Recent Developments in Electronics and Communication Systems
KVS Ramachandra Murthy et al. (Eds.)

doi:10.3233/ATDE221284

Artificial Intelligence Based Fake News Detection Techniques

Sankar Desamsetti[a], Satya Hemalatha Juttuka[b], Yamini Mahitha Posina[c], S. Rama Sree[d], B.S.Kiruthika Devi[e,1]
[a,b,c] *U.G Student, Department of CSE, Aditya Engineering College (A), Surampalem, A.P, India*
[d] *Professor, Department of CSE, Aditya Engineering College (A), Surampalem, A.P, India*
[e] *Research Mentor, CL Educate Ltd., New Delhi, India*

Abstract. Fake news on social media platforms is increasing rapidly, so many people are becoming victims of this news without their interference. It is a big challenge for us to detect who is spreading fake news. Fake news spreads faster nowadays than in the past due to the widespread use of the internet. This research paper is a study of techniques based on artificial intelligence, such as neural networks, natural language processing, and machine learning algorithms that work together. The learning models surveyed are Convolutional Neural Network (CNN), Long Short-Term Memory (LSTM), and Bidirectional Recurrent Neural Network (RNN) methods. Natural language processing methods contain the tokenization model, and machine learning includes Term Frequency-Inverse Document Frequency (TFIDF) and unsupervised algorithms. The algorithms are compared and their effectiveness in detecting fake news is investigated, along with the advantages and disadvantages of the respective techniques.

Keywords. Convolutional neural network, long short-term memory, recurrent neural network, term frequency-inverse document frequency

1. Introduction

Fake news is the deliberate spread of misinformation and its false and misleading information published as news. It is also called junk news. To detect fake news, various methods and algorithms are used to determine if the news is real or fake. Fake news' main aim is to focus on a selected person or organization's economic loss [1-6]. The Facebook feed and web programmers like Google increase the amount of fake news drastically. Falsified detection could be an important and demanding subject in the field of Natural Language Processing (NLP). False news has gained traction as a result of social media's uprise because of the simplicity with which it can now be shared. As a result, the impact of fake news has grown, sometimes reaching offline realms and posing a danger to people. Fake news, whether created by humans or algorithms, has a significant influence on people and the political system [7-10].

[1] Corresponding Author, B.S.Kiruthika Devi, Research Mentor, CL Educate Ltd., New Delhi, India; E-mail: kiruthika.devi@accendere.co.in

In today's society, the media plays a huge influence in shaping public opinion. Right now, the field of studying how to spot fake news is a hive of activity. Automated approaches to detect inaccuracies in news items are being created with the help of NLP and machine learning [11-14]. Machine learning has played an important role in the classification of knowledge, although with some limitations. For this model, CNN and LSTM models are used for designing the sequence prediction problems with spatial inputs like images, text, and videos [15-18]. The widespread use of fake news has significantly impacted our lives in politics and economics. Supervised computing algorithms are used for extracting fake news; they can transform the info set into a structured format with text mining methods [19-21].

2. Related Work

In this section, fake news or real news is detected by fact-checking the legitimacy of the information. The various models are briefed as below.

2.1. Natural language processing

Natural language processing is a branch of artificial intelligence. It can easily understand human language and hear the speech signals. Examples of NLP are spam check and voice text messaging.

2.1.1. Rumor detection

Rumor detection is defined as the process of determining whether or not a story or online post is a rumor. Detection of rumors is done by some techniques called cascade based rumor detection and network based detection. Cascade-based detection means we can directly detect rumor propagation paths. Network-based means we can indirectly detect by constructing flexible networks by cascading.

2.1.2. NLP Methods

Fake news can be detected using a hybrid approach using this system. The five types of NLP used are ARI readability, stop words, proper nouns to nouns ratio, text sentiment analysis using Google NLP API, and total sentiment analysis using ARI. It has more sentiment analysis features and employs the Automated Readability Index (ARI), which is a readability index for English texts. The dissemination of claims across a number of credible sources is also measured [3].

2.1.3. Identifying Fake News

Different survey approaches are used to preprocess the data in NLP. This is done with the help of language, vectorization, dimensionality reduction, machine learning, and quality evaluation. The fundamental algorithms for processing each step in a Natural Language Processing framework devoted to spotting bogus news in social media [4].

