IMPROVED ACCURACY IN DIGITAL SIGNATURE IDENTIFICATION AND VERIFICATION SYSTEM USING CONVOLUTION NEURAL NETWORK COMPARED WITH SUPPORT VECTOR MACHINE

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Abstract:

Aim: To estimate accuracy in Digital signature identification and verification using Novel Convolutional Neural Network compared with Support Vector Machine.
Materials and Methods: Convolutional Neural Network and Support Vector Machine Algorithms are implemented in this research work. Sample size is calculated using G power software and determined as 10 per group with pretest power 80%.
Results and Discussion: Convolutional Neural Network provides a higher of 98.34% compared to Support Vector Machine with 97.63% in Digital signature identification and verification. There is a statistically significant difference between the study groups with $p = 0.125$ ($p<0.05$). Independent T-test value states that the results in the study are insignificant.
Conclusion: Convolutional Neural Network gives better accuracy then Support Vector Machine Algorithm.

Keywords: Digital signature identification, Novel Convolutional Neural Network, Accuracy, Image Processing, Support vector machine, Recognition.

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1. Introduction:

Digital Signature verification is a behavioral biometric used to confirm a person's identity. In addition to being a major research issue in pattern recognition and image processing, signature verification is a vital component of many applications, including access control, security, and privacy (Nanni and Lumini 2008). The task of authenticating a person based on his handwritten signature is known as signature verification. Signature recognition subdivided into 2 categories. Handwritten signatures are the most commonly applied biometric attribute since handwriting is an unconscious process and some pen gestures are invariant and cannot be easily altered during forgery. Signature verification is a method of verifying a person's identity by comparing his signature to samples in the database (A. K. Jain, Griess, and Connell 2002).

There are around 270 articles published in IEEE and 72 articles published in Google Scholar for the past 5 years.It has introduced a new model called Novel convolutional neural network model to recognize driver drowsiness detection. And used the Support Vector Machine(SVM) algorithm for actions recognition and improvised models to give higher accurate results than existing algorithms (Shanker, Piyush Shanker, and Rajagopalan 2007). Among all the articles and journals the most cited papers are (Shanker, Piyush Shanker, and Rajagopalan 2007) and (A. Jain and Hong 1996).

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). All the previously existing deep learning and machine learning models produce less accurate results in detecting Digital Signature Identification and Verification. So the current paper aims is to recognize the actions using Convolutional Neural Network Algorithm and Support Vector Machine Algorithm with comparatively higher improved accurate results by modifying the models and selecting more datasets with a greater number of parameters and more diverse outcomes aids in finding patterns much better than prior models. The aim is to improve the accuracy rate using an enhanced Novel Convolutional Neural Network algorithm in comparison with Support Vector Machine (SVM) algorithm for Digital Signature Identification (Vélez et al. 2009).

2. Materials and Methods:

The research work was performed in the Image Processing Lab, Department of Computer Science and Engineering, Saveetha School of Engineering, Saveetha Institute of Medical and Technical Sciences. Basically it is (Revathi et al. 2021) considered with two groups of classifiers namely Convolutional Neural Network and Support Vector Machine Algorithm, which is used to detect Digital signature identification and verification. Group 1 is the Novel Convolutional Neural Network algorithm with the sample size of 10 and the Support Vector Machine algorithm is group 2 with the sample size of 10 and it was (A, Gayathri, and Thanga 2020) compared for more accuracy score and Loss values for choosing the best algorithm to detect Digital signature identification and verification. Sample size has ("Fine Tuning Data Mining Algorithm for an Efficient Classification of E-Coli" 2019) been calculated and it is identified as standard deviation for Convolutional Neural Network = 0.24 and Support Vector Machine = 0.52.

Convolutional Neural Network Algorithm

The CNN was utilized for classifying and differentiating input data types.A Convolutional Neural Network is a Machine Learning method that can take an input image, assign importance to various features of the image, and differentiate between them.

