Various Approaches for Fake News Detection

RAMYA P[1], CHAITRA B[2], SAI SWAROOPA A[3], SHUBHA B K[4], SINDHU S N[5]

[1, 2, 3, 4, 5] Department of Information Science and Engineering, Acharya Institute of Technology, Bangalore

Abstract- Traditional media has been changed via way of means of online network and has end up as main platform for spreading fake news. Access to the Internethas led to create faster and easier ways of communication through social media instead of traditional news sources. Fake news can be spread easily from unverified sources which may mislead the readers. Detecting fake news was accomplished manually in the past which was tedious, but now there are many automated methods which uses machine learning techniques and other related fields which reduces human effort. This paper provides comparison and evaluation of various machine learning techniques in different social media platforms. These techniques include classification algorithms like Naive Bayes and other deep learning algorithms like CNN, RNN, LSTM.

Indexed Terms- deep learning, fake news, online network, machine learning.

I. INTRODUCTION

Fake news is a huge threat to digital world. It is interpreted as a subject which includes data, news, reports and information that may be real or fake.Fake news has created a threat to country's economy, security and prosperity. Every day, billions of news articles and messages are created on the web. Without knowing whether the news is real or fake, people may become serving hands for spreading the news. As a result, there is a need to work on detectingfake news. Fake news is intentionally and verifiable false news articles that mislead readers. The definition of fake news has two key features: authenticity and intent. Firstly, the false information present in the fake news is verified. Secondly, fake news is created to misguide the public. Most of the fake news detection systems utilize the linguistic feature of the news. However, there is a difficulty in sensing highly ambiguous fake news which can be detected only after identifying their meaning and latest related information.

Many challenges are faced during identification of fake news in social media. Initially, there is a difficulty in collecting fake news data and labeling them manually. As fake news is written explicitly to misguide readers, detecting them based on the news content is difficult. It is not easy to verify the credibility of newly emerging and time- bound news as they are not sufficient to train the application dataset.

In these cases, the aim is to process the data in the form of text document. Further deciding, whether the news is fake or not. This paper discusses about various approaches of fake news detection by using supervised learning algorithms. These includes classification algorithms such as linear regression, logistic regression, Naive Bayes and other deep learning algorithm's such as Bi-LSTM - RNN, RNN, CNN, LSTM.

The rest of the paper is structured as follows: Section II defines related work to detect fakenews using deep learning methods. In Section III and IV discusses about evaluation results and conclusion.

II. LITERATURE REVIEW

The objective of the proposed solution is to build a model which classifies the article as real or fake using deep learning techniques like recurrent neural networks - RNN (LSTM and GRU) [1]. Authors prepared a large dataset by gathering news articles from different trusted and non-trusted news sources. The proposed model is evaluated by testing it on the large dataset prepared by authors. It has also been tested on the datasets which are developed in the recent works of literature. Comparison between diverse datasets shows efficiency of model. Model proposed here shows better accuracy in all the given datasets.

Fake news is spreading like wild-fire around the globe. To eradicate this problem, a fake news detection

system is inevitable. Fact data Corpus is a kind of database with full of facts. The related sentences from input sentences are extracted from theFact data Corpus and are verified whether they both are true or false. Korean specific pre-training model is constructed based on state-of-the-art BERT. A huge collection of 1.5 million articles is gathered and constructed the Fact data Corpus. The construction ofmodel involves three stages: Generating a dataset, generating a pre-training model using the collection Korean natural language, Generating the result byrunning the deep learning model. This model shows the accuracy of 96.25% and AUROC score of 83.8% after evaluating 5000 sets of test sets [2].

The authors had developed a webapp which detects the fake news. This webapp has 3 modules- the admin, news provider and users. Admin performs all the functionalities, the news providers can publish news after the approval of admin, users can view, comment and like the news. A neural network model is used as a tool for classification. This model detects fake news using the title and content of article or post. The dataset used for training is adopted from clickbait challenge site. For text preprocessing NLP is used, the model is trained with the linkage betweenthe headline and context of article, opinions advertised by users. Sentimental analysis is applied on model to check the veracity of the news [3]. Model predicts the input given is fake or real byaccepting inputs as title and text of the news.

