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Fake News Prediction using Machine Learning Approaches

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Abstract

Fake news detection and prediction is the crucial research issue in now a day because it is very difficult to know the news authenticity on social media. It has a devastating impact on societies and democratic institutions as online life in these days are one of the principal news hotspots for many individuals around the world because of their minimal effort, simple access, and quickly spread of the unauthorized news. However, measurable ways to deal with battling fake news have been drastically restricted by the absence of named benchmark datasets. Smart machine learning classifiers are used to solve the problem of fake news prediction and classification. The proposed research study works on the LIAR dataset, the open-source available dataset for fake news classification with 12.8K decade-long, hand-labelled short statements in various contexts. The proposed research study has used a novel approach to deal with the fake news prediction accurately and this approach outperforms in this scenario for the same dataset. Naïve Bayes classifier for classification is used to reduce the variance values in the dataset to get rid of the overfitting issue. This classifier shows more improved results than other prior classifiers and the accuracy value was 99%. The proposed research study performed experiments and evaluated through different evaluation measures, the results of accuracy for the Naïve Bayes are best as compared to Random Forest, Decision tree, and Neural Networks are computed for each algorithm. The proposed research study could be applied in real-time applications to deal the fake news prediction in social media and digital media platforms.

Keywords: Fake News, Classification, Prediction, Supervised Learning

1. Introduction

This part shows the establishment of social media discouragement to the extent of intelligent examination. Additionally, we talk about the objections to this recommendation and our essential responsibility, fake news prediction for this research work.

1.1. Background

In the previous decade, online media has gotten one of the fundamental wellsprings of data for individuals around the planet. However, utilizing web-based utilization is twofold. From one viewpoint, it offers easy, simple access, and fast dispersal. Then again, it accompanies the threat of openness to 'counterfeit news' containing inadequately checked or even purposefully bogus data pointed toward deceiving and controlling the perusers to seek after certain political or financial plans. Because of the expanding measure within the recent time spent on the web, individuals will in general search out and get news from internet-based life (K. Shu et al.,).

Later on Oxford Dictionary later declared 'post-truth' as their word of the year for 2016, characterizing it as "conditions in which target realities are less compelling in forming general conclusion than offers to feel and individual conviction". Counterfeit News is utilized to engage, advance motivation, or, stirred on mass by extensive quantities of bots or sock manikins, endeavour to influence general feeling. So common has the idea of phony news become that the term is regularly utilized as a pejorative to raise doubt about the legitimacy of a customary source (Flintham et al., 2018).

In the previous decade, online life has turned out to be one of the primary wellsprings of data for individuals around the globe. However, social life for news utilization is a twofold-edged sword. From one viewpoint, it offers easy, simple access, and fast scattering. Then again, it accompanies the risk of presentation of ‘fake news' containing inadequately checked or even deliberately false data went for misdirecting and controlling the pursuers to seek certain political or monetary motivation (Frasca et al.,).

An ongoing report from Pew Research guarantees that 62% of grown-ups get their news from online life in the United States, with 29% among them doing so frequently (Street et al., 2018). Late investigations have observationally appeared phony and genuine news spread distinctively via web-based networking media, shaping proliferation designs that could be saddled for the programmed phony news identification.

(Rubin et al.,) have deciphered speculations of funniness, incongruity, and parody into a prescient strategy for parody recognition. The proposed research study was focused on the identification of fake news in the social media dataset. The proposed model outperformed the model with an accuracy of 90%, and the f-score value was 87%. Present news identification with the availability of fake or lie news was the crucial problem and this study provides the best solution to compare the other research studies.

(Torabi Asr et al.,) proposed the model to address the fake news prediction and identification in the large volume dataset. The proposed model highlighted the very crucial problem in the domain of fake news identification. Machine learning approaches were used to train the model for the identification of fake news and lie detection in the test dataset. SVM and Naïve Bayes classifiers outperform the given dataset and produce quality results.

