Configuration Manual

MSc Research Project
MSc in Data Analysis

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MSc Project Submission Sheet

School of Computing

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Module:	RESEARCH IN COMPUTING		
Lecturer:	HAMILTON NICULESCU		
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Project Title:	ADVANCED FAKE NEWS DETECTION USING ALBERT AND KNOWLEDGE GRAPHS		

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PLEASE READ THE FOLLOWING INSTRUCTIONS AND CHECKLIST

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Configuration Manual

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1 INTRODUCTION

1.1 Overview of the Fake News Detection Model

This configuration manual is for a very high-performance fake news detection model that marries the state-of-the-art techniques in natural language processing with graph-based feature extraction methods. From a different perspective, it looks at this problem as classifying "real" versus "fake" news articles into high-accuracy classes.

Key features of the model include:

- Utilization of ALBERT (A Lite BERT), a powerful pre-trained language model, for text representation
- Integration of graph-based features to capture structural information in the text
- Custom attention mechanisms for improved feature weighting
- Advanced fusion layer for combining ALBERT and graph embeddings

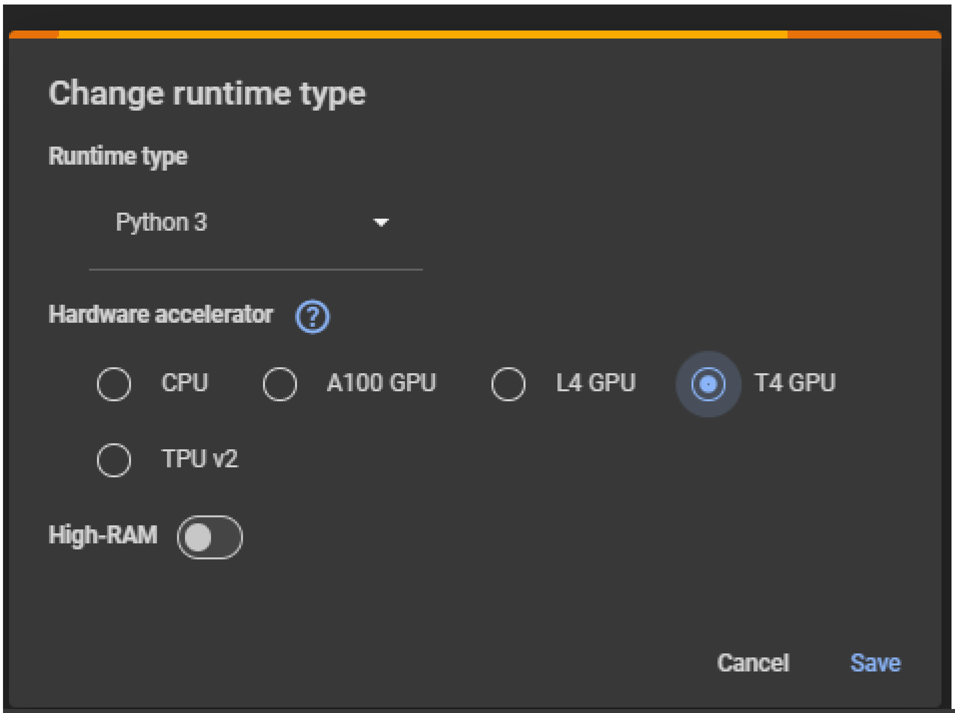
The model architecture consists of:

1. An ALBERT-based encoder
2. A knowledge graph generator and embedding layer
3. An advanced fusion layer
4. A custom attention layer
5. A final classification layer.

2 Connecting to a Colab Session and Drive setup

2.1 Colab session setup

1. Go to https://colab.research.google.com/
2. If prompted, sign in with your Google account
3. Click on "New Notebook" to start a new session
4. Ensure you're using a GPU runtime:
    - Go to "Runtime" > "Change runtime type"
    - Select "GPU" from the Hardware accelerator dropdown menu
    - Click "Save"



