted Label : ', categories[np.argmax(predictions_single)])
print('True Label : ', categories[np.argmax(y_test[X])])
```

#Confusion Matrix

```
from sklearn.metrics import confusion_matrix
from mlxtend.plotting import plot_confusion_matrix

test_labels = np.argmax(y_test, axis = 1)
predictions = model.predict(x_test)
predictions = np.argmax(predictions, axis = -1)
cm = confusion_matrix(test_labels, predictions)
```

# Plot Confusion Matrix

```
plt.figure()
plot_confusion_matrix(cm, figsize = (12,8), hide_ticks = True, cmap = plt.cm.Blues)
plt.xticks(range(5), ['Normal', 'Doubtful', 'Mild', 'Moderate', 'Severe'], fontsize = 16)
plt.yticks(range(5), ['Normal', 'Doubtful', 'Mild', 'Moderate', 'Severe'], fontsize = 16)
plt.show()
```

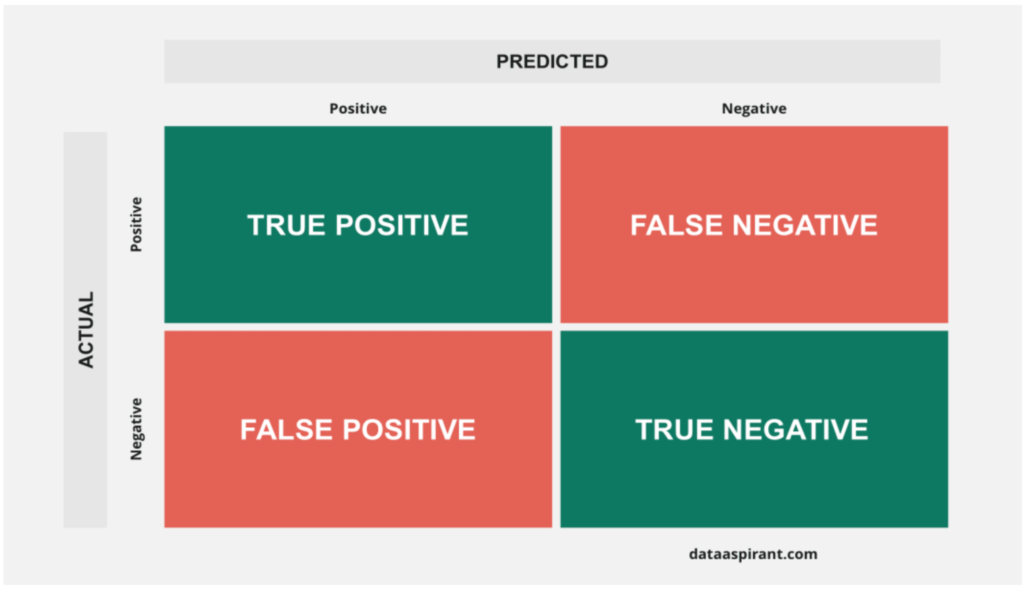
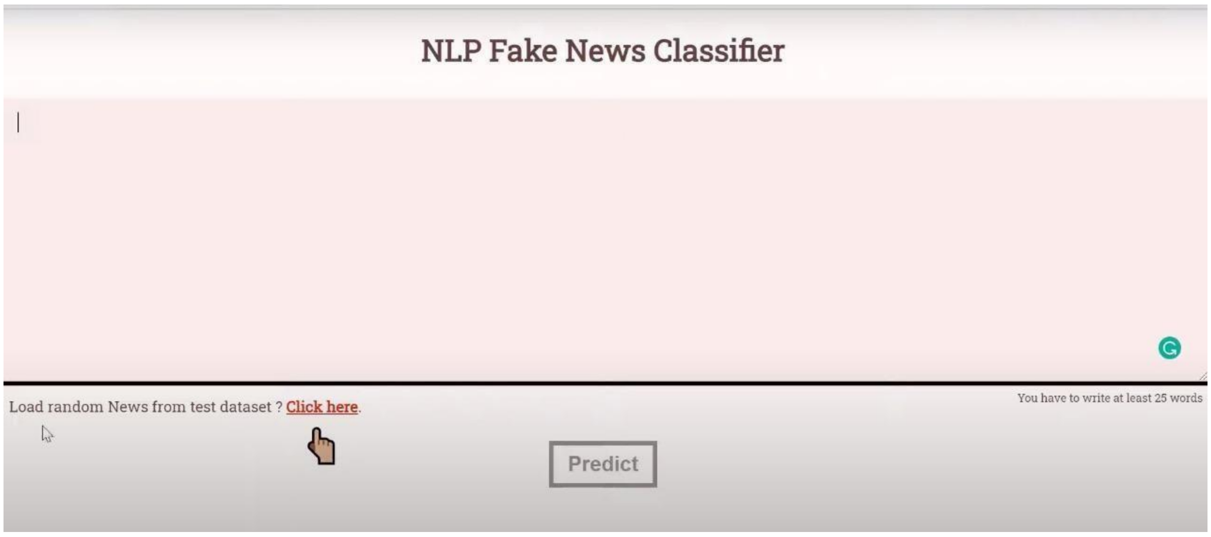


Fig 6.3.1 Confusion Matrix

#Connecting Web Interface with Flask