Currently, for detecting fake news several types of features were explored. In this paper, author has proposed unique features set and measured the accomplishment of existing features with new ones. Articles which were published during US 2016 elections were used to prepare dataset. Features canbe categorized into 3 types: Features drawn out from news content, Features taken out from news source, Feature extracted from environment. The authors had evaluated the strength of previous features using several classifiers namely, Support vector machine (SVM), Naive Bayes (NB), k-Nearest Neighbors (KNN), XGBoost (XGB), Random Forest (RF) [4]. The foremost results were yielded by XGB and RF classifiers with 0.86 and 0.85 for AUC.

The aim of authors is at utilizing natural language processing (NLP) for text preprocessing and based on the headline or context of the article, deep learning models are trained to detect fact about the article. Data set used here comes from Kaggle. The method observed right here is, following NLP strategies textual content preprocessing is done, subsequent they may be vectorized into N-gram or sequence vectors. Then those vectors are fed to a deep learning models for prediction. Here, authors had developed 4 models: Model1: trained using news title's N-gram vectors, Model2: trained using news context's N- gram vectors, Model3: trained using news title's sequence vectors, Model4: trained using news context's sequence vectors [5]. Through performance comparison between the models, it is evident that Model 2 has highest accuracy of 90.3%.

As social media is exploded everywhere, spread of fake news is made easy and without any cost. To overcome this, a fake news detection system is built using deep learning methods. This system is builtusing hybrid of CNN and RNN model. Two datasets (ISO and FA-KES) were used for training and validating the model. FA-KES dataset contains 804 news datasets (53% true and 47% fake). ISOT dataset contains 45,000 news datasets (50% true and 50% fake). Word embedding is used for mapping words inthe text to vectors called word vectors. Feature extraction is performed with CNN and RNN is used for capturing long term dependencies between the text. From experiments, it confirmed that, a hybrid of CNN and RNN model improved the state-of-the-art baselines for detecting fake news [6]. Results shows 100% accuracy for ISOT dataset and nearly 60% accuracy for FA-KES dataset. This paper concludes that, Hybrid models shows better performance and results than the non-hybrid models.

Social media networks are considered to be the fastest medium for spreading misinformation. Many models can be used for detecting the fake news. Hence, Evaluation and comparison between different models should be done. Deep learning methods like CNN, RNN, LSTM, hybrid models and traditional machine learning approaches like Naive Bayes are used for comparison. This comparison is not only done within deep learning or machine learning methods, but also between the traditional and non- traditional methods.

From this paper, one can select the best deep learning or machine learning method for solving problem regarding the balance between light weightiness and accuracy [7]. Support Vector Machine showed greater accuracy when compared to other machine learning techniques. In deep learning techniques, hybrid model of LSTM-CNN performed much better than the normal LSTM and other deep learning techniques.

Detection fake News is a classic problem because classifying a piece of text as real or fake is much difficult [8]. A comparison is made between the present Deep Learning techniques (ANN, CNN and RNN). Two types of datasets are collected. The LIAR dataset and the public Fake News dataset which is available on Kaggle and these datasets are represented in vector space. A number of experiments have been carried out using various permutations and combinations. Vector Space representation is carried out using One-Hot, TFIDF, Word2Vect and Doc2Vec on each dataset. By using the accuracy obtained from these vector representation models, a comparison is carried out between them. Results shows that, though all models performed well with Kaggle dataset, CNN model trained with Kaggle dataset performed better with TFIDF than other models. TFIDF is used when dataset contains large paragraphs. When training model with either Kaggle dataset/Liar dataset using One Hot encoding, only Bi-LSTM model performed well than other models in both datasets. This is because Bi-LSTM learns the words in both directions. Coming to Doc2Vec on Kaggle dataset, Bi-LSTM showed good results.

Social media is one of the biggest sources for spreading false information [9]. To overcome this, a classifier model is built to detect whether the information present in social media is real or fake. Different Models were built. They include LSTM models and RNN models based on technique like vanilla, GRU (Gated Recurrent Unit). The dataset used is the LIAR dataset collected from Kaggle. These datasets are used for training the model. The results show GRU is best because it overcomes the vanishing gradient problem. Following GRU, LSTM showed better results and lastly vanilla. By using hybrid model of CNN and GRU on same dataset, results proved to show much higher accuracy than non-hybrid model.

