CURRENCY RECOGNITION SYSTEM USING SUPPORT VECTOR MACHINE AND COMPARE PREDICTION ACCURACY WITH DECISION TREE

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Abstract

Aim: To recognise the currency value accurately using the machine learning algorithms support vector machine and analyze the accuracy with the Decision Tree.
Materials and Methods: Currency recognition using support vector machine (n=10) and Decision Tree (n=10) which are machine learning algorithms. Here the pretest power analysis was carried out with gpower 80% and the sample size for the two groups is 20.
Results: Currency recognition system was done with the support vector machine and Decision Tree with the accuracy of 87.09% and 80.64% respectively. From the experiment, it has the statistical 2-tailed significant difference in the accuracy of the two algorithms is 0.001 ($p<0.05$) by performing independent samples t-tests.
Conclusion: Support Vector Machine executes significantly better than the Decision Tree in currency recognition system.

Keywords: Support Vector Machine, Currency Recognition, Phony Cash, Novel Hamming Distance, Decision Tree, Machine Learning.

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1. Introduction

Modern advancements of the technology have now turned into an indispensable part that has been utilized in this cutting edge world (Kolvoort et al. 2020). In the course of the recent years, various grumbling had been made to banks furthermore other cash offices about Novel Hamming Distance, the uprise utilization of the phony cash and sluggish proficiency of the cash trade (Haman 2008). These effects have brought about a critical need to foster currency recognition utilizing machine learning algorithms to be utilized all over the world (Parpanathan 2021). The application of this research work is to help in extracting the features on the currency note, to recognise the currency value and to find accuracy of its feature identification (Singh et al. 2014).

In this research of currency recognition systems, the number of papers published in the research gate are 1100 and the number of papers published in google scholar are 980 (Kwon et al. 2016). Currency recognition system, it had been necessary to recognize the denomination of the currency in this advancing society (R, Vishnu, and Omman 2014). Indian money notes are the ones that have their own elements rundown, for example: watermark, bleed lines, security thread, intaglio printing, see through register etc and so on. Phony cash has increased a lot, the government had an estimation that there are almost Rs.2000 billion valued fake currency available for the use over in India (Pilania et al. 2016). The manual check of each and every note to find phony cash is almost impossible, however when the issue starts rising such currency is attacked into the market and circulated through the normal residents. Even though there are a lot of ways to find phony cash, still phony cash is rolling out (Gupta 2021). Novel hamming distance helps in recognizing the features of the currency.

Our institution is keen on working on latest research trends and has extensive knowledge and research experience which resulted in quality publications (Rinesh et al. 2022; Sundararaman et al. 2022; Mohanavel et al. 2022; Ram et al. 2022; Dinesh Kumar et al. 2022; Vijayalakshmi et al. 2022; Sudhan et al. 2022; Kumar et al. 2022; Sathish et al. 2022; Mahesh et al. 2022; Yaashikaa et al. 2022). The research on currency recognition using machine learning algorithms shows that there are many limitations on recognizing the currency value of a currency like wrong identity of value when it is folded or when it was soiled. This research worked on both Support vector machine and Decision Tree algorithms to identify the currency value and analyze the results

2. Materials and Methods

The experiment was conducted in Deep Learning Laboratory, Saveetha School of Engineering, Saveetha Institute of Medical And Technical Sciences. In this research two groups were taken, one group refers to Support Vector Machine and the other group refers to Decision Tree. The proposed system has a total of 154 samples from the dataset for currency recognition. The application of algorithms for Support Vector Machine clustering and Decision Tree with the G-power having 80%, alpha and beta values with 0.05, 0.2 respectively and the threshold value is 0.002 (Gupta 2021).

The data collection is taken from the open-source access website IEEE-dataport.org that is used for Currency Recognition using Support Vector Machine and Decision Tree (Patel, Jaliya, and Brahmbhatt, n.d.). The open-access dataset consists of 7 different currency value data like 10/-(22 items), 20/-(22 items), 50/-(22 items), 100/-(22 items) ,200/-(22 items), 500/-(22 items), 2000/-(22 items). The Anaconda software with windows 10 system has been used to develop this currency recognition. The proposed system uses two groups Support Vector Machine and Decision Tree where these algorithms are fitted into the dataset which is then tested and trained for the process of estimating the currency recognition where the value of a currency is known, the sample size of the dataset is 154.

