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RESEARCH ARTICLE

Comparative Analysis of Identifying Accuracy of Online Misinformation of Covid-19 Using SVM Algorithm with Decision Tree Classification

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ABSTRACT

Aim: To improve the accuracy percentage of predicting misinformation about COVID-19 using SVM algorithm. **Materials and methods:** Support Vector Machine (SVM) with sample size = 20 and Decision Tree classification with sample size = 20 was iterated at different times for predicting the accuracy percentage of misinformation about COVID19. The Novel Poly kernel function used in SVM maps the dataset into higher dimensional space which helps to improve accuracy percentage. **Results and Discussion:** SVM has significantly better accuracy (94.48%) compared to Decision Tree accuracy (93%). There was a statistical significance between SVM and the Decision Tree (p=0.000) (p<0.05 Independent Sample T-test). **Conclusion:** SVM with Novel Poly kernel helps in predicting with more accuracy the percentage of misinformation about COVID-19.

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Introduction

The research of this study is to predict the accuracy percentage of COVID-19 misinformation. In recent days, spreading of covid-19 misinformation has become one of the major pandemic issues ("A Pinnacle Technique for Detection of COVID-19 Fake News in Social Media" 2020). At the time of spreading such misinformation in and around makes lots of confusion and fear to the public (Obiała et al. 2021). The usage of social media has become more, which creates an array of spreading of misinformation. When the misinformation was spread, it is difficult to identify the fake news. When the fake news spreads faster among people it may lead to difficult situations (Elhadad, Li, and Gebali 2020). It helps the government to keep track of COVID-19 cases and situations more accurately and also helps in detecting misleading information on any future global health issues (Al-Rakhami and Al-Amri 2020).

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Identifying misinformation of COVID-19 was implemented by many researchers to bring awareness about COVID-19. Around 16 articles published in IEEE and 20 papers in google scholar. (Obiała et al. 2021), implemented Buzzsumo analytical tool for analysing the accuracy of COVID-19 misinformation. The accuracy obtained was 80%. (Nguyen, n.d.) implemented deep learning techniques and machine learning models for classifying the fake news articles related to COVID-19 and proved with accuracy of 71%. (Sadgali, Sael, and Benabbou 2019) implemented the Decision Tree machine learning algorithm for predicting financial fraud detection and accuracy was 91%. (Elhadad, Li, and Gebali 2020) implemented a Decision Tree machine learning algorithm for predicting the accuracy of misinformation about COVID-19 and accuracy was 93%. The most cited article was (Elhadad, Li, and Gebali 2021) focused on predicting accuracy of misinformation of COVID-19 using the Decision Tree

Classification machine learning algorithm with an accuracy of 93%.

Previously our team has a rich experience in working on various research projects across multiple disciplines (Sathish and Karthick 2020; Varghese, Ramesh, and Veeraiyan 2019; S.R. Samuel, Acharya, and Rao 2020; Venu, Raju, and Subramani 2019; M. S. Samuel et al. 2019; Venu, Subramani, and Raju 2019; Mehta et al. 2019; Sharma et al. 2019; Malli Sureshbabu et al. 2019; Krishnaswamy et al. 2020; Muthukrishnan et al. 2020; Gheena and Ezhilarasan 2019; Vignesh et al. 2019; Ke et al. 2019; Vijayakumar Jain et al. 2019; Jose, Ajitha, and Subbaiyan 2020). Now the growing trend in this area motivated us to pursue this project.

Collecting the ground-truth data may not give exact accuracy as many persons may not respond to the ground-truth data and always they may not give correct information. Based on the literature review, it can be summarized that machine learning algorithms have been used for predicting accuracy of misinformation about COVID-19. SVM algorithm mainly focus on classification and regression.

Materials and Methods

The study setting was done in our university. In this study 2 sample groups were identified. The group 1 was SVM algorithm and group 2 was Decision Tree Classification. The SVM and Decision Tree classification algorithm was iterated at different times with a sample size of 20 (Elhadad, Li, and Gebali 2020), 95% confidence interval and pretest power of 80% ("Sample Size Calculator" n.d.).