Change runtime type

Runtime type

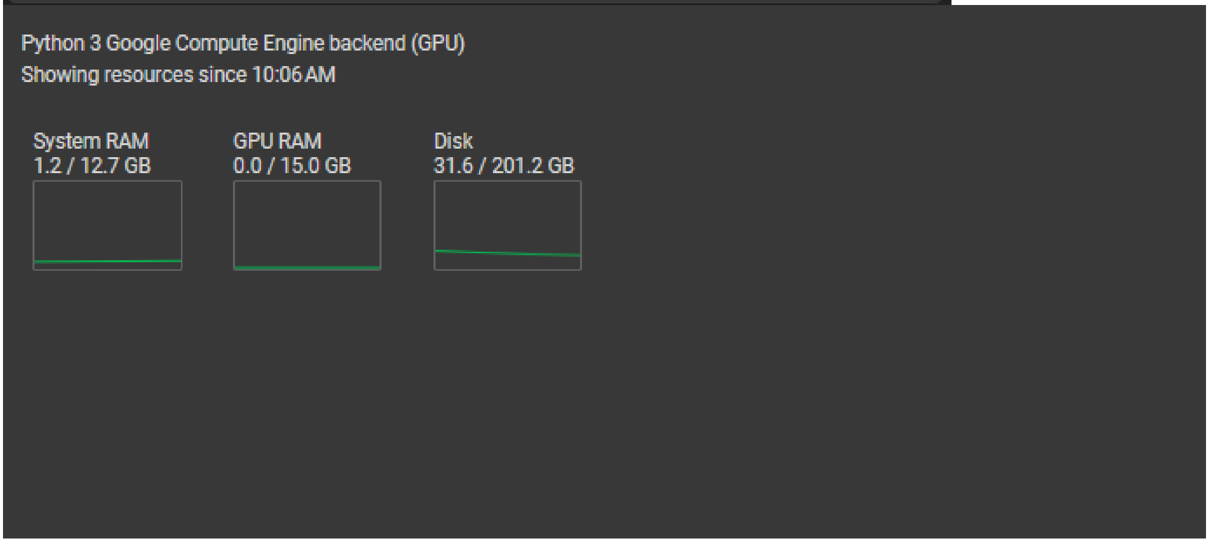
Python 3

Hardware accelerator

○ CPU ○ A100 GPU ○ L4 GPU ● T4 GPU

○ TPU v2

High-RAM



Python 3 Google Compute Engine backend (GPU)
Showing resources since 10:06 AM

System RAM
1.2 / 12.7 GB

GPU RAM
0.0 / 15.0 GB

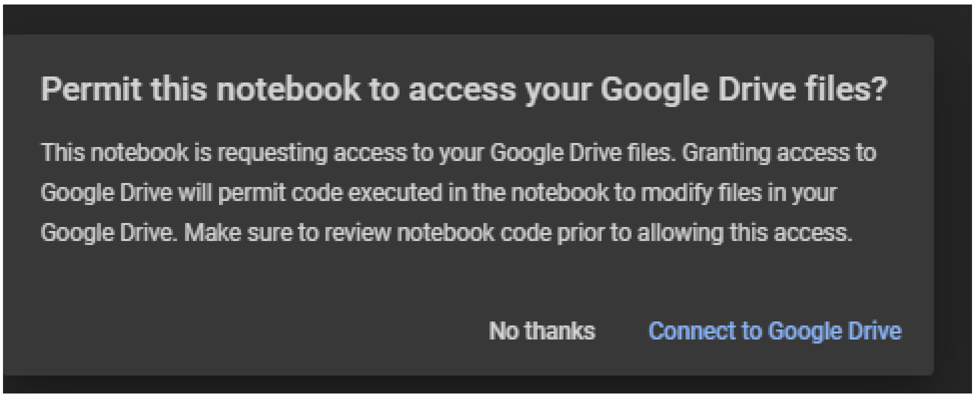
Disk
31.6 / 201.2 GB

2.2 Drive connection

1. Run the following code to mount your Google Drive:

```
from google.colab import drive
drive.mount('/content/drive')
```

