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FAKE AND REAL NEWS DETECTION USING MACHINE LEARNING TECHNIQUES AND PYTHON

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ABSTRACT

In the new media age, fake news has become a widely known occurrence. The spread of false news refers to the rapid dissemination of false or misleading information through various media platforms, often with the intention to device or manipulate the public, and can direct to debates, social media wars and hatred arguments. To detect fake news, our proposed framework extracts the data from the news articles and the social contexts. This proposed model is based on Machine Learning techniques, which has four components namely data storage, abstraction, generalization and evaluation. Challenge in fake news detection is to detect it in the earlier phase and the unavailability or the shortage of labelled data for training the detection models. In this paper, the dataset is chosen relatively to real and fake news detection. Determining the accuracy and precision of the entire dataset sets the objective of this paper. The analysis had been done using Python and the outcomes are envisioned in the form of graphs. The outcomes showed the certitude that the dataset grabs 95% of the accuracy. The number of actual predicted cases is coded and the result obtained is 296. Upshots of this paper reveals that the accuracy of the model dataset is 95.26 % the precision results 95.79 % whereas recall and F-Measure shows 94.56% and 95.17% accuracy, respectively. There are 296 positive attributes, 308 negative attributes 17 false positives and 13 false negatives in the predicted models. This research advocates that legitimacy of news should be inspected first instead of framing an opinion and its performance is based on predicting real and fake news which speaks about the ethics of both journalists and news consumers.

Keywords: Fake News Detection, F-Measure, Machine Learning, Python, Social Contexts

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INTRODUCTION

The information that is misleading or false and is presented as real news is said to be the fake news (Shu *et al*., 2020) During the 2016 presidential elections in United States, the term 'fake news' became popular. Following from this, Google, Twitter, Facebook took steps to fight against fake news. However, distinguishing between real and fake news has become difficult due to the exponential growth of information in online news portals and social media sites. After making necessary research on the defined issue, we consider and built up an opinion, regarding fake & real. This fake news is controlled by variety of fields and business to fulfill political agenda and they are often perceived as one of the greatest threats to democracy, independence and national interests.

Usually, the fake news detection methods are trained on the present information (available during that time), which may not hypothesize to future events. With the newly developed events, many of the labelled samples from the verified fake news get outdated soon. Consider an example, before the COVID-19 a model that is trained on fake news data may not classify fake news properly during that period. Concept drift is one problem of dealing with a target concept (e.g., news as 'real' or 'fake') when the underlying relationship between the input data and target variable changes over time (Hoens *et al.,* 2012)

This paper addresses the challenges to identify fake news. For fake news detection we introduce a novel framework based on a deep neural network architecture. The existing works, in this regard, rely on the content of news (Jwa *et al.,* 2019; Liu *et al.,* 2019; Kaliyar *et al.,* 2020), social contexts (Mohammad Rezaei *et al.,* 2018; Popat *et al.,* 2018; Shu *et al.,* 2019; Yang *et al.,* 2019; Liu *et al.,* 2020; Zellers *et al.,* 2020), or both (Nguyen *et al.,* 2020; Shu *et al.,* 2019). The first phase of the paper explains about literature review regarding to the defined dataset i.e., fake news detection. The second phase deals with the methodology. The third part discusses the research results based on the detailed analysis. The fourth phase deals with Discussion, conclusion and references.

