A predictive model based on machine learning methods to recognize fake persian news on twitter

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Abstract

False rumors and news are always published as purposeful approaches with social, economic, political intents in order to provide false information and deceive people in the communities. This leads to a lack of trust in news and information. Differentiating real news from rumor has been considered as one of the most important aspects of news evaluation and different approaches have been used to identify and distinguish fake news from real one. Among them, the use of artificial intelligence and machine learning methods has been more important due to the successes achieved. Due to this advantage, the present study has attempted to use machine learning algorithms including SVM, k-NN, decision tree, random forest and MLP, to identify and classify fake and real news in the data set collected from Persian Twitter messenger. Based on the results of the confusion matrix implementation and functional evaluation of learning algorithms, it has been determined that Randomized decision trees and decision tree have the highest accuracy in evaluations with 90.25 and 90.20 as in the next step, the accuracy of the random forest is 89.99%. This indicates the ability of tree decision-making algorithms in optimal evaluation and better identification of fake news on Persian Twitter. Also, random forest and Randomized decision trees algorithms have the highest precision in implementation with 92%, and after these two algorithms, decision tree with 90.20% is in the third rank of precision.

Keywords: Fake Persian News, Artificial Intelligence, Machine Learning, Learning Algorithms, Twitter Messenger.
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1. Introduction

The people and governments have long been involved with rumors conspiracy as the history of rumour dates back to the time of the Roman and ancient Greek emperors. As the city of Rome was set on

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fire in 12 AD, rumor had it that Nero had started the fire. Therefore, to blame someone else for it, the fire was said to have been caused by the Christians. This rumor spread well because Christians did not have a good reputation with the people. Thus, people temporarily forgot their hatred and enmity towards Nero. In the late 19th century, Gustav Lauben, while investigating the Paris riots, presented a theory. He believed that riots were the result of group harmony and that they were contagious. In the early twentieth century, using scientific method to study group behaviours of "rumor" in the form of group behaviours has been the subject of study and research by sociologists, psychologists, psychiatrists, anthropologists and researchers of popular culture. Some believed that spreading rumors during this period depended on the advent of the press and radio into society; because during this period, due to the increase of social and political awareness of people, they want to provide accurate and timely information about various events by these widespread media, and if these media do not disseminate information on time or their information is contradictory, they will inadvertently propagate more rumors [9].The veracity of rumors in different situations indicates that rumors are made with specific attitudes and motivations. One of the most important motivations for processing and spreading rumors is attracting social attention (since one of the characteristics of rumor is its special importance for a particular group and therefore it is propagated easily, it should be acknowledged that the rumor tellers also feels that because he is the source of such important news, he is also an important and noteworthy person when he attracts the attention of others. Therefore, one way to attract people's attention in different places is being proud via rumors spreading. Many people with low self-esteem and low social skills, use this method to attract the attention of others) and projection (whenever an individual's emotional state is reflected in his interpretation of his surroundings unconsciously, he is unsuccessful in using purposeful and completely neutral evidence to describe the facts around himself. These people subconsciously express their desires, inner desires, hopes and aspirations in the form of "rumors" in the third person: "they say", "they have said", and one person said. In other words, they show an interpretation of reality that corresponds to our private lives, which tends to be believed and propagated [3].

In general, rumor can be considered an active form of probable communication. Rumor is expressing the concerns and anxieties of people against information deception. Rumor does not convince anyone, it says something that the public is willing to believe. It is easily spread among the news, and ambiguity can help its propagation. Rumor can be confirmed by the authorities; In this case, it will become news and if it is denied, it will remain a rumor. In some cases, even when the news is denied by informed authorities, it may still remain a rumor, which happens when people do not trust media. Rumor is defined in the social sciences culture Dictionary, written by Alan Bieru: "Rumors in French, like Latin reveals a news story, a baseless commotion. Rumors form public opinion, and even a kind of reputation. Sociologically, the phenomenon of rumor is a process through which news is broadcast and (often exaggerated) without going through the usual channels. The rumor may be based on false information, or the source of the information may be true but exaggerated and misleading, and the news may be passed on from one person to another, from one group to another, without knowing its vivid source or definite reasons for its accuracy " [9].

