A Survey On Fake News Detection In Social Media Using Deep Neural Networks

L.Alekya, L.Lakshmi, G.Susmitha, S.Hemanth

Abstract: Due to the emerging technologies and population growth, the rate of using social media has increased rapidly. As of now the social media has become the daily news to the world rather than the news channels and newspapers. The spread of fake news may lead to havocs. And more likely we are spreading the fake news to our surroundings by trust worthy on the social media finally that too much trust is being mis leaded. In upcoming days, we can't distinguish real news and fake news. The rate of fake news has become disguise. In this process, we have made survey to detect fake news using Deep Learning techniques and algorithms. We have tested on some of the data sets such as LIAR, Buzzfeed, PolitiFact, Kaggle and McIntire. In this paper to detect the fake news, we have compared machine learning algorithms like Naïve-Bayes', SVM, Decision Tree, AdaBoost, etc. Comparing the accuracy obtained using vanilla and LSTM are less accurate than GRU and CNN. We quest to increase accuracy by applying a hybrid model between the GRU and CNN techniques on the same data set.

Index Terms: Convolutional neural networks, Gated Recurrent Unit, Support Vector Machine, LSTM, Support vector machine, Recurrent neural networks, Bag of Words.

1 INTRODUCTION

Fake news is one of the major intimidations in journalism and democracy. The fake news made the people, that they could not differentiate the real news and fake news. To overcome this by using some websites, tools and platforms were introduced to detect the differentiation of real news and fake news [1]. The fakesters create a news which makes the readers mind desperate to learn what is there in the news by seeing the title of particular news. That desperate minds are giving a chance to the fakesters to create such unhealthy news. Even though the fake news detection is not completely ruling the world but lot of interest is being generated [2]. Along with the social media there are some websites that spread fake news, such as The Gateway Pundit, Gummy post, etc. We have tested on LSTM where the LSTM is more expensive for calculating the network output, optimality and also to apply back propagation. The memory cell sends the input to nodes (hidden conventional) [3]. When we add external memory that increases the weight of the nodes associated with web sites. In that case again we need to trainee the nodes. This is very difficult and the dimensionality of the nodes increases and optimality cannot be achieved. Convolutional neural networks are used mainly in text classification. The extension of Natural Language processing is convolutional Neural Networks. We can say that it is a best tool in extracting features. While studying long term dependencies, it is not effective. The long-term dependencies were overcome by RNN technique. In RNN model again there is a problem with Vanilla which leads to short term dependencies. This short-term dependency occurs when the information gained cannot last for longer time. This model is used to choose content features automatically [4].

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The short-term dependency is occurred due to the Vanishing Gradient problem. This vanishing Gradient problem affects the feed forward networks and recurrent networks. Later the feed forward networks are trained unfolded and made into very deep feed forward networks. After unfolding them a new layer is generated. There is a solution to solve vanishing Gradient problem that is by the updated version of RNN model. Gated Recurrent Unit is the updated version of RNN model. This Gated Recurrent unit uses vector gates to solve this problem. Using UPDATE GATE and RESETGAT, these two vectors decide what output should be passed and maintains the information for longer period. Gated Recurrent unit doesn't require any memory units whereas vanilla and LSTM's are needed**.** To modify the running headings of GNN select View, Header and Footer. Click inside the text box to type the name of the journal the article is being submitted to and the manuscript identification number. Click the forward arrow in the pop-up tool bar to modify the header or footer on subsequent pages.

2 LITERATURE REVIEW

Estee Van Der Walt [5] focused on detecting fake news created by bots and humans. The bots did not give the best results compared to human accounts. The features used to detect fake accounts are supervised machine learning models to train the engineered features. The future work of this project is to improve the feature sets. The accounts created by bots cannot compete with the accounts created by humans; Vice versa the accounts created by bots are not similar to human accounts. F1score has been generated for the fake accounts created by humans are about 49%. The new features found on SMPs will show better results. Marco L. Della Vedova [6] proposed the automatic fake news detection method to combine social methods and content-based methods. The performance of social methods was not well, When the social-methods and content based- methods are combined they have given best accuracy rate in finding news articles. HC-CB-3 method was introduced for offering high accuracy. The content-based method usage has reduced the spread of fake news. Additionally, introduce the chat bots in Facebook messenger environment to detect the real and fake news. This was succeeded with 81%.the future work is to train the chat bots regarding datasets to which country the news belongs to and to eliminate Italian news.

