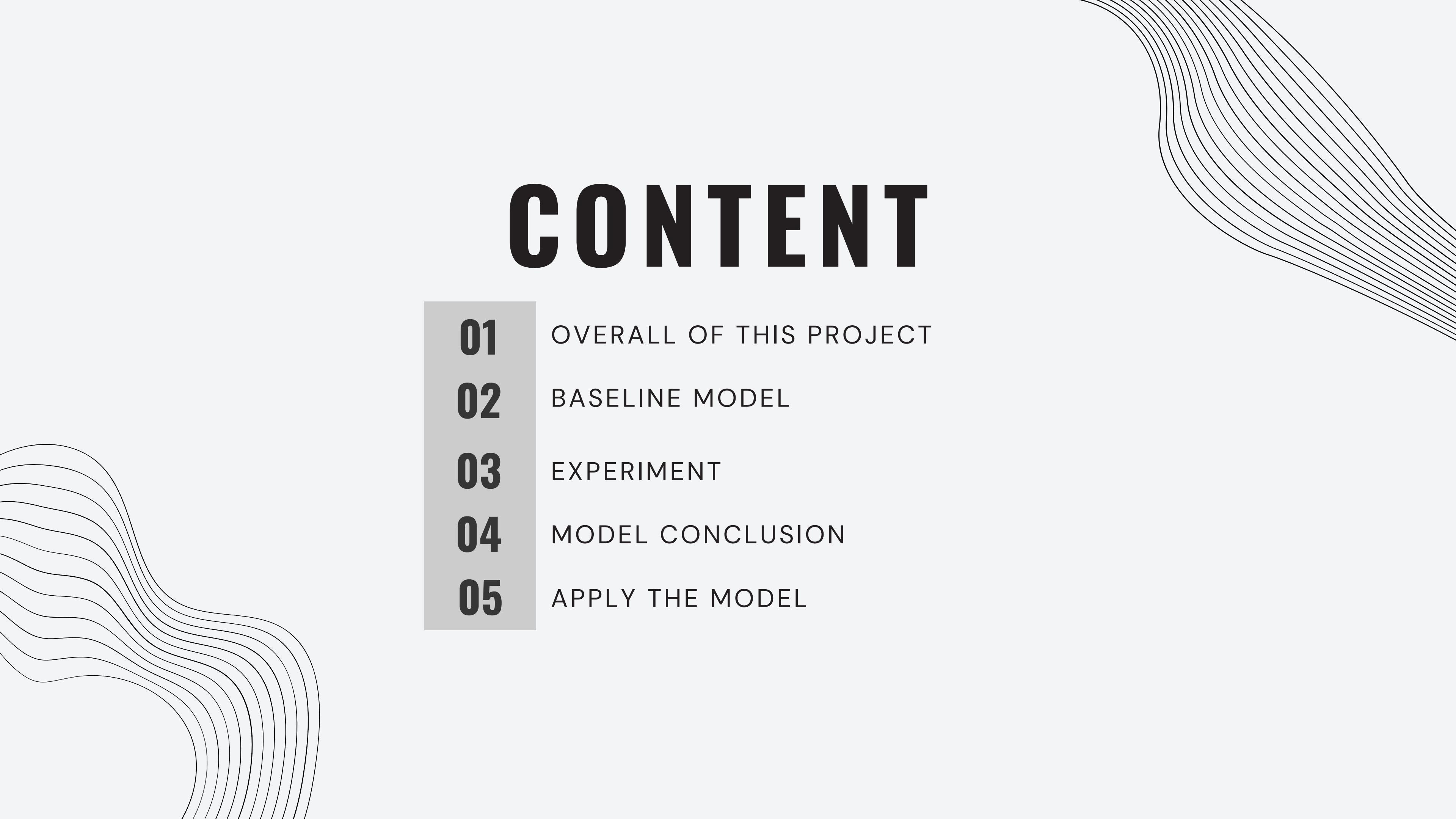




# **US POLITICAL FAKE NEWS DETECTOR BY USING LSTM**

# CONTENT

- 
- 01** OVERALL OF THIS PROJECT
  - 02** BASELINE MODEL
  - 03** EXPERIMENT
  - 04** MODEL CONCLUSION
  - 05** APPLY THE MODEL

# OVERALL

This project was designed and explore to test how well a model can generalize across different datasets, reflecting real-world scenarios where data shifts over time or varies between sources.

# WE DO CLEAN & TOKENIZATION DATA THIS IN EVERY MODEL ON DATASET

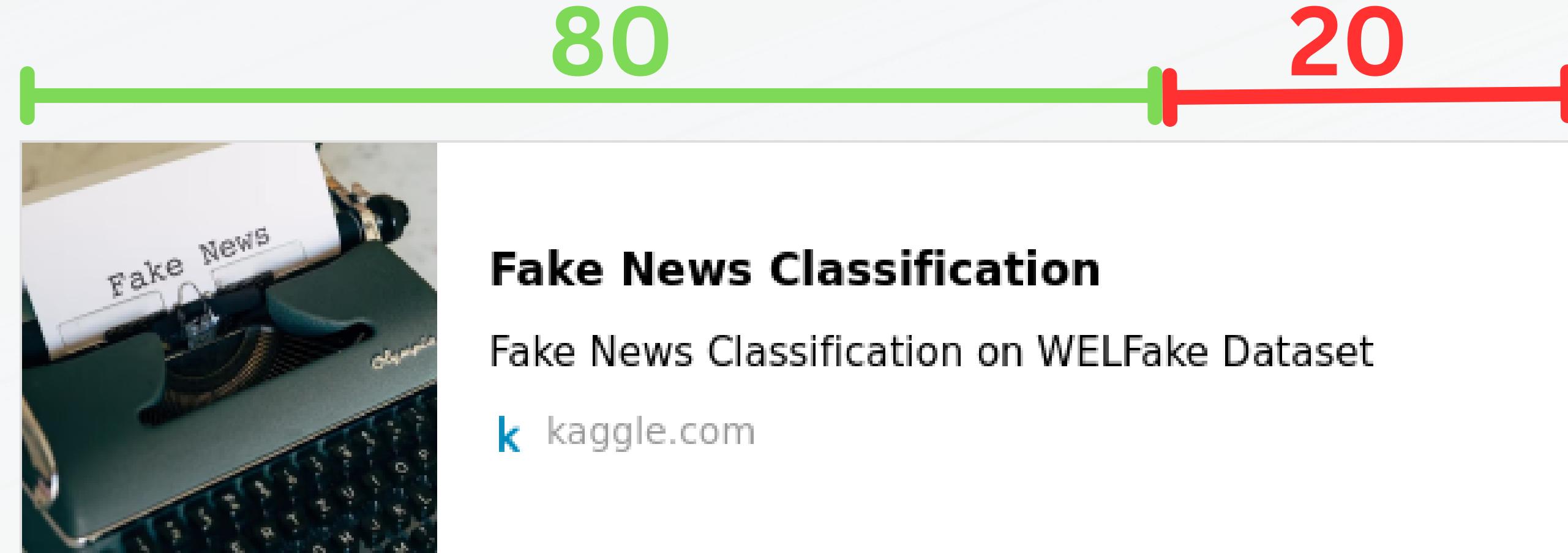
1. **Remove Unnamed Columns:** Any unnamed columns are removed to clean up the dataset.
2. **Handle Missing Values:** Missing or empty values in the text column are filled with the word "missing."
3. **Convert to Lowercase:** All text in the text column is converted to lowercase.
4. **Remove Punctuation:** Punctuation is removed from the text to leave only words and spaces.
5. **Remove Stopwords:** Common words (like "the", "and", "is") that don't add much meaning are removed using NLTK's stopwords.
6. **Tokenization:** The cleaned text is split into individual words (tokens), excluding non-alphanumeric characters.
7. **Lemmatization:** Words are reduced to their base form (e.g., "running" becomes "run") to standardize them for better processing.

# BASELINE MODEL PREPARATION

1. Data Loading: A cleaned dataset with 71,537 news articles is loaded, containing 36,509 real and 35,028 fake news samples. The news is labeled as real (1) or fake (0).

## 2. Data Preparation:

- Text data is tokenized (limited to the top 10,000 words) and padded to a sequence length of 200.
- The dataset is split into training (80%) and testing (20%) sets.



## **Model Architecture:**

Embedding layer (12 dimensions) followed by two Bidirectional LSTM layers.  
Dropout layers (30%) to reduce overfitting.

Dense Layer: 12 units, ReLU activation.

Output Layer: Single neuron with a sigmoid activation function for binary classification.

## **Model Training:**

The model was compiled with the Adam optimizer, binary cross-entropy loss, and accuracy as the evaluation metric.

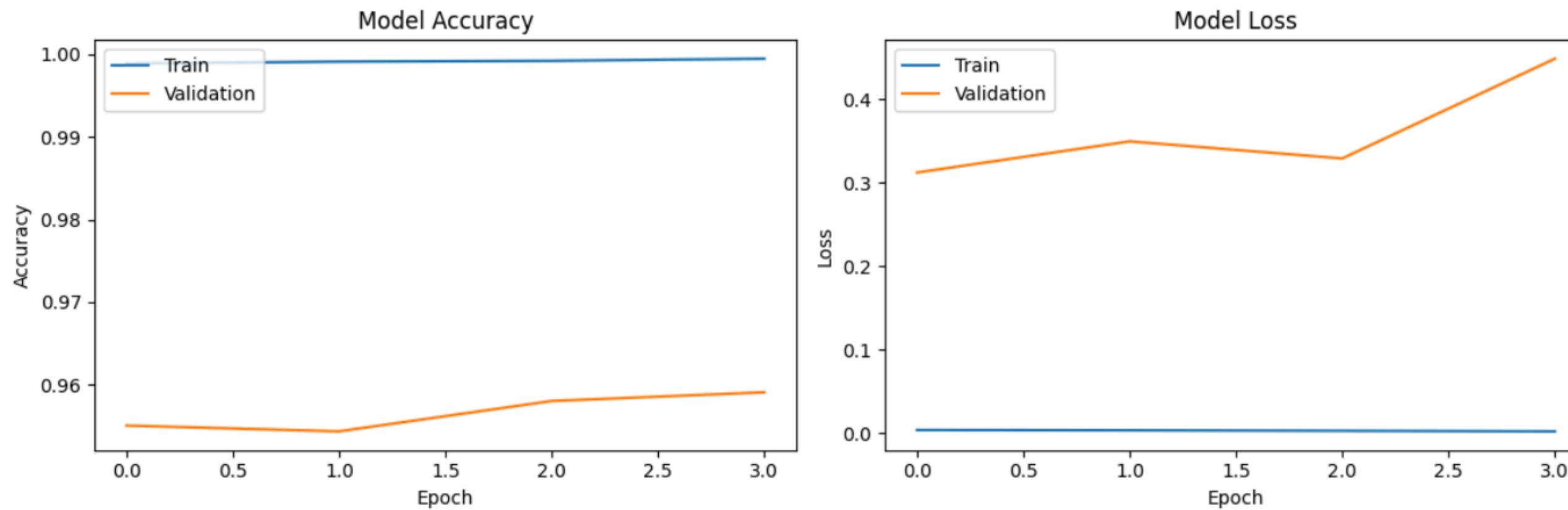
Early stopping was used to prevent overfitting, with patience of 3 epochs.