(De Souza et al.,) introduced that web-based media has become the essential hotspot for talk spreading, and data quality is an undeniably significant issue in this unique situation. Most recent years, numerous scientists chipping away at strategies to improve the talk order, particularly on the ID of phony news in web-based media, with great outcomes. Nonetheless, because of the intricacy of the common language, this assignment presents troublesome difficulties and many exploration openings. This overview breaks down 87 particular distributions, which were methodically chosen out of 1333 up-and-comers.

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(Allen et al.,) "Fake news," extensively characterized as bogus or deluding data taking on the appearance of genuine news, is oftentimes stated to be unavoidable online with genuine ramifications for popular government. Utilizing an interesting multimode dataset that includes a broadly delegated test of the portable, work area, and TV utilization, we discredit this customary way of thinking on three levels.

(Vishwakarma et al.,) guaranteed the legitimacy of data has become an essential issue effect affecting the general public. News distributors at this point don't have control over the data stream since expanding the number of individuals presently depend on web-based media to get data and news. Henceforth, there is a squeezing need to guarantee that the news present online is real. Online media is ground-breaking enough to arrive at a large number of individuals in seconds and henceforth deception can without much of a stretch be spread if there is no dynamic checking on it. All things considered, a few people can exploit this to accomplish their plans or objectives. Thus, this subject request appropriate consideration and guidelines. Counterfeit news information comprises evident and purposefully bogus data and may delude anybody. Counterfeit news discovery has become a difficult examination issue that is drawing developing interest. As it very well may be found in Fig. 1, numerous scientists are attempting to discover strategies to characterize counterfeit news from genuine news and an increment in the number of scientists in this field has been noted.

(Silva et al.,) In the most recent years, the ubiquity of cell phones and interpersonal organizations has been adding to the spread of phony news. Through these electronic media, this sort of information can trick a large number of individuals in a brief timeframe and cause extraordinary damage to people, organizations, or society. The different assessed situations and the reached inferences from the outcomes shed light on the probability of the strategies and on the difficulties that phony news discovery presents.

1.2. Research Objectives

The research objectives are to give the optimum solution for fake news prediction, A few main objectives are identified which are discussed below.

- To analyze the pre-processing techniques like removing noisy data.
- To extract the necessary features for a fake new classification.
- To develop an intelligent algorithm to classify fake news.
- To explore the feasibility of fake news classification.

1.3. Problem Statement

The rise of social media and its use is the reason people are interested in watching social media. The quality and authenticity of the content shared through social media are not trustworthy and this low quality of news results in being exposed to fake news, of course, it is a real-world problem. Smart classification will be used to solve this problem.

1.4. Main Contribution

The proposed research study was focused on identifying the real-time research problem in the fake news prediction. Where this type of news come and how it could be resolved to accurately identify. Fake news prediction is a crucial research problem in the current research era. The proposed research study identified the fake news in the open-source dataset by using different machine-learning approaches. Naïve Bayes with their improved parameters addressed the fake news prediction problem. The evaluated model outperforms the test dataset as compared to the other machine learning models.

The remaining portion of this report is divided into the literature review, material, and design, results and discussion, Finally, we discuss the conclusion of the dissertation.

2. Literature Review

State-of-the-approaches applied to address the current research problem with the use of some valuable techniques on the open-source or real-time dataset. But in this section, the research study deeply elaborates on the existing approaches for specifically targeting the fake news prediction problem. (Amante et al.,) discussed in the development of fake news in the virtual world is an awful method to innovate the future. The innovation showed up to help and supplement individuals daily in reality this adverse point about the innovation, is primarily about utilizing the informal communities, individuals do not realize what was valid or fake in the news. A great deal of time, this fake news is utilized to control individuals' thinking and make wrong philosophy to people about this present reality. In this situation, it was made numerous methodologies and approaches by utilizing Machine Learning and Deep Learning to tackle these affected news issues.

