FAKE DETECT: A DEEP LEARNING ENSEMBLE MODEL FOR FAKE NEWS DETECTION

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ABSTRACT:

Intentionally deceptive content presented under the guise of legitimate journalism is a worldwide information accuracy and integrity problem that affects opinion forming, decision making, and voting patterns. Most so-called 'fake news' is initially distributed over social media conduits like Facebook and Twitter and later finds its way onto mainstream media platforms such as traditional television and radio news. The fake news stories that are initially seeded over social media platforms share key linguistic characteristics such as making excessive use of unsubstantiated hyperbole and non-attributed quoted content. In this paper, the results of a fake news identification study that documents the performance of a fake news classifier are presented. The Textblob, Natural Language, and SciPy Toolkits were used to develop a novel fake news detector that uses quoted attribution in a Bayesian machine learning system as a key feature to estimate the likelihood that a news article is fake. The resultant process precision is 63.333% effective at assessing the likelihood that an article with quotes is fake. This process is called influence mining and this novel technique is presented as a method that can be used to enable fake news and even propaganda detection. In this paper, the research process, technical analysis, technical linguistics work, and classifier performance and results are presented. The paper concludes with a discussion of how the current system will evolve into an influence mining system.

1. INTRODUCTION

Fake news is also known as deceptive news or misinformation. A news story is a piece of fake news if its authenticity is verifiable false, and it intends to mislead the reader. As compared to fake news, the authenticity of legitimate news is verifiable real, and it plans to convey authentic information to the users (Abonizio et al., 2020). Fake news can take on numerous structures including, edited text stories, photoshopped pictures, and unordered video clips. Fake news is similar in appearance to legitimate news, but the aims are different. The aims of spreading fake news are multipurpose, including deceiving readers into benefiting the author, propaganda

about a politician to win the election, increased sale of a product by posting fake positive reviews to benefit a businessman, and defame a showbiz star (Monteiro et al., 2018). There are numerous hazardous impacts on our society of the proliferation of fake news. Fake news changes the manner of the individual to interpret and reply to legitimate news. Besides, fake news makes individuals skeptical by destroying consumers' trust in the media by posting fabricated and biased news stories (Agarwal & Dixit, 2020).

Spreading fake news is not a new problem in our time. Before the advent of the internet, fake news was transmitted through face-to-face (oral), radio, newspaper, and television. In recent years with the advent of the computer, the internet, smartphones, websites, news blogs, and social media applications have contributed to transmitting fake news. There are several reasons for spreading fake news through the internet and social media. It requires less cost and time than traditional news media. It is very easy to manipulate legitimate digital news and share the fabricated news story rapidly. Since 2017, there has been a 13% global increase in social media users (Kaur, Kumar & Kumaraguru, 2020). Fake news influences different groups of people, products, companies, politicians, showbiz, news agencies, and businessman.

It requires more energy, cost, and time to manually identify and remove fake news or fake reviews from social media. Some previous studies conclude that humans perform poorly than automated systems to separate legitimate news from fake news (Monteiro et al., 2018). For the last few years, machine learning methods' focus is to differentiate between fake and legitimate news automatically. After the U.S. presidential elections in 2015, few popular social media applications like Twitter, Facebook, and Google started to pay attention to design machine learning and natural language processing (NLP) based mechanisms to detect and combat fake news. The remarkable development of supervised machine learning models paved the way for designing expert systems to identify fake news for English, Portuguese (Monteiro et al., 2018; Silva et al., 2020), Spanish (Posadas-Durán et al., 2019), Indonesian (Al-Ash et al., 2019), German, Latin, and Slavic languages (Faustini & Covões, 2020). A major problem of machine learning models is that

different models perform differently on the same corpus. Their performance is sensitive to corpus properties like corpus size, distribution of instances into classes (Pham et al., 2021). For example, the performance of K-nearest neighbor (KNN) depends on the number of nearest points (k) in the dataset. Support Vector Machine (SVM) suffers from numerical instability when solving optimization problems (Xiao, 2019). Similarly, the performance of an artificial neural network is prone to optimal architecture and tuning its parameters (Pham et al., 2021).