```
from flask import Flask, jsonify, request, render_template
from predictionModel import PredictionModel
import pandas as pd
from random import randrange

app = Flask(_name_, static_folder="./public/static",
         template_folder="./public")

@app.route("/")
def home():
   return render_template('index.html')

@app.route('/predict', methods=['POST'])
def predict():
   model = PredictionModel(request.json)
   return jsonify(model.predict())

@app.route('/random', methods=['GET'])
def random():
   data = pd.read_csv("data/fake_or_real_news_test.csv")
   index = randrange(0, len(data)-1, 1)
   return jsonify({'title': data.loc[index].title, 'text': data.loc[index].text})


# Only for local running
if _name___== '_main_':
   app.run()
```

CHAPTER 6
RESULT



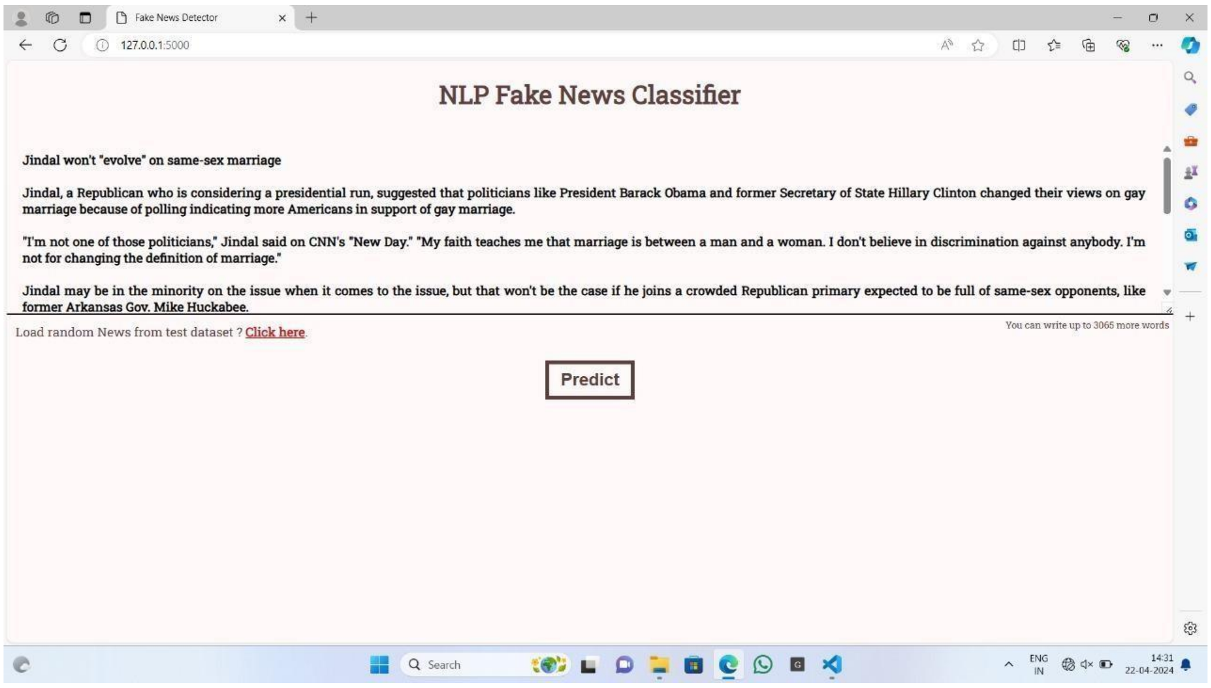
NLP Fake News Classifier

Load random News from test dataset ? Click here.