Model checkpointing was set to save the model every 5 epochs.

The model was trained for 4 epochs, after which early stopping was triggered due to lack of improvement in validation loss.

# BASELINE MODEL

```
448/448 6s 12ms/step - accuracy: 0.9525 - loss: 0.3587
Test Loss: 0.33255189657211304
Test Accuracy: 0.9545708894729614
```



The growing gap between training and validation loss is another indicator of overfitting. This shows that while the model is learning the training data perfectly, it is struggling to generalize to the validation data.

# Even though the model has a high evaluation accuracy score, we used it with a new dataset from another source that was not included in the training and testing datasets.

In [ ]:

```
# Run the interface in a loop
while True:
    user_input_interface()
    # Ask the user if they want to classify another text
    cont = input("Do you want to classify another news? (yes/no): ").strip().lower()
    if cont != 'yes':
        break
```

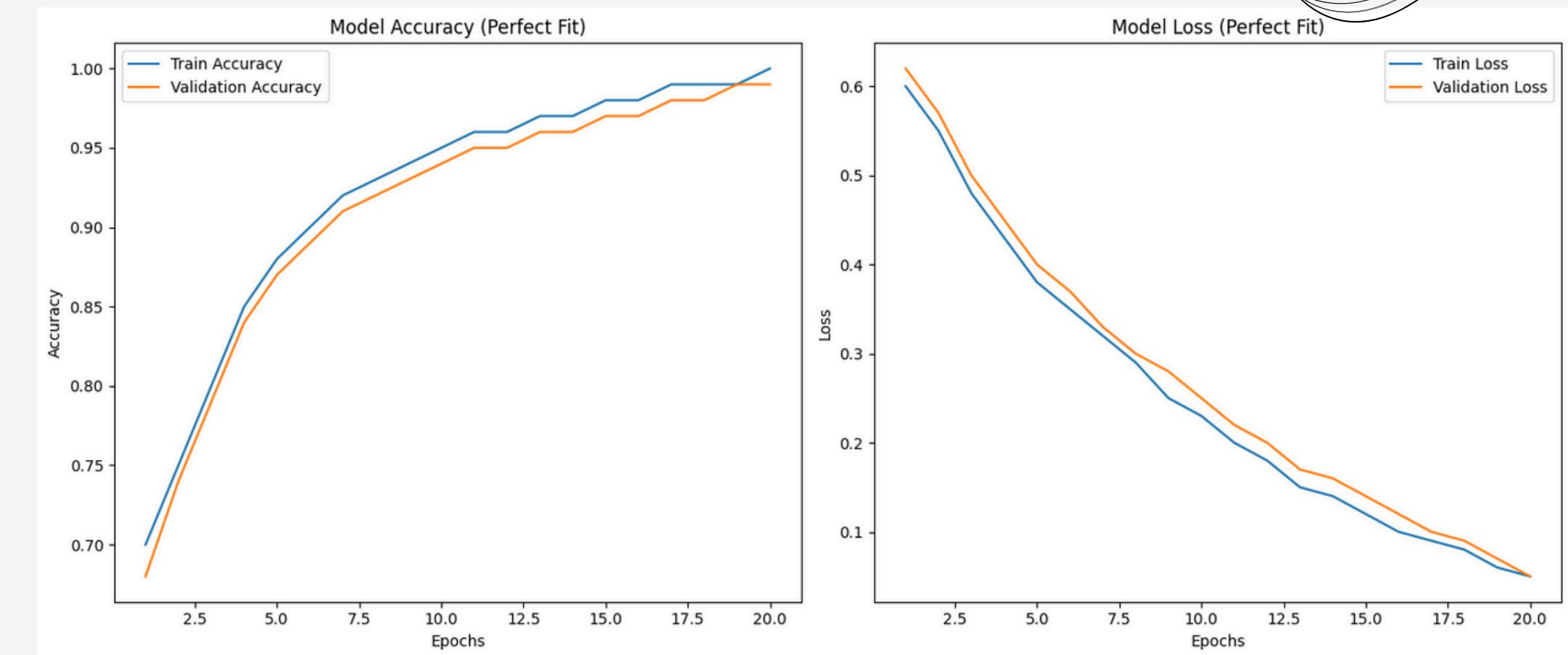
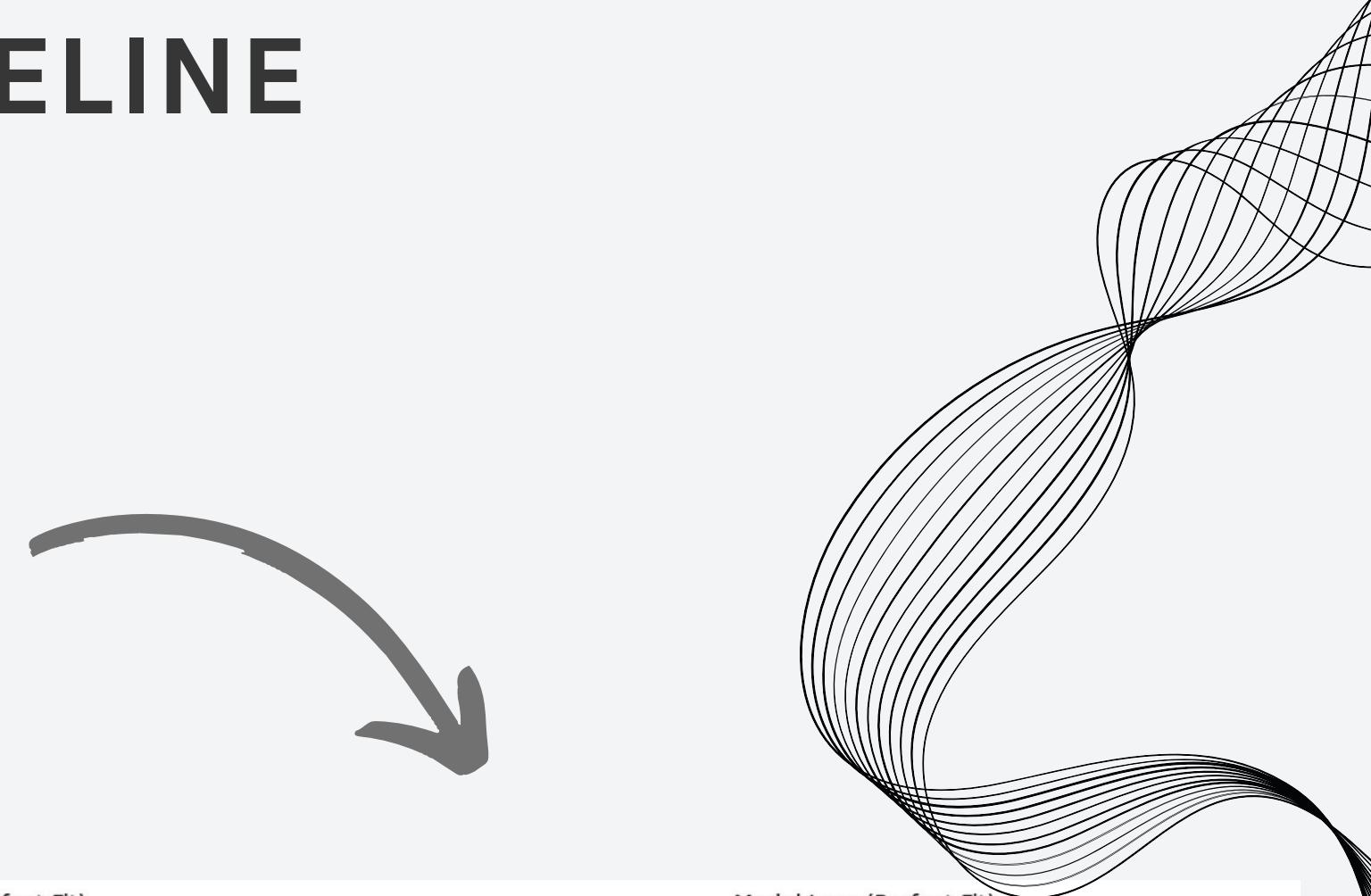
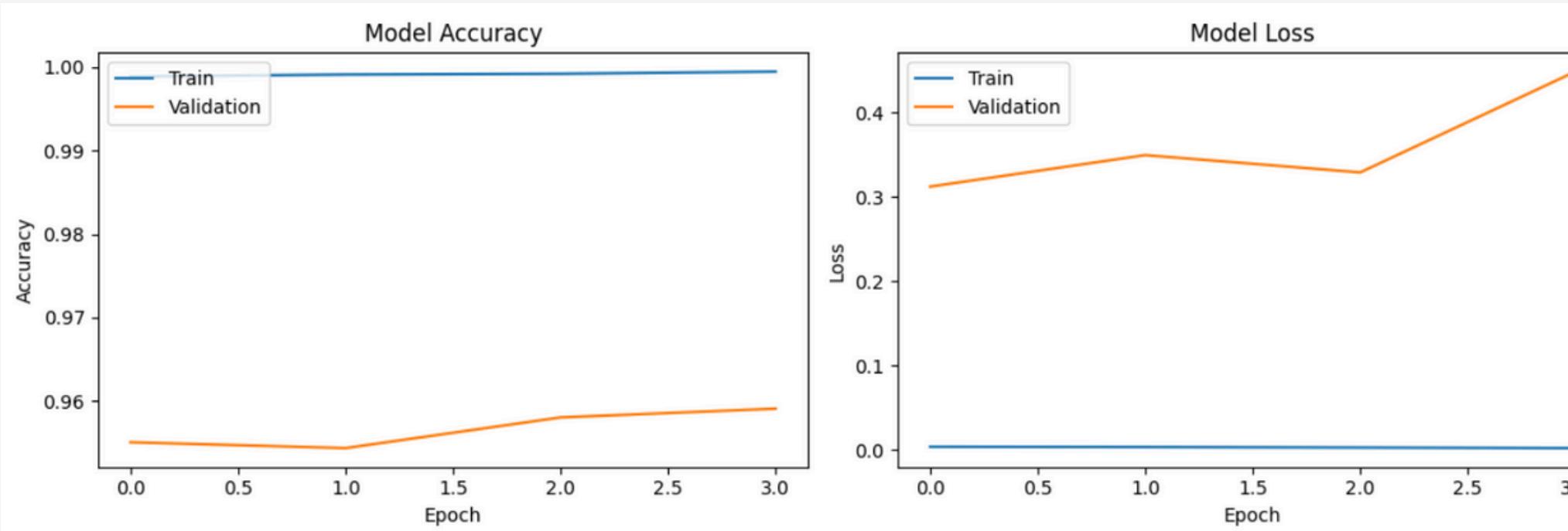
Please enter the news text you want to classify: MOGADISHU (Reuters) - More than 200 people were killed by twin bombs that struck busy junctions in the heart of Somalia's capital Mogadishu, officials said on Sunday, marking the deadliest attacks since an Islamist insurgency began in 2007. President Mohamed Abdullahi Farmajo declared three days of national mourning and called for donations of blood and funds to victims of Saturday's attack. At least 100 others were wounded. Today's horrific attack proves our enemy would stop nothing to cause our people pain and suffering. Let's unite against terror, he tweeted. Police said a truck bomb exploded outside a hotel in the K5 intersection that is lined with government offices, restaurants and kiosks, flattening several buildings and setting dozens of vehicles on fire. Two hours later, another blast struck the capital's Medina district. We have confirmed 200 civilians died in yesterday's blast. We understand the death toll is higher than that. Many people are still missing their relatives, Abdifatah Omar Halane, the spokesman for Mogadishu's mayor, told Reuters. A spokesman for Aamin Ambulance service said it knew of more than 250 people wounded during the bombings on Saturday. Some people who searched for their relatives just found unrecognizable body parts, its director Abdiqadir Abdirahman told Reuters. In our 10 year experience as the first responder in #Mogadishu, we haven't seen anything like this, tweeted the ambulance service, which is reliant on private donations and the only free ambulance service in the city. We're mourning the loss of 5 Somali Red Crescent volunteers, also killed in this attack, tweeted the International Committee of the Red Cross. Police and emergency workers searched the rubble of destroyed buildings on Sunday. They had recovered dozens of corpses the night before, most of which were charred beyond recognition. Hundreds of people came to the junction in search of missing family members and police cordoned off the area for security reasons. There was no immediate claim of responsibility, although the Islamist militant group al Shabaab, which is allied to al Qaeda, stages regular attacks in the capital and other parts of the country. The group is waging an insurgency against the U.N.-backed government and its African Union allies in a bid to topple the weak administration and impose its own strict interpretation of Islam. The militants were driven out of Mogadishu in 2011 and have been steadily losing territory since then to the combined forces of African Union peacekeepers and Somali security forces. But al Shabaab retains the ability to mount large, complex bomb attacks. Over the past three years, the number of civilians killed by insurgent bombings has steadily climbed as al Shabaab increases the size of its bombs.

```
1/1 0s 30ms/step
The news is classified as: Fake
Do you want to classify another news? (yes/no): no
```