Ensemble learning is considered an efficient technique that can boost the efficiency of individual machine learning models, also called base-models, base-predictors, or base-learners, by aggregating the predictions of these models in some way (Lee et al., 2020). Ensemble learning aims to exploit the diversity of base-predictors to handle multiple types of errors to increase overall

performance. Ensemble learning techniques show superior performance in various recent studies about fake news detection. In a recent study, the ensemble learning technique outperformed the four deep learning models including the deep structured semantic model with RNN, intentCapsNet, LSTM model, and capsule neural network (Hakak et al., 2021). In another recent study, Mahabub (2020) applied eleven machine learning classifiers including the neural network-based model MLP on a fake news detection corpus. After that, three out of eleven machine models were selected to ensemble a voting model. Ensemble voting with soft voting outperformed the other models. Gutierrez-Espinoza et al. (2020) applied two ensemble methods bagging and boosting with SVM and MLP base-predictors to detect fake reviews detection. Experiments show that boosting with MLP outperforms the other.

This can be achieved in numerous ways, including homogenous models with diverse parameters, heterogeneous models, resampling the training corpus, or using different methods to combine predictions of base-predictors (Gupta & Rani, 2020). Ensemble learning can be of two types: parallel and sequential. In the parallel ensemble, base-predictors are trained independently in parallel. In the sequential ensemble, base-predictors are trained sequentially, where a model attempts to correct its predecessor (Pham et al., 2021). Ensemble learning methods have shown good performance in various applications, including solar irradiance prediction (Lee et al., 2020), slope stability analysis (Pham et al., 2021), natural language processing (Sangamnerkar et al., 2020), malware detection (Gupta & Rani, 2020), traffic incident detection (Xiao, 2019). In the past, several studies explored machine learning models for fake news detection task in a few languages like Portuguese (Monteiro et al., 2018; Silva et al., 2020), Spanish (Posadas-Durán et al., 2019; Abonizio et al., 2020), English (Amjad et al., 2020; Amjad, Sidorov & Zhila, 2020), Arabic (Alkhairet al., 2019), Slavic (Faustini & Covões, 2020; Kapusta & Obonya, 2020), and English (Kaur, Kumar & Kumaraguru, 2020; Ozbay & Alatas, 2020). As compared to machine learning, a few efforts have been made to explore ensemble learning for fake news detection like Indonesian (Al-Ash & Wibowo, 2018; Al-Ash et al., 2019), English (Kaur, Kumar & Kumaraguru, 2020; Sangamnerkar et al., 2020). Therefore, this study aims to investigate ensemble learning methods for the fake news detection task.

2. LITERATURE SURVEY

Wang et al. [3] implemented a logistic classifier to detect deceiving web pages that consist of artifice news. Their approach is heavily based on a model that identifies keywords in the URL and then classifies the particular web page. The implementation results yielded maximum accuracy in a random tree model with 99.3%. But the usage of URL prediction to calculate fake news leads to an over road conclusion.

Weijie, Wang et a l. [6] worked on imp le menting a deep neural network, RNN to form a hybrid network that concatenates metadata and extracted news features to build a neural network mode l that provides the classification and result. Their NN model on the CSI dataset performed with an accuracy of 89.2%. Seo et al. [1] in their approach proposed a hybrid attention-based LSTM model fo r this task. It takes up two distinctive features of using the profile as an attention factor and provides LSTM to incorporate this additional data.

There have been approaches to using deep learning techniques to predict the accuracy of the news.

Baja j [2] incorporated several neural network le-aring systems on two different datasets composed of fake and original news artic les and observed that classifiers based on GRU and LSTM produced more accurate results than the classifiers based on convoluted neural network.

Xingyou Wang et al. [6] co mb ined CNN and RNN models for sentiment analyses on short texts due to lesser words in the text.

William Wang [14] provided a dataset 'Liar' which had been used by researchers to create a novel solution. Reddy et al. [12] and achieved an accuracy of 82% in the detection stage using techniques of natural language processing for news outlet stance detection.

Arjun et al. [13] work on fake news detection through the use of images to verify news was based on utilizing visual features and coherence scores. They also considered the statistical features of images like count and image ratio. They achieved an accuracy of about 83%.