You have to write at least 25 words

Predict

Fig 8.1 Home Page



Fake News Detector

127.0.0.1:5000

NLP Fake News Classifier

Jindal won't "evolve" on same-sex marriage

Jindal, a Republican who is considering a presidential run, suggested that politicians like President Barack Obama and former Secretary of State Hillary Clinton changed their views on gay marriage because of polling indicating more Americans in support of gay marriage.

"I'm not one of those politicians," Jindal said on CNN's "New Day." "My faith teaches me that marriage is between a man and a woman. I don't believe in discrimination against anybody. I'm not for changing the definition of marriage."

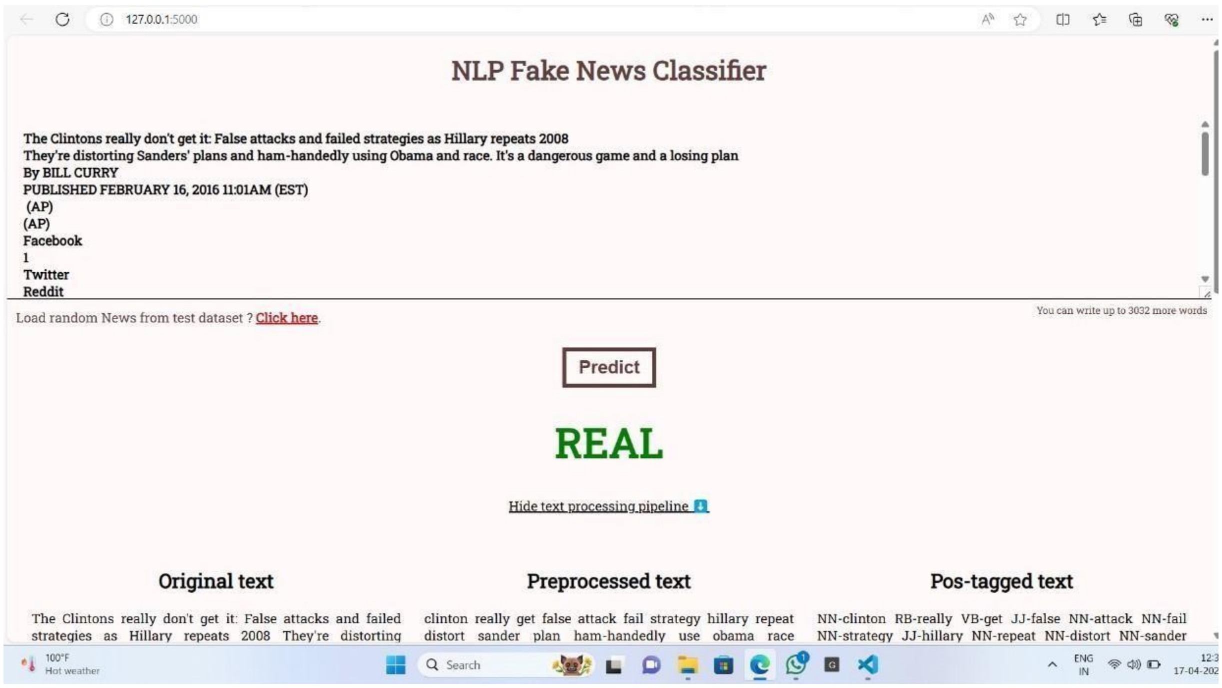
Jindal may be in the minority on the issue when it comes to the issue, but that won't be the case if he joins a crowded Republican primary expected to be full of same-sex opponents, like former Arkansas Gov. Mike Huckabee.

Load random News from test dataset ? Click here.

