Project Report
Introduction to Artificial Intelligence
NYCU 2023 Spring Semester

group "Wish us luck"

Content: (active links)

1. Introduction ([content](#))

Fake news has become a major problem in today's society. It is defined as an attempt to deceive others, by spreading untrue information. Misinformation can sometimes cause a lot of harm. This is why it is essential to detect and prevent the spread of fake news.

In this project, we aim to develop a fake news detection system using deep learning techniques. We will be using a hybrid CNN-RNN-based deep learning approach proposed in the paper 'Fake news detection: A hybrid CNN-RNN-based deep learning approach' by Jamal Abdul Nasir et al.. The proposed model combines Convolutional Neural Networks (CNN) and Recurrent Neural Networks (RNN) to detect fake news. The CNN layer is used to extract local features from the input vectors, while the RNN layer is used to learn long-term dependencies. The proposed model was evaluated on two publicly available datasets, and the results showed that it outperformed several state-of-the-art models.

Our project will be using the techniques mentioned above for detecting fake Covid-19 news. We realize that the pandemic is a big problem that humanity encountered, and there is still a lot of news being published on this topic. We would like to proceed and make information safer for people.

This project has a lot of potential applications in the field of fake news detection. In particular, it can be used to detect fake "medical" news related to Covid-19. Many publications related to Covid-19 contain a lot of medical terms and jargon, which can be difficult for the general public to understand. By detecting fake medical news related to Covid-19, we can help prevent the spread of misinformation and ensure that people have access to accurate and reliable information, regardless of whether the pandemic is over or not.

2. Literature review

One of the key challenges in addressing the issue of fake news is defining what it is and how it differs from other types of misinformation. Some scholars have argued that fake news should be defined narrowly as intentionally false information that is designed to deceive readers. Others have suggested a broader definition that includes both intentional and unintentional forms of misinformation. Regardless of the definition used, it is clear that fake news is a complex and multifaceted phenomenon that requires a nuanced approach to understanding its causes, effects, and potential solutions.

Fake News Detection on Social Media: In this paper titled "A Data Mining Perspective" by Shu et al. (2017). The author presents an overview of fake news detection techniques and discusses the challenges and opportunities of using data mining techniques to combat fake news.

Fighting Fake News: A Role for Computational Linguistics and Machine Learning" by Li et al. (2018). On the other hand, presents a comprehensive review of the state-of-the-art techniques in fake news detection and discusses the challenges and opportunities of using computational linguistics and machine learning to combat fake news. Among others, we can categorize the different methods that can be used:

- **Rule-based** In these methods fake news can be identified using predefined rules based on common characteristics. They are simple to implement but have limitations. They may not capture the complexity of sophisticated fake news articles, and their assumptions about fake news characteristics may not always be true.
- **Feature-based** These methods use a set of features extracted from the text of the news article to identify fake news. These features can include the frequency of certain words or phrases in the article, the length of the article, or the number of images or videos included in the article. Feature-based methods are more advanced than rule-based methods, but they have limitations. They can be tricked by small changes in the text, and selecting features and thresholds for good performance can be challenging and time-consuming.

- **Machine learning** algorithms can identify fake news by learning patterns in the data. They need large amounts of labeled data for training but can be effective. Neural networks are particularly good at detecting complex patterns. However, they are computationally expensive, need significant resources, and can be vulnerable to attacks that modify input data.
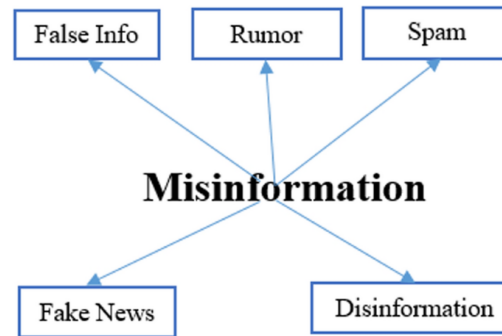
3. Methodology ([content](#))

The hybrid CNN-RNN-based deep learning approach is a good approach for fake news detection because it combines the strengths of both CNNs and RNNs. CNNs are good at extracting local features from the input vectors, while RNNs are good at learning long-term dependencies. By combining these two types of neural networks, the hybrid CNN-RNN-based deep learning approach can detect fake news more accurately than other methods.

CNNs are particularly effective at detecting patterns in images and other types of visual data. They work by applying a set of filters to the input data and then pooling the results to create a feature map. This allows them to extract local features from the input data that are relevant to the task at hand.

RNNs, on the other hand, are particularly effective at processing sequential data such as text. They work by maintaining an internal state that is updated with each new input and can be used to make predictions about future inputs. This allows them to learn long-term dependencies in the data that are important for tasks such as language modeling and machine translation.

By combining these two types of neural networks, the hybrid CNN-RNN-based deep learning approach can detect fake news more accurately than other methods. The CNN layer is used to extract local features from the input vectors, while the RNN layer is used to learn long-term dependencies. This allows the model to capture both local and global patterns in the data, which is important for detecting fake news.

4. Implementation ([content](#))

Please refer to our GitHub for more information [LINK](#)

There are plenty of Datasets available on the internet. We would like to implement a couple of them: COVID-19 Fake News Dataset by MÖBIUS, and COVID-19 Fake News Dataset by OpenAIRE.