2.1. Deep Learning Approaches

In this research study the Convolution Neural Network (CNN), utilized the information layer and separately some middle layers and the yield layers, with an information proficient amount to prepare, approve and test the model was conceivable and did the phony news characterization. Nonetheless, this isn't all, because fundamental that the calculation would compelling. The fundamental inspiration for this new way to deal with fake news arrangements was the chance to streamline the calculations by utilizing a few philosophies from Meta Optimization Semantic Evolutionary Search (MOSES) to build the calculation effectiveness. In which, the MOSES can be applied to any one kind of Artificial Intelligence issue. The article's objective comprises the new way to deal with counterfeit news orders utilizing an ML instrument that would be named, for example, MOSES. In light of this, it can dissect the strategies applied and report the union between a CNN execution and the MOSES device (Amante et al.,).

(Bozarth et al.,) discussed the pervasiveness of fake news and its disturbing downstream effects have spurred both the business and the scholarly community to assemble a generous number of phony news grouping models, each with its special design. However, the exploration of the local area presently does not have a far-reaching model assessment system that can give multifaceted examinations between these models past the straightforward assessment measurements, for example, exactness or f1 scores. In our work, we inspect an agent subset of classifiers utilizing a straightforward arrangement of execution assessment and blunder investigation steps. We exhibit that model presentation fluctuates impressively depending on I) dataset, ii) assessment paradigm, and iii) execution measurements. Furthermore, classifiers additionally show an expected predisposition against little and moderate inclining tenable news locales. At long last, the models' presentation differs depending on outer occasions and article subjects. In aggregate, our outcomes feature the need to advance toward methodical benchmarking.

(Kapusta et al.,) elaborate on the continually developing online media and various sorts of wellsprings of data, we are confronting distinctive phony information and various kinds of deception. Right now, we are dealing with a task to distinguish pertinent strategies for recognizing counterfeit news for drifting language types. We investigated various ways to deal with recognizing counterfeit news in the introduced research, which depends on morphological examination.
(Kaliyar et al.,) highlighted the web-based media stages have improved on the sharing of data, which incorporates news too when contrasted with conventional ways. The simple entry and sharing the information with the insurgency in portable innovation has prompted the expansion of fake news. Counterfeit news can control popular assessments and consequently, may hurt society. Along these lines, it is important to inspect the validity and genuineness of the news stories being shared via online media. These days, the issue of phony news has acquired enormous consideration from research networks and requires an ideal arrangement with high effectiveness and low viability. Existing discovery strategies depend on either news substance or social settings utilizing client-based highlights as a person.

2.2. Machine Learning Approaches

(Choudhary et al.,) discussed that social media is utilized as a predominant wellspring of information conveyance among clients. Approaches used Gaussian Naïve Bayes, Kernal Naïve Bayes, Linear SVM, and Gaussian SVM for the classification. Fake news detection is predicted in this paper and this paper used different machine learning algorithms named LSTM, the core part of this research was conducted using deep learning algorithms. The proposed system was evaluated using the different evaluation measures and the results are satisfactory. This system can be used for further processing in future research work.
Based on the different state-of-the-art approaches which were used the machine learning and a few of them used deep learning approaches addressed in detail to find the research gaps. The proposed research study did a comprehensive research study on the research gap analysis. Table 1 shows the detail found to address the research problem.

Table 1: State-of-the-art survey

Year	Publisher	Author Name	Classifier	Evaluation Measure
2021	Elsevier	Choudhary et al. [15]	Gaussian Naïve Bayes, Kernal Navie Bayes, Linear SVM, Gaussian SVM	Accuracy
2021	Springer	Kaliyar et al. [14]	XGBoost	Accuracy, precision, recall, F1-score
2020	Research gate	Amante et al. [11]	CNN	Accuracy
2020	Elsevier	Silva et al. [10]	LR, SVM, DT, Bagging, RF	recall, precision, F-measure
2020	AAAI	Bozarth et al. [12]	AdaBoost, RF, LSTM, MLP	Accuracy, precision, recall, F1-score
2020	MDPI	Kapusta et al. [13]	Decision tree	accuracy