[https://huggingface.co/datasets/Cartinoe5930/Politifact\\_fake\\_news](https://huggingface.co/datasets/Cartinoe5930/Politifact_fake_news)

Result: It's predicting true news to fake news it shows that it overfitting and couldn't use it in the real world where data shifts over time or varies between sources.

# SO THIS PROJECT IS AIMMING REDUCE OVERFITTING OF THE MODEL BASELINE



# AND USE THE DIFFERENT DATASET TO MEASURE HOW THIS MODEL WORK WELL IN REAL-WORLD

## Train



### Fake News Classification

Fake News Classification on WELFake Dataset

[kaggle.com](https://www.kaggle.com)

## Test



### Example :Dataset1

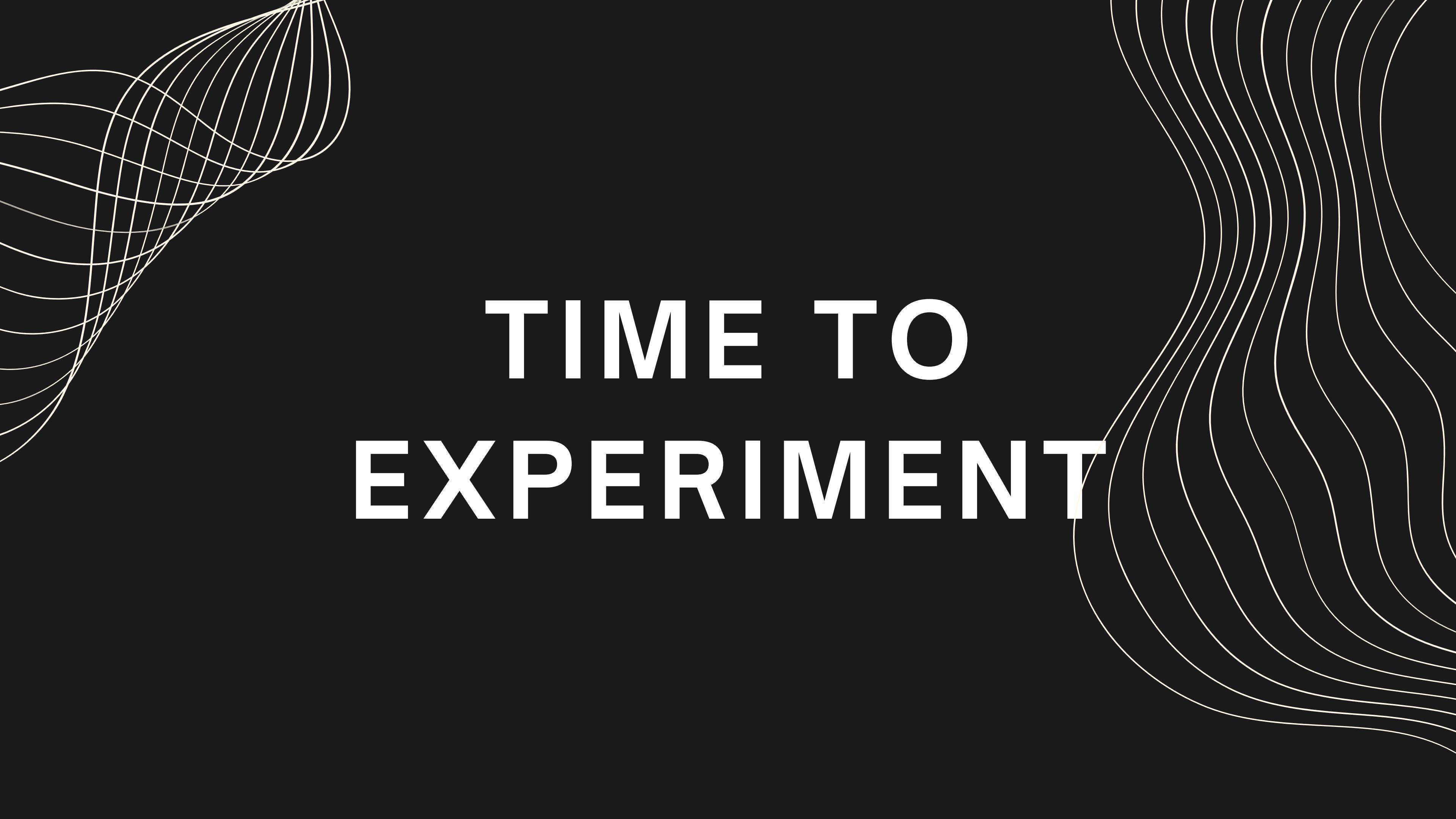
murdered sandra bland nappy hair like fyf911 black radical sa  
movement palmetto star describes one head organizer said y  
mcgrone nocturnus libertus posted help young afrikan clean r

Dataset1 is informal and disorganized  
**71,537 articles**

### Example :Dataset2

pennsylvania court order count ballot election day viral post f  
appears refer court ruling whether count mail absentee ballo  
guidance county september stated ballotreturn envelope und

Dataset 2 is formal, structured, and focused on  
providing factual legal information.  
**21,318 articles**



**TIME TO  
EXPERIMENT**

# MODEL 1

WE USE THE SAME MODEL ARCHITECTURE BUT  
USING THE DIFFENET TRAIN AND TEST  
DATASET SOURCE TO EVALUTED IT

Test.csv

Train.csv



## Fake News Classification

Fake News Classification on WELFake Dataset

[kaggle.com](https://www.kaggle.com)

Models

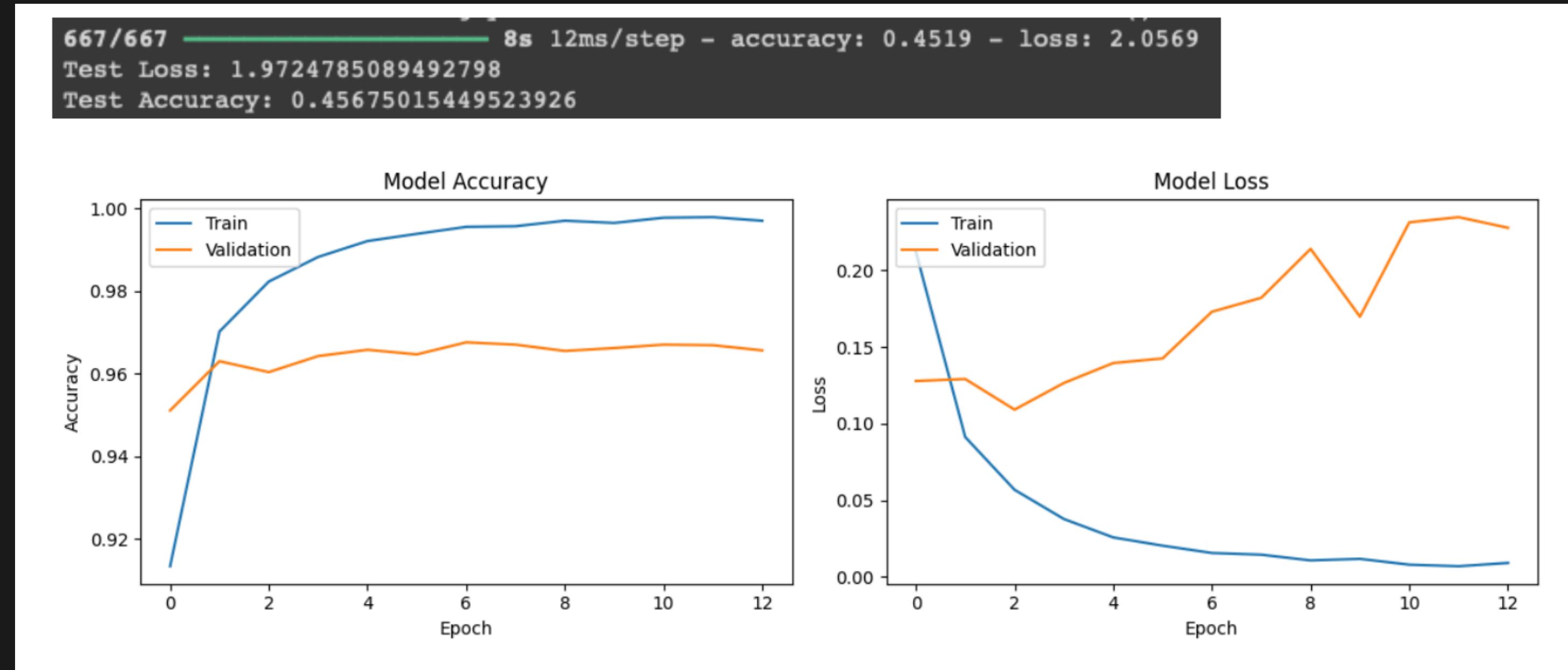
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Cartinoe5930/Politifact\_fake\_news · Datasets at Hugging Face

We're on a journey to advance and democratize artificial intelligence through open source and open science.

huggingface



**Model Accuracy:** Training accuracy quickly reaches almost 100%, while validation accuracy starts to plateau after a few epochs and fluctuates slightly.