In general, rumors on news sites is fake news , a kind of yellow or propaganda journalism with the intention of spreading false information that is propagated in traditional print media, news media, and social media. Fake news is written with the aim of misleading and harming an agency, institution, or person, or to achieve financial or political goals, often using sensitive, incorrect headlines that can be used to increase readers' online sharing and gain profit based on clicking on Internet. In the second case, it is spread similar to the hilarious online news like "Click" and is based on advertising revenue from this activity, regardless of the accuracy of the story. False and misleading news is not distinguished from humor or vague imitation that makes humor instead of misleading the audience.

Fake news, especially with the development of technology, has influenced politics. For the media, the ability to attract viewers of their websites is necessary in order that the advertisers to make the advertisers to advertise on their websites. If the publication of a story with the wrong content produces a big sign and attracts the audience, it may be useful for advertising advertisers and their ranking. Easy access to online advertising income, increased political credibility and popularity on social media and the media news feed has been a major contributor to the spread of fake news. The story of government actors is also involved in the production and distribution of fake news, especially in election. False news also influences serious media coverage, making it difficult for journalists to cover important news. In fact, fake news can be classified to attract clicks, advertisement, humor / imitation, false and biased journalism, misleading headlines, and biased news that are created for specific purposes. Such cases can be dedicated to false lies on April 13 or false news on their main pages, or we can say Shargh newspaper dedicated its front page to fake news in its April 4, 2005 issue: "Milad Tower is on the verge of collapse "and" Ali Larijani establishes Iran's first private television " [18].However, such news always causes false sentiment and biased misuse. Identifying and differentiating this news can be used to discover the sources and achieve the origin and goals of this news.

Recently, data mining and natural text processing, which is a branch of artificial intelligence, have been used in many fields. In this study, by using data mining algorithms and data sets collected from different types of news (true and false) models , we present a variety of machine learning models to distinguish truthful news from deceptive ones. To do this, first we use different types of text pre-processing for text purification. Then, using data mining algorithms; we extract the necessary attributes from the text. In the next step, we use a variety of machine learning algorithms such as decision trees, random trees, k-NN, SVM, and neural networks for data learning. The results of the experiments show a high learning rate for the decision tree and random trees.

This paper is organized as follows. First, the literature and background of the research are presented. Then, the research methodology is provided. In the next section, the research findings are elaborated and finally the conclusion of this research is presented.

2. Theoretical literature and research background

Marchi [11] by studying the social networks, investigated the behaviors and attitudes of adolescents to different news. Based on interviews with 61 high school students from different high schools, the study discusses how adolescents become informed about current events and why they prefer certain news formats to others. The results reveal changing ways news information is being accessed, new attitudes about what it means to be informed, and a youth preference for opinionated rather than objective news. This does not indicate that young people ignore the basic ideals of professional journalism but, rather, that they desire more authentic renderings of them [11].

Shojaei et al. [16] applied a stylometric-based model for review classification. They used the golden standard dataset developed by Out et al., to extract 234 stylometric features, i.e. lexical and syntactic, using supervised machine learning classifiers, i.e. Support Vector Machine (SVM) and Naive Bayes. Thus, using F-measure calculations, they tested lexical and syntactic features separately and in a combination. SVM with combined or separated features exceeded Naïve Bayes. The highest measured F score was 84% using both lexical and syntactic features [16].

Tanha et al. [17] presented a boosting algorithm for multiclass semi-supervised learning called SemiAdaBoost. The algorithm is based on a novel multiclass loss function for semi-supervised learning and can boost any basic classifier. This algorithm consists of the margin cost on labeled data and two regularization terms on labeled and unlabeled data. One algorithm is presented for multi-class

semi-supervised learning. Most methods use one- vs. -all method to turn the multi-class problems to some binary classification problems [17].Liu [10] focused on making its classifier using uncontrolled techniques to deal with the non-access of labeled data and the situations in which the important features are not available. They created a method to calculate the review factor by estimating the sentiment overlapping of the content of the games [10].