The dataset was taken from https://www.kaggle.com/datatattle/covid-19 ("Website" n.d.). The real time dataset used was "covid-tweet-analysis". This Dataset consists of 6 attributes. The attributes are UserName, ScreenName, Location, TweetAt, Original Tweet, and Sentiment. The primary attribute of covid dataset is "OriginalTweet", which represents the original post information. The "UserName" feature has the twitter id of a user. "ScreenName" feature contains the user's screen id. "TweetAt" attribute represents the date of the user post, it is in dd/mm/yyyy format. "Sentiment" attribute contains two labels i.e., positive and negative based on the OriginalTweet attribute. Based on this information accuracy of misinformation about COVID-19 was predicted.

In order to have an accurate outcome data cleaning was performed. In the data cleaning process, the primary step is to remove all the null and duplicate values. In the second step, conversion of uppercase letters to lower case letters and removal of html tags, urls, and noisy symbols are performed. In feature extraction, textual data counting and tokenization was done. Stop words are used to remove irrelevant and noisy words. The data was pre-processed after importing the dataset by removing missing values. The dataset was splitted into two parts as 80% of the train set and 20% of the test set. The SVM and Decision Tree classification algorithms were evaluated with respect to train and test tests, the required parameter accuracy percentage was calculated. The learning process of SVM and Decision Tree was given below.

Decision Tree belongs to a supervised family (Sadgali, Sael, and Benabbou 2019). It tries to solve the problem using tree representation. The internal node represents the OriginalTweet attribute and the leaf node represents the Sentiment labels with values of Positive or Negative. Based on the attribute, from the leaf node if the information is true then it labels as Positive otherwise it labels as Negative. Decision Tree classification algorithm shown in Fig.1.

```
Import required packages
Import dataset
Define x and y as OriginalTweet and Sentiment respectively
Define test and train sets
Classifier ← DecisionTree.classifier()
Print classifier
Classifier.fit (x_train, y_train)
y_pred ← classifier.predict (x_test)
score ← accuracy_score (y_test, y_pred)
print score
```

Fig. 1. Algorithm for Decision Tree classification (x,y)

```
Import required packages
Import dataset
Define x and y as OriginalTweet and Sentiment respectively
Define test and train sets
clf ← SVC(kernel = 'poly', degree = 8)
clf.fit (x-train, y_train)
clf.score (x_test, y_test)
predictions ← clf.predict (x_test)
score ← accuracy_score (y_test, predictions)
print score
```

Fig. 2. Algorithm for SVM (x,y)

SVM supports both classification and regression and provides linear or non-linear solutions. The Novel Poly kernel is a non-stationary kernel and well suited for problems where all the training data is normalized. Based on the OriginalTweet attribute the data was classified as Positive or Negative. The Novel Poly kernel helps in predicting the categorical variables using independent variables by mapping the dataset into higher dimensional space. SVM algorithm shown in Fig. 2.

The mathematical equation for Novel Poly kernel was shown in equation (1),

$$k(x, y) = (x^T y + b)^d \quad (1)$$

Where, $x^T y$ is dot product of vector

b is constant

d is degree

Accuracy was calculated for SVM and Decision Tree based on equation (2)

$$Accuracy = TP + TN/TP + TN + FN + FP \quad (2)$$

Where TP = True Positive and FP = False Positive

TN = True Negative and FN = False Negative

Software tool used for predicting accuracy of misinformation about COVID-19 was Google colab© with python programming language. Hardware configuration was Intel core i5 (2.70 GHZ) processor with 8 GB RAM and 64bit OS, x64-based processor system with 917 GB HDD. The Software configuration was the Windows 10 operating system.

From the total sample size 80% of the data with features extracted is trained in the SVM and Decision Tree algorithm. For training the model involves a number of iterations to get better performance. After training the algorithm, random test data is given to the algorithm.

The work was statistically analyzed using the Statistical Package for the Social Sciences (SPSS) ("SPSS Software" n.d.) and Google colab© software tools. Descriptive statistics for mean, standard deviation and standard error was carried out for SVM and Decision Tree algorithm. Independent variables are UserName, ScreenName, Location, TweetAt, OriginalTweet, and Sentiment. The dependent variable was output variables (Accuracy). Independent sample t-test is performed to compare the performance of algorithms.