You can write up to 3065 more words

Predict

Fig 8.2 Generate Random News



NLP Fake News Classifier

The Clintons really don't get it: False attacks and failed strategies as Hillary repeats 2008
They're distorting Sanders' plans and ham-handedly using Obama and race. It's a dangerous game and a losing plan
By BILL CURRY
PUBLISHED FEBRUARY 16, 2016 11:01AM (EST)
(AP)
(AP)
Facebook
1
Twitter
Reddit

You can write up to 3032 more words

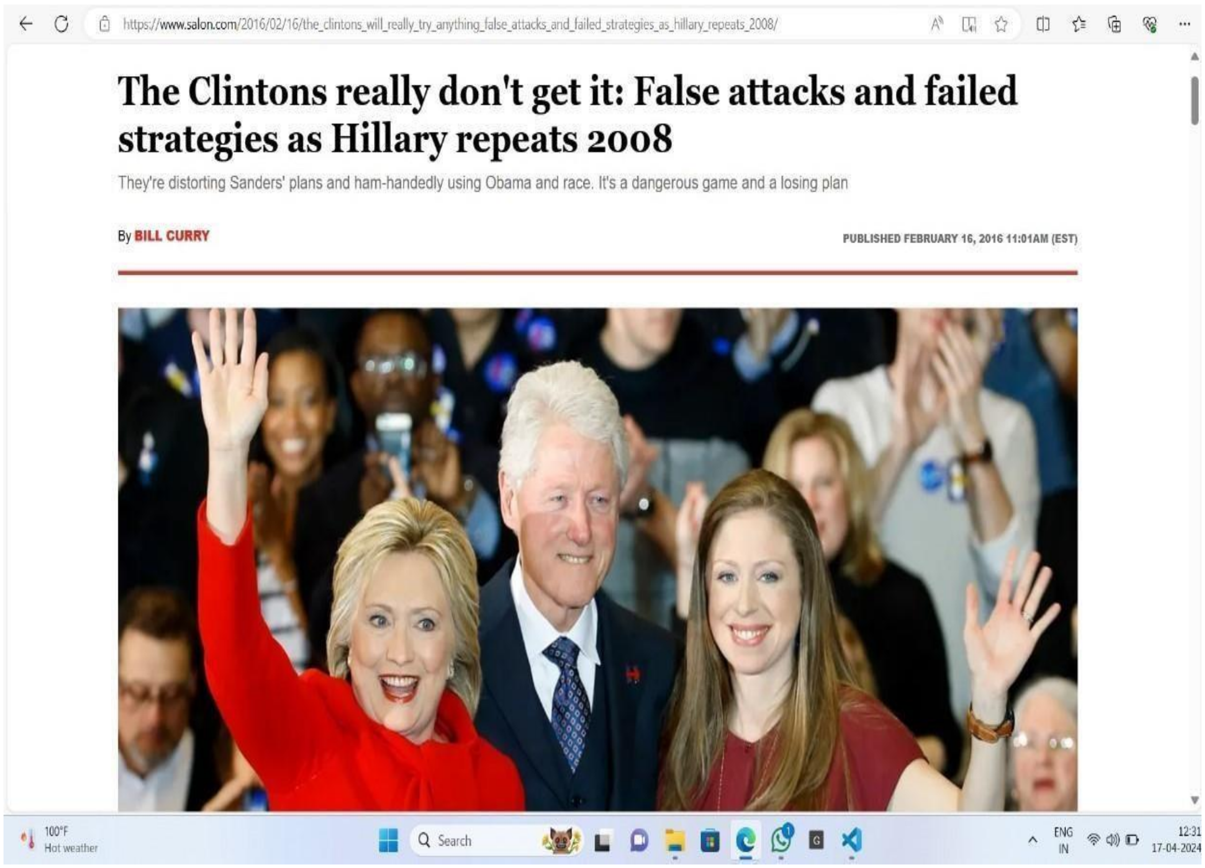
Load random News from test dataset ? Click here.