In table 1, it has summed up the condition of the workmanship overview of papers. Everyone has his reasoning, information, and examination measures (Iqbal et al., 2022). In certain papers, we couldn't discover all the data we referenced above in various sections. So we need to go through hours to gather this information. Some have worked so well that we may discover everything in an overseen and coordinated way, but few have missing segments in papers (Iqbal et al., 2022). We have referenced all online media, author names, procedures, and highlights used to investigate information distribution year meeting, diary, and assessment measures utilized (Iqbal et al., 2023).

3. Material and Design

This chapter discusses the dataset and proposed methodology for the proposed model. There are two sub-sections where we discuss the dataset description and proposed methodology.

3.1. Dataset Description

The first step is to choose a source that has more accurate and authentic data. As we all know there are some fake accounts or some people have multiple accounts for different purposes on social media. Each dataset has its format and structure. There are many social media sites and apps to collect data using the internet worldwide. According to our research, we found that progressively exact and bonafide information Liar dataset. This data contains three main folders such that for testing, training, and validating the dataset (Iqbal et al., 2022). LIAR is a publically available open-source dataset. So we pass this dataset to the preprocessor to make it understandable and remove noisy data like extra spaces, and symbols (Iqbal et al., 2022). Data preprocessing is self-explanatory terminology. Real-world data is mostly inconsistent, and incomplete, containing extra spaces symbols, unnecessary punctuation, and symbols that sometimes make no sense contain many errors, and lack certain trends and behaviors. It is a well-known technique to resolve such kinds of issues. It prepares such kinds of data for supplementary processing.

3.2. Proposed Methodology

There are various approaches discussed in the literature review section where people used machine learning approaches. We proposed the system by using machine learning algorithms for fake news prediction. An open-source LIAR dataset is used for the experiments. The detailed approach we used for the fake news prediction is discussed below in the following points (Iqbal et al., 2022) (Iqbal et al., 2023).

i. Deep data analysis in different ways
ii. How the fake news data distributed
iii. Fake news labels analysis with plots and word clouds

iv. Analysis of the Fake News Statement
v. Cleaning the statement of fake news to support the above labels of fake news properly
vi. Analysis of subject(s) with graphs and preparation to make groups of subjects that will more distinguish the labels of fake news
vii. Analysis of speakers with graphs
viii. Analysis of speaker's job title with graphs and preparation to make groups of speaker's job title that will more distinguish the labels of fake news
ix. Analysis of state info with graphs
x. Analysis of party affiliation with graphs and preparation to make groups of party affiliation that will more distinguish the labels of fake news
xi. Analysis of venue with graphs and preparation to make groups of the venue that will more distinguish the labels of fake news
xii. Analysis of Numeric Data Type Features with plots
xiii. Models Training and Evaluation

Fig.1 shows the detailed flow for the proposed methodology. Each step followed by the model and executed in the implementation.