LITERATURE REVIEW

Balmau *et al., (*2018) in their research describe the fact that Today's social media platforms enable to spread both authentic and fake news very quickly. They developed a mechanism to limit the spread of fake news which is not based on content, by using a Bayesian approach, They estimated the trustworthiness of future news items. They also evaluated the effectiveness and overhead of this technique on a large Twitter graph. They identified that more than 99% of fake news items with no false positives. The performance impact is very small: the induced overhead on the 90th percentile latency is less than 3%, and less than 8% on the throughput of user operations.[14] Brody *et al.,* (2018) In their research consider fake news as a danger to democracy. According to them until now there has been no clear understanding of how to define fake news, and how to model the paper addressing both these issues. So, they used two approaches for the designing of fake news and its effects in elections an referendums. The first approach is based on the idea of a representative voter, is shown to be suitable to obtain a qualitative understanding of phenomena associated with fake news at a macroscopic level. Whereas the second approach, based on the idea of an election microstructure, describes the collective behaviour of the electorate by modelling the preferences of individual voters. Results of their study shows that the mere knowledge that pieces of fake news may be in circulation goes a long way towards mitigating the impact of fake news. Monti *et al.,* (2019) in their research consider social media as one of the main news sources for millions of people around the globe due to their low cost, and easy They used core algorithms of classical convolutional neural networks to graphs, activity, social graph, and news propagation. Their model was trained and tested on news stories, verified by professional fact-checking organizations, that were spread on Twitter. Their results showed that social network structure and propagation are important features allowing highly accurate. Secondly, they observed that fake news can be reliably detected at an early stage, after just a few hours of propagation. Third, they tested the aging of their model on training and testing data separated in time. Vicario, *et al.,* (2019) in their research introduced a framework for promptly identifying polarizing

content on social media and, thus, predicting future fake news topics. They validated the performances of the proposed methodology on a massive Italian Facebook dateset, showing that they are able to identify topics that are susceptible to misinformation with 77% accuracy. They also able to recognize fake news with 91% accuracy. Their results concluded the fact that a series of characteristics related to users' behavior on online social media such as Facebook is an important step towards the mitigation of misinformation phenomena by supporting the identification of potential misinformation targets and thus the overall design of tailored counter-narratives.

Kleinberg *et al.,* (2017) in their research describe the fact that the production of misleading information in everyday access media outlets such as social media feeds, news blogs, and online newspapers have made in a challenging manner to detect trustworthy news sources and hence enhancing the requirement for computational able to provide insights into the reliability of content which is present online. They are basically focusing on the automatic identification of fake content in online news. For the task of fake news detection, they introduced two novel datasets, which covers seven different news domains. They also described the collection, annotation, and validation process in detail and presented several exploratory analyses on the identification of linguistic differences in fake and legitimate news content. Nextly, they organized a set of learning experiments in order to build accurate fake news detectors. In addition, they provided a comparative analyses of the automatic and manual identification of fake news. Furthermore, they also addressed the task of automatic identification of fake news. They introduced two new fake news datasets, one obtained through crowd sourcing and covering six news domains, and another one obtained from the web covering celebrities. They developed classification models that rely on a combination of lexical, syntactic, and semantic information, as well features representing text readability properties. The results of their model showed that they Our best performing achieved accuracies that are comparable to human ability to spot fake content. Wang *et al.,* (2017) In their research consider Social media for news consumption as a double-edged sword. On the one side, its easy access, low cost and rapid dissemination of data makes people to seek out and consume news from the social media. Besides, it enables the wide spread of fake news", i.e., low quality news with intentionally false information or data. The extensive spread of fake news has the potential for extremely negative impacts on both individuals and society. Therefore, fake news detection on social media has recently become an emerging or trending research that is seeking tremendous attention. They also describe the fact that Fake news detection on social media presents unique characteristics and challenges that make existing detection algorithms from traditional news media incentive or not applicable. Fake news are intentionally written to mislead readers to believe false information, which makes it difficult and nontrivial to detect based on news content; They included auxiliary information, such as social engagements on social media platforms which helps in making a determination. Second, by exploiting this auxiliary data is complicated for users where social engagements with fake news provides data which are noisy, incomplete and extremely big. We conducted this survey to further facilitate research on the problem because the issues of fake news detection on social media is really relevant and challenging. They presented a comprehensive review of detecting fake news on social media, including fake news characterizations on psychology and social theories, existing algorithms from a data mining perspective, evaluation metrics and representative datasets. They also discussed related research areas, open problems, and future research directions for fake news detection on social media.

METHODOLOGY

PROBLEM DEFINITION:

The task of fake news detection is to determine if a news item is fake or real, given a ***multi-source news dataset*** and ***social contexts*** of news consumers (social media users). Basically, the problems of fake news detection are defined as :

- Input – It includes news items, associated side information and social contexts
- Output – It possesses one of the two labels namely 'fake' or 'real'.