REAL

Hide text processing pipeline

Original text	Preprocessed text	Pos-tagged text
The Clintons really don't get it: False attacks and failed strategies as Hillary repeats 2008 They're distorting	clinton really get false attack fail strategy hillary repeat distort sander plan ham-handedly use obama race	NN-clinton RB-really VB-get JJ-false NN-attack NN-fail NN-strategy JJ-hillary NN-repeat NN-distort NN-sander

Fig 8.3 Result page


https://www.salon.com/2016/02/16/the_clintons_will_really_try_anything_false_attacks_and_failed_strategies_as_hillary_repeats_2008/
100°F
Hot weather
Search
ENG
IN
12:31
17-04-2024

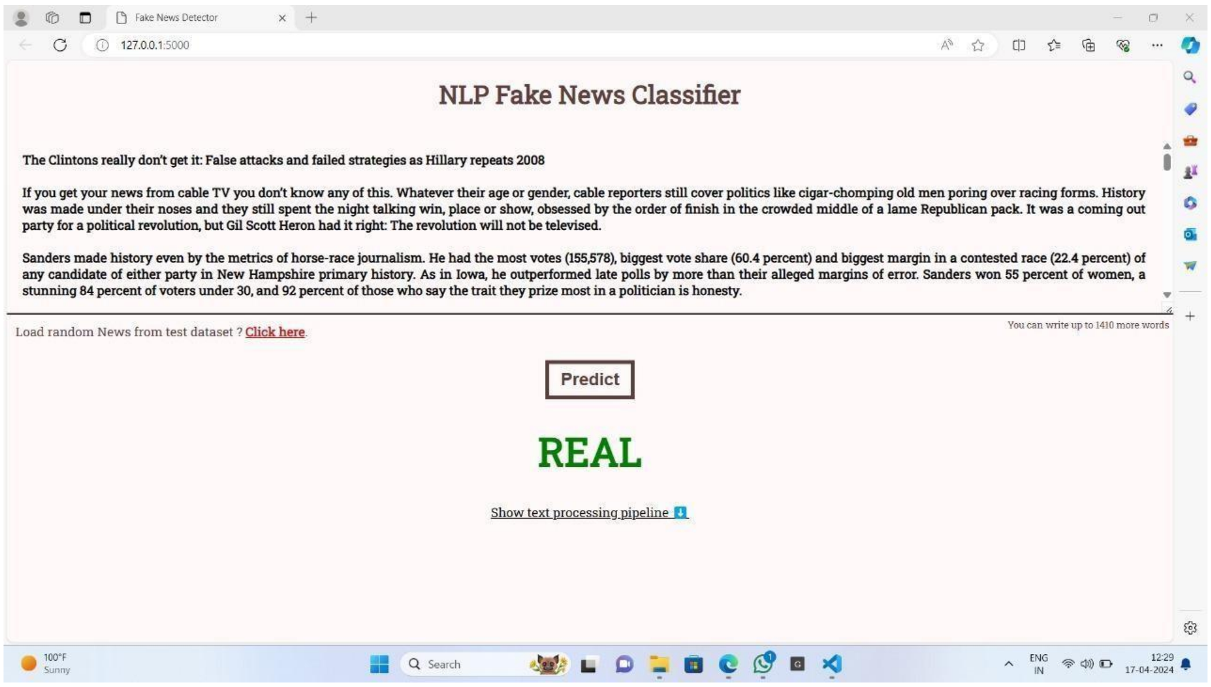
The Clintons really don't get it: False attacks and failed strategies as Hillary repeats 2008

They're distorting Sanders' plans and ham-handedly using Obama and race. It's a dangerous game and a losing plan

By BILL CURRY

PUBLISHED FEBRUARY 16, 2016 11:01AM (EST)

Fig 8.4 News From Search Engine


Fake News Detector

127.0.0.1:5000

NLP Fake News Classifier

The Clintons really don't get it: False attacks and failed strategies as Hillary repeats 2008

If you get your news from cable TV you don't know any of this. Whatever their age or gender, cable reporters still cover politics like cigar-chomping old men poring over racing forms. History was made under their noses and they still spent the night talking win, place or show, obsessed by the order of finish in the crowded middle of a lame Republican pack. It was a coming out party for a political revolution, but Gil Scott Heron had it right: The revolution will not be televised.