Conroy et al., [5] conducted a comprehensive study on the approaches of detecting fake news. They expressed the fake news detection as the main duty in news classification in terms of news and source accuracy and by measuring the accuracy of source and news, defined the accuracy of intentional deceptions, effect scale and its risk [5].Rubin et al., [15] by the investigation of Satire as an attractive subject in deception detection research found that it is a type of deception that intentionally incorporates cues revealing its own deceptiveness. Whereas other types of fabrications aim to instil a false sense of truth in the reader, a successful satirical hoax must finally be exposed as a jest. These researchers stated that a conceptual overview of satire and humor, elaborating and illustrating the unique features of satirical news. These features can be used in civics, science, business, and "soft" news (fantasy and reality), etc. They proposed an SVM-based algorithm, enriched with 5 predictive features including Absurdity, Humor, Grammar, Negative Affect, and Punctuation and tested their combinations on 360 newspapers. The results of study showed that the applied algorithm is with a 90% precision and 84% recall (F-score=87%) [15].

Kucharski [7] evaluated the impact of the 2016 US presidential election and the UK vote and future elections to spread different News among British users and the sentiment climate of these elections. They revealed that the propagated information in social networks namely social and economic aspects is a new element in the political victories [7].

Allcott and Gentzkow [2] considering the news and comments on social media related to the 2016 US presidential election, investigated the changes and effects of the publication of fake stories and false news in this regard. The researchers conducted a comprehensive online survey and created a large database of online news websites that identified four key features, including "very important" news sources, findings, and repetitions, as 14% of Americans followed very important news directly from Facebook and Twitter, of which 30 million times Trump and 8 million times Clinton have been repeated and resent on Facebook. By evaluating fake or probably fake news, it has been found that 12% of people believe this news to some extent and consider the Canadians to be ideal [2].

Lazer et al. [8] assessed the impact of the spread of fake news in various fields on the Internet, describing it as a global concern that can affect various social, economic, cultural and industrial aspects and play a deviant role. These researchers stated that a new system of protective measures is required [8].Clayton et al. (2019) believed that social media has increasingly enabled fake news to circulate most notably during the 2016 U.S. presidential campaign. These intentionally false or misleading stories threaten the democratic goal of a well-informed electorate. This study evaluates the effectiveness of strategies used by Facebook. Results from the experiment indicate that false headlines are perceived as less accurate when specific headlines are accompanied by a "Disputed" or "Rated false" tag (Clayton et al., 2019).

Reese et al. [13] stated in an article that a large part of recent studies has focused on perceiving and detecting fake news on social media. To achieve this goal, these studies detect several types of news-derived features, including social media resources and posts. In addition to examining the main features presented in the literature to detect fake news, the researchers used supervised algorithms such as SVM to detect fake news. Introducing a new collection in this field, they showed that the results of the research show a useful performance in recognizing the importance of the characteristics of false news detection [13].

3. Research methodology

Using artificial intelligence and machine learning to detect and predict events, processes, etc. is one of the new topics in the humanities and basic sciences. In the present study, by the aid of this significant advantage, an attempt has been made to extract a feature for classifying news including true and false, achieve a mechanism for fake news detection using machine learning algorithms including SVM algorithms, k-nearest neighbour, random forest, Perceptron neural network, decision tree and Randomized decision trees. Also, different classification methods are used to achieve the best results. In this regard, it can be stated that the present study attempts to provide an optimal model based on machine learning algorithms for fake news detection. In terms of application, this model can be used in our country to evaluate scientific journals and various conferences and identify unpleasant events such as plagiarism, forgery, and unreal events fabrication. Also, the results of this study are undoubtedly very useful for both ordinary and special audience due to increasing their ability to detect fake news, minimizing the spread of fake news using control mechanisms and preventing users from re-propagation of fake news in cyberspace. Also, the results of the present study can be useful for online media for strategic application in order that they pay much attention in using the vocabularies in order that these choices provide a solution to better review the news published. Methodologically, learning algorithms are part of machine learning that are used for classification purposes and extracting various characteristics [6].