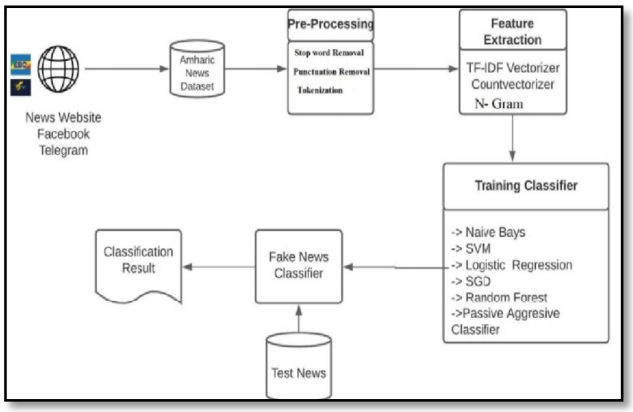

Figure 1 - Overall model

MACHINE LEARNING TECHNIQUES:

To detect fake news, Machine learning techniques are used. The experiments employ three common methods namely Naive Bayes, Neural Networks, and Support Vector Machines. Based on the news content methods for identifying fake news need to be developed urgently.

Methods

Using the machine learning algorithm ***Naive Bayes,*** we handle the categorization issues. Its foundation is the Bayes Theorem. It is one of the most basic yet effective ML algorithms in use and has uses across many sectors. Consider a scenario in which you have a classification problem to tackle, have produced the features and the hypothesis, but your superiors still demand to see the model. To train the data set, you have thousands of data points and several factors. Use of the Naive Bayes classifier, which is far quicker than other classification algorithms, would be the best course of action in this case. The Bayes' Theorem is used by Naive Bayes, which also presupposes that each predictor is independent. The Naive Bayes model is easy to construct and facilitates working with large datasets. Additionally, this equation is well-known for outperforming a number of sophisticated classification algorithms in terms of performance.

Here's the equation for Naive Bayes:

$$P(a \mid b) = P(b \mid a)\, P(a) \,/\, P(b)$$

$$P(a \mid b) = P(b1 \mid a) \times P(b2 \mid a) \times \ldots P(bn \mid a) \times P(a)$$

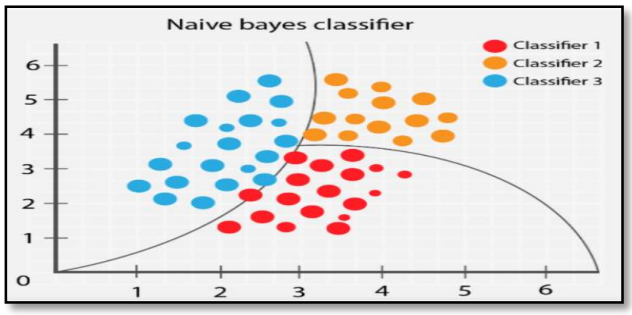

Figure 2 - Naive Bayes

Deep learning techniques are based on ***Neural Networks***, sometimes referred to as Artificial Neural Networks (ANNs) or Simulated Neural Networks (SNNs), which are a subgroup of machine learning. The SVM nomenclature and structure are designed only after human brain, mirroring the interaction between the organic neurons. An input layer, one or more hidden layers and an output layer is the node layer of an Artificial Neural Networks (ANN). Artificial neuron, or each node, is connected to others and holds a threshold or a weight that goes along with it. Any node whose output exceeds beyond the defined threshold value is activated and it begins providing data to the network's uppermost layer. Training data is crucial for neural networks to evolve and enhance their precision over time.

However, these learning algorithms become effective implement in computer science and artificial intelligence once they are adjusted for precision, enabling us to quickly arrange and cluster data. Tasks in speech recognition or picture recognition can be done within minutes as opposed to hours when we compare it to manual identification by human experts. A neural network that is most well-known is the Google's search algorithm.