Sanders made history even by the metrics of horse-race journalism. He had the most votes (155,578), biggest vote share (60.4 percent) and biggest margin in a contested race (22.4 percent) of any candidate of either party in New Hampshire primary history. As in Iowa, he outperformed late polls by more than their alleged margins of error. Sanders won 55 percent of women, a stunning 84 percent of voters under 30, and 92 percent of those who say the trait they prize most in a politician is honesty.

You can write up to 1410 more words

Load random News from test dataset ? Click here.

Predict

REAL

Show text processing pipeline

Fig 8.5 Prediction Page

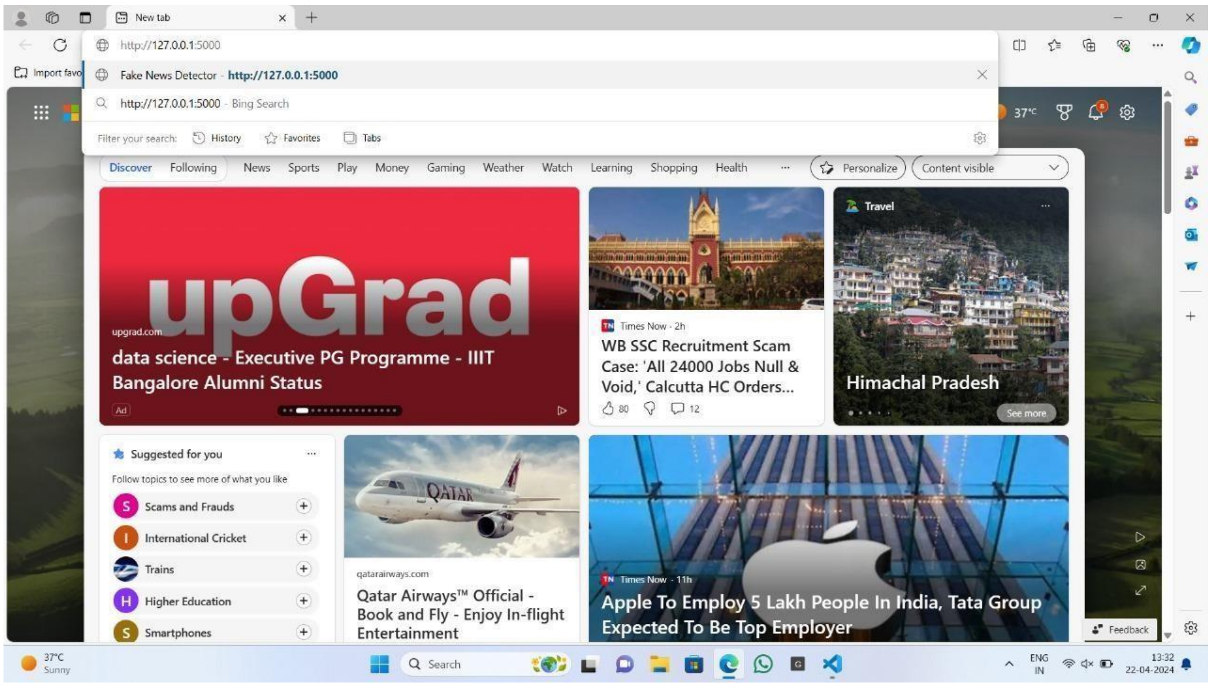
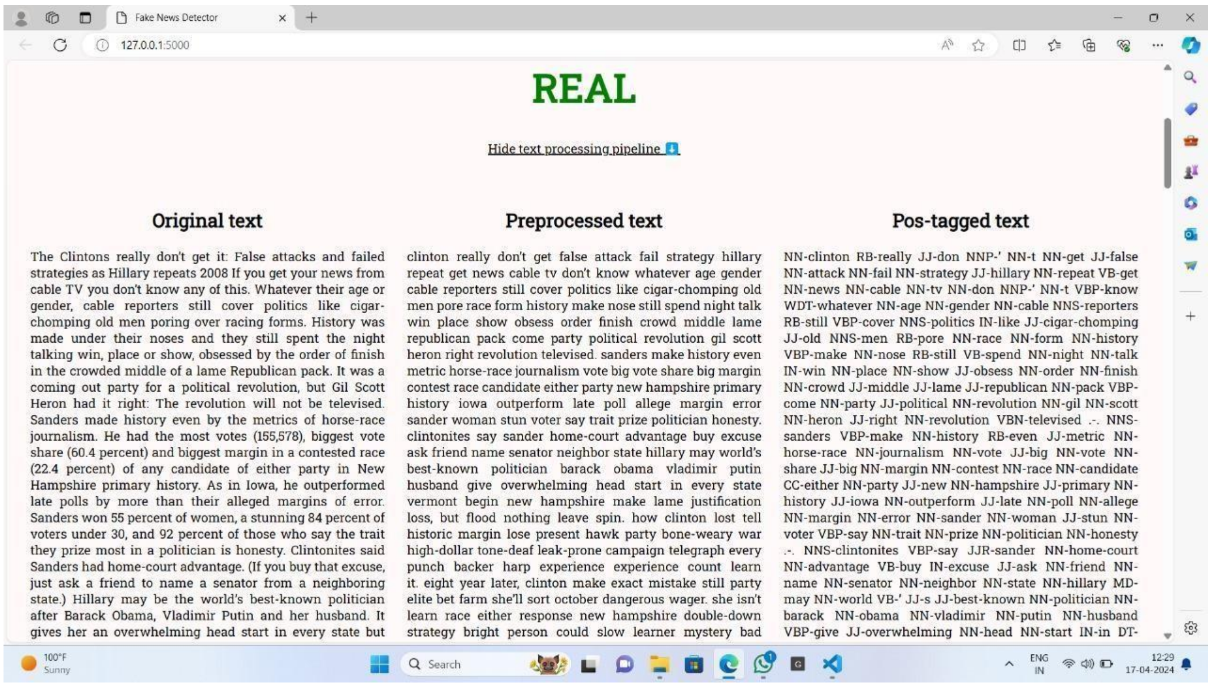

New tab
http://127.0.0.1:5000
Fake News Detector - http://127.0.0.1:5000
http://127.0.0.1:5000 - Bing Search
Discover
Following
News
Sports
Play
Money
Gaming
Weather
Watch
Learning
Shopping
Health
Personalize
Content visible
upGrad
data science - Executive PG Programme - IIIT Bangalore Alumni Status
WB SSC Recruitment Scam Case: 'All 24000 Jobs Null & Void,' Calcutta HC Orders...
Travel
Himachal Pradesh
Suggested for you
Scams and Frauds
International Cricket
Trains
Higher Education
Smartphones
Qatar Airways™ Official - Book and Fly - Enjoy In-flight Entertainment
Apple To Employ 5 Lakh People In India, Tata Group Expected To Be Top Employer

Fig 8.6 About Page



REAL

Hide text processing pipeline ⬇️

Original text

The Clintons really don't get it: False attacks and failed strategies as Hillary repeats 2008 If you get your news from cable TV you don't know any of this. Whatever their age or gender, cable reporters still cover politics like cigar-chomping old men poring over racing forms. History was made under their noses and they still spent the night talking win, place or show, obsessed by the order of finish in the crowded middle of a lame Republican pack. It was a coming out party for a political revolution, but Gil Scott Heron had it right: The revolution will not be televised. Sanders made history even by the metrics of horse-race journalism. He had the most votes (155,578), biggest vote share (60.4 percent) and biggest margin in a contested race (22.4 percent) of any candidate of either party in New Hampshire primary history. As in Iowa, he outperformed late polls by more than their alleged margins of error. Sanders won 55 percent of women, a stunning 84 percent of voters under 30, and 92 percent of those who say the trait they prize most in a politician is honesty. Clintonites said Sanders had home-court advantage. (If you buy that excuse, just ask a friend to name a senator from a neighboring state.) Hillary may be the world's best-known politician after Barack Obama, Vladimir Putin and her husband. It gives her an overwhelming head start in every state but