The development of internet had led to the quick spread of information via social network. Different deep learning models were used for evaluating and comparing the accuracy and performance of BiLSTM-RNN model with CNN, vanilla RNN and LSTM-RNN. Two unstructured news article datasets available publicly are used for analyzing the performance of the model. GloVe is used for text classification as it deals with high dimensional news dataset. The result shows that when extracting position and local-invariant features, CNN performed better while classification for long-range semantic dependency LSTM-RNN performed well. For sequential tasks modeling, RNN worked better. The results conclude that Bi-directional LSTM - RNN model is more effective and better than unidirectional models [10].

The development of this technique is to identify fake news and fake users in the Twitter network. This paper uses two approaches, linguistic and social networking approaches. The techniques used involve automatic learning, dictionaries with specific term to a domain to monitor, Naive Bayes classifiers, models based on SVM and Maximum Entropy. All these are used in amalgamation with techniques and specific tools to natural language processing like POS, removal of stop-words, identifying name-type entities, identification of sentiment [11]. Also determines other statistics, such as the overall emotion (sentiment) of the tweet, by considering the emoji and hashtags that are used in twitter.

The main aim is to understand user profiles on social media for detecting fake news. This works on two aspects -Detecting Fake news and Measuring profiles of the users on social media. Detecting Fake News on social media pivots on news contents and social contexts [12]. The approaches based on News content withdraw characteristics from linguistic and visual information. The approaches based on Social Contexts incorporate characteristics from social networks, user profiles, and post contents. Measuring user profiles pivots on explicit and implicit characteristics. Characteristics of explicit profiles are already supplied in raw user meta data while Characteristics of implicit profiles are not directly supplied, and are usually very useful to predict user profiles for particular tasks, which include personality, gender, age etc.

The goal of the authors is to detect fake news on social media. This paper analyses two features for detecting fake news problem: The first is characterization and the second is detection. The datasets used here are BuzzFeedNews, LIAR, BS Detector and CREDBANK [13]. In this paper the news content mostly depends on linguistic-based and visual based. From text content the linguistic based features are withdrawn, such as documents, words, characters, sentences. In the same way from visual elements the visual based features are withdrawn, such as images and videos.

The development of this approach is to confer a method for automatically detecting fake news in Twitter. This uses a classification model to predict whether a Twitter chat will be marked as correct or incorrect using characteristics caused by existing work on reliability of Twitter. The datasets used are PHEME and the CREDBANK-crowd. PHEME is the hand-selected dataset which is used for chat threads about rumors in Twitter filled with journalist notations for truth, and CREDBANK is the large-scale set of Twitter chats which is about events and crowdsourced accuracy which is calculated for each event. The CREDBANK model performs better than the PHEME model [14].

The development of paper is to detect the fake news on twitter using a propagation structure. The datasets used here are FakeNewsNet dataset which is made in clearing the response for the lack of existing fake news data sets. The approach for collecting the data is to crowd news articles which is taken from fact-checking organizations that is from Gossipcop and Politifact, along with the truth label which is assigned by independent journalists [15]. This paper extracts features manually from the propagation graphs. Further to look over the important difference between how the propagation of fake and real news takes place in Twitter. The propagation graphs include two types: The first one is a classifier which is trained on the manually extracted features, and the second one is a Geometric Deep Learning approach which is trained on the propagation graphs.

The methodology aims to construct multiple deep learning models for detecting fake news and categorizing it into pre-defined fine-grainedcategories

[16]. An ensemble model based on Bi-LSTM and CNN architecture is developed and trained using the LIAR dataset. Other models based on the CNN and Bi-LSTM alone were also developed. The proposed model tries to learn the pattern of information of the short statements and also learns about the behavior of the source speaker from various attributes present in the dataset. Then it integrates all the gained knowledge to generate fine-grained multi-class categorization i.e., whether thestatements are true, false, half true, barely true, mostly true. The accuracies obtained for CNN, BiLSTM and CNN+Bi-LSTM model are 0.4289, 0.4265 and 0.4487 respectively. Ultimately thismodel tries to capture the relationship between different attributes by concatenating them and classifying them into fine-grained classes of fakeness.