Some examples from the dataset:

All deaths by respiratory failure and pneumonia are being registered as COVID-19, according to the Civil Registry website. **Fake**

"With retail, people are moving around and you don't have as much a chance to spread the virus (as you do) when people are sitting or standing indoors" for long periods of time. **True**

We have around 9727 fake news and 474 non-fake news from the second dataset. Whether or not we expand the dataset depends on model performance.
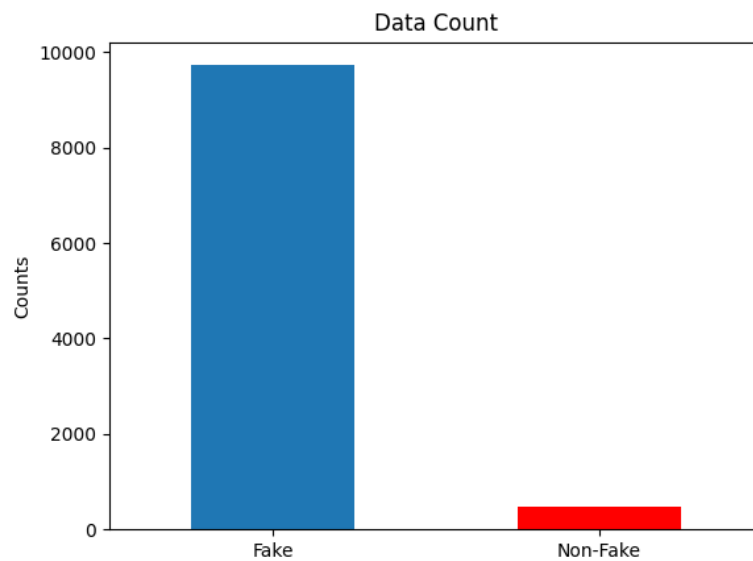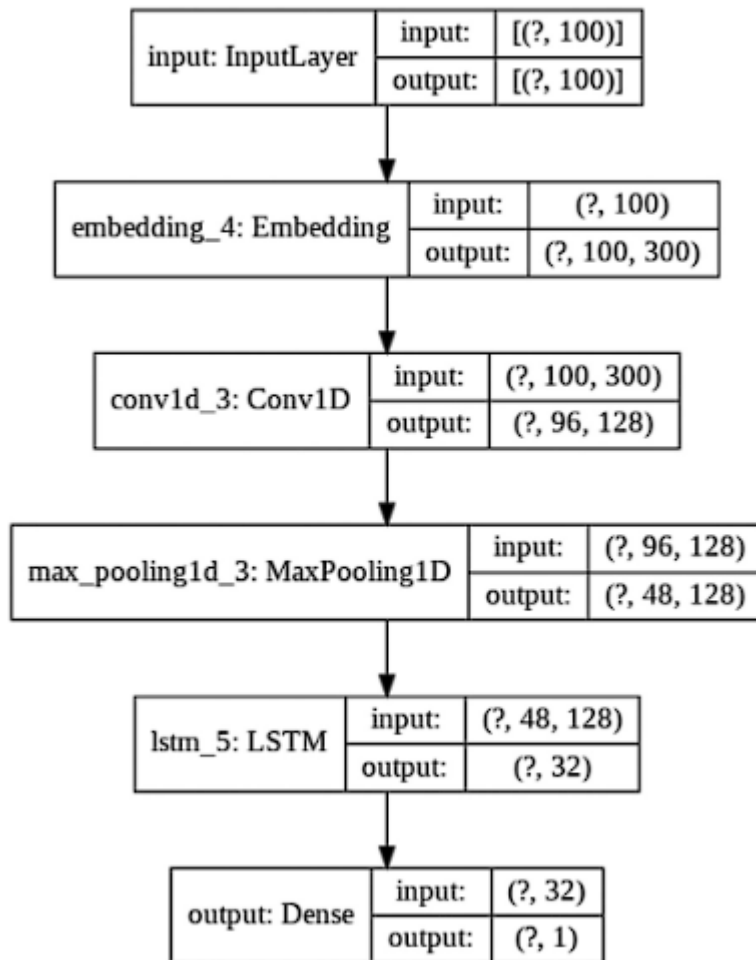
Common pre-processing steps that can be done on text classification datasets include sentence segmentation, word tokenization, lowercasing, stemming or lemmatization, stop word removal, and spelling correction. These steps are used to clean and normalize the text data before it is used for training a machine learning model. By cleaning and normalizing the text data, we can improve the accuracy of our machine-learning models.

After pre-processing, the sentence "All deaths by respiratory failure and pneumonia are being registered as COVID-19, according to the Civil Registry website." could be tokenized into individual words, converted to lowercase, and stop words like "and" and "the" could be removed to improve the accuracy of a machine learning model trained to identify COVID-19 related deaths.

Example: "deaths respiratory failure pneumonia registered COVID-19 Civil Registry website"

As per the article the proposed model summary will be tested in our simulation.

| input: InputLayer | input: | [(?, 100)] |
| | output: | [(?, 100)] |

| embedding_4: Embedding | input: | (?, 100) |
| | output: | (?, 100, 300) |

| conv1d_3: Conv1D | input: | (?, 100, 300) |
| | output: | (?, 96, 128) |

| max_pooling1d_3: MaxPooling1D | input: | (?, 96, 128) |
| | output: | (?, 48, 128) |

| lstm_5: LSTM | input: | (?, 48, 128) |
| | output: | (?, 32) |

| output: Dense | input: | (?, 32) |
| | output: | (?, 1) |

5. References ([content](#))

- https://www.sciencedirect.com/science/article/pii/S2667096820300070
- https://www.kaggle.com/datasets/arashnic/covid19-fake-news?resource=download
- https://covid-19.openaire.eu/search/dataset?pid=10.17632%2Fzwfdmp5syg.1