Preprocessed text

clinton really don't get false attack fail strategy hillary repeat get news cable tv don't know whatever age gender cable reporters still cover politics like cigar-chomping old men pore race form history make nose still spend night talk win place show obsess order finish crowd middle lame republican pack come party political revolution gil scott heron right revolution televised. sanders make history even metric horse-race journalism vote big vote share big margin contest race candidate either party new hampshire primary history iowa outperform late poll allege margin error sander woman stun voter say trait prize politician honesty. clintonites say sander home-court advantage buy excuse ask friend name senator neighbor state hillary may world's best-known politician barack obama vladimir putin husband give overwhelming head start in every state vermont begin new hampshire make lame justification loss, but flood nothing leave spin. how clinton lost tell historic margin lose present hawk party bone-weary war high-dollar tone-deaf leak-prone campaign telegraph every punch backer harp experience experience count learn it. eight year later, clinton make exact mistake still party elite bet farm she'll sort october dangerous wager. she isn't learn race either response new hampshire double-down strategy bright person could slow learner mystery bad

Pos-tagged text

NN-clinton RB-really JJ-don NNP-' NN-t NN-get JJ-false NN-attack NN-fail NN-strategy JJ-hillary NN-repeat VB-get NN-news NN-cable NN-tv NN-don NNP-' NN-t VBP-know WDT-whatever NN-age NN-gender NN-cable NNS-reporters RB-still VBP-cover NNS-politics IN-like JJ-cigar-chomping JJ-old NNS-men RB-pore NN-race NN-form NN-history VBP-make NN-nose RB-still VB-spend NN-night NN-talk IN-win NN-place NN-show JJ-obsess NN-order NN-finish NN-crowd JJ-middle JJ-lame JJ-republican NN-pack VBP-come NN-party JJ-political NN-revolution NN-gil NN-scott NN-heron JJ-right NN-revolution VBN-televised .-. NNS-sanders VBP-make NN-history RB-even JJ-metric NN-horse-race NN-journalism NN-vote JJ-big NN-vote NN-share JJ-big NN-margin NN-contest NN-race NN-candidate CC-either NN-party JJ-new NN-hampshire JJ-primary NN-history JJ-iowa NN-outperform JJ-late NN-poll NN-allege NN-margin NN-error NN-sander NN-woman JJ-stun NN-voter VBP-say NN-trait NN-prize NN-politician NN-honesty .-. NNS-clintonites VBP-say JJR-sander NN-home-court NN-advantage VB-buy IN-excuse JJ-ask NN-friend NN-name NN-senator NN-neighbor NN-state NN-hillary MD-may NN-world VB-' JJ-s JJ-best-known NN-politician NN-barack NN-obama NN-vladimir NN-putin NN-husband VBP-give JJ-overwhelming NN-head NN-start IN-in DT-