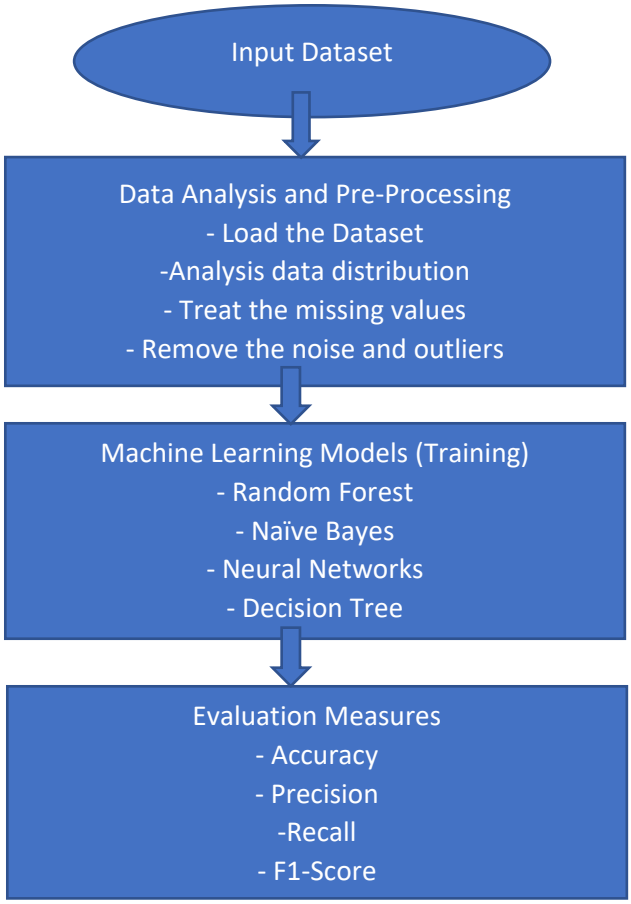

Figure 1: Proposed model methodology

4. Result Analysis and Discussion

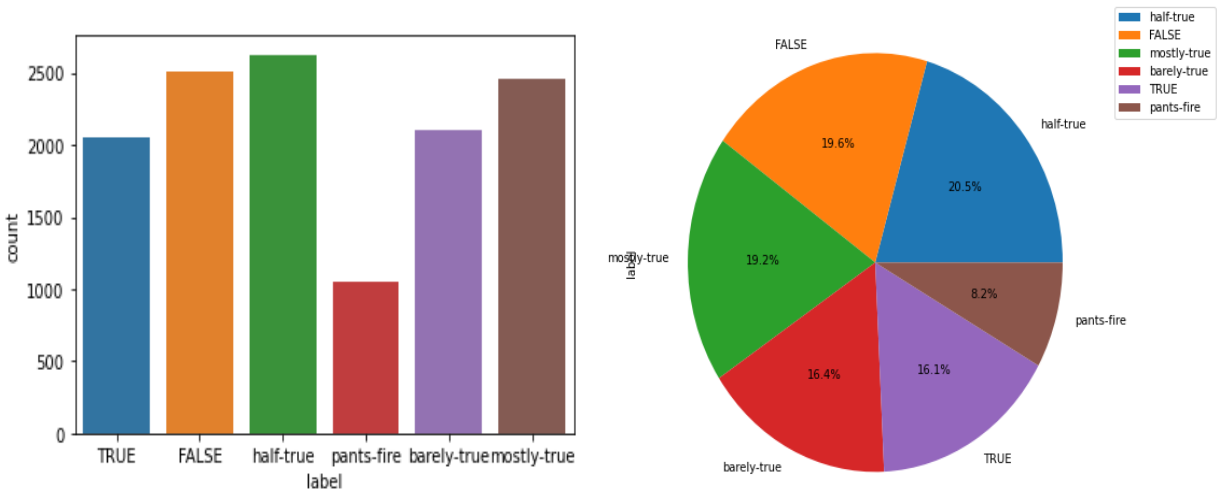

Figure 2: Distribution of fake news labels and percentages

After applying the proposed methodology for the fake news prediction, the proposed research was evaluated to test the model performance. Evaluations of the proposed research study calculated the evaluation measures and obtained values in the form of visuals as well as in the statistical order. In the initial steps, the proposed model analyzed the dataset distribution as shown in the Fig. 1, where the distribution of the data according to the labels was analyzed. Fig. 2 shows the histogram and the pie chart for the distribution of data in the whole volume.

After analyzing each label with their distribution, we also analyze the words that are most prominent in these labels separately. Such that the most prominent words contained in the barely-true news are shown in Fig. 3. These words are analyzed using the word cloud method. This word analysis helps us to understand what words make the news fake so it will be easy to understand and predict the fake news from the text statement of the news.