The Support Vector Machine (SVM) is one of the supervised machine learning methods for classification and regression. This method is one of the relatively new methods for classification compared to the traditional ones. The basis of SVM classifier is the linear classification of data that in the linear division of data, it is attempted to use a linear approach with high reliability of margin in evaluation. Solving the equation of finding the optimal line for the data is done by QP methods or second-order programming, which are common methods for solving restricted problems. Before the linear division, in order for the machine to be able to classify high-complexity data, the data is carried into a much higher dimension by the phi function, and the very high dimension problems are solved using these methods (e.g. Lagrange dual theorem). To convert the minimization problem to its dual form, which uses a simpler function called the kernel function as the multiplication of the phi function to perform the analyses with high speed, so, complex phi function is not used as it takes the analytical list to a high dimensional space. Different kernel functions including exponential Kernel, polynomial and sigmoid are used. The SVM algorithm is one of the pattern recognition and supervised learning algorithms. The SVM algorithm can be used where there is a need to identify patterns or categorize objects in specific classes [1]. The k-nearest neighbour (k-NN) algorithm is a non-parametric statistical method used for statistical classification and regression. In both states, k contains the nearest training example in the data space, and its output varies depending on the type used in classification and regression. In classification state, according to the value specified for k, it calculates the point distance where the label will be determined, with the nearest points. Based on the maximum number of votes of these neighbouring points, it is decided about the given point label. Various methods can be used to calculate this distance, one of the most important of which is the Euclidean distance for continuous changes and the Hamming distance for discrete changes. In regression mode, the mean values obtained from k are its output. The initial data are vectors in a multidimensional space, each containing a label called set. The learning phase of this algorithm includes the storage of feature vectors and the label of the initial examples set. In the classification phase, k is defined as a constant by the user, and the non-labelled vector (test point) is the set with the highest number of k-NN of that point. In this way, the test point label is also specified. The Perceptron Network Algorithm (MLP) is a machine learning algorithm considered in the supervised

learning set. The Perceptron algorithm is a binary classification algorithm (a type of classification that can decide by the input vector). This algorithm is a linear classifier, meaning that it makes predictions according to the weighted linear composition of the algorithm input. Also, this algorithm is an on-line algorithm because it investigates its inputs one by one over time. The perceptron algorithm was invented in 1958 at the Cornell Aeronautical Laboratory by Frank Rosenblatt, and is one of the first artificial neural networks used in machine learning evaluations. The Perceptron algorithm is an iterative algorithm, and first the weight and bias vectors are quantified, and then at each step, the algorithm changes the values of weight and bias according to the points that are not properly classified so that these points are classified correctly. If the given points are not linearly separable, the perceptron algorithm does not end, but if the linear points are separable, the algorithm terminates in a finite number of steps [6].

Decision Tree (DT) is a decision support tool that uses trees for modelling. Decision tree is commonly used in various researches and operations. In particular, it is used in decision analysis to determine the strategy most likely to achieve the goal. Another use of decision trees is to describe conditional probability calculations. In decision analysis, a decision tree is used as a tool to visualize and analyse the decision, where the expected values of the competition are calculated alternately. A decision tree has three types of nodes such as decision node, random node, and terminal node, respectively, which are used in the continuous decision-making process. Among the decision support tools, decision tree and the decision diagram have specific advantages that are given special attention in classifications. These benefits include simple understanding (any human being with a little study and training can learn how to work with the decision tree), working with large and complex data (decision tree can easily work with complex data at the same time and make decisions based on them), easy re-use (if decision tree was created for a problem, different examples of that problem can be calculated with that decision tree) and the ability to combine with other methods (the result of decision tree can be combined with other decision-making techniques and achieve better results), as in managerial and planning analyses, this algorithm is of great importance [6].Finally, random forests or random decision forests (RFs) are a combined learning method for classification, regression, which works based on a structure consisting of many decision trees, on the time of training and output of classes (classification) or predictions of each tree separately. Random forests are suitable for decision trees that are more adaptable in the training set. The first algorithm for random decision forests was developed by "Tin Kam Ho "using the random subsets method. As part of the machine learning mechanism, the predictive random forest naturally guides non-labelled measurements between unsupervised ones. It can also define a random forest between non-labelled data. The idea of RF is that the construction of a random forest distinguishes predictive data from appropriate artificial data. Observational data is the original unlabelled data, and artificial data is taken from the distribution reference. A random forest can seem interesting because it can manage combined data well, and is strong in terms of observations. Random forest can easily differentiate between intrinsic variables and a large number of discrete variables [12].In the present study, the above learning algorithms have been used to evaluate and identify fake news and rumors on the social media Twitter Persian.