**Model Loss:** Training loss decreases steadily, but validation loss increases after the first few epochs, showing an increasing divergence between training and validation loss.

# MODEL 2

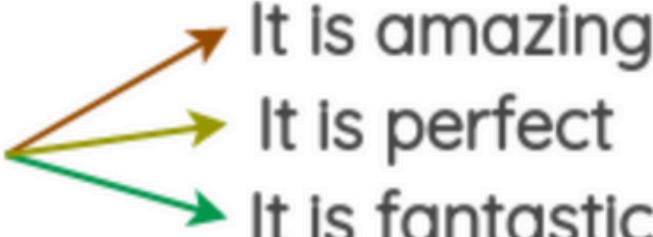
Model 2 builds on Model 1 to address the limitations such as overfitting, lack of sufficient complexity, and the need for more robust generalization. **By adding more complexity** (larger embedding and LSTM layers), regularization (dropout and L2), and **basic data augmentation**, Model 2 is designed to achieve higher performance and handle more diverse and unseen data better than Model 1.

## Nearest neighbors in word2vec



Nearest Neighbors with Word Vectors

For example, you can replace the word with the 3-most similar words and get three variations of the text.

It is awesome 

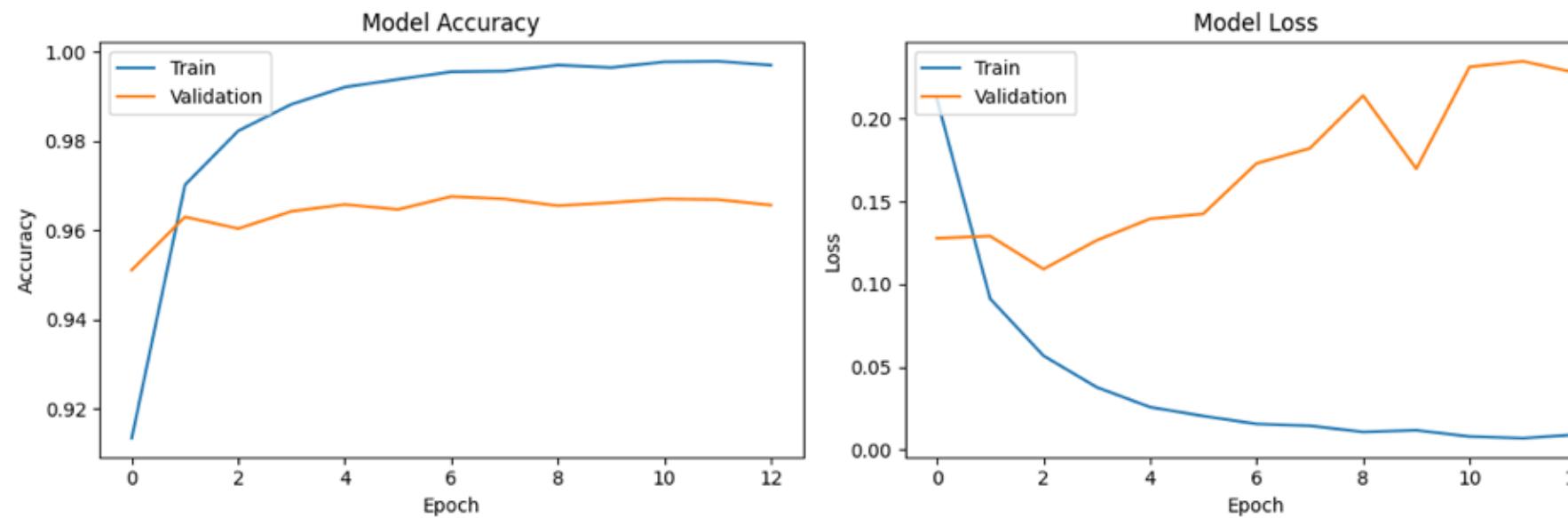
It is amazing  
It is perfect  
It is fantastic

Augmenting text with word embeddings

We apply data augmentation techniques (synonym replacement, random insertion, and random deletion) to increase training data diversity by using Wordnet

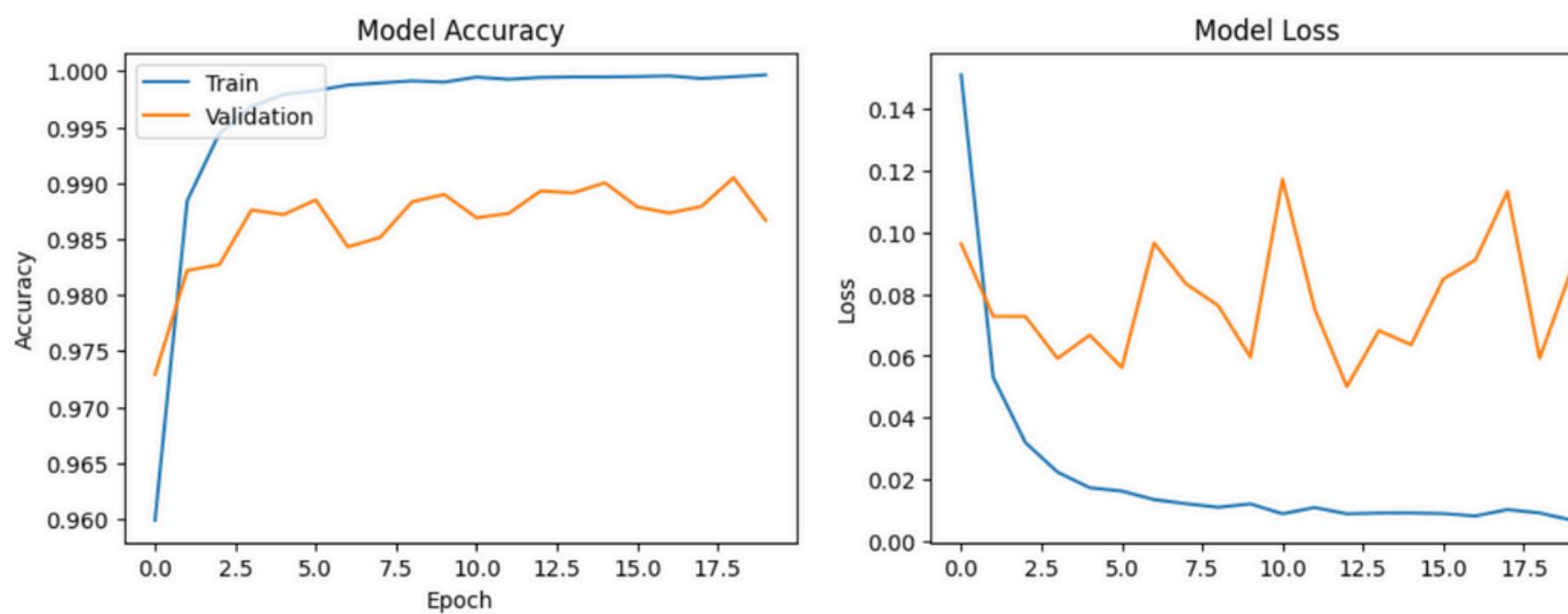
# MODEL1

```
667/667 8s 12ms/step - accuracy: 0.4519 - loss: 2.0569  
Test Loss: 1.9724785089492798  
Test Accuracy: 0.45675015449523926
```



# MODEL2

```
667/667 9s 14ms/step - accuracy: 0.4439 - loss: 3.5715  
Test Loss: 3.846203088760376  
Test Accuracy: 0.44994840025901794
```



## 1.Embedding Layer:

- Model 1: Uses an embedding dimension of 12.
- Model 2: Uses a larger embedding dimension of **128**.

## 2.LSTM Layers:

- Model 1: Includes two bidirectional LSTM layers, each with 12 units.
- Model 2: Uses two bidirectional LSTM layers, each with **64 units**.

## 3.Dropout Layers:

- Model 1: Includes a 0.3 dropout rate.
- Model 2: Increased the dropout rate to **0.5**, which provides better regularization.

## 4.Dense Layers:

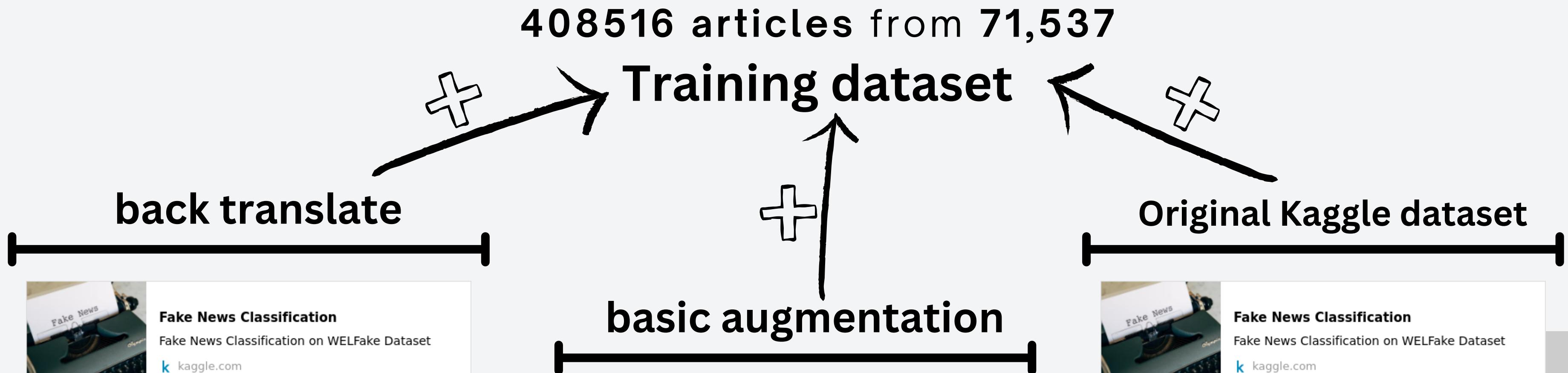
- Model 1: Two dense layers with 24 and 12 units.
- Model 2: Dense layers with **128** and **64** units, also including L2 regularization to avoid overfitting.

