FAKE NEWS DETECTION

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***Abstract*—Categorizing a news statement as a 'real news' or 'fake news' using machine learning techniques. The classification is a binary one.**

The spread of fake news and misinformation is causing serious problems to society, partly due to the fact that more and more people only read headlines or highlights of news assuming that everything is reliable, instead of carefully analyzing whether it can contain distorted or false information. The authenticity of Information has become a longstanding issue affecting businesses and society, both for printed and digital media.

In this Project, we will use various natural language processing techniques and machine learning algorithms to classify fake news articles using sci-kit libraries from Python with maximum accuracy using just the headline of the news. We will create a simple frontend containing search bar for typing headline and result tells if its fake or real based on chosen candidate classifier model trained on a dataset.

***Index Terms*—NLP, Deep Learning Models, Naive Bayes , LSTM.**

I. Introduction

The motive behind creating a fake news is basically to mislead people by making them fall prey to a variety of hoaxes, propaganda and inaccurate information. There are articles that are either completely false or just random opinion pieces presented as news. Some of the major platforms for the spread of fake news include Facebook, Twitter, Whatsapp, Reddit, etc. Often, false news try to mimic real headlines and manipulate the content. In today's world most of the organizations employ the use of social media and hence own the accounts on Twitter, Facebook and Instagram for multiple business purposes such as announcing corporate information, advertisement regarding new product releases, etc. Consumers, investors, and other stake holders take these news messages as seriously as they would for any other mass media. Detecting misleading information on social media is an extremely important but also a technically challenging problem. The difficulty arises from the fact that even the human eye cannot accurately distinguish true from false news. The prevalence of Fake news enforced a great impact over the entire democracy during the US Presidential Elections held in the year 2016. Media later stated that since a lot of US adults tend to use social media to get news, it was definitely the reason why Donald Trump was favoured over Hillary Clinton.In India the spread of fake news has reached a new peak since 2019 with multiple events, from the general elections and Pulwama attack to scrapping of Article 370 and the ongoing protests against the Citizenship Amendment Act, as well as the recent crisis which has been taking a hit due to the outspread of Corona Covid-19 virus. All these events triggering lead to a massive spread of misleading news and opinions across multiple social media platforms. In this paper we propose a method for identification of the fake news using a few Machine Learning algorithms such as Naïve-Bayes, Support Vector Machine (SVM), Logistic Regression and Deep learning algorithms like LSTM's and Neural Networks using Keras. Our project consists of two major sections: In the first section we perform comparative analysis between different algorithms viz. Naïve-Bayes, SVM, Neural Networks using Keras, and Recurrent Neural Networks (LSTM). In the second part we retrieve the real time tweets from twitter and classify them as suspicious and non-Suspicious based on text as well as user characteristics using the Logistic Regression Classifier.

II. COMPARITIVE ANALYSIS

This will be our first level of implementation in which we will perform the classification on the dataset using four different algorithms. The result will be displayed for each algorithm with its individual accuracy score. We will be using the following four algorithms: Naïve-Bayes, Support Vector Machine, LSTM using Recurrent Neural Networks and Keras Neural Network and Logistic Regression.

A. Dataset

LIAR is a publicly available dataset for fake news detection. A decade-long of 12.8K manually labeled short statements were collected in various contexts from POLITIFACT.COM, which provides detailed analysis report and links to source documents for each case. This dataset can be used for fact-checking research as well. Notably, this new dataset is an order of magnitude larger than previously largest public fake news datasets of similar type. The LIAR dataset4 includes 12.8K human labeled short statements from POLITIFACT.COM's API, and each statement is evaluated by a POLITIFACT.COM editor for its truthfulness. We use the TSV format of dataset which has total of 14 columns , where in few cases we have used only label and statement columns for training and testing data.