Pseudocode for CNN Algorithm

```
Import Convolutional Neural Network Classifier
Import Convolutional Neural Network as CNN
filename,
pathname = uigetfile({'*.jpg'; '*.bmp'; '*.tif'; '*.gif';
'*.png'; '*.jpeg'}
'Load Image File';
if isequal(filename,0)||isequal(pathname,0)
warndlg('Press OK to continue', 'Warning');
else image aqa = imread([pathname filename]);
imshow(image aqa);
title('Input');
image aqa = Preprocess( image aqa );
figure;
imshow(image aqa);
title('Preprocess');
 image aqa = imresize(image aqa);
Compare images and gives the accuracy;
Plot the graph for accuracy;
Plot the graph for specificity;
```

Accuracy of the Convolutional Neural Network classifier;

Support Vector Machine Algorithms

The analysis was done out of a SVM Classifier. In order to complete the task, Support Vector Machine Algorithms require the required amount of input data. By summing the values of the inputs it gets, a Support Vector Machine Algorithm replicates how a biological neuron operates.

Pseudocode for SVM Algorithm

```
Import Support Vector Machine Classifier
Import Support Vector Machine as SVM
filename, pathname = uigetfile({'*.jpg'; '*.bmp'; '*.tif'; '*.gif'; '*.png'; '*.jpeg'}
'Load Image File';
if isequal(filename,0)||isequal(pathname,0)
warndlg('Press OK to continue', 'Warning');
else
image aqa = imread([pathname filename]);
imshow(image aqa);
title('Input');
image aqa = Preprocess( image aqa );
figure; imshow(image aqa);
title('Preprocess');
image aqa = imresize(image aqa);
Compare images and gives the accuracy;
Plot the graph for accuracy;
Plot the graph for specificity;
Accuracy of the Support Vector Machine classifier;
```

The Jupyter (Anaconda) programme was used to evaluate the algorithms. An Core I7 processor with 8GB of RAM was used in the hardware configurations. The system's software configuration is 64-bit Windows OS, 64-bit processor, and 2TB HDD.

Statistical Analysis

IBM SPSS version 28 was used during the analysis. It's a type of statistical software that's used to analyse data. Both proposed (Gayathri and Nandhini 2011) and existing (Gayathri and Nandhini 2011) innovative models and algorithms With a maximum of 20 samples, 10 iterations were performed, with the anticipated accuracy indicated for each (Revathi et al. 2021) iteration. The value obtained from the Independent Sample (B, Dheeraj, and Gayathri 2022) T-test iterations was calculated.

3. Results

Images selected from the dataset are framed to check the Digital signature identification and verification.Table 1 represents the Group statistics results which depict CNN with mean accuracy of 98.34%, and standard deviation is 0.24. SVM has a mean accuracy of 97.63% and standard deviation is 0.52. Proposed Innovative CNN algorithm provides better performance compared to the SVM algorithm. Table 2 shows the independent samples T-test value for CNN and SVM with Mean difference as 0.711, std Error Difference as 0.181. Significance value is observed as 0.12. Fig. 1 shows the bar graph comparison of mean of accuracy on CNN and SVM algorithm. Mean accuracy of CNN is 98.37% and SVM is 97.56%

4. Discussion

In the area of digital signature verification, many techniques and techniques have been developed. In his method, which allows general features of the signature to be extracted at a low resolution and the rest of the features from characteristic areas of the signature to be extracted at a high resolution, he has used both local and global information as a feature vector in the verification decision process (Rivard, Granger, and Sabourin 2013). He proposes a method based on local granulometric size distributions. A signature image has been chosen .that is centred on a grid of rectangular retinas and triggered by local signature sections (Schafer and Viriri 2009). Signature verification has been thoroughly researched, and it is currently being investigated in offline mode. Because a lot of dynamic information is not available in the offline mode, online signature verification has proved to have substantially higher verification rates than offline signature verification. As a result, signature verification via the internet is frequently more successful. Signatures are usually a collection of alphabets, letters, and words, not a collection of alphabets, letters, and words (Xia et al. 2017).

Based on score correlation, we suggested a Digital Signature Verification mechanism. Vertically divided feature points are extracted, and horizontally split feature points are extracted. To get the left and right sections of the signature image, a vertical line is drawn through the geometric centre of the image (Zafar and Qureshi 2009). This median is calculated by finding a region in the signature where the amount of black pixels is half of the overall number of black pixels. The top and bottom elements of the trademark image are split by a horizontal line flowing through the central axis (Batista, Granger, and Sabourin 2010).

