

<Conference abbreviation>

<Conference Series name>

<Volume number and Year> <DOI Number>

True vs. Fake News Classification Using Long Short-Term Memory Networks

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Abstract.

The news distribution and consumption in a digital age has changed radically with the extensive resources of online news. Nevertheless, this richness has also contributed to the spread of fake news at an accelerated pace undermining the levels of trust in the population, harmony, and Sustainable Development Goals of peace, justice, and strong institutions. The proposed model is learned on the dataset of news article annotations obtained by reputable sources and confirmed fact-checkers. The experimental validation has confirmed that the model comes out with a high level of accuracy of 97.90% to differentiate genuine news and misinformation.

Keywords. Artificial Intelligence, Deep Learning, Model Training, Fake News Detection, Long Short-Term Memory (LSTM).

1. INTRODUCTION

The purpose of this research is to come up with a well-built and smart system that can automatically confirm or reject the authenticity of news based on the features of the text in news. With the proposed Long Short-Term Memory (LSTM)-based model targeting an accuracy rate of 97.90, there is an extensive testing and validation which is carried out on a dataset with the labelled samples of both authentic and fake news obtained through reputable news sources and verified sources of fact-checking.

2. LITERATURE

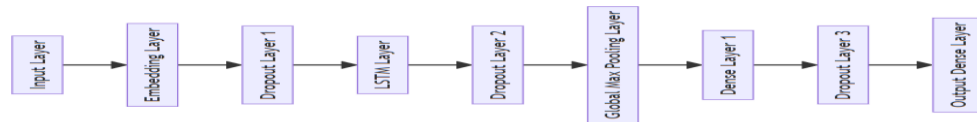
All these phases make the LSTM successful in detecting misinformation since it learns dependencies and contextual features of textual data and hence produces stable prediction results [1]. Nevertheless, some of the previous works on fake news detection had weaknesses related to low accuracy, low quality preprocessing, and poor choice of structure. Other issues like selection of irrelevant features, poor values of the model parameters, and lack of normalization of data were among the factors that led to poor model performance [2]. The proposed study seeks to overcome these shortcomings by proposing an optimized deep learning model that improves the detection of fake news. It makes use of the best methods of hyperparameter tuning, such as Grid Search and Random Search, to optimize the hyperparameters of the LSTM to give them a better prediction [3]. Moreover, this study applies machine learning into detecting false information using different methods that can respond to the dynamic and numerous characteristics of fake news [4].

3. INPUT DATASET

Above all on the dataset used in the given research, an LSTM-based model was trained that classifies news articles as either a legitimate or a fake story with a staggering precision of 97.90%. The data set is made up of a mixed collection of news contents of different fields and the style of reporting through different credible sources and databases that fact-check the content.

4. FINE-TUNED LSTM MODEL

Starting with a sequence as represented by an input layer, the much more tuned LSTM model architecture as in Flowchart 1 proceeds through an Embedding layer that converts integer-encoded vocabulary indexes to dense 100-size vectors. One of them gets overfitting through a dropout 50 percent rate layer. Following another dropout layer, the model is then basically a bi-directional LSTM layer with 150 units maintaining the time aspects and sequence processing.



Flowchart 1. Layer-wise depiction of the Fine – Tuned LSTM

5. PROPOSED METHODOLOGY

As shown in Fig. 1, this study designs and tests an LSTM-based model to detect fake news journals in real-time using a four-phase methodology that is designed in a structure. All stages are crucial in the reliability of the model, its efficiency and its robustness. The first step, Dataset Collection, refers to putting together a complete set of data based on the valid news archives and fact-checking sources, as well as reliable archives.

6. RESULTS

The analysis of the research shows that the accuracy of the fake news identification is high at 97.90 when Long Short-Term Memory (LSTM) architecture is used. LSTM performed more successfully than others particularly using GloVe embeddings and intense hyperparameter optimization methods such as grid search.

A. Analysis of Classification Report.

Table 1 shows the results of the Long Short-Term Memory (LSTM) algorithm in the classification of authentic and inauthentic news articles. Strong balance between the model and the precision and recall (0.94) also showed that the model got 94 percent of the real news items correct.

Table 1. Classification Report Analysis

	Precision	Recall	F1-Score	Support
True News	0.95	0.94	0.94	5000
Fake News	0.93	0.94	0.93	4500
Accuracy				97.90%
Macro Avg.	0.94	0.94	0.94	9500
Weighted Avg.	0.94	0.94	0.94	9500

B. Training and Validation Loss Analysis

To identify the difference between genuine and counterfeit news, Figure 2 shows that the Long Short-Term Memory (LSTM) model compares the training and validation losses with the settings of real news. At the beginning, a large loss in the epoch 0 is anticipated as a result of randomization in the learning, however, the decrease in training loss at the start suggests successful learning.

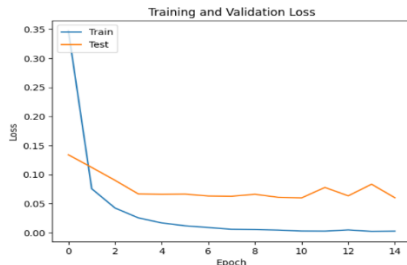


Fig. 2 Training and Validation Loss Analysis

C. Training and Validation Accuracy Analysis

The performance of the Long Short-Term Memory (LSTM) model in classifying the real and fake news depending on the training and validation accuracy is shown in Figure 3. The training accuracy increases drastically in the initial epoch to almost 1.0 in the

third epoch indicating that the model has adequately learned the training samples.

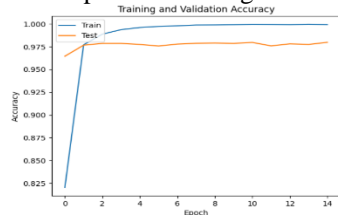


Fig. 3 Training and Validation Accuracy Analysis

D. Confusion Matrix Analysis

A distinction of actual and fake news through the Long Short-Term Memory (LSTM) model is displayed in a confusion matrix in figure 4. The table is a representation of the predicted and actual classifications as the model is able to recognize 4,145 real news articles and 3,428 fake news articles.

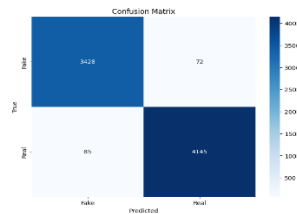


Fig. 4 Confusion Matrix Analysis

7. CONCLUSION

The dissemination of information which is accessible on the internet avenues of the digital era has changed the manner the knowledge is shared and taken in the shape of news. Nevertheless, this information overload has also contributed to spreading fake news and false information therefore destroying the opinion of the people, social trust and democracy. Creative natural language processing, and machine learning, in this case, Long Short Term Memory networks, in particular, have shown that it is almost possible to automate the process of identifying and classifying fake news. It is on the basis of this work that the LSTM model was developed that shows astonishing results with an accuracy of 97.90 to tell the truth and the fake news.

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