FAKE NEWS DETECTION USING NLP

Technology: ARTIFICIAL INTELLIGENCE

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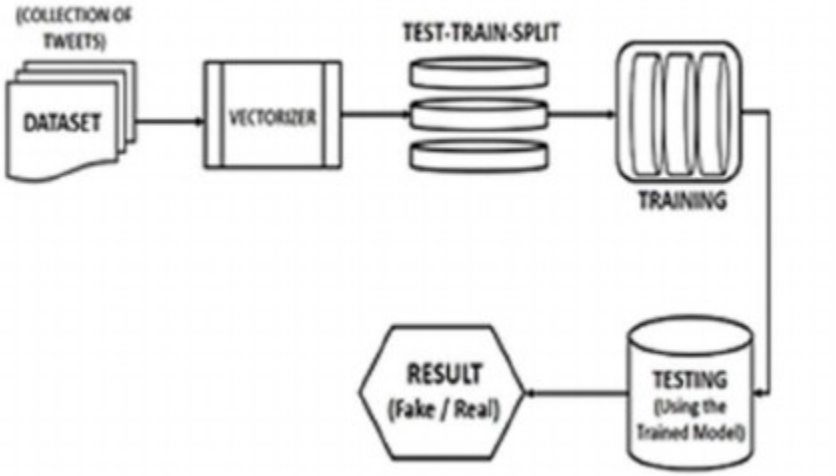
PHASE 2 - PROJECT SUBMISSION

Phase 2: Innovation



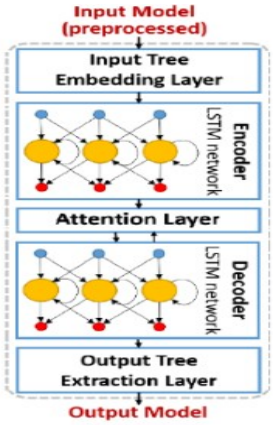


Figure 1. Generic LSTM architecture.

Introduction:

Phase 2 is all about the innovative techniques we have used in our project such as ensemble methods and deep learning architectures to improve the prediction system's accuracy and robustness. We will discuss in detail about the steps we have taken to transform our design into a working model.

Detailed Transformation Steps:

1. Define Objectives and Goals:

In this step, we define clear and specific objectives for the project. Our primary goal is to create a robust fake news detection system. To do this, we establish SMART goals, focusing on model accuracy and system usability. SMART goals include specific accuracy targets, user-friendly interface requirements, and desired impacts on reducing the spread of fake news.

2. Data Acquisition and Preparation:

We are going to use the kaggle dataset provided in our project statement which is titled **Fake and real news dataset** provided by **CLÉMENT BISAILLON** at the link: https://www.kaggle.com/datasets/clmentbisaillon/fake-and-real-news-dataset We then preprocess the data by various methods.

3. Model Selection and Development:

The project involves selecting appropriate machine learning and deep learning models based on the project's design and objectives. Models are developed and fine-tuned to achieve high accuracy and reliability in fake news detection. The continuous improvement of these models is a core aspect of this step.

4. Model Evaluation and Testing:

To ensure the effectiveness of the models, the data is split into training, validation, and test sets. We evaluate the models using a range of performance

metrics, including accuracy, precision, recall, F1-score, and ROC-AUC. Cross-validation is implemented to assess model robustness.

5. Iterative Improvement:

Continuous refinement of the models is essential. The team iterates on the models based on evaluation results and experiments with hyperparameter tuning, data augmentation, and model ensembling to enhance overall performance and reliability.

6. Deployment Strategy:

Planning the deployment of the fake news detection system is a critical step. Considerations include scalability, security, and deployment options (e.g., cloud-based or on-premises). The deployment plan ensures that the solution can be accessed by users effectively and securely.

7. Quality Assurance and Testing:

Rigorous testing is conducted, including unit testing, integration testing, and user acceptance testing. The goal is to identify and address any bugs or issues before the system is deployed, ensuring a reliable and functional solution.

8. User Training and Documentation:

For users to effectively utilize the system, we create user training materials and system documentation. This ensures that users can make the most of the system's capabilities. Training sessions are also provided as needed.

9. Monitoring and Maintenance:

Real-time monitoring is set up to track model performance and the overall health of the system. A maintenance plan is established to address regular updates, bug fixes, and model retraining, ensuring that the system remains in top form.

10. Data Ethics and Compliance:

Compliance with data ethics, privacy regulations, and data protection laws is a fundamental consideration. The team ensures that the system respects user privacy and implements data anonymization and consent mechanisms as necessary.