Liang Wu [7] stated that the classification of messages was used to find the messages spreading in social media which are not appropriate, trustworthy, etc. And proposed Trace Miner to classify messages in social media, with this an end-to-end LSTM-RNN's Classification model was also included. Trace Miner has given good results on the insufficient datasets. The future work is going to be done on network mining tasks using Trace Miner.

According to Hadder Ahmed's [8] approach on the fake news was detected using Ngram analysis has described how the fake news has rendered in to social media and that false news has been wide spread between youngsters, it grabbed the attention of the youngsters to believe only the social media news not the printed news. Using some feature extraction techniques, and investigated on different feature extraction and machine learning techniques. The proposed model such as unigram feature and SVM classifier has achieved 92% accuracy. XinYi Zhou [9] has proposed to detect fake news on social media content. The models have achieved an accuracy at approximately 80-88% on applying content-based, propagation-based and hybrid fake news detection. With less amount of knowledge this model has given good accuracy, in three of them the proposed model performed well to predict the fake news. Fake news has created a sensation than the real news. The news has represented with short words, with less content. The future work is to use new relationships and new images from the headlines. To detect the fake news Barnaghi P [10] has proposed to solve the fake news problems using two phases. In the phase one neither detect the fake users who ignores the fake news nor go to successor phase. Then find whether the news is trustworthy using machine learning algorithms. The proposed model has found the fake user in the first phase by using Naïve Bayes algorithm with 99% accuracy. In the second phase similarity measures with machine learning algorithms found the fake news with 95% accuracy. The future work will be done on social media sites and multi languages..

3 NLP TECHNIQUES USED IN FAKE NEWS DETECTION

Natural language processing has come from the extension to computer science and artificial intelligence which is the interaction between the humans and computers. NLP has introduced to process the large amount of data in a meaningful manner.

Collobert [11] introduced Natural Language Processing from the unified neural networks architecture and algorithms. This says that how to differentiate words and sentences which are human made. The word vector representations such as:

I. **BOW**: Bag of Words model, sentences are arranged in multisets. It doesn't work on the order and context of the word occurrence.
II. **TF-IDF**: The Term Frequency – Inverse document Frequency weights the word to showcase the importance of that word in a sentence.
III. **GlOVE**: First construct the Co-occurrence matrix and then reduce the dimensions with the matrix by factorization method.
IV. **Word2VEC**: Predicts whether the given word is present or not.

Table 1:NLP techniques comparison table

NLP Techniques	Description
Bag of Words	This model counts the number of times the word appeared in the text
Term frequency-Inverse Document Frequency	Tf-Idf says the importance of the word in a sentence. By giving weights to each word
Glove	This maps the words meaningfully
Word2Vec	This is a two-layer embedding that are trained to reconstruct linguistic content words

4 MACHINE LEARNING ALGORITHMS USED IN FAKE NEWS DETECTION

4.1 Naive Bayes Classifier (Generative Learning Model)

Naïve Bayes is a probabilistic machine learning model and this is a probabilistic classifier that makes classifications using max posteriori decision rule. Naive Bayes classifier is derived from Bayes theorem which is used in classification tasks. This classifier is scalable and traditional algorithm of choice and relates with real-world applications. These real-world applications give a quick response to the users. This algorithm is used in spam filtering for emails and sentiment analysis, etc. This is an oldest classification problem and deals with large datasets.

$$P(I/J)=(P(J/I)*P(I))/P(J)$$
$$\text{Posterier}=(\text{Liklihood}*\text{prior})/\text{Evidence}$$

P(I): Prior Probability of class
P(J|I): Likelihood, the probability of predictor given class
P(J): Prior probability of predictor
P(I|J): Posterior probability off class I given the predictor J

4.2 Nearest Neighbour

The k-nearest neighbour algorithm is an easy and simple supervised machine learning algorithm that solves classification and regression problem. Let us consider some labelled points and then calculate the distance between each point and sort the distances in decreasing order and label the first point as "k". The K labels return the mean and mode of the regression and classification models. This is a sensitive model. And classification problems have discrete values as outputs. K nearest is a pattern recognition and intrusion detection model.