2.2. Deep learning Models

Deep learning is a subset of machine learning and it makes the computer able to think like a human. It mainly uses hierarchical models and neural networks. In this approach, CNN, RNN, LSTM, CNN+LSTM bidirectional, and other algorithms are used. This research mostly focuses on the sentiments of the news stories while not paying continuous attention to the credibility of the new source [5]. An amalgam of convolutional neural networks makes up this model. It is a better solution than the others because it generates precision values of 97.12%. In this method, GloVe embedding manipulates the relations and dissimilarities with other words in the vocabulary [6].

2.3. Machine learning approaches

In this model, a supervised machine-learning algorithm is used for fake news classification. Textual analysis is performed using tools such as Python Scikit-learn and natural language processing. Detecting fake news can be found in two stages; they are characterization and disclosure. Various algorithms are used to detect fake news [7]. When looking for an alternative, fake news could be detected in an unsupervised manner. may detect their viewpoint towards the authenticity of news using an efficient Gibbs sampling approach to assess the news authenticity and users' credibility [8].

3. Methodology Used

A blend of neural networks and machine-learning approaches is used to detect if the news is legitimate or not based upon the information. Tokenization converts the extracted data into tokens using the tokenization method [5] [6]. The dataset contains 60% training data and 40% testing data, and the output is evaluated and accuracy is compared amongst the traditional methods.

3.1.1. Deep learning models

Seven models are analyzed for understanding the accuracy of data. They are : i) CNN ii) LSTM iii) Bidirectional LSTM iv) CNN+ LSTM Ensemble model v) Bidirectional CNN+ LSTM Ensemble model vi) CNN + LSTM ensemble model with attention mechanism vii) CNN + bidirectional LSTM ensemble model with attention mechanism. viii) Bidirectional LSTM-RNN

3.1.1.1. CNN Model

Three convolutional blocks are being used, and each block consists of conv-1D models and MaxPooling models. A flatten layer is added and the LeakyRelu activation function is being employed in the network for classification. Non-linear downsampling is used to reduce the number of operations that the layer actually performs in the next layer of CNN. Dropout is a regularisation technique used to reduce the complexity of any model and avoid the over-fitting problem of our model [5] [8].

3.1.1.2. LSTM Model

Long-term dependencies are overcome using LSTM. The model remembers the information for a long time. It predicts a positive, negative, or neutral polarity. It increases memory and captures long-term temporal dependencies without suffering from

optimization. Each memory cell contains three gates, such as an input gate, an output gate, and a forget gate. LSTM refers to previous data and makes decisions based on it.

3.1.1.3. Bidirectional LSTM

The Bidirectional LSTM is an extension of the traditional LSTM model. It improves the model accuracy by using two LSTM models. The two methods are forward and backward, which makes the method better in reading and remembering for a long time. [5] [12].

3.1.1.4. CNN + LSTM ensemble model

This is a hybrid deep learning model that has two models that are CNN and LSTM. The two ways of performing dimensionality reduction are through feature extraction and selection. Principal Component Analysis (PCA) is an unsupervised method that doesn't decrease the dataset size. Chi Square is utilized to estimate the connection between categorical variables. This method improves text classification performance with inherent supported feature reduction [5] [9]

3.1.1.5. Bidirectional LSTM + LSTM ensemble model

To improve efficiency, long short-term memory (LSTM) and a bidirectional LSTM model are used. This model is also used in speech recognition and handwriting recognition. When compared to competing models, it offers superior performance.

3.1.1.6. CNN + LSTM ensemble model with attention mechanism

CNN+LSTM and some additional layers are used to improve the efficiency. It can be used in both supervised and unsupervised models. This model was developed for fault diagnosis of actuator faults. It shows the accuracy of fault diagnosis. It predicts the base-level classifiers and the output from the base-level predictions already found.

3.1.1.7. CNN + bidirectional LSTM ensemble model with attention mechanism

Traditional CNN with 3 conv-1D layers and LeakyRelu activation function combined with Bidirectional LSTM to improve efficiency. Before attaining the attention of this Bidirectional LSTM, its aim is to capture long-term dependencies using forward and backward directions of input sequences. The input consists of a query, key, and value vector with dimensions, and the output consists of the weighted sum of features.

3.1.1.8. Bidirectional LSTM-RNN

Bidirectional LSTM-RNN consists of a convolutional neural network and a recurrent neural network. Convolutional neural networks are feed-forward artificial neural networks. In this model, they are first tokenized into words with the help of CNN and later converted into the embedded matrix. RNN handles a variable length sequence. It is used for long-distance information. RNN uses a back-propagation algorithm for training.