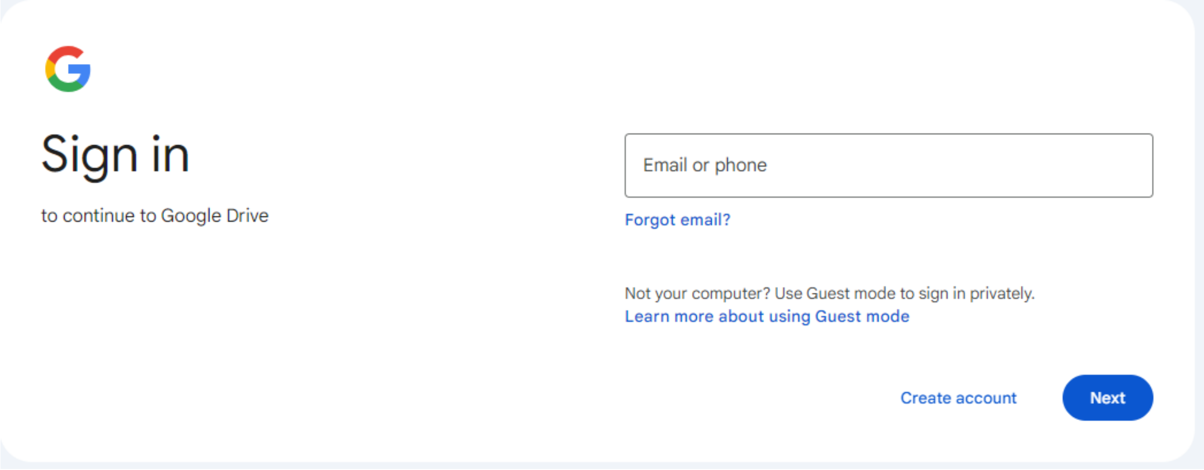
2. Follow the authentication prompts to give Colab access to your Google Drive as follow and select Connect to Google Drive



Permit this notebook to access your Google Drive files?

This notebook is requesting access to your Google Drive files. Granting access to Google Drive will permit code executed in the notebook to modify files in your Google Drive. Make sure to review notebook code prior to allowing this access.

3. Login to the account you want to connect to as follows



Sign in

to continue to Google Drive

Not your computer? Use Guest mode to sign in privately.

3 Uploading Files to Google Drive

Before you start with Google Colab, you need to upload the provided files to your Google Drive:

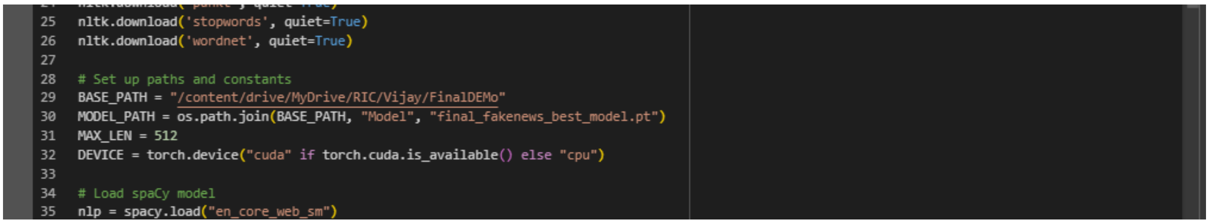
1. Go to https://drive.google.com/ and sign in with your Google account.
2. In your Google Drive, create a new folder called "FakeNewsDetection".
3. Inside "FakeNewsDetection", create the following subfolders:
   - Model
   - Dataset
4. Upload the files as follows:
   - Upload "final_fakenews_best_model.pt" to the "Model" folder.
   - Upload "augmented_fake_news_data.csv" to the "Dataset" folder.
   - Upload any other provided files directly to the "FakeNewsDetection" folder.

4 Changing the Paths

When working with the fake news detection model in Google Colab, it's crucial to set up the correct paths to your model and dataset. These paths will point to the locations in your Google Drive where you've stored the necessary files.