4. Research findings

In the present study, it is attempted to present a model based on machine learning algorithms including SVM, k-NN, RF, MLP, DT and Randomized decision trees algorithms. For this purpose, evaluation and confusion matrix criteria have been used to measure the precision recall, and accuracy of the models. In general, the precision recall, and accuracy of the confusion matrix are determined

according to the following Equations and Table 1, respectively [12].

$$Accuracy = \frac{TP_i + TN}{TP_i + FN + TN + FP_i}$$

(4.1)

$$Precision = \frac{TP_i}{TP_i + FP_i}$$

(4.2)

$$Recall_i = \frac{TP_i}{TP_i + FN_i}$$

(4.3)

Table 1: Confusion matrix for a binary classification problem

Record type		Predicated Records)	
Actual Records	Set type	Negative set	Positive set
	Negative set	TN	FP
	Positive set	FN	TP

TN: indicates the number of records their actual set is negative and classification algorithm recognizes their classification true negative.
TP: Indicates the number of records whose actual category is positive, and the classification algorithm recognizes it true positive.
FP: Indicates the number of records whose actual category is negative, and the classification algorithm recognizes it false positive.
FN: Indicates the number of records whose actual category is positive, and the classification algorithm recognizes it false negative.

After implementing learning algorithms on the data set of the news collected from Persian Twitter messengers; it has been attempted to evaluate the performance of each machine learning algorithm in identifying and classifying fake news over real news. For this purpose, a confusion matrix was prepared for the proposed models and the precision, accuracy, recall and f1 criteria were estimated for these models. Figures 1 and 2 show the results of implementing learning models to extract features and identify fake news in Persian Twitter messengers. As shown in Figure 1, the Randomized decision trees and decision tree showed the highest accuracy in the assessments with 90.25 and 90.20%. In the next step, the accuracy of the random forest is 89.99%. This reflects the ability of tree decision-making algorithms for optimal assessment and better identification of fake news on Persian Twitter. As shown in Figure 2, random forest and Randomized decision trees algorithms have the highest precision in implementation with 92%. After these two algorithms, the decision tree is in the third rank with 90.20% precision. Table 2 shows the results of implementing various machine learning algorithms in fake Persian news detection.