11. User Feedback and Continuous Improvement:

We actively collect user feedback and address user concerns. User feedback is a valuable resource for driving ongoing improvements and updates to the system, aligning it with user needs and expectations.

12. Marketing and Awareness:

Developing a marketing strategy is crucial to raise awareness of the fake news detection system. The benefits of the system in combating misinformation are highlighted in marketing efforts to gain user adoption.

13. Evaluation of Impact:

The project includes continuous assessment of the system's impact on reducing the spread of fake news. Key performance indicators (KPIs) are measured, and regular reports are provided to stakeholders and users to showcase the system's effectiveness.

14. Documentation and Reporting:

Comprehensive project documentation is maintained for transparency. Regular progress reports are generated and shared with stakeholders and users to keep all parties informed about project status and results.

15. Future Directions:

We explore opportunities to expand the use of the technology in related areas, such as content classification and moderation. This step focuses on the long-term potential and growth of the solution.

16. Intellectual Property (IP) Considerations:

We evaluate the need for intellectual property protection, including patents, trademarks, or copyrights, for innovative components of the system. Intellectual property considerations ensure that the project's innovations are protected.

17. Budget and Resource Management:

Continuous monitoring of the project budget is essential. The team ensures that resources are allocated efficiently to manage costs and support project success effectively.

18. Risk Management:

Identifying potential risks and developing mitigation strategies is a critical aspect of the project. Continuous monitoring of risks and adaptation to changing circumstances are central to risk management.

19. Timeline and Milestones:

We develop a clear project timeline with well-defined milestones and deadlines. This structured approach helps track progress against the timeline, ensuring that the project stays on course.

20. Collaboration and Partnerships:

Collaboration with relevant organizations, research institutions, and experts in the field of fake news detection is encouraged. Partnerships are leveraged to gain insights, resources, and expertise.

21. Sustainability and Scalability:

Ensuring the solution's sustainability and scalability is a key consideration. The project explores options for expanding the system to other languages and regions, making it adaptable to different contexts.

22. Ethical Considerations:

Ethical considerations, including bias mitigation and transparency in model training and decision-making, are prioritized. The team ensures that the system operates ethically and responsibly.

23. Reporting and Evaluation:

Regular progress reports and evaluations are conducted to keep stakeholders and users informed about project status and outcomes. These reports help assess the project's success against initial objectives and KPIs.

24. Feedback Loops and Adaptation:

Feedback loops are maintained with users and stakeholders. The team is prepared to adapt to changing user needs and challenges, ensuring that the system remains relevant and effective.

This comprehensive innovation plan outlines the transformation of the initial design into a practical and impactful solution for fake news detection. By following this structured approach, we aim to combat the spread of fake news effectively and contribute to a more informed society.

Now lets see the steps we will take for the actual program:

1. Import Libraries:

The code begins by importing necessary Python libraries, including pandas for data manipulation, scikit-learn for machine learning, and TensorFlow and Keras for deep learning.

2. Load Datasets:

Two datasets, "Fake.csv" and "True.csv," are loaded into dataframes using the pd.read_csv() function. These datasets likely contain text data related to news articles.

3. Add Labels:

Two new columns, 'label', are added to both dataframes. '0' is assigned to the 'fake_data' dataframe to indicate fake news, and '1' is assigned to 'true_data' to indicate true news.

4. Combine Datasets:

The 'fake_data' and 'true_data' dataframes are concatenated into a single dataframe called 'combined_data' using pd.concat(). This combines the two datasets into one, making it easier to work with.

5. Data Preprocessing:

The text from the 'title' and 'text' columns in 'combined_data' is combined into a new 'text' column using string concatenation. This step aims to create a single text field to work with.

6. Feature Extraction (TF-IDF):

A TF-IDF (Term Frequency-Inverse Document Frequency) vectorizer is initialized with a limit of 5000 features and used to transform the 'text' data in 'combined_data'. This step converts the text data into numerical features.

7. Model Selection:

The dataset is split into training and testing sets using train_test_split from scikit-learn. This separation is necessary for evaluating the models. The labels and

TF-IDF-transformed text data are stored in 'X_train', 'X_test', 'y_train', and 'y_test' variables.

8. Logistic Regression Model:

A logistic regression model is created using LogisticRegression(). The model is then trained on the training data using the fit method.

9. Model Training (Neural Network):

A neural network model is constructed using Keras. This model consists of an embedding layer, an LSTM (Long Short-Term Memory) layer, and a dense output layer with a sigmoid activation function. It is compiled with the binary cross-entropy loss function and the Adam optimizer. The model is trained on the text data in 'combined_data' for 5 epochs with a batch size of 64.