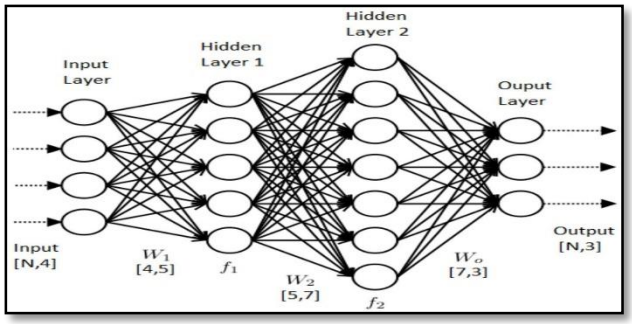

Figure 3 - Neural Networks

Support Vector Machine or SVM is one of the most well-liked supervised learning algorithms which is used to solve Classification and Regression problems. However, it is also employed in Machine Learning Classification issues in larger manner. The objective of this SVM algorithm is to establish the decision boundary or the best line that can divide n-dimensional space into classes, allowing us to quickly classify fresh data points in the future. The name that is given to this optimal decision boundary is called the hyperplane. SVM selects the extreme vectors and points that aid in the design of the hyperplane. The basis for SVM method is formed by the Support Vectors which are used to represent those extreme instances. SVM can be classified into two categories. ***Linear SVM*** is employed for linearly separable data, which is defined as data that can be divided into two groups using a single straight line. Linear SVM classifier is the classifier used for such data. ***Non-linear SVM*** is used for non-linearly separated data, which implies that if a data set cannot be grouped using a straight line, it is considered to be non-linear data, and this classifier employed is called the Non-linear SVM classifier.

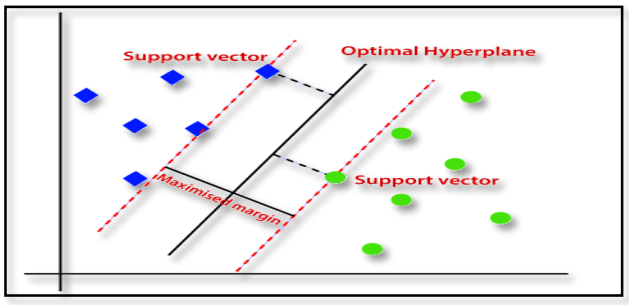

Figure 4 - Support Vector Machine(SVM)

Strategies for applying Machine Learning for detecting fake news

Using ***Natural Language Processing*** (NLP) methods is one strategy to examine the language that is being used in the news story. NLP algorithms can be used to recognize the language patterns which are frequently present in publications that purport to be the news. For instance, false news pieces frequently utilize spectacular titles, distort facts and employ more emotive languages. By examining the language, Machine Learning algorithms can determine whether an article is legitimate or fraudulent.

Employing ***Network analysis*** is another methodology for detecting the fake news. The network of social media accounts that are disseminating the news is analysed by using machine learning algorithms in this method. The spreading of false news pieces is frequently through a network of phoney accounts or automated programmes. By examining these networks of accounts which are disseminating the news, Machine Learning algorithms can find patterns which are frequently present in networks of fake news.

Thirdly, the phoney news items can be identified and detected by the usage of machine learning algorithms using the method ***Fact-checking databases***. Based on the use of databases, Cross-Checking the statements that were made in the news story can be done and this contains data which has facts those are confirmed already. By comparing the facts that are in the database to news report, the credibility of the news statements can be evaluated through the machine learning algorithm.

Categories

Detection of fake news by using machine learning is still only in its early phase. Even though having serious issues, Machine Learning has the potential to combat and tackle the problem of fake news. In order to lessen the effect of fake news, machine learning can be used for detecting false information before it can spread. Machine learning algorithms used for fake news detection can be divided into two main categories namely supervised and unsupervised learning.

Supervised learning algorithms are trained based on labelled datasets, in which every news article is labelled in two categories namely real or fake. The algorithm learns from the dataset that is labelled and is then used to classify the new news articles into either real or fake. Concepts like logistic regression, decision trees, support vector machines and neural networks are all Supervised learning algorithms.

Unsupervised learning algorithms, on the other side, does not require labelled datasets. Based upon the similarities, they group news articles into clusters. This clustering technique then identifies the features of those clusters which contains the fake news articles. Concepts like k-means clustering, association rule learning and hierarchical clustering are all Unsupervised learning algorithms.