5. Conclusion

The Image Digital signature identification and verification by using Novel Convolutional

Neural Network Compared with Support Vector Machine. The current study focused on algorithms such as, Convolutional Neural Network over Support Vector Machine for higher classification in detecting Digital signature identification and verification. The outcome of the study Convolutional Neural Network 88.67% higher accuracy than Support Vector Machine 83.72%.

Declarations

Conflict of Interests
No conflict of interest

Authors Contribution
Author SS was involved in data collection, data analysis, manuscript writing.
Author AG was involved in the Action process, Data verification and validation, and Critical review of manuscript.

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Tables and Figures

Table 1. Group Statistics Results-CNN has an mean accuracy (98.34%), std.deviation (0.24), whereas for SVM has mean accuracy (97.63%), std.deviation (0.52).

	Groups	**N**	**Mean**	**Std deviation**	**Std. Error Mean**
Accuracy	CNN	10	98.34	0.24	0.076
	SVM	10	97.63	0.52	0.164

Table 2. Independent Sample T- test Result is done with confidence interval as 95% and level of significance as 0.125 (Convolution Neural Network algorithm appears to perform significantly better than Support vector machine algorithm with these value of $p < 0.05$)

Accuracy	Independent Samples Test									
	Levene's Test for Equality of Variances						T-test for Equality of Means			
	F	Sig	t	df	Significance		Mean Difference	Std.Error Difference	95% Confidence Interval of the Difference	
					One-Sided p	Two-Sided p			Lower	Upper
Equal variances assumed	2.590	0.125	3.916	18	<.001	<.001	0.71000	0.18132	0.32906	1.09094
Equal variances not assumed			3.916	12.699	<.001	<.001	0.71000	0.18132	0.31734	1.10266

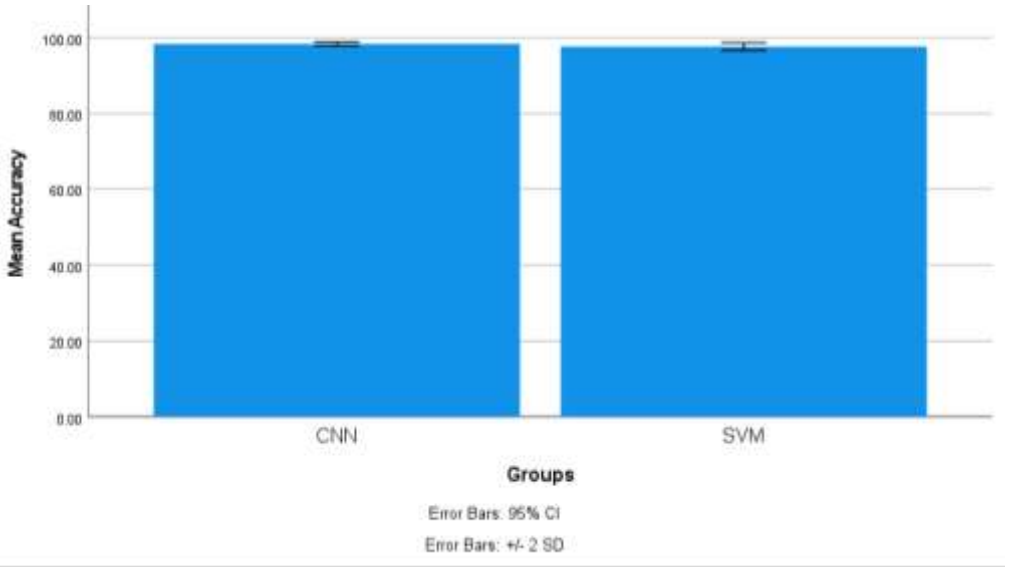

Fig. 1. Examination of SVM set of rules along with CNN set of rules in phrases of mean accuracy Std.Deviation of CNN (98.34%) is somewhat higher than SVM (97.63%). X Axis: CNN vs SVM. Y Axis: Mean accuracy of detection ± 1 SD.