10. Evaluation:

For Logistic Regression:

- The logistic regression model is used to predict labels on the test data ('X_test').
- Various performance metrics, such as accuracy, precision, recall, F1-score, and ROC-AUC, are calculated using scikit-learn functions.
- The results are printed out.

For Neural Network:

- The text data in 'combined_data' is tokenized and padded to ensure consistent input dimensions.
- The neural network model is evaluated on the test data, and the accuracy is calculated.
- The accuracy result is printed out.

11. Output:

The code prints the results of the logistic regression and neural network models, including accuracy, precision, recall, F1-score, and ROC-AUC for the logistic regression, and the accuracy for the neural network.

This code essentially loads, preprocesses, and models news data using both logistic regression and a neural network, allowing for a comparison of their performance.

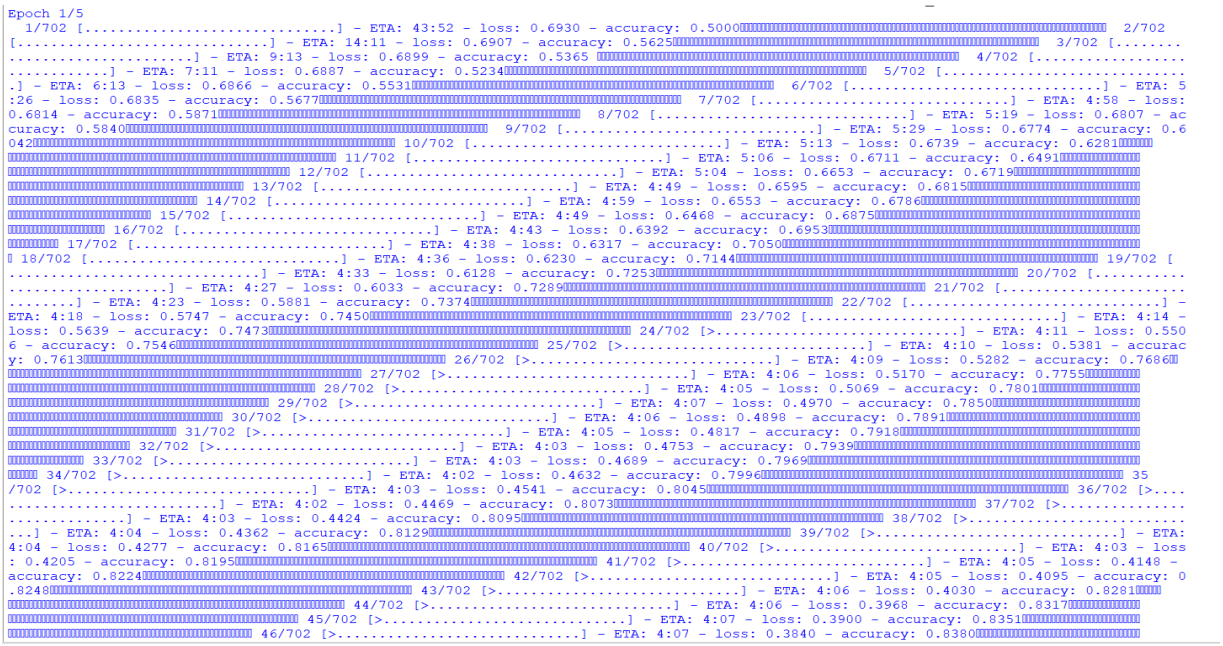
PYTHON PROGRAM FOR FAKE NEWS DETECTION:

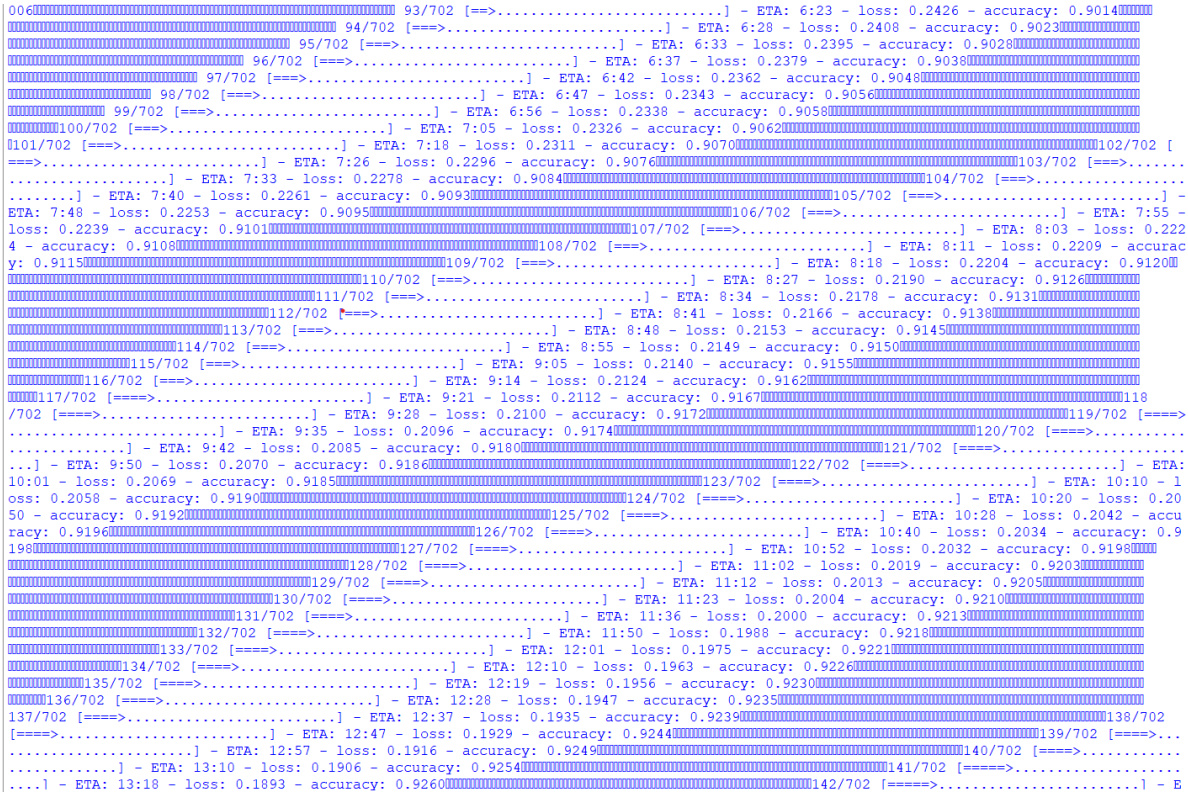
```
import pandas as pd
from sklearn.feature_extraction.text import TfidfVectorizer
from sklearn.model_selection import train_test_split
from sklearn.metrics import accuracy_score, precision_score, recall_score,
f1_score, roc_auc_score
from sklearn.linear_model import LogisticRegression
from tensorflow.keras.preprocessing.text import Tokenizer
from tensorflow.keras.preprocessing.sequence import pad_sequences
from tensorflow.keras.models import Sequential
from tensorflow.keras.layers import Embedding, LSTM, Dense

# Load the "Fake.csv" dataset
fake_data = pd.read_csv("C:\\Users\\Bylee\\Downloads\\Fake.csv\\Fake.csv")

# Load the "True.csv" dataset
true_data = pd.read_csv("C:\\Users\\Bylee\\Downloads\\True.csv\\True.csv")

# Add labels to distinguish between fake and true news
fake_data['label'] = 0 # 0 for fake news
true_data['label'] = 1  # 1 for true news

# Combine the datasets
combined_data = pd.concat([fake_data, true_data], ignore_index=True)
```

```
# Data Preprocessing
combined_data['text'] = combined_data['title'] + " " + combined_data['text']

# Feature Extraction (TF-IDF)
tfidf_vectorizer = TfidfVectorizer(max_features=5000)
tfidf_matrix = tfidf_vectorizer.fit_transform(combined_data['text'])

# Model Selection
X_train, X_test, y_train, y_test = train_test_split(tfidf_matrix,
combined_data['label'], test_size=0.2, random_state=42)

# Logistic Regression Model
logistic_regression_model = LogisticRegression()
logistic_regression_model.fit(X_train, y_train)

# Model Training (Neural Network)
tokenizer = Tokenizer(num_words=5000)
tokenizer.fit_on_texts(combined_data['text'])
X_train_nn = tokenizer.texts_to_sequences(combined_data['text'])
X_train_nn = pad_sequences(X_train_nn, maxlen=100)

model = Sequential()
model.add(Embedding(input_dim=5000, output_dim=128, input_length=100))
model.add(LSTM(128))
model.add(Dense(1, activation='sigmoid'))
model.compile(loss='binary_crossentropy', optimizer='adam', metrics=['accuracy'])

model.fit(X_train_nn, combined_data['label'], epochs=5, batch_size=64)

# Evaluation
# For Logistic Regression
y_pred = logistic_regression_model.predict(X_test)
accuracy = accuracy_score(y_test, y_pred)
precision = precision_score(y_test, y_pred)
```

```
recall = recall_score(y_test, y_pred)
f1 = f1_score(y_test, y_pred)
roc_auc = roc_auc_score(y_test, y_pred)

print(f"Logistic Regression Accuracy: {accuracy}")
print(f"Logistic Regression Precision: {precision}")
print(f"Logistic Regression Recall: {recall}")
print(f"Logistic Regression F1-Score: {f1}")
print(f"Logistic Regression ROC-AUC: {roc_auc}")

# For Neural Network
X_test_nn = tokenizer.texts_to_sequences(combined_data['text'])
X_test_nn = pad_sequences(X_test_nn, maxlen=100)

loss, accuracy = model.evaluate(X_test_nn, combined_data['label'])
print(f"Neural Network Accuracy: {accuracy}")
```