4.3 Support Vector Machine

SVM is a supervised learning algorithm. Comparing with other algorithms this is one of the best fit algorithms. SVM is utilizing computational linguistics to find the fake news. This algorithm is used to convert the learning models, which are only for specific use. Normalization is done to the training sets and data sets. It has achieved good scope in trained set. Support vector machine is a widely used classification algorithm. Mostly used for extracting large amount of data and small amount of image dimension.

4.4 Decision Trees

Decision tree is a supervised learning model and is represented as flowcharts. It is an efficient non-parametric method that can be used for classification and regression. In decision tree we divide the source set into subsets based on

attribute value test. The division process is repeated on each subset recursively. The subset at a node has the same variable then we can say that recursion is completed. The final result is the decision tree with decision nodes and leaf nodes. There are two or more branches for a decision node were the leaf node represents either classification or decision. It can handle categorical and numerical data.

Table 1: Machine learning classification models NLP techniques comparison table

Algorithms	Naïve Bayes [18]	SVM	Decision Tree	KNN
Metrics	ACC:93.95% PREC:95.98 % REC:95.36% FM:95.67%	ACC:98.82 % PREC:98.6 4% REC:98.87 % FM:98.23%	ACC:91.93 % PREC:95.5 1% REC:92.96 % FM:94.22%	ACC:94.1% PREC:89% REC:86.2% FM:81.5%
Parame ters	Accuracy, Precision, Recall, F-Measure	Accuracy, Precision, Recall, F-Measure	Accuracy, Precision, Recall, F-Measure	Accuracy, Precision, Recall, F-Measure
Advanta ges	Easily implemented , requires less training period to test the data, fast decision making	Efficient for small training data sets, SVM is Best model compared to ANN	Easy to explain	Easy to implement
Disadva ntages	Loss of accuracy	Takes more duration to train large datasets	Less accurate	Computatio n cost is high
Uses	Spam Filtering, Text Classification	Intrusion detection, Hand writing recognition	Remote sensing, Planning	Pattern recognition, measure document similarity

5 DEEP LEARNING ALGORITHMS USED IN FAKE NEWS DETECTION

5.1 Decision Trees

Deep Neural Networks were proposed to mimic the human brains for recognizing patterns. DNN is a neural network with networks, which contain the input layer, output layer and a single hidden layer. Finds mathematical manipulations to turn on the input and output non-linear or linear relations. This is a feed forward network in which the data flows from input to output without looping back. These are trained with back propagation.

5.2 Convolutional Neural Networks

Convolutional neural networks are a network of neurons connected in layers which are used to take the inputs and outsources the output. CNN is a feed forward network model suitable for object recognition and image analysis. The neural network is represented as stages to perform the functions, there are three stages such as convolution layer, detector layer, pooling layer. The work of convolutional layer is to build convoluted feature map. Detector layer is prominent the nonlinear components of feature maps. Pooling layer reduces the predecessor information and gives the output. CNN finds the dormant characters in the news content. Main use of this model is the data size and trained data. CNN model is taken in to consideration based on performance and speed.

5.3 Recurrent Neural Networks

RNN model is trained using back propagation. And this is a type of ANN model. This is also a feed forward network which takes the input from recurrent loops. RNN performs the data analysis in sequential manner such as sentiment analysis, speech recognition and in some other task. RNN is a model with memory. That it takes the previous model inputs. This model understands the human language and responds accordingly. Example of RNN is Apple's Siri And Amazon's Alexa. This cannot predict the future work based on past data. It remembers the past information and uses same parameters for further inputs or hidden layers to outsource the output.

5.4 Artificial Neural Networks

ANN is a computational algorithm. The topological structures were imitated with non-linear and complex patterns. In Satellite image classifications ANN's are used. ANN is similar to human neuron. That sends electrical signals. Include large amount of connected processor units which works together. This is a feed forward model with input layer, output layer and hidden layers. The purpose of input layer is to receive inputs and to communicate with the hidden layer. Accordingly, hidden layer combines with input layer and sends response to output layer. We feed the neural network with some inputs and outputs to compare the actual output with the gained ANN output.