A Bidirectional LSTM based model for fake news detection is developed. The dataset used here is obtained from FNC-1. The proposed model employs augmentation technique which uses desired data to increase the amount of relevant data. This augmented data undergoes preprocessing where, removing stopwords, tokenization and vectorization is done. The model is trained, validated and tested by splitting the data in the dataset accordingly. The developed model classifies the body and headlines of a news into classes i.e., whether they belong to unrelated, agree, disagree or discuss class [17]. As the dataset was unbalanced the accuracy obtained was not high but the model also showed that when augmentation was applied it performed better. The paper also discussed about analytical problems regarding datasetwhen it contains sarcasm in the statements as a result the model cannot distinguish them properly into the different classes. It can be concluded that augmentation process helps the model to perform better when the dataset is unbalanced.

A hybrid model is built using Bidirectional LSTM and CNN which incorporates part of speech tags mechanism. The dataset used here is LIAR dataset which contains around 12836 short statements along with other attributes like subject, speaker, state, party and prior history. The hybrid model uses NLTK POS tagger to tag each word in the dataset with one of the k tags [18]. It also employs padding and word embedding (each of 300 dimension) of the news articles. Here the statements are passed into Bi-LSTM

layer and speaker's profile is passed into CNNlayer. The models are evaluated individually. The Bi-LSTM model uses pos tags information on statements and CNN architecture which uses the encodes speaker profile shows that both perform better than state of art architecture. Overall, the proposed hybrid model with pos tag mechanism performed better than the other models that were used to compare, in this paper.

A hybrid Neural Network architecture is developed which combines the capabilities of CNN and LSTM. The hybrid model is used with Principle Component Analysis (PCA) and Chi-Square which are called as dimensionality reduction approaches. The dataset is obtained from Fake News Challenges (FNC) website, it as four classes like agree, disagree, discuss, and unrelated [19]. 49,972 and 25,413 samples of headlines, body of the article are used to train and test the model. The first set of training data is sent into the model without pre-processing and the second set of training data is pre-processed which it is carried out by using Chi square and PCA to obtain the reduced feature set to perform component analysis. The results are compared between reduced dataset and non-reduced dataset, where it showed that the model trained with reduced dataset obtained from the dimensionality reduction approaches significantly improved the accuracy than the model trained with non-reduced dataset.

An ensemble model based on CNN and Bi-LSTM is developed using attention mechanism. This paper also compares various state of art approaches like CNN, LSTM and other models. The dataset used in this study was produced by gathering 1356 news items from different users via Twitter and media sites like PolitiFact. The model uses sentimental analysis for fake news detection. It also performs data preprocessing to discover patterns in data, which might include anything from strange capitalization to random exclamation/question marks, among other things. Various ensemble models like CNN+LSTM, Bi-LSTM+LSTM and also separate ensemble models using attention mechanism were built and trained. After evaluating all the models, it can be concluded that CNN + bidirectional LSTM model with attention mechanism achieved the highest accuracy than all other models [20].

III. RESULTS

In Machine learning techniques, Natural Language Processing (NLP) could be utilized to train the model for better accuracy. But there are some limitations when using NLP. For example, if the content in the dataset is poorly worded, then the result may be ambiguous. This problem can be addressed by classification and deep learning algorithms. In case to choose a machine learning technique, Support Vector Machine (SVM) can be preferred as it shows better performance than any other machine learning algorithms.

CNN predicts more faster than RNN andconsidered to be more powerful than RNN. RNNwith more hidden layers shows high accuracy for detecting fake news. RNN includes less feature compatibility when compared with CNN. Models trained with hybrid of two deep learning techniques (hybrid of CNN with LSTM-RNN or merging two CNN's) showed better performance and greater accuracy when compared with only one deep learningtechnique. Hybrid model of CNN-LSTM will yield a good classification accuracy of more than 92%.

Bi-directional LSTM-RNN model has produced signifying results than any other model. Hence, Bi-LSTM combined with either CNN or RNNperforms better than other deep learning algorithms like simple RNN, CNN, unidirectional LSTM-RNN and Vanilla RNN. Therefore, it can be concluded that any deep learning hybrid models shows better outcomes than the non-hybrid first base methods.

CONCLUSION

In this paper, different deep learning and machine learning algorithms were employed to train the model for identifying Fake news. Some traditional machine learning approaches, such as NLP, Bi- MPM, classification algorithms etc., and deep learning approaches like RNN, Bi-LSTM, RNN are discussed for visualizing accuracy. From aforementioned literature review, it's evident that deep learning approaches, such as hybrid models of CNN, RNN, and Bi-LSTM performed better than the traditional machine learning approaches. This study paves a way

to select a best approach to trainthe model for Fake News Detection.

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