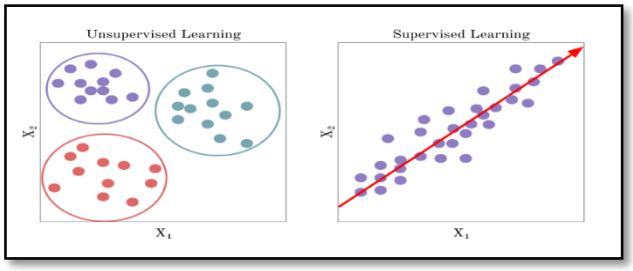

Figure 5 - Supervised and Unsupervised Learning

The term "artificial intelligence" (AI) refers to the application of computerized reasoning. It focuses on the development of computer programs that can information for their own purposes and utilize it for this study's analysis of decision-making, the dataset is processed and interpreted with Python.

PYTHON :

A. The Data

News.csv is the filename for the dataset utilized in this study. The shape of it is 7796*4. The title and content of the news are listed in the second and third columns, respectively, while the fourth column has labels indicating if the news is real or fake.

B. Python

Python is a good programming language for both academic and practical use. It was developed by Guido van Rossum and is a very high-level, object-oriented programming language. It is also renowned for having a large number of libraries that help with data analysis and scientific computing. It is an high-level programming language with lots of libraries and learning resources. It encourages users to keep using it since it allows a large range of third-party tools, which makes it much simpler to use. It also has an elegant syntax. Compared to languages like C++, Java, and C#, Python applications are significantly simpler to read and write. It makes programming enjoyable and enables you to concentrate on the answer rather than the syntax. Additionally, since Python is more forgiving of mistakes. Thus, up until the issue area, you can still compile and run your application. Python is an easy-to-learn programming language. The structural and object-oriented programming paradigms can both be supported by this language.

The steps to be followed are:

- Importing Libraries and dataset
- Pre-processing Dataset
- Generating Word Embeddings
- Model Architecture
- Model Evaluation and Prediction

Prerequisites starts by installing the following libraries with pip:

- pip install NumPy pandas sklearn

To install Jupyter Lab to run your code. Run the following command to get your command prompt:

- C:\Users\DataFlair>jupyter la

A new browser window opens up and now create a new console for using it to run your code. To run multiple lines of code at once, press Shift + Enter.

C. Accuracy

The ratio of the number of correctly classified cases to the total of cases under evaluation is referred to as accuracy of the model. Accuracy is said to be the best when its value is 1 and worst when its value is 0.

D. Precision

When it is defined with respect to either of the classes it is called the precision. The ability of the classifier not to label as positive a sample that is negative is the precision of negative class. Obviously, the ability of the classifier not to label as negative a sample that is positive is the precision of positive class. The best value for the precision is 1 and worst is 0.

E. F-Measure

Amongst the classification models, F-Measure is considered to be the one of the best metrics regardless of class imbalance. The weighted average of recall and precision of the respective classes is the F-Measure in a given dataset. The best value of F-Measure is considered as 1 and the worst value is 0.

F. Recall

Recall can be defined by considering either of the cases. Recall of positive class is also termed as sensitivity and is defined as the ratio of the True Positive to the number of actual positive cases. It can dedicatedly be expressed as the capacity of the classifier to acquire all the positive cases. This can also be termed as True Positive Rate(TPR). Recall of negative class is also termed as specificity and is defined as the ratio of the True Negative to the number of actual negative cases. It can inherently be indicated as the capability of the classifier to capture all the negative cases. It is also referred as the True Negative Rate(TNR).

In the ***confusion matrix***, the variables TP, FP, TN and FN refers to the following:

- True Positive (TP): The number of fake news that are identified as fake news.
- False Positive (FP): The number of real news that are identified as fake news.
- True negative (TN): The number of real news that are identified as real news.
- False negative (FN): The number of fake news that are identified as real news.