Figure 3: Prominent words analysis in the given labels (a) barely-true news, (b) half-true news, (c) mostly-true news, (d) True news, (e) False news (f) pants fire news

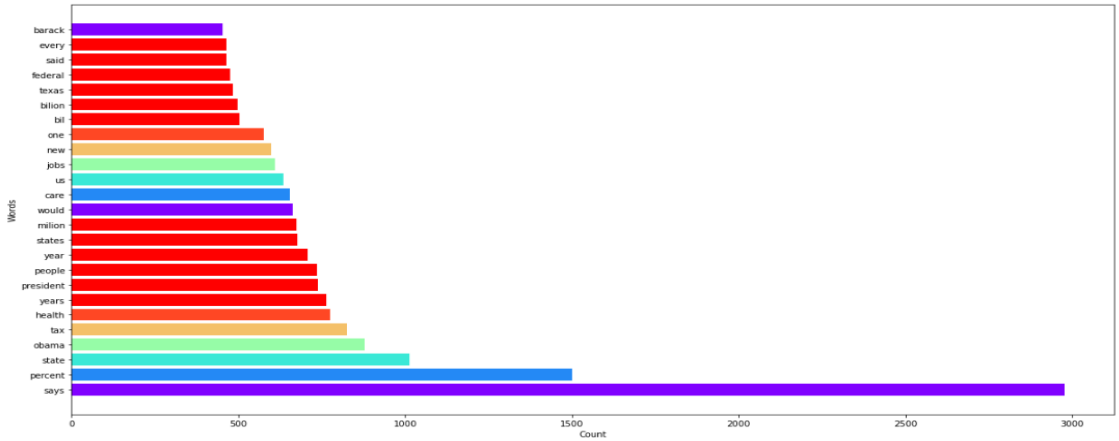

Figure 3: Top 25 frequently occurring words in the news text dataset

Figure 3 shows the visual analysis of the data for the prominent words, barely true news, half true news, mostly true news, true news, false news and the pants fire news. Analyzing the LIAR dataset, we examine there are top 25 words which are mostly occur in the dataset and have also a major impact on the target goal. Figure 4 shows the different most occurring words in the dataset with their count values.

Figure 4 shows the frequently occurring words in the news dataset. The proposed research study applied machine learning classifiers Random Forest, Naïve Bayes, Neural Networks, and Decision Tree. We applied the kfold cross-validation from 1 to 5 to check the optimum values for each classifier on the same dataset. Execution time for each algorithm to compute k-fold 1, k-fold-2, k-fold 3, k-fold 4, and k-fold 5 was recorded to check which fold cross-validation takes how much time and also to check each algorithm execution tie for the same dataset. Table 1 shows the obtained results for each algorithm with their k-fold cross-validation and execution time to each fold and each algorithm separately.

Table 2: Machine learning algorithms evaluation results and running time with k-fold validation

No	Algorithm	K-Fold	Accuracy	Precision	Recal	F1-Score	Running Time
1	Random Forest	kfold1	0.90	0.91	0.91	0.91	52.6s
		kfold2	0.92	0.93	0.93	0.93	52.0s
		kfold3	0.90	0.91	0.91	0.91	54.6s
		kfold4	0.91	0.91	0.91	0.91	52.1s
		kfold5	0.90	0.91	0.91	0.91	54.3s
2	Naïve Bayes	kfold1	0.99	1.00	1.00	1.00	1.49s
		kfold2	0.99	1.00	1.00	1.00	1.44s
		kfold3	0.99	1.00	1.00	1.00	1.66s
		kfold4	0.99	1.00	1.00	1.00	1.38s
		kfold5	0.99	1.00	1.00	1.00	1.27s
3	Neural Networks	kfold1	0.97	0.97	0.97	0.97	10m 15s
		kfold2	0.90	0.91	0.90	0.90	7m 8s
		kfold3	0.95	0.95	0.95	0.95	8m 32s
		kfold4	0.92	0.93	0.93	0.93	8m 26s
		kfold5	0.97	0.97	0.97	0.97	10m 38s
4	Decision Tree	kfold1	0.91	0.93	0.92	0.91	10m 52s
		kfold2	0.89	0.91	0.90	0.90	7m 58s
		kfold3	0.91	0.92	0.92	0.92	7m 52s
		kfold4	0.88	0.90	0.89	0.88	10m 24s
		kfold5	0.81	0.84	0.81	0.80	7m 11s