3.2.2. Artificial intelligence model

Text -collection is a process that operates on the datasets such as Kaggle extracted from

Text-collection is a process that operates on datasets such as Kaggle, extracted from 244 websites. It consists of around 13,000 posts that can be noted for 30 days. This data must be quantified and used in machine-learning classifiers after tokenization. Word embedding and count vectorization are both performed using the same technique as word embedding, and TF-IDF is used to construct vectors.

3.2.2.1. Support Vector Machine

By using the SVM method, fake news is classified based on the final feature subset. By using some functions, nonlinear SVM is converted into linear SVM. The SVM model is mainly based on humor, punctuation, and negative affect [13].

3.2.2.2. Logistic Regression

It is a supervised learning technique, most popular in machine learning algorithms. Logistic regression can be used for binary representation. It gives either 0 or 1, true or false values. It is used for predicting outcomes and calculating probabilities [14].

3.2.2.3. Decision Trees

It is a graphical representation to make a decision on all solutions. It is also a supervised machine learning method. A decision tree can be explained in terms of two entities: decision nodes and leaves. Each decision node contains a two-class SVM, which produces two homogeneous clusters [15].

3.2.2.4. Random Forest

It can be used to build multiple decision trees. It gives more accurate and stable predictions. By using row sampling and feature sampling, decision trees can be converted from high variance into low variance. It is a classifier irreducible module and can change over time [16].

4. Results and Discussions

Table 1 shows the comparison between various intrusion detection systems in the cloud. The advantages and disadvantages of each are discussed, along with accuracy. The various tools used by the methods are Tensorflow 2.0, keras, scikit learn, GPU, numpy, pandas, matplotlib, and seaborn.

Table 1. Comparison between various intrusion detection systems in cloud

S.No	Techniques Used	Advantages	Disadvantages	Accuracy
1	CNN [5]	Automatic detection is achieved.	It needs high data to train our model	73.29%
2	LSTM [5]	Multiple parameters are considered.	Requires more memory to train	80.62%
3	Bidirectional LSTM [17]	It solves the problem of fixed sequence to sequence.	The training cost is high	83.81%
4	CNN+LSTM [8]	This ensemble model has high accuracy	The training cost is high	86.14%
5	Bidirectional LSTM +LSTM [18]	It has high accuracy	The training cost is high	86.89%
6	CNN + LSTM ensemble [18]	This model has high accuracy.	The training cost is high	86.79%
7	CNN + bidirectional LSTM ensemble [18] [4].	It gives high accuracy	It needs a high GPU	88.78%
8	Bidirectional LSTM-RNN [18]	It performs better in language related tasks.	It causes gradient exploding and vanishing problems.	85%

9	Support Vector Machine [13]	It works comparable and effectively.	It is not acceptable for large data sets.	80%
10	Logistic Regression [14]	It performs very well and has good accuracy	It solves linear problems only non-linear problems cannot solve.	80%
11	Decision Trees [15]	It is used for different kinds of data.	Its time complexity is very huge.	87%
12	Random Forest [16]	Uses multiple decision trees.	It is a complex algorithm.	84.97%

5. Conclusion and Future Work

This research paper mainly focuses on the study of fake news detection using artificial intelligence based methods. In deep learning models, CNN, LSTM, RNN, and blends of neural networks give the expected output by performing convolutional layers of matrix multiplication, max pooling, and prediction on the nature of the news. Natural language processing is used for checking facts and rumors. Machine learning approaches use stop word removal, TFIDF, vectorization methods, and supervised algorithms. The CNN+LSTM ensemble model gives 88.78% accuracy. In the future, algorithms will be improved so that they can handle fast data and complicated situations.