## 5.Optimizer and Regularization:

- Model 1: Regular model with Adam optimizer.
- Model 2: The optimizer remains Adam, but regularization has been added to dense layers (**L2 regularization**) to prevent overfitting.

# MODEL 3

We use Model 2 Architecture but apply the back-translation technique + basic augmentation + Original Kaggle dataset to make data more noise on training dataset



# Back Translation

We use google api translate for doing back translation from English -> Japanese -> Spanish -> English, aim to reduce the overfitting if this project, this model use dataset from back translation algorithm then clean and do tokenization

## ENGLISH -> JAPANESE

English ↔ Japanese

Donald Trump Secretly Signs Executive Order to Abolish Social Security and Medicare by 2023 ×

ドナルド・トランプ大統領、2023年までに社会保障とメディケアを廃止する大統領令に秘密裏に署名 ☆

Donarudo toranpu daitōryō, 2023-nen made ni shakai hoshō to medikea o haishi suru daitōryō-rei ni himitsu ura ni shomei

91 / 5,000 [More]

🔉 🔊 ↻ ↺ ↻ ↻

## JAPANESE -> SPANISH

Japanese ↔ Spanish

ドナルド・トランプ大統領、2023年までに社会保障とメディケアを廃止する大統領令に秘密裏に署名 ×

Donarudo toranpu daitōryō, 2023-nen made ni shakai hoshō to medikea o haishi suru daitōryō-rei ni himitsu ura ni shomei

47 / 5,000 あ [More]

🔉 🔊 ↻ ↺ ↻ ↻

El presidente Donald Trump firma en secreto una orden ejecutiva para eliminar el Seguro Social y Medicare para 2023 ☆

El presidente Donald Trump firma en secreto una orden ejecutiva para eliminar el Seguro Social y Medicare para 2023

115 / 5,000 [More]

🔉 🔊 ↻ ↺ ↻ ↻

## SPANISH -> ENGLISH

Spanish ↔ English

El presidente Donald Trump firma en secreto una orden ejecutiva para eliminar el Seguro Social y Medicare para 2023 ×

El presidente Donald Trump firma en secreto una orden ejecutiva para eliminar el Seguro Social y Medicare para 2023

115 / 5,000 [More]

🔉 🔊 ↻ ↺ ↻ ↻

President Donald Trump secretly signs executive order to eliminate Social Security and Medicare by 2023 ☆

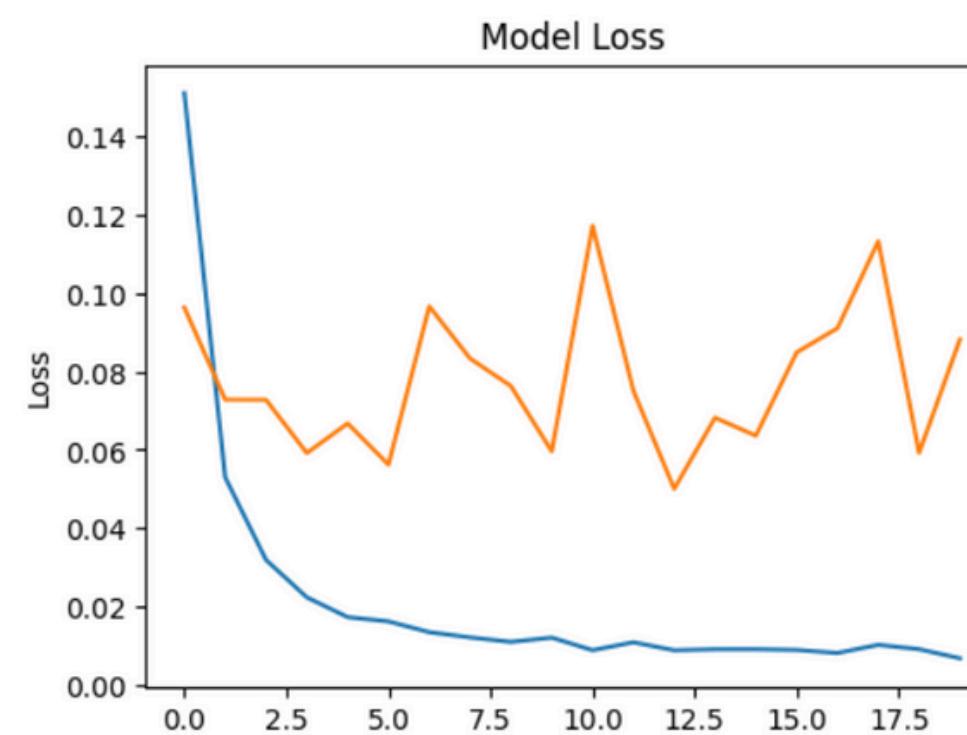
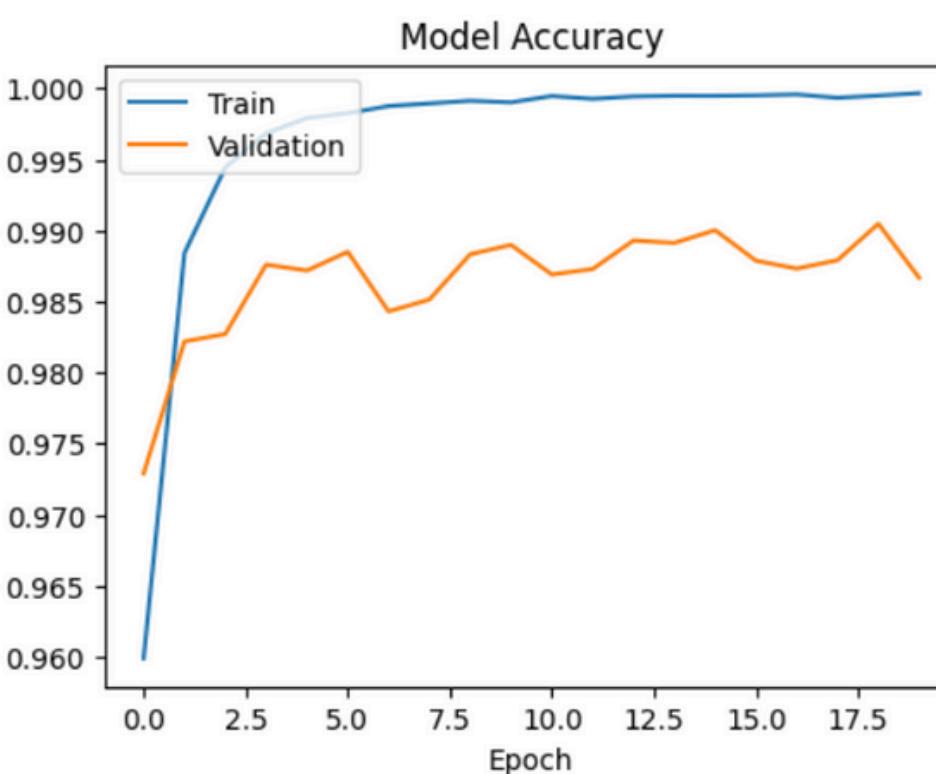
President Donald Trump secretly signs executive order to eliminate Social Security and Medicare by 2023

115 / 5,000 [More]

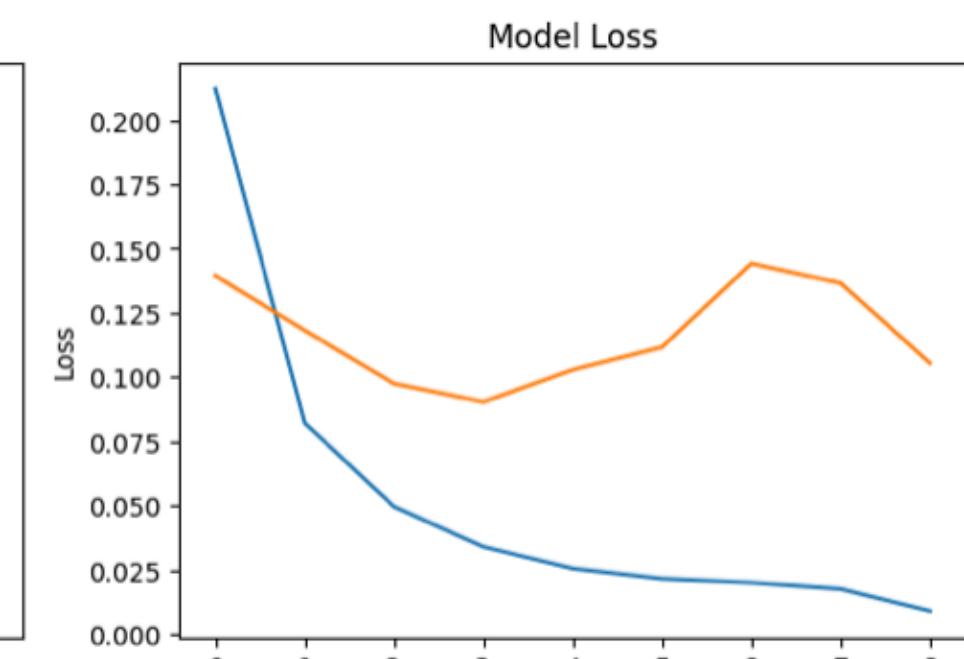
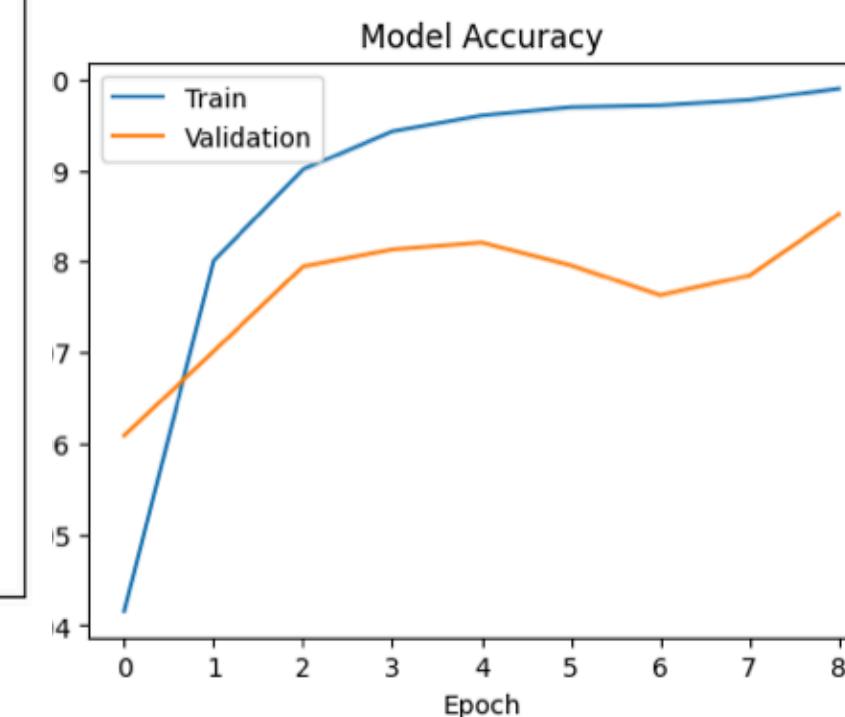
🔉 🔊 ↻ ↺ ↻ ↻