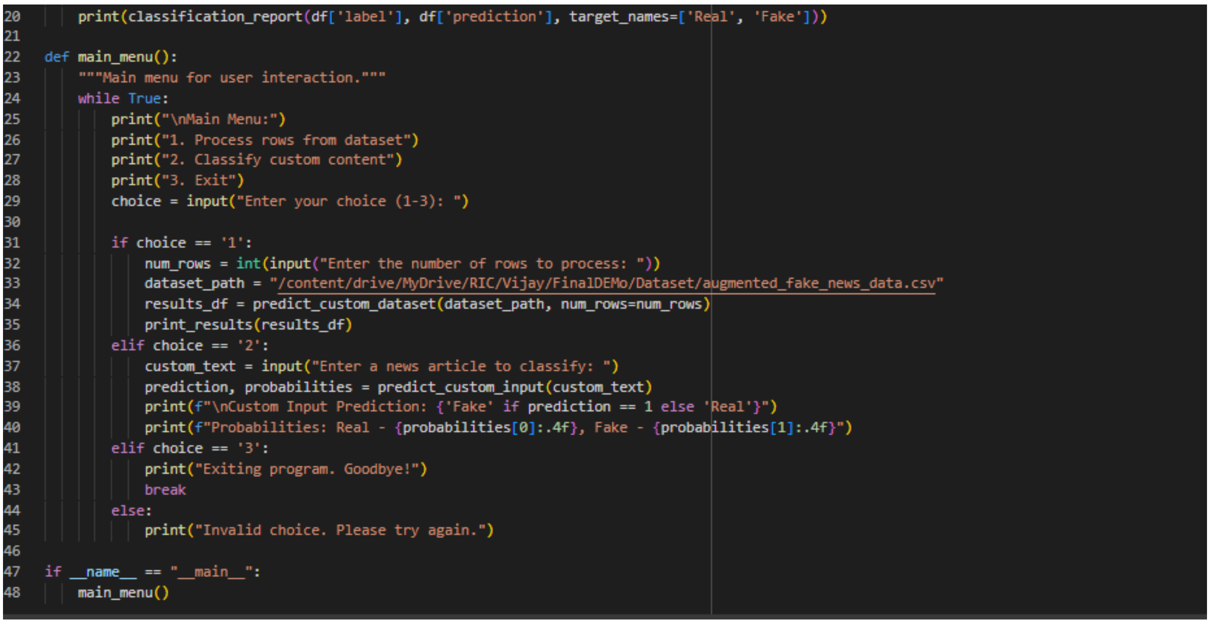
Now change the paths as in the following as per the above directory structure

4.1 Below is for the model file:



```
nltk.download('punkt', quiet=True)
nltk.download('stopwords', quiet=True)
nltk.download('wordnet', quiet=True)

# Set up paths and constants
BASE_PATH = "/content/drive/MyDrive/RIC/Vijay/FinalDEMo"
MODEL_PATH = os.path.join(BASE_PATH, "Model", "final_fakenews_best_model.pt")
MAX_LEN = 512
DEVICE = torch.device("cuda" if torch.cuda.is_available() else "cpu")

# Load spaCy model
nlp = spacy.load("en_core_web_sm")
```