3. PROPOSED SYSTEM

we are investigating the issue of fake news detection in the English language. The major aim of this study is to explore the capability of ensemble learning models in improving fake news predictions in resource-poor language English. Our significant contributions to this study have been summarized below:

- We manually built an annotated news corpus composed of English news articles distributed into legitimate and fake categories.
- We perform several experiments using three diverse traditional machine learning classifiers Naïve Bayes (NB), Decision Tree (DT), and SVM, and five ensemble models, including Stacking, Voting, Grading, Cascade Generalization, and Ensemble Selection, to achieve improved prediction quality relative to conventional individual machine learning models.
- We investigate the performance of our models using three feature sets generated through character-level, word-level, and statistical-based feature selection methods.
- We report experiments of both machine learning and ensemble learning models on two fake news corpora of the English language.
- We comparatively analyze the performance of our models using four performance measures, including balanced accuracy, the area under the curve, time and mean absolute error.

Procedure of Implementation:

Dataset preparation and preprocessing

Articles in the corpus are in an unstructured format and cannot be processed directly by the machine learning models. We must have to perform a series of operations on the corpus to convert an unstructured corpus into a structured corpus. We have cleaned and processed both corpora's news articles before generating the feature vectors for feature selection. We tokenized the text using space characters. Special characters, email addresses, and website URLs were removed from the text. After cleaning the text, we removed the most frequent and rare words of the Urdu language (also known as stopwords) from the text. The cleaned and the preprocessed articles were converted into numeric feature vectors using the

term frequency-inverse document frequency (TF-IDF) method as used in a recent study (Ozbay & Alatas, 2020). Both corpora were passed through the same number of preprocessing steps.

Feature selection

In our experiments, we have performed the experiments using three feature selection methods character tri-grams, BOW, and information gain (IG). A recent study shows the superiority of the character n-gram method over word-level n-grams in short text classification tasks (i.e., offensive language detection) in Urdu text comments (Akhter et al., 2020b). Character n-gram is a contiguous sequence of characters in the text. In character n-grams, the value of n is taken as three, which means the combination of three characters makes a tri-gram feature. From the UFN corpus, 1,084-character n-grams, and from the BET corpus 1,091 n-grams were extracted. BOW is a content-based feature representation in which a news article is represented as a set of words that occur in it at least once. IG measures the goodness of the features in the text. A comparative study concludes that IG is the best feature selection method for document-level text classification of Urdu. In our experiments, we have selected the top one thousand IG features from both corpora. A total of 1,225 and 1,214 Bow features from BET and UFN, respectively.

Heterogeneous machine learning models

In our experiments, for machine learning classification, we use three individual machine learning models NB, SVM, and DT to detect fake news. All three models are heterogeneous. The working of these models is entirely different from each other. Using character-level n-grams from text articles, these models analyze the article's text and classify it into one of the categories legitimate or fake. Detail description of these machine learning models is given in "Machine Learning Models".

Ensemble learning models

Ensemble classification is usually based on two levels: base-level and ensemble-level. We use three diverse machine learning models, SVM, DT, and NB, as base-predictors at the base-level. Input to these base-predictors is the character-level n-grams extracted

from the news articles. Output predictions of these base-predictors are input to ensemble- level models. The basic aim of using the ensemble model is to overcome the base- predictors' shortcomings and improve overall prediction accuracy. We use five ensemble models for ensemble classification, known as Voting, Grading, Stacking, Cascading Generalization, and Ensemble Selection. A brief description of our ensemble models is given in "Naïve Bayes".

Performance measures

To compare the performance of individual machine learning models and ensemble learning models, in this study, we employed the three well-known performance measures mean absolute error (MAE), balanced accuracy (BA), and area under the curve (AUC).

User Interface:

Admin will have login, he can login and choose the data set for analysis.

Admin will have option to load the dataset to system for analysis, and he can view the result.

The background process is defined as below.

To find out the fake news, certain steps must be followed. i.e., Preprocessing, Feature extraction, Training of classifier and Classification. Preprocessing of data set, is bringing all the data into structured data. Then comes extracting features of a preprocessed data.

4. CONCLUSION

Fake news detection through ensemble models is the most prominent topic of machine learning. If the traditional machine learning models are used for fake news detection task, the performance is not encouraging because their performance is limited to corpus characteristics. In this study, we deliberately choose ensemble methods to classify fake and legitimate news article.

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