# MODEL2

```
7/667 ━━━━━━━━ 9s 14ms/step - accuracy: 0.4439 - loss: 3.5715  
st Loss: 3.846203088760376  
st Accuracy: 0.44994840025901794
```



```
NING:absl:You are saving your model as an HDF5 file via `model.save()` o  
/667 ━━━━━━━━ 8s 12ms/step - accuracy: 0.4133 - loss: 4.0839  
st Loss: 3.9157962799072266  
st Accuracy: 0.44173938035964966  
/667 ━━━━━━━━ 9s 13ms/step
```



Model 3 shows slightly less overfitting because it has more stable validation accuracy and less fluctuation in validation loss compared to Model 2. However, both models exhibit some degree of overfitting.

# **HYPERPARAMETER TUNING MODEL**

## Model 3 (previous model)

### Model Architecture:

Embedding layer: 128 dimensions.

LSTM units: Two Bidirectional LSTM layers (**32 units each**).

Dropout: 0.6 applied after both LSTM and dense layers.

Dense layers: Two dense layers (64 and 32 units) with L2 regularization.

Batch normalization: Used after every LSTM and dense layer.

### Complexity:

Highest complexity with more LSTM units and batch normalization in each layer,

## Model 4

Embedding layer: 128 dimensions.

LSTM units: Two Bidirectional LSTM layers (**16 units each**).

Dropout: 0.7 applied after LSTM and dense layers.

Dense layers: Two dense layers (64 and 32 units), using L2 regularization.

Batch normalization: Present after LSTM layers.

Moderate complexity, focuses on balancing regularization and performance.

## Model 5

Embedding layer: 128 dimensions.

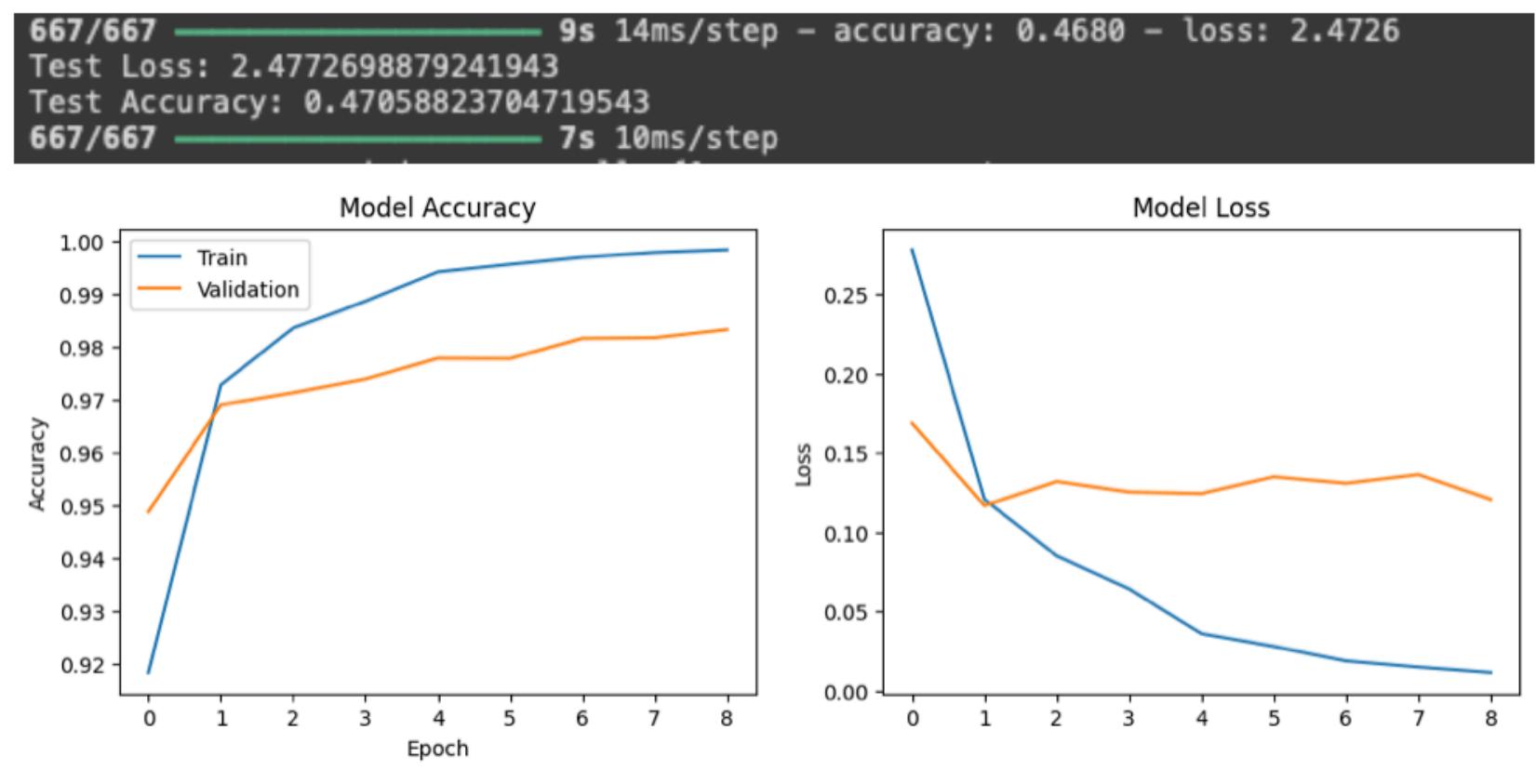
LSTM units: Two Bidirectional LSTM layers (**8 units each**).

Dropout: 0.5.

Dense layer: A single dense layer with 32 units, no L2 regularization.

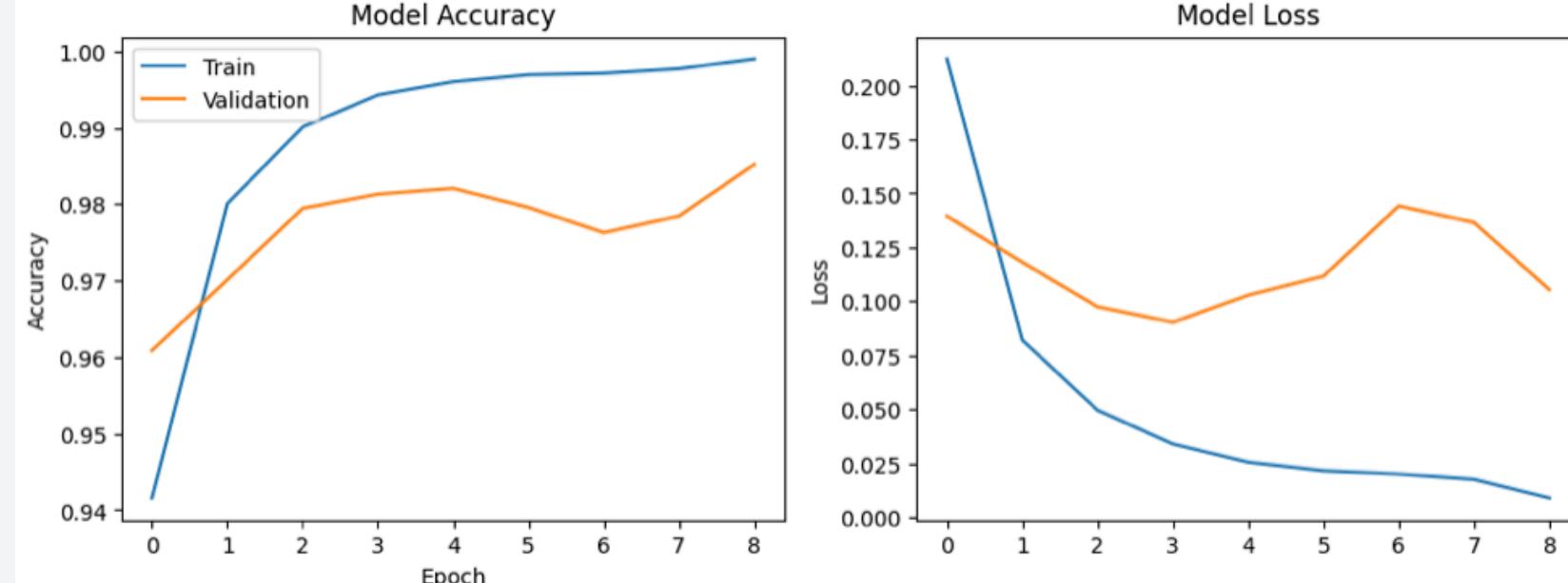
Simplest model with fewer layers and units, making it fast but less robust for complex tasks.