4.2 Change dataset in the dataset_path variable



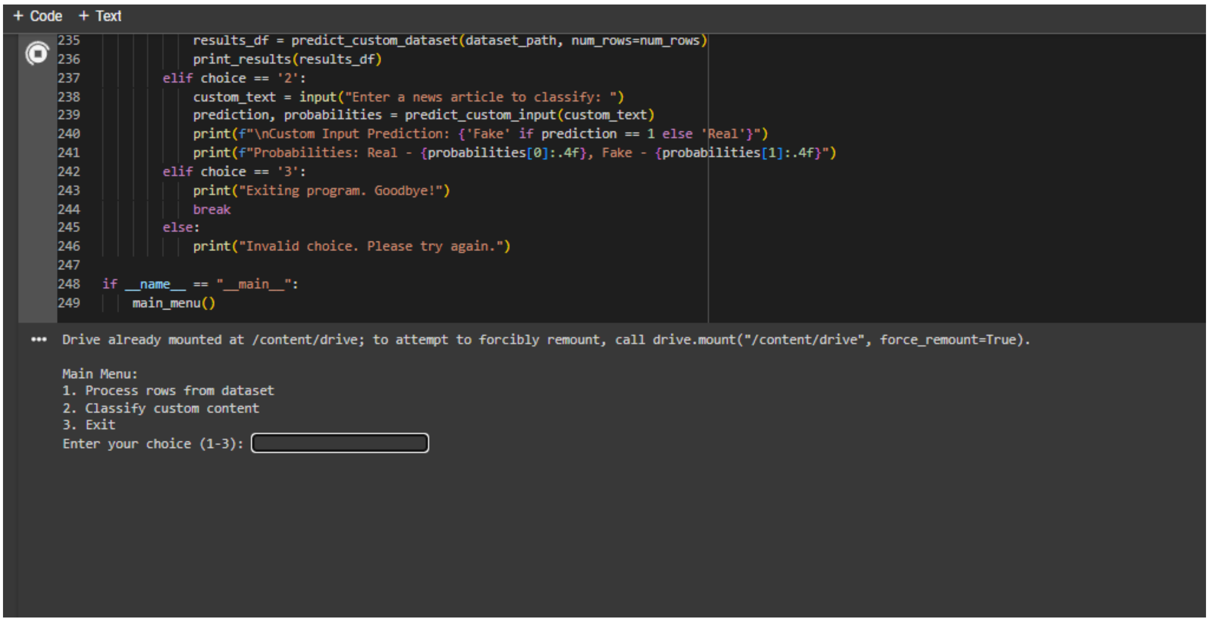
```
    print(classification_report(df['label'], df['prediction'], target_names=['Real', 'Fake']))

def main_menu():
    """Main menu for user interaction."""
    while True:
        print("\nMain Menu:")
        print("1. Process rows from dataset")
        print("2. Classify custom content")
        print("3. Exit")
        choice = input("Enter your choice (1-3): ")

        if choice == '1':
            num_rows = int(input("Enter the number of rows to process: "))
            dataset_path = "/content/drive/MyDrive/RIC/Vijay/FinalDEMo/Dataset/augmented_fake_news_data.csv"
            results_df = predict_custom_dataset(dataset_path, num_rows=num_rows)
            print_results(results_df)
        elif choice == '2':
            custom_text = input("Enter a news article to classify: ")
            prediction, probabilities = predict_custom_input(custom_text)
            print(f"\nCustom Input Prediction: {'Fake' if prediction == 1 else 'Real'}")
            print(f"Probabilities: Real - {probabilities[0]:.4f}, Fake - {probabilities[1]:.4f}")
        elif choice == '3':
            print("Exiting program. Goodbye!")
            break
        else:
            print("Invalid choice. Please try again.")

if __name__ == "__main__":
    main_menu()
```

5 Running the Fake News Detection Model

After you've successfully uploaded the files and configured the paths, you'll see a simple menu interface in the Colab notebook. This menu allows you to easily interact with the model without needing to understand or modify any code.

5.1 Using the Menu Interface

1. Look for a cell in the notebook labeled "Run Model Interface"
2. Click run cell
3. You'll see a menu appear below the cell with the following options:
    1. Process Dataset
    2. Classify Custom Input
    3. Exit
4. To select, type the number of your choice and press ENTER to choose.



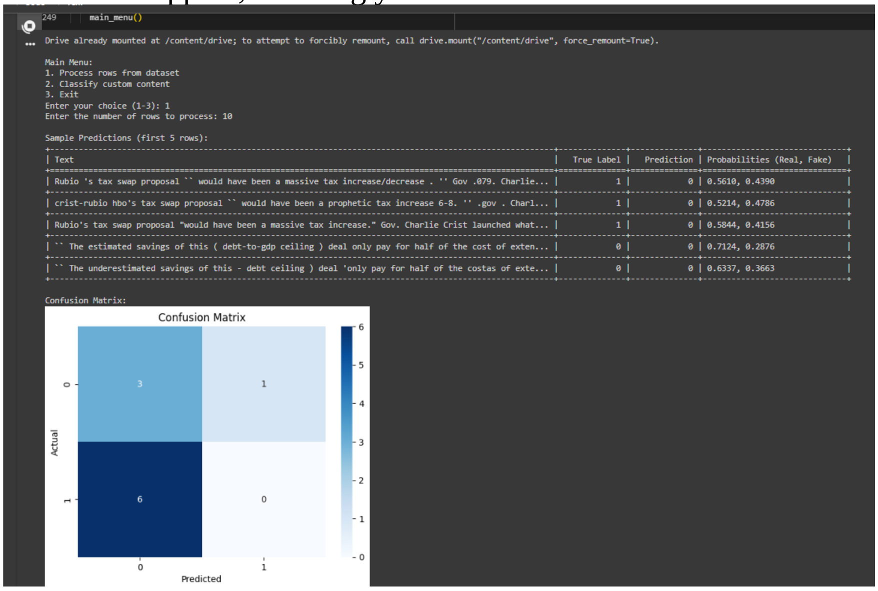
```
            results_df = predict_custom_dataset(dataset_path, num_rows=num_rows)
            print_results(results_df)
        elif choice == '2':
            custom_text = input("Enter a news article to classify: ")
            prediction, probabilities = predict_custom_input(custom_text)
            print(f"\nCustom Input Prediction: {'Fake' if prediction == 1 else 'Real'}")
            print(f"Probabilities: Real - {probabilities[0]:.4f}, Fake - {probabilities[1]:.4f}")
        elif choice == '3':
            print("Exiting program. Goodbye!")
            break
        else:
            print("Invalid choice. Please try again.")

if __name__ == "__main__":
    main_menu()
```

```
Drive already mounted at /content/drive; to attempt to forcibly remount, call drive.mount("/content/drive", force_remount=True).

Main Menu:
1. Process rows from dataset
2. Classify custom content
3. Exit
Enter your choice (1-3):
```