Support Vector Machine

Support Vector Machine learns the pattern of the currency features, it extracts the features, vectors that are used to train the system. Machine learning algorithm, support vector machine learns the patterns of the trained currency and then the outcome is classified. Support Vector Machine uses novel hamming distance to identify the vectors. The Support Vector Machine has the ability to detect the phony cash.

Pseudocode for Support Vector Machine

Step-1: To regularize the parameter - Cfloat, default=1.0

Step-2: Specifying the kernel type used in algorithm- kernel{‘poly’, ‘rbf’, ‘precomputed’, ‘sigmoid’, ‘linear’}, along with default= ‘rbf’

Step-3: The kernel coefficient of the ‘rbf’- gamma{‘auto’, ‘scale’} or as float, with default= ‘scale’

Step-4: If the gamma = ‘scale’ (as the default) has passed then it is used as [1 / (X.var()* n_features) as the value of gamma.

Step-5: Support Vector Machine analyzes the picture for the feature extraction using

novel hamming distance.

Step-6: Novel hamming distance identifies the features to verify the currency value.

Step-7: Shows the accuracy percentage and currency value.

Decision Tree

It specifies the variables name of the dependent and independent, it identifies the least number of case instances available in the parent, child nodes and the maximum depth of the tree has been selected for building the model. For greater results and the low complexity, decision tree technique has been chosen as a growing tree method because it uses the multiway splits and it works efficiently in vast sample sizes.

Pseudocode for Decision Tree

Step-1: Instantiate a DecisionTreeClassifier 'dt' - dt = DecisionTreeClassifier()

Step-2: Fitting the training set as dt - dt.fit(X_train, Y_train)

Step-3: Setting labels as - y_ pred to predict the test = dt.predict(X_test)

Step-4: Computing the test set dt accuracy = accuracy_score(Y_test, y_pred)*100

Step-5: Prints the accuracy of the value.

The software tools used to evaluate the Support Vector Machine and the Decision Tree was Spyder Anaconda. Hardware configuration with an AMD Ryzen5 processor with 8GB RAM and operating system of Windows 10.

Statistical Analysis

The analysis was done by using the IBM SPSS version 25. Independent variables project, team_exp, year_end, etc and dependent variables are id, length, effort. For the both existing and proposed algorithms, iterations had done with the 20 samples, for every iteration, the accuracy that was predicted was noted to analyze (Yem 2002). The value obtained from the iterations, an T-test independent sample has been performed.

3. Result

In Table 1, it was observed that the Support Vector Machine is better than the Decision Tree. In the dataset, it is observed that the accuracy and performance of Support Vector Machine is significantly better than the Decision Tree.

In Table 2, the Support Vector Machine achieved a mean of 87.0480, a standard deviation of 0.06713 and a standard error mean of 0.02123. Decision Tree mean is 80.8280, standard deviation is 0.23332 and standard error mean is 0.07378.

The mean difference, and standard error difference of Support Vector Machine and Decision Tree algorithm was analyzed by Independent Samples Test has been tabulated in the Table 3, which shows that there are significant differences between the two groups since 2-tailed significance values is less than 0.001 ($p<0.05$) it says that this thesis is better.

Figure 1, represents mean accuracy of the currency recognition for the Support Vector Machine and Decision Tree. The Support Vector Machine has obtained 87.09% accuracy and Decision Tree obtained 80.64% accuracy. Support Vector Machine achieved better performance than Decision Tree.

4. Discussion

This research on currency recognization observed that accuracy for recognizing the currency value and identifying the phony cash is better than the Support Vector Machine from Decision Tree machine learning algorithms which uses supervised classification procedure. The Support Vector Machine uses the novel hamming distance to identify the vectors for feature recognition. The prediction accuracy of Support Vector Machine (87.09%) is higher than the recognition rate of Decision Tree (80.64%). The confusion matrix has been plotted to analyze the number of times the algorithm predicted the digit accurately with respect to the real numbers. 2-tailed significance values smaller than 0.001 ($p<0.05$), hence algorithms produce effective output (Soe and Sann 2018).