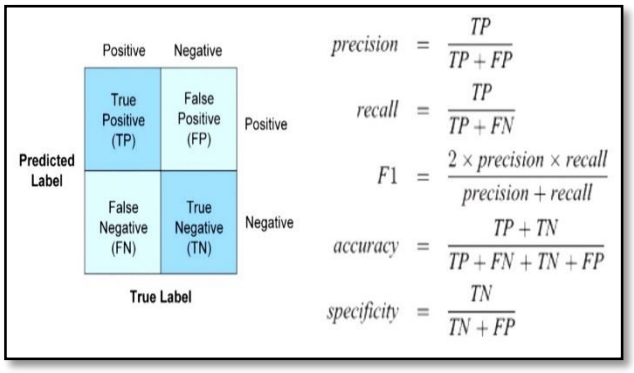

Figure 6 - Formula of accuracy, precision, f-measure and recall

To calculate the AUC, we calculate the true positive rate (TPR) and the false positive rate (FPR).TPR is a synonym for the recall, whereas FPR is calculated as:

$$FPR = FP/\ FP + TN$$

In a binary classifier, the receiver operating characteristic (ROC) will plot the trade-offs between the TPR and FPR at different thresholds. The aggregate measure AUC is used to estimate the performance of the model across all those possible thresholds. The AUC is better at ranking predictions when compared to the accuracy measure ACC. For instance, in the classification if there are a greater number of fake news samples, the accuracy measure may favour the majority class. On the other side, along with the accuracy score the AUC measure gives the score order also called as ranking. The average precision AP which gives the average precision at all possible thresholds is also included, similar to the area under the precision–recall curve.

RESULTS AND DISCUSSION

Python programming tool was used to interpret the results for the specified data collection. The outcomes are displayed using a variety of tables and a bar graph.

RESULTS	VALUES
Accuracy	95.26814
Precision	95.79288
Recall	94.56869
F-Measure	95.17685

Table 1 - Dataset evaluation result

The evaluation findings for the specified dataset are displayed in Table 1. Recall and F-Measure reveal accuracy of 94.56% and 95.17%, respectively, while the model dataset accuracy is 95.26% and precision is 95.79%.

MODEL		PREDICTION YES	PREDICTION NO
Actual	Yes	296	17
Class	No	13	308

Table 2 - Predicted class results

Table 2 shows the predicted class results so with this model we have 296 positive attributes, 308 negative attributes 17 false positives and 13 false negatives.

MODEL	PREDICTED CLASS		
Actual	Yes	TP	FN
Class	No	FP	TN

Table 3 - Actual and fake news

Table 3 represents actual and fake news in the form of prediction noted by True Positive (TP) & false positive (FP).

A bar chart or bar plot is a graph that represents the category of data or information in rectangular bars with lengths and heights that is proportional to the values which they represent. The bar plots can be plotted either horizontally or vertically. A bar chart that describes the comparisons between these discrete categories. One of the axes of the plot represents the measured values corresponding to the categories, while the other axis represents the specific categories being compared. In python, the matplotlib API includes the bar() function which can be used in MATLAB style or as an object-oriented Application Program Interface.

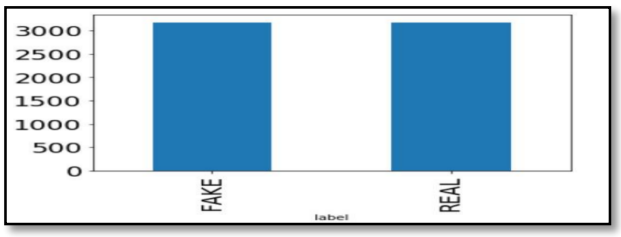

Figure 7 - Graphical representation of real and fake news

Based on results it is observed that The accuracy of the model dataset is 95.26 % the precision results 95.79 % whereas recall and F-Measure shows 94.56% and 95.17% accuracy respectively. In the predicted models there are 296 positive attributes, 308 negative attributes, 17 false positives and 13 false negatives. In bar chart the results of the real and fake news are shown.

CONCLUSION

The results show that the accuracy of the model dataset is 95.26 % the precision results 95.79 % whereas recall and F-Measure shows 94.56% and 95.17% accuracy respectively. There are 296 positive attributes, 308 negative attributes 17 false positives and 13 false negatives in the predicted models. This research recommends that authenticity of news should be analyzed first instead of drafting an opinion, sharing fake news or false information is considered unethical journalists and news consumers both should act responsibly while sharing any news. The public and the media are equally responsible for this problem. People take advantage of the power they hold, and small drops of misinformation turn into a huge sea of misunderstandings.

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"The gateway to grace is living in a state of gratitude."

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