5.2 Option 1: Process Dataset

If you choose this option:

- You will be asked to provide the number of rows from dataset to process. Type any number and press enter.Processing the entire dataset may take a long time, so start with a small number (e.g., 10 or 20) to test.
- The model will process the specified number of rows from the dataset you uploaded earlier.
- After processing, you'll see a summary of the results, including:
    - A sample of processed texts with their true labels and the model's predictions
    - A confusion matrix showing the model's performance
    - A classification report with precision, recall, and F1-score
- The menu will reappear, allowing you to make another selection.



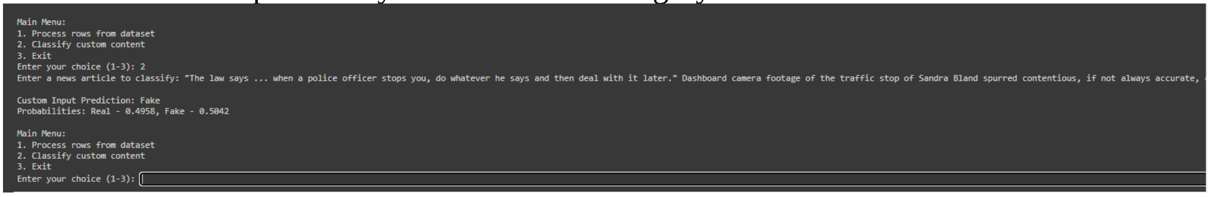
```
    main_menu()
```

```
Drive already mounted at /content/drive; to attempt to forcibly remount, call drive.mount("/content/drive", force_remount=True).

Main Menu:
1. Process rows from dataset
2. Classify custom content
3. Exit
Enter your choice (1-3): 1
Enter the number of rows to process: 10

Sample Predictions (first 5 rows):
+--------------------------------------------------------------------------------------------------+--------------+--------------+-------------------------------+
| Text                                                                                             |   True Label |   Prediction | Probabilities (Real, Fake)    |
+==================================================================================================+==============+==============+===============================+
| Rubio 's tax swap proposal `` would have been a massive tax increase/decrease . '' Gov .079. Charlie... |            1 |            0 | 0.5610, 0.4390                |
+--------------------------------------------------------------------------------------------------+--------------+--------------+-------------------------------+
| crist-rubio hbo's tax swap proposal `` would have been a prophetic tax increase 6-8. '' .gov . Charl... |            1 |            0 | 0.5214, 0.4786                |
+--------------------------------------------------------------------------------------------------+--------------+--------------+-------------------------------+
| Rubio's tax swap proposal "would have been a massive tax increase." Gov. Charlie Crist launched what... |            1 |            0 | 0.5844, 0.4156                |
+--------------------------------------------------------------------------------------------------+--------------+--------------+-------------------------------+
| `` The estimated savings of this ( debt-to-gdp ceiling ) deal only pay for half of the cost of exten... |            0 |            0 | 0.7124, 0.2876                |
+--------------------------------------------------------------------------------------------------+--------------+--------------+-------------------------------+
| `` The underestimated savings of this - debt ceiling ) deal 'only pay for half of the costas of exte... |            0 |            0 | 0.6337, 0.3663                |
+--------------------------------------------------------------------------------------------------+--------------+--------------+-------------------------------+

Confusion Matrix:
```