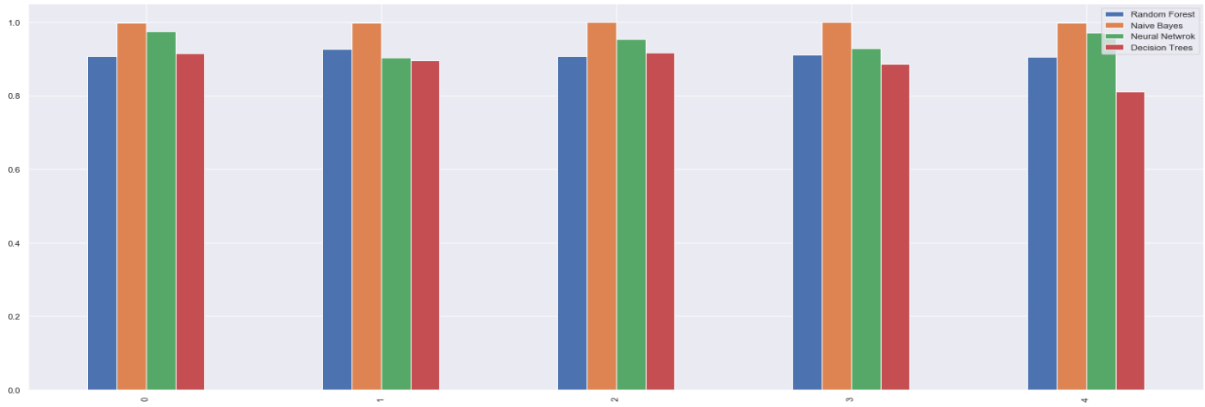

Figure 5: Results comparison between these algorithms

After evaluating the proposed system using Random Forest, Naïve Bayes, Neural Networks, and Decision Tree we observe the values against each machine learning algorithm. We calculate the accuracy, precision, recall, and f-score for each algorithm. In the same way, we calculate the running time for each algorithm for each k-fold cross-validation shown in Table 1 Tab. 2 shows the statistical results for the applied machine learning algorithms evaluated results. Some algorithm takes more time to execute the whole system using the same dataset for all but Naïve Bayes outperforms because it takes less conversing time and gives the best values for accuracy, precision, recall, and f1-score. So Naïve Bayes good fit for this dataset and proposed system, for further processing we can use this algorithm due to its best performance.

Figure 5 clearly shows the performance for each algorithm where Naïve Bayes has greater values as compared to the other algorithms due to its high values for accuracy, precision, recall, and f1-score measures and also convergence time.

5. Conclusion

In this project, we have measured the progress of research under machine learning techniques and intelligent methods using LIAR data to detect fake news. We have looked into different datasets to find better data sets for experiments. Previous research showed more research on the LIAR dataset. So, our experience also agreed that the LIAR dataset is the best, most accurate, and most reliable data source. After finalizing data sets and keeping in view our goal, we have implemented intelligent machine learning techniques and mentioned results in figures and tables. We found different results by using a general data set. According to our sole purpose we have achieved maximum accuracy by using the homogenous nature of the classifier known as Random Forest, Neural Network, Decision Tree, and Naïve Bayes. We used the k-fold cross-validation approach to make parts in k-fold 1, k-fold 2, k-fold 3, k-fold 4, and k-fold 5. All these algorithms are used for each k-fold and also calculate the running time for each. In the end, concluded that the Naïve Bayes algorithm outperforms as compared to the other algorithms due to its high evaluation measure values and convergence time.

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