# MODEL4



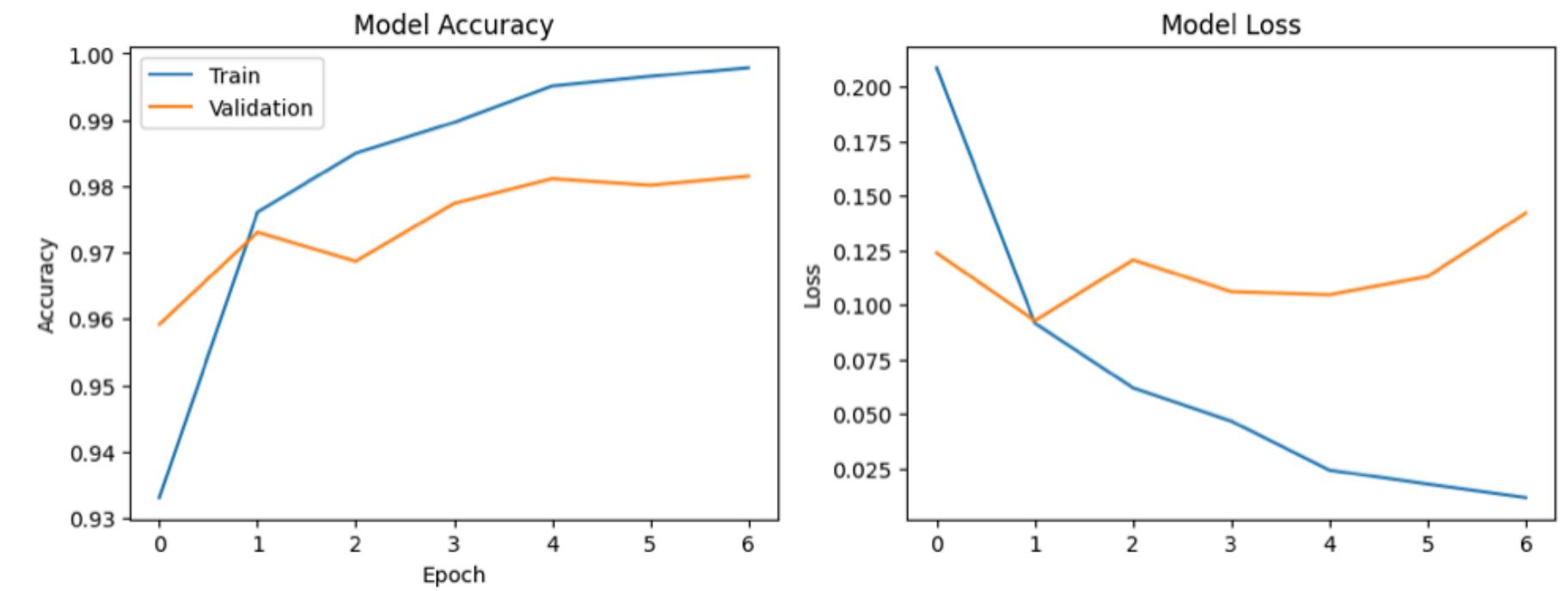
# MODEL 3 (PREVIOUS MODEL)

```
WARNING:absl:You are saving your model as an HDF5 file via `model.save()` or
667/667 8s 12ms/step - accuracy: 0.4133 - loss: 4.0839
Test Loss: 3.9157962799072266
Test Accuracy: 0.44173938035964966
667/667 9s 13ms/step
```



# MODEL5

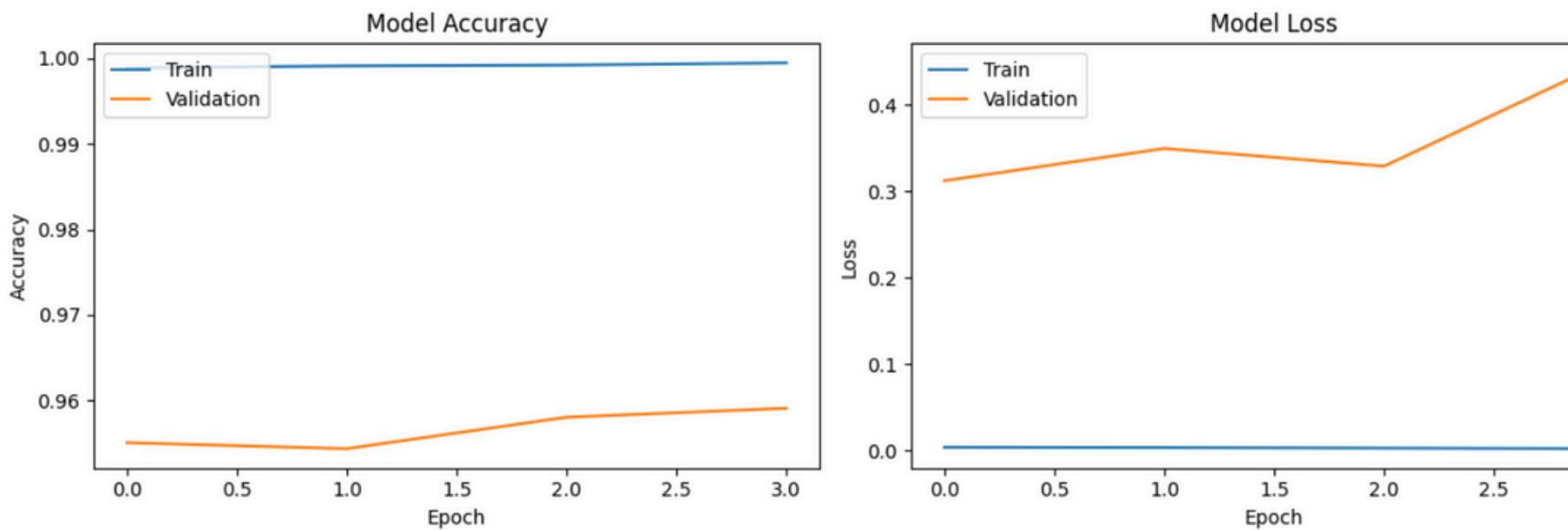
```
Test Loss: 2.8220224380493164
Test Accuracy: 0.4406135678291321
```



# MODEL CONCLUSION

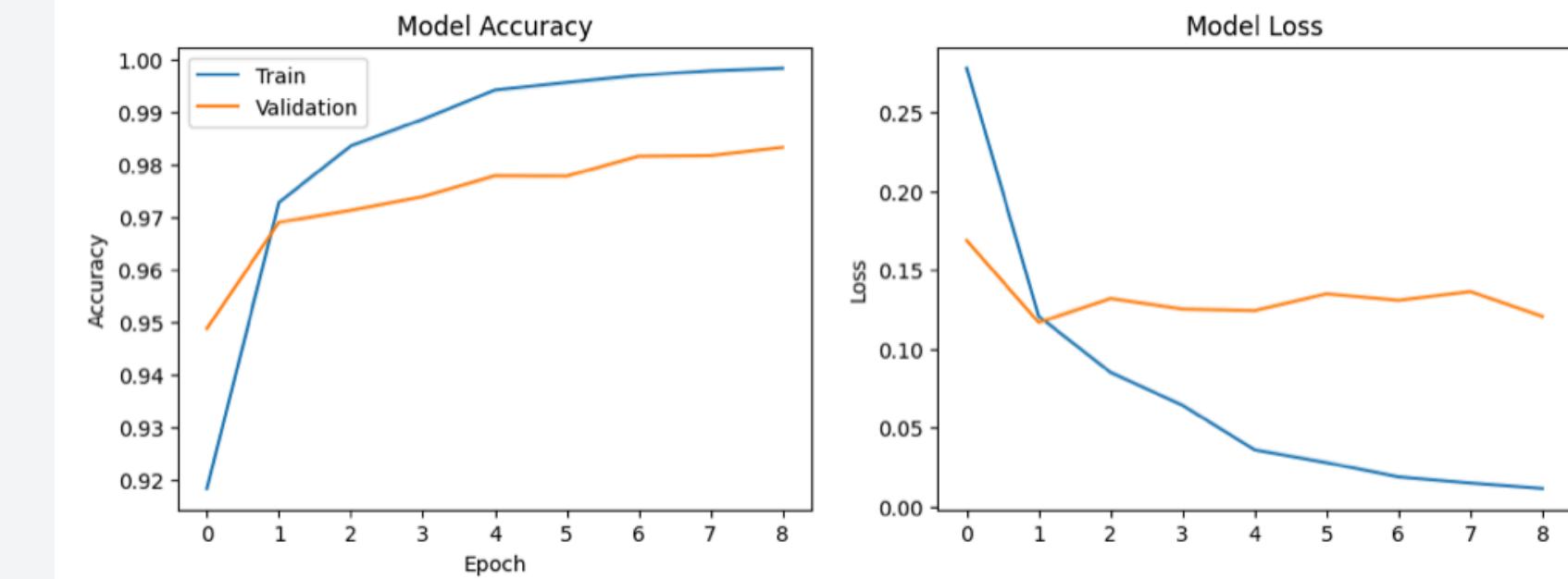
## MODEL BASELINE

```
448/448 6s 12ms/step - accuracy: 0.9525 - loss: 0.3587  
Test Loss: 0.33255189657211304  
Test Accuracy: 0.9545708894729614
```



## MODEL4

```
667/667 9s 14ms/step - accuracy: 0.4680 - loss: 2.4726  
Test Loss: 2.4772698879241943  
Test Accuracy: 0.47058823704719543  
667/667 7s 10ms/step
```



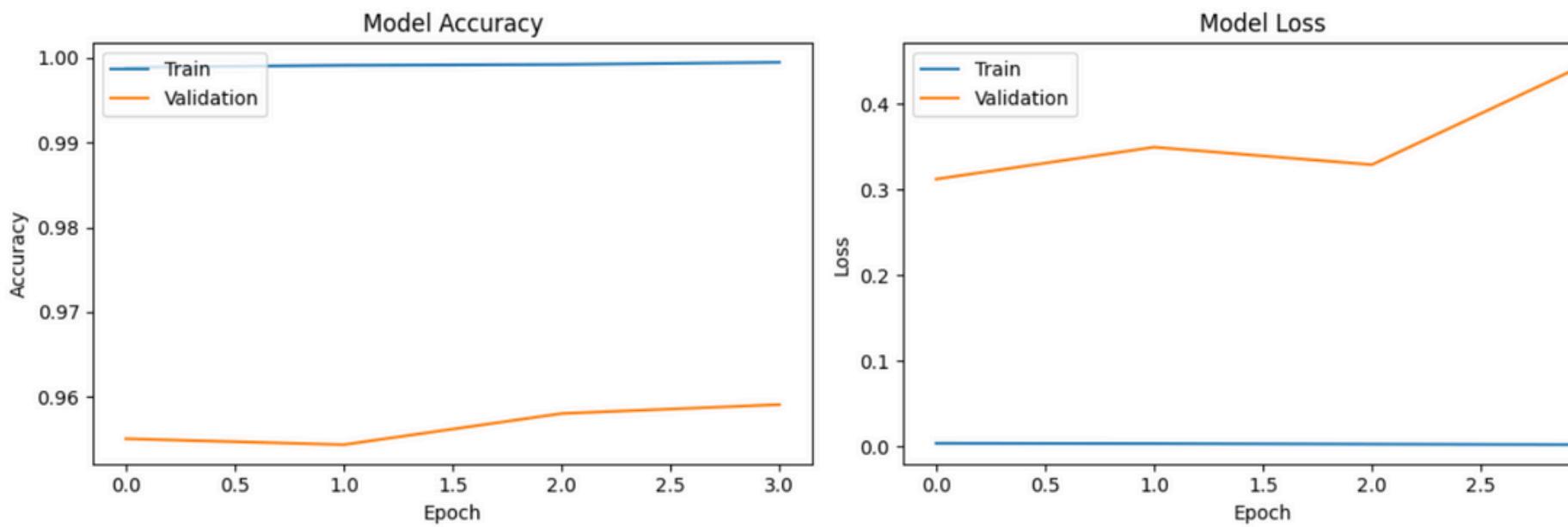
How to we Improve Baseline so far:

- Increase the Embedding Dimension:** Increase the embedding size to capture more contextual information from the input text.
- Increase Regularization:** Use more dropout layers (up to 0.7), and apply L2 regularization to dense layers to avoid overfitting.
- Data Augmentation:** Use data augmentation techniques like back translate synonym replacement and random insertion/deletion to increase the diversity of the training data.
- Add Batch Normalization:** Normalize the outputs of layers to stabilize the training process.
- Use Learning Rate Schedulers:** Implement ReduceLROnPlateau to reduce the learning rate when performance plateaus, allowing for better convergence.