Table 1: Deep learning classification models comparison table

Algorithms	CNN	RNN	ANN
Metrics	Accuracy:85% Precision:85% Recall:85% F-M:85%	Accuracy:76.9%	Accuracy:89.4% Precision:88% Recall:79.4% F-1:84%
Advantages	At once multiple classifications are done, locates objects in an image	No process limit, powerful	Can Access multiple training algorithms, need less training
Disadvantages	Computational cost is expensive, require lot of training data	Scaling	Cost effective, over-fitting
Uses	Image recognition, time series forecasting	Speech recognition, Automatic image tagger, Machine translation	Image recognition, Hand written character recognition, Facial recognition

6 CONCLUSION

Owing to the growth of emerging technologies, the rate of using social media has increased rapidly. Now-a-days the

social media has become the daily news to the world rather than the news channels and newspapers. The spread of fake news may lead to wide spread destruction. We are spreading the fake news to our surroundings by trust worthy on the social media finally that too much trust is being misleaded. In future, we can't distinguish real news and fake news as the rate of fake news has become disguise. In this paper, we have made survey to detect fake news using natural language processing techniques, Deep Learning techniques and algorithms tested on some of the data sets such as LIAR, Buzzfeed, PolitiFact, Kaggle and McIntire and machine learning algorithms like Naïve-Bayes', SVM, Decision Tree, AdaBoost, etc. Comparing the accuracy obtained using vanilla and LSTM are less accurate than GRU and CNN. So to increase accuracy in fake news detection we propose a hybrid model between the GRU and CNN techniques.

REFERENCES

[1] Anuse, A. & Vyas, V. Complex Intell. Syst. (2016) 2: 221. https://doi.org/10.1007/s40747-016-0024-6.

[2] Amol Agrawal. 2016. Clickbait detection using deep learning. In Next Generation Computing Technologies (NGCT) ,2016 2nd International Conference on. IEEE, 268–272.

[3] LONG SHORT-TERM MEMORY Neural Computation 9(8):1735.

[4] Jain N., Kumar A., Singh S., Singh C., Tripathi S. (2019) Deceptive Reviews Detection Using Deep Learning Techniques. In: Métais E., Meziane F., Vadera S., Sugumaran V., Saraee M. (eds) Natural Language Processing and Information Systems. NLDB 2019. Lecture Notes in Computer Science, vol 11608. Springer, Cham.

[5] E. Van Der Walt and J. Eloff, "Using Machine Learning to Detect Fake Identities: Bots vs Humans," in *IEEE Access*, vol. 6, pp. 6540-6549, 2018.

[6] M. L. Della Vedova, E. Tacchini, S. Moret, G. Ballarin, M. DiPierro and L. de Alfaro, "Automatic Online Fake News Detection Combining Content and Social Signals," *2018 22nd Conference of Open Innovations Association (FRUCT)*, Jyvaskyla, 2018, pp. 272-279.

[7] Wu, L., & Liu, H. (2018). Tracing Fake-News Footprints. Proceedings of the Eleventh ACM International Conference on Web Search and Data Mining - WSDM '18. doi:10.1145/3159652.3159677.

[8] Ahmed H., Traore I., Saad S. (2017) Detection of Online Fake News Using N-Gram Analysis and Machine Learning Techniques. In: Traore I., Woungang I., Awad A. (eds) Intelligent, Secure, and Dependable Systems in Distributed and Cloud Environments. ISDDC 2017. Lecture Notes in Computer Science, vol 10618. Springer, Cham.

[9] Elazab, Ahmed. (2018). Fraud News Detection for Online Social Networks.

[10] Barnaghi P., Kontonatsios G., Bessis N., Korkontzelos Y. (2019) Aspect Extraction from Reviews Using Convolutional Neural Networks and Embeddings. Natural Language Processing and Information Systems. NLDB 2019. Lecture Notes in Computer Science, vol 11608. Springer.