Results

In Table.1, it was observed that SVM and Decision Tree algorithms were run at different times in Google colab© with a sample size of 20 and accuracy was calculated. The SVM algorithm appears to have better accuracy than the Decision Tree algorithm. In Table.2, Independent Sample T-Test was performed to compare the accuracy of SVM and Decision Tree and a statistically significant difference was noticed P < 0.001 with 95% confidence level showed that our hypothesis holds good. With respect to changes in the input values (independent variables) the corresponding output values (dependent variables) also changes (Table 2). The mean difference of accuracy was identified as 2.133. In Table.3, The statistical analysis of 10 samples was performed. SVM obtained 0.68 standard deviation with 0.21 standard error while Decision Tree obtained 1.41 standard deviation with 0.44 standard error. Accuracy percentage of SVM (94.48) and Decision Tree (93) inferes that SVM appears to have better accuracy than Decision Tree (Fig.3). The simple mean Bar graph shows the Standard deviation of SVM slightly better than Decision Tree (Fig.4).

Table 1. Predicted Accuracy of COVID-19 misinformation (SVM algorithm accuracy of 94.48% and Decision Tree Classification accuracy of 93%)

SL. No	Sample Size	SVM algorithm Accuracy (%)	Decision Tree Accuracy (%)
1	21	93.79	93.45
2	31	92.82	91.03
3	41	91.51	90.14
4	51	94.48	93.10
5	61	93.10	91.38
6	71	94.82	89.66
7	81	94.13	92.76
8	91	94.82	93.45
9	100	93.79	91.03
10	120	93.85	91.02

Table 2. Independent Sample T-test Results with confidence interval of 95% and level of significance of 0.05 (SVM appears to perform significantly better than Decision Tree with the value of p=0.000)

	Levene's Test for Equality of Variances		t-test for Equality of Means						
	F	sig.	t	df	Sig.(2-tailed)	Mean Difference	Std.Error Difference	95% Confidence Interval of the difference	
								Lower	Upper
Accuracy Equal Variances assumed	6.569	.020	4.297	18	.000	2.133	.49638	1.0901	3.1758
Equal variances not assumed			4.297	13.06	.001	2.133	.49638	1.0611	3.2048
Loss Equal Variances assumed	6.569	.020	-4.297	18	.000	-2.133	.49638	-3.1758	-1.0901
Equal variances not assumed			-4.297	13.06	.001	-2.133	.49638	-3.2048	-1.0611

Table 3. Statistical analysis of SVM and Decision Tree. Mean accuracy value, Standard deviation and Standard Error Mean for SVM and Decision Tree algorithms are obtained for 10 iterations. It is observed that the SVM algorithm performed better than the Decision Tree algorithm

Algorithm	N	Mean	Std.Deviation	Std.Error Mean
Accuracy SVM	10	94.4840	.68916	.21793
Decision_Tree	10	92.2410	1.41033	.44599
Loss SVM	10	5.6260	.68916	.21793
Decision_Tree	10	7.7590	1.41033	.44599

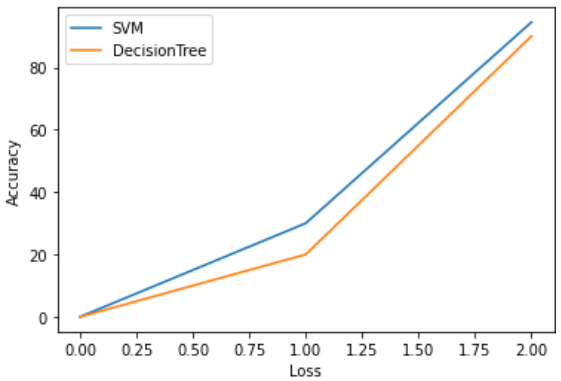

Fig. 3. Comparison of accuracy percentage (SVM algorithm accuracy of 94.48% with Decision Tree algorithm 93%)