References

[1] Oshikawa R, Qian J, Wang WY. A survey on natural language processing for fake news detection. arXiv preprint arXiv:1811.00770. 2018 Nov 2.
[2] Horne BD, Adali S. This just in: Fake news packs a lot in title, uses simpler, repetitive content in text body, more similar to satire than real news. In Eleventh international AAAI conference on web and social media 2017 May 3.
[3] Giglio C, Palmieri R. Analyzing informal learning patterns in Facebook communities of international conferences. Procedia-Social and Behavioral Sciences. 2017 Feb 21;237:223-9.
[4] Kumar S, Asthana R, Upadhyay S, Upreti N, Akbar M. Fake news detection using deep learning models: A novel approach. Transactions on Emerging Telecommunications Technologies. 2020 Feb;31(2):e3767.
[5] Agarwal A, Mittal M, Pathak A, Goyal LM. Fake news detection using a blend of neural networks: An application of deep learning. SN Computer Science. 2020 May;1(3):1-9.
[6] Khanam Z, Alwasel BN, Sirafi H, Rashid M. Fake news detection using machine learning approaches. In IOP Conference Series: Materials Science and Engineering 2021 Mar 1 (Vol. 1099, No. 1, p. 012040). IOP Publishing.
[7] Kaliyar RK, Goswami A, Narang P, Sinha S. FNDNet–a deep convolutional neural network for fake news detection. Cognitive Systems Research. 2020 Jun 1;61:32-44.
[8] Umer M, Imtiaz Z, Ullah S, Mehmood A, Choi GS, On BW. Fake news stance detection using deep learning architecture (CNN-LSTM). IEEE Access. 2020 Aug 26;8:156695-706.
[9] Ozbay FA, Alatas B. Fake news detection within online social media using supervised artificial intelligence algorithms. Physica A: Statistical Mechanics and its Applications. 2020 Feb 15;540:123174.
[10] Smitha N, Bharath R. Performance comparison of machine learning classifiers for fake news detection. In2020 Second International Conference on Inventive Research in Computing Applications (ICIRCA) 2020 Jul 15 (pp. 696-700). IEEE.
[11] Suyanto S. Synonyms-Based Augmentation to Improve Fake News Detection using Bidirectional LSTM. In2020 8th International Conference on Information and Communication Technology (ICoICT) 2020 Jun 24 (pp. 1-5). IEEE.
[12] Priya BJ, Kunda P, Kumar S. Design and Implementation of Smart Real-Time Billing, GSM, and GPS-Based Theft Monitoring and Accident Notification Systems. In Proceedings of International Conference on Recent Trends in Machine Learning, IoT, Smart Cities and Applications 2021 (pp. 647-661). Springer, Singapore.
[13] Shaikh J, Patil R. Fake news detection using machine learning. In2020 IEEE International Symposium on Sustainable Energy, Signal Processing and Cyber Security (iSSSC) 2020 Dec 16 (pp. 1-5). IEEE.

[14] Saw M, Saxena T, Kaithwas S, Yadav R, Lal N. Estimation of prediction for getting heart disease using logistic regression model of machine learning. In2020 International Conference on Computer Communication and Informatics (ICCCI) 2020 Jan 22 (pp. 1-6). IEEE.
[15] Nimmakayala S, Mummidi B, Kunda P, Kumar S. Modern Health Monitoring System Using IoT. InICCCE 2020 2021 (pp. 1135-1144). Springer, Singapore.
[16] Elaidi H, Elhaddar Y, Benabbou Z, Abbar H. An idea of a clustering algorithm using support vector machines based on binary decision tree. In2018 International Conference on Intelligent Systems and Computer Vision (ISCV) 2018 Apr 2 (pp. 1-5). IEEE.
[17] Sindhu S, Patil SP, Sreevalsan A, Rahman F, AN MS. Phishing detection using random forest, SVM and neural network with backpropagation. In2020 International Conference on Smart Technologies in Computing, Electrical and Electronics (ICSTCEE) 2020 Oct 9 (pp. 391-394). IEEE.
[18] Sudeep SV, Venkata Kiran S, Nandan D, Kumar S. An Overview of Biometrics and Face Spoofing Detection. ICCCE 2020. 2021:871-81.
[19] Lyu S, Lo DC. Fake news detection by decision tree. In2020 SoutheastCon 2020 Mar 28 (pp. 1-2). IEEE.
[20] Jiang T, Li JP, Haq AU, Saboor A. Fake News Detection using Deep Recurrent Neural Networks. In2020 17th International Computer Conference on Wavelet Active Media Technology and Information Processing (ICCWAMTIP) 2020 Dec 18 (pp. 205-208). IEEE.
[21] Khan JY, Khondaker M, Islam T, Iqbal A, Afroz S. A benchmark study on machine learning methods for fake news detection. arXiv preprint arXiv:1905.04749. 2019 May:1-4.