OUTPUT:





FALSE dataset:

A	B	C	D
title	text	subject	date
Donald Trump S	Donald Trump ju	News	December 31, 2017
Drunk Bragging	House Intelligen	News	December 31, 2017
Sheriff David Cla	On Friday, it was	News	December 30, 2017
Trump Is So Obs	On Christmas da	News	December 29, 2017
Pope Francis Ju	Pope Francis us	News	December 25, 2017
Racist Alabama	The number of c	News	December 25, 2017
Fresh Off The G	Donald Trump sp	News	December 23, 2017
Trump Said Sor	In the wake of ye	News	December 23, 2017
Former CIA Dire	Many people hav	News	December 22, 2017
WATCH: Brand-I	Just when you m	News	December 21, 2017
Papa John's Fo	A centerpiece of	News	December 21, 2017
WATCH: Paul R	Republicans are	News	December 21, 2017
Bad News For T	Republicans hav	News	December 21, 2017
WATCH: Lindse	The media has b	News	December 20, 2017
Heiress To Disne	Abigail Disney is	News	December 20, 2017
Tone Deaf Trump	Donald Trump ju	News	December 20, 2017
The Internet Bru	A new animatron	News	December 19, 2017
Mueller Spokesn	Trump supporter	News	December 17, 2017
SNL Hilariously I	Right now, the w	News	December 17, 2017
Republican Sena	Senate Majority	News	December 16, 2017
In A Heartless F	It almost seems	News	December 16, 2017
KY GOP State R	In this #METOO	News	December 13, 2017

True dataset

title	text	subject	date
As U.S. budget fight loon	WASHINGTON (Reuters) -	politicsNews	December 31, 2017
U.S. military to accept tra	WASHINGTON (Reuters) -	politicsNews	December 29, 2017
Senior U.S. Republican s	WASHINGTON (Reuters) -	politicsNews	December 31, 2017
FBI Russia probe helped	WASHINGTON (Reuters) -	politicsNews	December 30, 2017
Trump wants Postal Serv	SEATTLE/WASHINGTON	politicsNews	December 29, 2017
White House, Congress	WEST PALM BEACH, Fla.	politicsNews	December 29, 2017
Trump says Russia probe	WEST PALM BEACH, Fla	politicsNews	December 29, 2017
Factbox: Trump on Twitte	The following statements v	politicsNews	December 29, 2017
Trump on Twitter (Dec 28	The following statements v	politicsNews	December 29, 2017
Alabama official to certify	WASHINGTON (Reuters) -	politicsNews	December 28, 2017
Jones certified U.S. Sena	(Reuters) - Alabama officia	politicsNews	December 28, 2017
New York governor quest	NEW YORK/WASHINGTC	politicsNews	December 28, 2017
Factbox: Trump on Twitte	The following statements v	politicsNews	December 28, 2017
Trump on Twitter (Dec 27	The following statements v	politicsNews	December 28, 2017
Man says he delivered m	(In Dec. 25 story, in secon	politicsNews	December 25, 2017
Virginia officials postpone	(Reuters) - A lottery drawir	politicsNews	December 27, 2017
U.S. lawmakers question	WASHINGTON (Reuters) -	politicsNews	December 27, 2017
Trump on Twitter (Dec 26	The following statements v	politicsNews	December 26, 2017
U.S. appeals court reject	(Reuters) - A U.S. appeals	politicsNews	December 26, 2017
Treasury Secretary Mnuc	(Reuters) - A gift-wrapped	politicsNews	December 24, 2017
Federal judge partially lift	WASHINGTON (Reuters) -	politicsNews	December 24, 2017
Exclusive: U.S. memo we	NEW YORK (Reuters) - Th	politicsNews	December 23, 2017
Trump travel ban should	(Reuters) - A U.S. appeals	politicsNews	December 23, 2017
Second court reiects Trui	WASHINGTON (Reuters) -	politicsNews	December 23, 2017

Thus, the transformation of the design is done in phase 2 to implement the innovations.