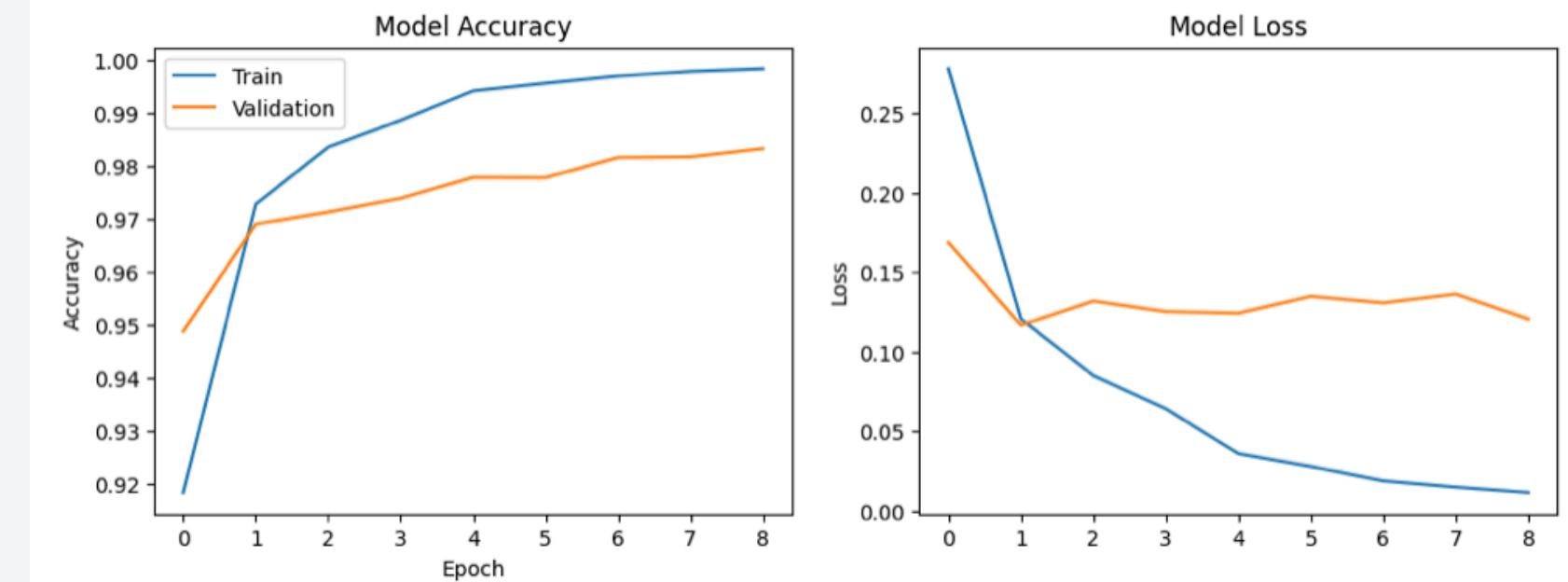
# PROJECT SUMMARY

## MODEL BASELINE

```
448/448 6s 12ms/step - accuracy: 0.9525 - loss: 0.3587  
Test Loss: 0.33255189657211304  
Test Accuracy: 0.9545708894729614
```

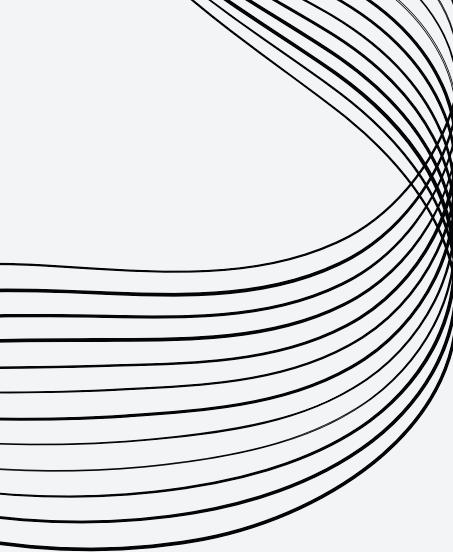


```
667/667 9s 14ms/step - accuracy: 0.4680 - loss: 2.4726  
Test Loss: 2.4772698879241943  
Test Accuracy: 0.47058823704719543  
667/667 7s 10ms/step
```



Even though the test accuracy dropped when applied to a different dataset, the model is **more robust and performs well in a more controlled environment** (like the validation set).

This tradeoff is a common occurrence when dealing with models designed for generalization in real-world applications



Fake News Detection - a Hugging Face Space by kritsadaK  
Discover amazing ML apps made by the community  
huggingface

# APPLY MODEL IN MINI APPLICATION IN HUGGING FACE SPACE

## How It Works:

**Enter URL:** Users can input the URL of a news article they want to analyze. The app scrapes the text from the webpage and analyzes it by using the model

**Preprocess the Text:** The app processes the text using like this model tokenization data so model can understand them.

**Model Prediction:** The app runs the preprocessed text through deep learning model to determine whether the article is likely fake. It displays the result as a percentage chance of being fake.

Model loaded successfully!  
Tokenizer loaded successfully!

## US Political Fake News Text Detector By using LSTM

### Analyze News from a URL

Enter the URL of the news article you want to analyze:

Detect whether a given piece of news is fake or real based on its content. Enter a URL to analyze its authenticity or test with a sample text.

Paul Horner [edit]

Name	Domain	Status	Notes	[hide] Sources
ABCnews.com.co	ABCnews.com.co	Defunct	Owned by Paul Horner. Mimics the URL, design and logo of <a href="#">ABC News</a> (owned by <a href="#">Disney–ABC Television Group</a> ). [16] [17]	
CBSnews.com.co	CBSnews.com.co		Mimics the URL, design and logo of <a href="#">CBS News</a> . [18]	
christianfreedommovement.com	christianfreedommovement.com			[18]
cnn.com.de	cnn.com.de		Impostor site of CNN. [18]	
isissingles.com	isissingles.com			[18]
iywib.com	iywib.com			[18]
keepdonaldtrump.com	keepdonaldtrump.com			[18]
makeredhatswearableagain.com	makeredhatswearableagain.com			[18]
mericaland.com	mericaland.com			[18]
microsoftsite.com	microsoftsite.com			[18]
nationalgeographic.com.co	nationalgeographic.com.co		Spoof of <a href="#">National Geographic</a> . [18]	
nationalreview.biz	nationalreview.biz		Spoof of <a href="#">National Review</a> . [18]	
NBC.com.co	NBC.com.co		Imitates NBC. [19][18]	
NBCNews.com.co	NBCNews.com.co	Defunct	Mimics the URL, design and logo of <a href="#">NBC News</a> . [20]	
News Examiner	newsexaminer.net		Started in 2015 by Paul Horner, the lead writer of the <a href="#">National Report</a> . This	[21]

**THANK YOU**  
**6311374 SUPHAWITH PHUSANBAI**  
**6420063 KRITSADA KRUAPAT**

## REFERENCES

[HTTPS://WWW.FIIVE.SE/EN/BLOG/BACKTRANSLATION-FOR-NER](https://www.fiive.se/en/blog/backtranslation-for-ner)

[HTTPS://PYPI.ORG/PROJECT/GOOGLETRANS/#DESCRIPTION](https://pypi.org/project/googletrans/#description)

BACK TRANSLATION

[HTTPS://WWW.MDPI.COM/2076-3417/13/24/13207](https://www.mdpi.com/2076-3417/13/24/13207)

BACK TRANSLATION IMPLEMENTATION

[HTTPS://WWW.FIIVE.SE/EN/BLOG/BACKTRANSLATION-FOR-NER](https://www.fiive.se/en/blog/backtranslation-for-ner)

GOOGLETRANS

[HTTPS://PYPI.ORG/PROJECT/GOOGLETRANS/#DESCRIPTION](https://pypi.org/project/googletrans/#description)

DATA PREPROCESSING

[HTTPS://WWW.JAVATPOINT.COM/DATA-PREPROCESSING-MACHINE-LEARNING](https://www.javatpoint.com/data-preprocessing-machine-learning)

BASIC NLP AUGMENTATION

[HTTPS://MAELFABIEN.GITHUB.IO/MACHINELEARNING/NLP\\_8/#](https://maelfabien.github.io/machinelearning/nlp_8/#)

[HTTPS://WWW.KAGGLE.COM/CODE/ANDRESHG/NLP-GLOVE-BERT-TF-IDF-LSTM-EXPLAINED/NOTEBOOK](https://www.kaggle.com/code/andreshg/nlp-glove-bert-tf-idf-lstm-explained/notebook)

## DATASET :

[HTTPS://HUGGINGFACE.CO/DATASETS/CARTINOE5930/POLITIFACT\\_FAKE\\_NEWS](https://huggingface.co/datasets/cartinoe5930/politifact_fake_news)

[HTTPS://HUGGINGFACE.CO/DATASETS/UCSBNLP/LIAR](https://huggingface.co/datasets/ucsnlp/liar)

[HTTPS://WWW.KAGGLE.COM/DATASETS/SAURABHSHAHANE/FAKE-NEWS-CLASSIFICATION?RESOURCE=DOWNLOAD&SELECT=WELFAKE\\_DATASET.CSV](https://www.kaggle.com/datasets/saurabhshahane/fake-news-classification?resource=download&select=welfake_dataset.csv)

## URL: POLITICAL NEWS

[HTTPS://EN.WIKIPEDIA.ORG/WIKI/LIST\\_OF\\_FAKE\\_NEWS\\_WEBSITES](https://en.wikipedia.org/wiki/List_of_fake_news_websites)

[HTTPS://DOCS.GOOGLE.COM/DOCUMENT/U/1/D/1G79SSALP03RDIVHRAEB9PFLHBL\\_5ZLVFFRYIOQHZS\\_W/PUB#H.LLH2UIHPU17E](https://docs.google.com/document/u/1/d/1G79SSALP03RDIVHRAEB9PFLHBL_5ZLVFFRYIOQHZS_w/pub#h.llh2uihpu17e)

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