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B. Work flow Diagram

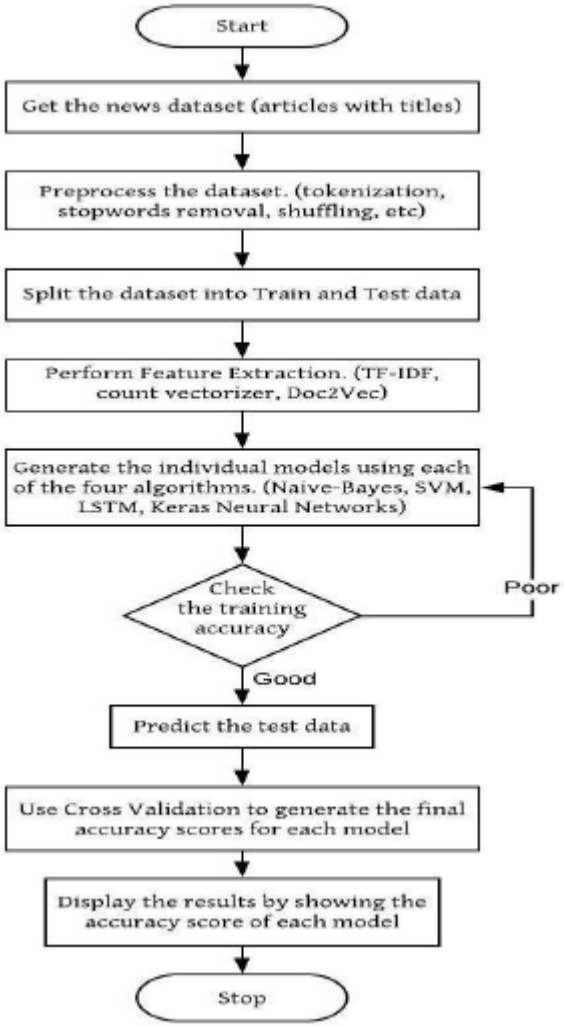

Fig. 1. Flowchart for Comparative Analysis

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C. Data Pre-processing

In this section we present various pre-processing techniques applied on the data from the dataset. The dataset downloaded from kaggle had a lot of raw data including missing rows and columns. Thus we first need to process this data and then split it into train and test data set. Some of the common data processing techniques which we have used in our project include: stopwords removal, stemming, tokenization and POS tagging.

- **Tokenization:** Tokenization is a process in which the sequence of string is broken into pieces such as keywords, words, phrases, symbols, etc. called as tokens. In the process of tokenization, some characters like punctuation marks are discarded. All characters within contiguous strings are part of the token.
- **Stopwords:** Stop words are actually the most common words in any language (like articles, prepositions, pronouns, conjunctions, etc) and does not add much information to the text. Examples of a few stop words in English are “the”, “a”, “an”, “so”, “what”.Removal of stop words definitely reduces the dataset size and thus reduces the training time due to the fewer number of tokens involved in the training.

D. Feature Extraction

In this section we have enlisted the various feature selection methods which we have performed using sci-kit learn python libraries.

- **Count Vector:** The Count Vectorizer provides a simple way to both tokenize a collection of text documents and build a vocabulary of known words, but also to encode new documents using that vocabulary. An encoded vector is returned with a length of the entire vocabulary and an integer count for the number of times each word appeared in the document.
- **TF-IDF:** The Term Frequency is used to summarize how often a given word appears within a document. Inverse Document Frequency is used to downscale words that appear a lot across documents. It also allows you to encode new documents. a) A vocabulary of words is extracted from the news article and each word is assigned a unique integer value in the output vector. b) We then calculate the inverse document frequencies for each word in the news article, and assign a lowest value of 1.0 to the word which occurs most frequently. c) Next, we encode the article using n-element sparse array and we can view the scores of each word having different values from the other words present in the document. We then normalize these scores by mapping them to a value between 0 and 1. Thus the document vectors are now encoded and can be used as an input to our four different classifiers.
- **Skip Grams:** word2vec is a class of models that represents a word in a large text corpus as a vector in n-dimensional space(or n-dimensional feature space) bringing similar words closer to each other. One such model is the Skip-Gram model. Skip-gram Word2Vec is an architecture for computing word embeddings. Instead of using surrounding words to predict the center word, as with CBow Word2Vec, Skip-gram Word2Vec uses the central word to predict the surrounding words.

E. Classifiers used to train our model:

- **Naive Bayes:** In machine learning, naive Bayes classifiers are a family of simple probabilistic classifiers based on applying Bayes theorem with strong (naive) independent assumptions between the features. Bayes classifiers evaluate every feature independently, which means it does not consider the interdependency between the values of two or more features. It typically use bag of words features

to identify spam news, a commonly used approach in text classification. The main idea is to treat each word of the news article independently. It considers the fact that, fake news articles often use the same set of words, which may indicate, that the specific article is indeed a fake news article.

- **LSTM:** Long short term memory is an extension of the RNN (Recurrent Neural Network). In addition to RNN, LSTM's also have memory over the long run. It comprises of three gates namely input gate, output gate and forget gate. The forget gate is used to forget features that have little value or weight. As the algorithm keeps running, it learns what is important and what is not by assigning the weights accordingly. This characteristic makes it the best fit for our news data, as the corpus is extensively large and we need to eliminate the unwanted data to predict the right label on the text. We feed our news article content to the LSTM unit in the vector embedded form, after it has been tokenized into words. For our project we have used the Sequential LSTM model. Each word is given to a separate LSTM unit.