Fig 8.7 Details Page

CHAPTER 7
CONCLUSION

In conclusion, the project on fake news detection using machine learning and natural language processing represents a significant step towards addressing the pervasive issue of misinformation in online media platforms. By leveraging advanced technologies and techniques, such as machine learning algorithms and natural language processing, we have developed a robust and scalable system capable of accurately identifying and flagging fake news articles in real-time. Throughout the project, we have focused on systematically addressing the challenges associated with fake news detection, including data preprocessing, feature engineering, model training, and deployment.

Our comprehensive testing approach has ensured that the system meets its intended functionality, performance, accuracy, and usability requirements. Through iterative testing and feedback collection, we have continuously improved the system's performance, reliability, and user experience.

Moving forward, our project aims to make a meaningful contribution to combating misinformation in online media platforms, empowering users with tools and resources to make informed decisions about the credibility of online content. By providing a reliable and user-friendly solution for fake news detection, we strive to promote a more informed and resilient information ecosystem, ultimately mitigating the harmful effects of fake news on society.

FUTURE SCOPE :

- **Enhanced Model Performance:** Continuously refine and optimize machine learning models to improve detection accuracy, robustness, and efficiency. Explore advanced algorithms, ensemble techniques, and deep learning architectures to achieve higher performance levels.
- **Multimodal Analysis:** Incorporate additional modalities, such as images, videos, and audio, to perform multimodal analysis for more comprehensive fake news detection. Develop techniques to integrate and analyze diverse media types in conjunction with textual content.
- **Real-time Monitoring:** Implement real-time monitoring capabilities to detect and flag fake news articles as they emerge online. Develop mechanisms for tracking news trends, identifying potential misinformation hotspots.

CHAPTER 8

REFERENCES

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