5. Conclusion

Fake news can be considered as one of the false and unethical approaches in publishing news, as well as creating rumors in societies, which usually spread rumors and false news among people with special goals and bias. From scientific aspects, the spread and diversity of rumors in different situations indicates that rumors are made with specific attitudes and motivations. The most
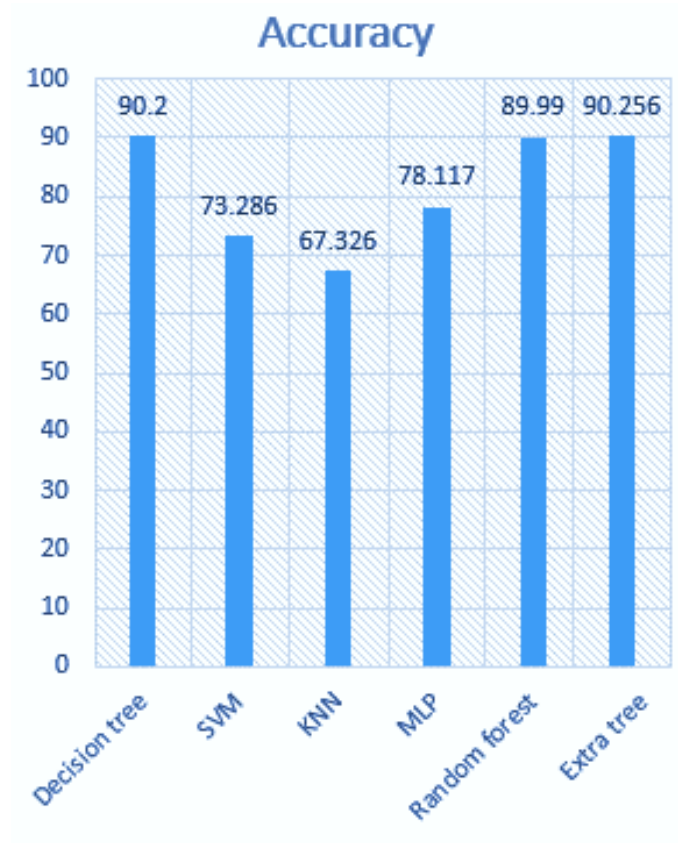
Figure 1: The accuracy results of machine-based learning models for fake news evaluation
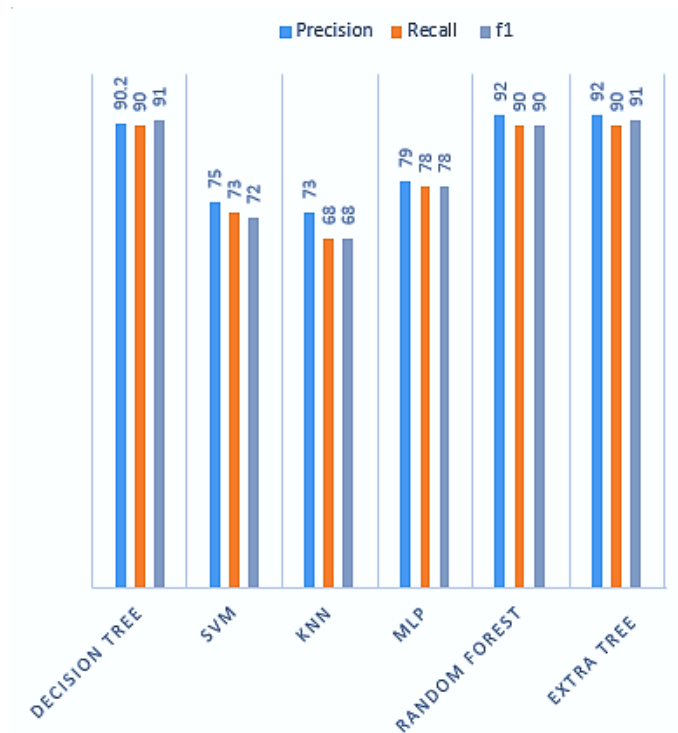

Figure 2: The results of confusion matrix for machine learning models

Table 2: Analysis results by various machine learning algorithms

Algorithm	Precision	Recall	Accuracy	F1-score	Error function
k-NN	73	68	67.326	68	-
Random forest	92	90	89.99	90	-
MLP	79	78	78.117	78	-
SVM	75	73	73.286	73	-
Decision tree	92	90	90.2	90	-
Randomized decision trees	92	90	91	90.256	**91**

important motives for processing and spreading rumors are attracting social attention, projection, military or political applications, chaos, lying and flattery, exaggeration, public opinion deception. In other words, fake news and rumors refer to all the behaviours and speeches that are used to deceive the public information of the society. Such behaviours generally reduce mutual trust between news presenters and people and this has a significant impact on society. Various approaches have been used to identify and separate false news from real news, the most successful of which are using artificial intelligence-based algorithms and machine learning. Presenting an optimal model based on machine learning algorithms for fake news detection can be used to evaluate scientific journals and conferences and identify unpleasant events such as plagiarism, forgery, and unreal events fabrication. Also, the results of this study are undoubtedly very useful for both ordinary and special audience due to increasing their ability to detect fake news, minimizing the spread of fake news using control mechanisms and preventing users from re-propagation of fake news in cyberspace. Also, the results of the present study can be useful for online media for strategic application in order that they pay much attention in using the vocabularies in order that these choices provide a solution to better review the news published. Due to this advantage, the present study has attempted to use machine learning algorithms including SVM, k-NN, decision tree, random forest and MLP, to identify and classify fake and real news in the data set collected from Persian Twitter messenger. Based on the results of the confusion matrix implementation and functional evaluation of learning algorithms, it has been determined that Randomized decision trees and decision tree have the highest accuracy in evaluations with 90.25 and 90.20 as in the next step, the accuracy of the random forest is 89.99%. This indicates the ability of tree decision-making algorithms in optimal measurement and better identification of fake news on Persian Twitter. Also, random forest and Randomized decision trees algorithms have the highest precision in implementation with 92%, and after these two algorithms, decision tree with 90.20% is in the third rank of precision.

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