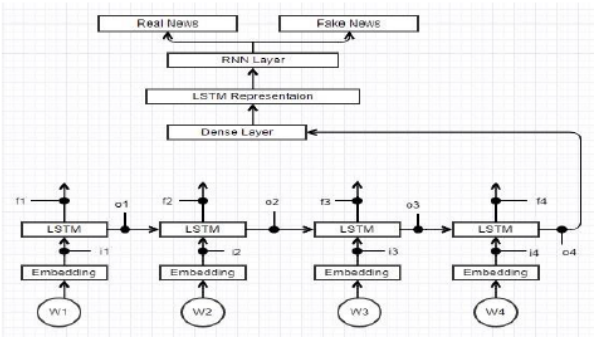

Fig. 2. Working of LSTM

The basic LSTM unit is as follows: In Figure 2, (i1, i2, i3) represent the input gates; (o1, o2, o3) represent the output gates; (f1, f2, f3) represent the forget gates and (w1, w2, w3) represent the tokenized words from the news articles. 1. Every word of the news article is embedded into a vector form and given as an input to the LSTM unit through the input gate. 2. The LSTM unit calculates the weight of the word and produces an output via the output gate. This output is then concatenated with the input of the next LSTM unit. This unit now calculates the combined weight of the two words. If a particular word or phrase is found to be redundant, the LSTM unit discards it via the forget gate. The important features evaluated are stored in the memory of LSTM in order to identify the similar features from the next input more efficiently. 3. This process is carried out sequentially, till the entire news article is evaluated. The output is then passed to the dense layer which summarizes the received output and converts it into a proper LSTM representation. 4. This representation is then passed on to the RNN layer. The RNN layer also receives other features such as the title, author and label from the dataset. Based on these features along with the LSTM encoded news article, it evaluates the functions and classifies the news as Real or Fake.

- **Support Vector Machine:** A support vector machine (SVM), is also considered to be a supervised learning algorithm. SVMs work by being trained with specific data already organized into two different categories. Hence, we construct a model after it has already been trained. Furthermore, the goal of the SVM method is to identify which category any new data falls under, as well as, it must also maximize the margin between the two classes.
- **Logistic Regression:** For the classification of our real-time tweets extracted from twitter, we have used the Logistic Regression classifier. Various text as well as user features extracted are given as an input to the classifier. Logistic Regression is a supervised machine learning algorithm that is used to predict the probability of a categorical dependent variable. In logistic regression, the dependent variable is a binary variable that contains data coded as 1 (true, success, etc.) or 0 (false, fail, etc.). It uses gradient descent to converge onto the optimal set of weights for the training set.

F. Implementation

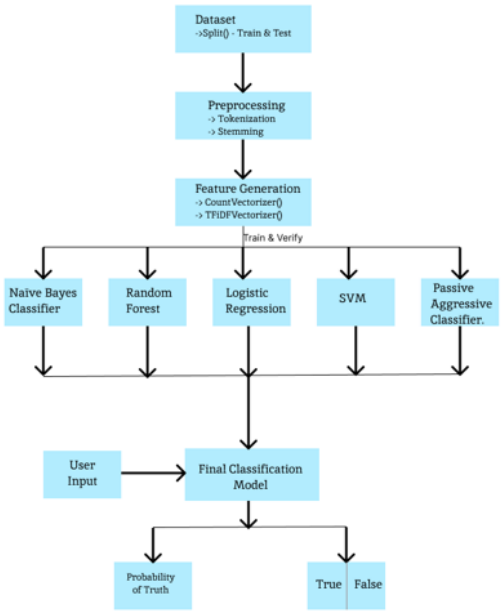

Fig. 3. WorkFlow for Implementation

The Dataset going to be used is LIAR dataset. Steps of implementation of project:

- Preprocessing data by data cleaning. This involves removing punctuation, tokenization, remove stopwords, stemming.
- Feature Generation : We can use text data to generate a number of features like word count, frequency of

large words, frequency of unique words, n-grams and Skip grams etc. By creating a representation of words that capture their meanings, semantic relationships, and numerous types of context they are used in, we can enable computer to understand text and perform Clustering, Classification etc.

- Training Using algorithms : Naïve Bayes Classifier, Logistic Regression, SVM, LSTM.
- After fitting all classifiers, select best performing model as candidate one (based on classification report) for fake news detection.

III. RESULTS

In this section we discuss the results by calculating the accuracies of the various models mentioned in the comparative analysis. The accuracy, precisions and f1 score can be computed with the help of confusion matrices.

- LOGISTIC REGRESSION: 58.93
- SVM: 57.81
- LSTM: 61.61
- NAIVE BAYES CLASSIFICATION: 60.97

CONCLUSION AND FUTURE WORKS

In this paper, we have presented a model for fake news detection using a variety of machine learning and deep learning algorithms. Furthermore, in the first level of implementation, we investigated the four different classifiers and compared their accuracies. The model that achieves the highest accuracy is LSTM and the highest accuracy score is 61

In future we thought of working with real time data instead of using existing dataset.Visual presentation also plays a huge role in people believing in fake news. Hence in the future work we need to verify not just the language but also the images and audio embedded in the content.

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