5.3 Option 2: Classify Custom Input

If you choose this option:

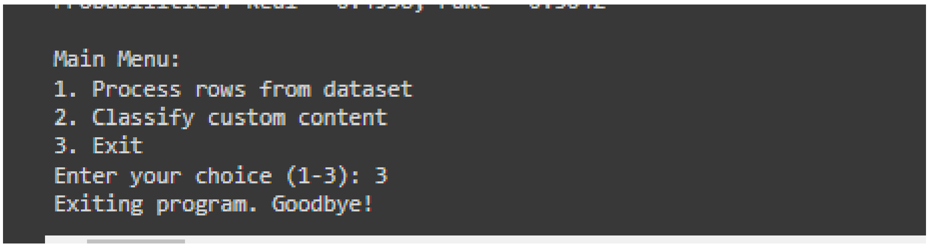
1. You'll be prompted to enter a news article or text that you want to classify.
2. Type or paste your text and press Enter.
3. The model will process your input and display the result, showing:
   - Whether the model classified the text as "Real" or "Fake"
   - The probability scores for each category



```
Main Menu:
1. Process rows from dataset
2. Classify custom content
3. Exit
Enter your choice (1-3): 2
Enter a news article to classify: "The law says ... when a police officer stops you, do whatever he says and then deal with it later." Dashboard camera footage of the traffic stop of Sandra Bland spurred contentious, if not always accurate,

Custom Input Prediction: Fake
Probabilities: Real - 0.4958, Fake - 0.5042

Main Menu:
1. Process rows from dataset
2. Classify custom content
3. Exit
Enter your choice (1-3):
```

5.4 Option 3: Exit

Selecting this option will end the program. It will print GoodBye!.



```
Probabilities: Real - 0.4958, Fake - 0.5042

Main Menu:
1. Process rows from dataset
2. Classify custom content
3. Exit
Enter your choice (1-3): 3
Exiting program. Goodbye!
```

6 Tips for Using the Interface

- • If you are not sure what to do at any time, look for prompts or instructions appearing below the menu.
- • If you miss something or would like to start over, it's only necessary that you re-execute this "Run Model Interface" cell.
- • Remember that no matter how advanced the model is, it is not infallible. Apply critical thinking whenever interpreting the results.
- • If you run into any errors or other weird behavior, then see the "Troubleshooting" section in the notebook.

On this menu-driven interface, everything about interacting with the fake news detection model is at your fingertips without having to write or change code. Go see the power of the model!

7 Tools and Languages Used

7.1 Primary Programming Language

- Python 3.8: Used for all aspects of the project implementation.

7.2 Deep Learning Framework

- PyTorch 1.9: Employed for building and training the ImprovedAlbertClassifier.

7.3 Natural Language Processing Libraries

- Transformers 4.5: Used for implementing the ALBERT model.
- NLTK 3.6: Utilized for text preprocessing tasks.
- SpaCy 3.0: Employed for named entity recognition in knowledge graph construction.

7.4 Data Manipulation and Analysis

- Pandas 1.3: Used for data loading, manipulation, and CSV output creation.
- NumPy 1.21: Employed for numerical operations and array manipulations.

7.5 Machine Learning Utilities

- Scikit-learn 0.24: Utilized for data splitting, metric calculation, and ROC curve generation.

7.6 Graph Processing

- NetworkX 2.5: Used for constructing and manipulating the knowledge graph.

7.7 Word Embeddings

- Gensim 4.0: Employed for training the FastText model used in data augmentation.

7.8 Visualization

- Matplotlib 3.4 and Seaborn 0.11: Used for creating performance plots and visualizations.

7.9 Development Environment

- Google Colab: The entire system was implemented and executed in Google Colab notebooks, utilizing GPU resources for model training.

References

Google Colab. (n.d.). https://colab.research.google.com/