Existing system accuracy for Support Vector Machine is 87.09% and Decision Tree is 80.64% respectively (Darade and Gidveer 2016). This analysis to recognize the currency helps us in identifying different parameters like watermark, bleed lines, security thread, intaglio printing, see through register etc (Abbasi 2014). This accuracy value shows us that Support Vector Machine had better accuracy than the Decision Tree (Li, Li, and Luo 2008). This prediction helps us in accessing a better algorithm for the currency recognition value, rather than using different algorithms to achieve the same output (Pan et al. 2011). The Support Vector Machine using novel hamming distance identifies the vectors for feature recognition. The prediction rate of Support Vector Machine (Mladjenovic 2021).

There are some limitations, that is, recognizing the currency value is low when the currency note is folded or torn or soiled. This type of currency is leading to false currency value or as invalid input. Use of UV light is necessary to recognize the currency value for this type of currency which is costly to build in our system.

5. Conclusion

Accuracy of Support Vector Machine (87.09%) performs better than the accuracy of Decision Tree (80.64%) in recognizing the currency value. This shows that the support vector machine gives better results in comparison with the decision tree.

Declaration

Conflict of Interests

No conflict of interest in this manuscript.

Authors Contributions

Author SH was involved in data collection, data analysis, manuscript writing. Author KT was involved in conceptualization, data validation and critical review of manuscript.

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Tables and Figures

Table 1: The comparison prediction of accuracy between the Support Vector Machine and the Decision Tree. The Support Vector Machine attained accuracy of 87% compared to Decision Tree 80%.

Execution	**Support Vector Machine**	**Decision Tree**
1	87.09	80.64
2	87.11	80.59
3	86.95	81.12
4	87.05	81.05
5	86.99	80.77
6	87.00	80.45
7	87.10	81.00
8	87.07	80.99
9	86.97	81.01
10	87.15	80.66

Table 2: The mean of the Support Vector Machine algorithm is 87.24 and Decision Tree mean value is 83.557. This table shows the Support Vector Machine has attained the standard deviation(0.51426) and the standard error means (0.16262).

	Algorithm	**N**	**Means**	**Std deviation**	**Std error means**
Accuracy	Support Vector Machine	10	87.048	0.6713	0.2123
	Decision Tree	10	80.828	0.2333	0.7378

Table 3: The independent samples test, accuracy increases and the error rate decreases. The 2-tailed significance is less than 0.001.

	Levene's Test for Equality of Variances		t-test for Equality of Means						
	f	sig	t	df	Sig. (2-tailed)	Mean Diff.	Std. Error Difference	95% Confidence Interval of the Difference	
								Lower	Upper
Equal variances assumed	27.09	0.001	81.014	18	<0.001	6.22	0.07678	6.0587	6.38130
Equal variances not assumed			81.014	10.48	<0.001	6.22	0.07678	6.04999	6.39001

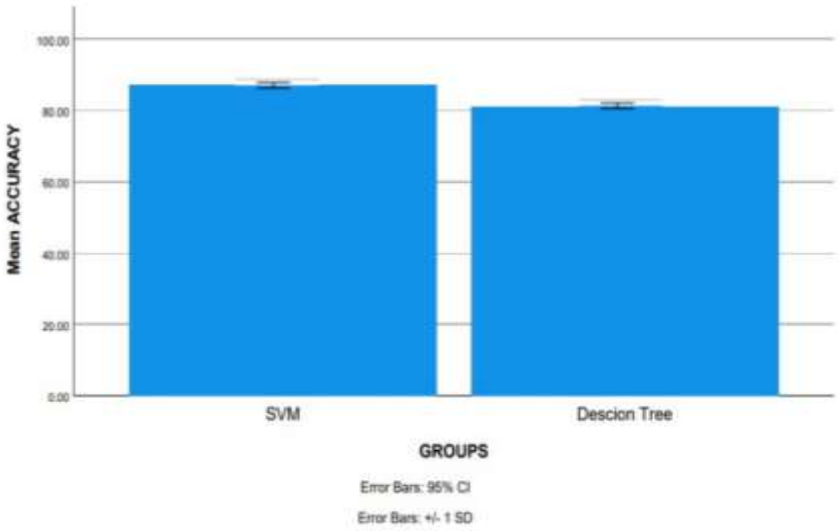

Fig. 1. Prediction accuracy for the two algorithms. The accuracy of the Support Vector Machine is better than the accuracy of the Decision Tree. X Axis: Support Vector Machine vs Decision Tree Y Axis: Mean accuracy of detection ± 1SD.