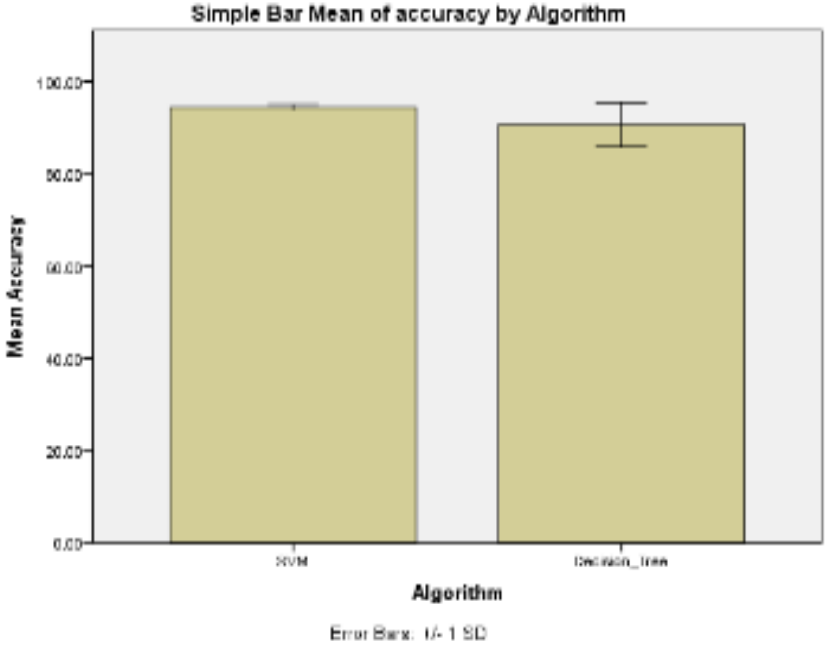

Fig. 4. Comparison of SVM algorithm and Decision Tree in terms of mean accuracy. The mean accuracy of SVM is better than Decision Tree and the standard deviation of SVM is slightly better than Decision Tree. X Axis: SVM vs Decision Tree Algorithm, Y Axis: Mean accuracy of detection ± 1 SD

Discussion

In this study the SVM and Decision Tree algorithm was analysed for predicting the accuracy percentage of COVID-19 misinformation. It is observed that SVM appears to have better (94.48%) compared to Decision Tree (93%) for predicting COVID-19 misinformation. The Novel Poly kernel function maps the dataset into higher dimensional space which helps to improve accuracy percentage. The results show the evidence there is a statistically significant difference between the SVM and Decision Tree algorithms.

This paper (Obiała et al. 2021) shows 80% of accuracy and was implemented using Buzzsumo analytical tool for predicting misinformation of COVID-19. (Nguyen, n.d.) Deep learning techniques were implemented with an accuracy of 71%. (Elhadad, Li, and Gebali 2021) explains about prediction of accuracy using the Decision Tree algorithm with an accuracy of 93%. (Shams et al. 2021) Implemented ANN algorithm with an accuracy of 93%. (Al-Rakhami and Al-Amri 2020) 85.5% of accuracy was predicted using Navis Bayes algorithm. (Shorten, Khoshgoftaar, and Furht 2021) implemented deep learning models with an accuracy of 90.3%.

The attributes that affect accuracy percentage of COVID-19 misinformation are UserName, ScreenName, Location, TweetAt. OriginalTweet and Sentiment features are mainly focused to calculate the accuracy percentage of COVID-19 misinformation.

Our institution is passionate about high quality evidence based research and has excelled in various fields (Vijayashree Priyadharsini 2019; Ezhilarasan, Apoorva, and Ashok Vardhan 2019; Ramesh et al. 2018; Mathew et al. 2020; Sridharan et al. 2019; Pc, Marimuthu, and Devadoss 2018; Ramadurai et al. 2019). We hope this study adds to this rich legacy.

It is proved that the proposed SVM appears to have better accuracy compared with previous research articles discussed. It can help the government to keep track of COVID-19 cases and situations. The limitation of the proposed work is that the real time dataset with more parameters may give more accurate results of predicting accuracy.

In future work, the framework can be extended to include trust information sources such as the "International Committee of the Red Cross" (ICRC) website which could get more parameters related to COVID-19 and thus it may result in predicting more accuracy percentage.

Conclusion

Based on the obtained results it is inferred that the SVM algorithm appears to have better accuracy of 94.48% when compared to the Decision Tree algorithm for predicting misinformation about COVID - 19.

Declarations

Conflict of Interests

No conflict of interest in this manuscript.

Authors Contributions

Author N Pravallaika was involved in data collection, data analysis, manuscript writing. Author Sashi Rekha K was involved in conceptualization, data validation, and critical review of manuscript.

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