

Performance Enhancement and Detection of Non Rapid Eye Movement using CNN Comparison over Recurrent Neural Network

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Abstract

Aim: The main aim of this work is to detect novel non rapid eye movements using Convolution Neural Networks (CNN) and comparing them with Recurrent Neural Networks (RNN). **Materials and Methods:** Two groups, namely Convolution Neural Network and Recurrent Neural Network algorithm were used to find the accuracy of Novel Non rapid eye movement detection with 15 samples each to evaluate, a total of 30 samples were taken for this study. Sample size was calculated using G power with pretest power at 80%, with the error rate of 0.05. Data models were trained using these Neural networks algorithms where the Novel Non rapid eye movement adapts the system effectively. **Results :** The accuracy of the Convolution Neural Network is significantly (0.013; $p < 0.05$) improved with 95.65% than the RNN with 92.1%. **Conclusion:** CNN algorithm has obtained more accuracy which significantly shows differences when compared to the RNN algorithm.

Keywords: Convolutional Neural Network, Recurrent Neural Network, Novel Non Rapid Eye Movement detection, Eye image, Image processing, Accuracy.

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INTRODUCTION

Based on the slow sleep of a person while doing important work or while driving the vehicle it leads to several accidents or mistakes. This can be prevented by a image processing system that supports novel non rapid eye movement detection using convolutional neural network and comparing the simulation results and data sets of convolution neural network and recurrent neural network for novel non rapid eye movement performance development and with an applied alert system (Vishesh et al. 2021). Convolution Neural Network (CNN) is a great way to use machine learning to classify the eye images. The convolution slides throughout the following pixel and rehashes similar interactions until all the image pixels have been covered. As it can cover all images one by one it can attain a higher accuracy rate and give better results. This study is important in this Novel Non Rapid Eye movement of the human face and can read the slow sleep rate of a person to improve the security and safety while doing work or driving (Chand, Varun Chand, and Karthikeyan 2022). Novel Non Rapid Eye movement detection (NREM) can be used for vast applications as it is used for monitoring the drowsiness, slow sleep of a person while driving the vehicle and applied with an alert system and can applied for surveillance security system in various fields like ATM robbery, PC security to improve security system (Chand, Varun Chand, and Karthikeyan 2022).

There are several articles published in this related topic which is helpful for this study. By searching it shows results about 488 from google scholar and 52 articles from Science Direct. Novel Non Rapid eye movement detection were detected by using many advanced algorithms in this CNN algorithm is used to find the Novel non rapid eye movement detection using CNN and RNN algorithms. Image processing technique is used in this study to process the input eye image with different numbers of samples along with CNN algorithm to detect the eye expression. CNN algorithm works by taking an input image, it gives significance to different viewpoints in the eye picture and can separate from each other. The CNN algorithm can be improved by tuning the model finely

with required subset data, though it is a slight slow process it runs slowly it can be pushed up by dropping a few data samples from the datasets that are collected (Meng and Zhao 2017). Eye movement classification can be done by using Convolutional Neural Networks (Prince et al. 2020). OpenCv and Keras models can be used with CNN image processing algorithm for drowsiness detection to get more accuracy (Rajahrajasingh 2019). A portion of the article which is most pertinent is taken for understanding at different exploration of projects across various disciplines (Kulkarni et al. 2019; Jabbar et al. 2020; Li et al. 2018; Quddus et al. 2021; Prince et al. 2020). Recently the developing pattern on this space propelled us to look after this undertaking. In this they said that the novel eye movement from NREM detection is observed by using the convolution neural network and studied the analysis of the human face with the help of eye image samples provided in training the algorithm. It helps in predicting the NREM sleep study with Accuracy and to give states of one's sleep or drowsiness. Our team has extensive knowledge and research experience that has translate into high quality publications (Bhansali et al. 2021; Jayanth et al. 2021; Sudhakar, Ravel, and Perumal 2021; Sathiyamoorthi et al. 2021; Deepanraj et al. 2021; Raju et al. 2021; Arun Prakash et al. 2020; Kamath et al. 2020; Shanmugam et al. 2021; Rajasekaran et al. 2020; Adhinarayanan et al. 2020; Rajesh et al. 2020; Aurtherson et al. 2021)

The obstruction in this existing research is using NREM with the help of CNN which gives as a result of low accuracy due to the slower working CNN algorithm as it has maximum poll or samples in it. Thus it requires lots of training data to get more accuracy. The main objective of this study is to find novel non rapid eye movement detection and enhance its performance using Convolution Neural Network with the comparison over Recurrent Neural Network.

Materials And Methods

The research is conducted in the Image processing laboratory, Institute of Electronics and Communication Engineering at Saveetha School of Engineering. In this study the samples of eye image from two groups were collected. Though samples are prepared in group 1 with a number of 15 samples that are to be given in the training module as an initial input for the convolution neural network algorithm. After group one, group 2 samples are given to the training module as an initial input of the Recurrent Neural network (Mishra and Birok 2020). The pre-test analysis has been prepared which has G power of 80%, CI 95% mean and standard deviation. Under the control group, independent groups are CNN and RNN algorithms and experimental groups are dependent groups for accuracy prediction in samples. The 15 sample's image accuracy is calculated one by one. It was identified that 15 samples/groups and that 15 samples were taken with standard deviation for CNN = .76133 and RNN = 1.08900 using G power (Meng and Zhao 2017).

Convolutional Neural Network (CNN) is a deep learning method which is a subset of machine learning due to its high level performance on its data. It is a great way to classify the images (Li et al. 2018). Usually computers see images using pixels. A gathering of pixels might relate an edge in an image of an example to connote it. Thus convolutions use its help to identify these images (Vishesh et al. 2021). It works on the matrix of pixels and sums up with multiplication values (Zhao et al. 2021). Recurrent neural networks are a class of neural networks that helps in modeling and sequence data (Quddus et al. 2021). The proposed method is an approach for the detection of Non- rapid eye movement detection (Mishra and Birok 2020). It remembers the input due to internal memory which involves the sequential data. Thus the output is processed under a morphological process and the eye ball movement to get the accuracy as shown in Fig. 1 which classifies the process of the Novel Non Rapid Eye movement detection.

The testing procedure of CNN algorithm was done in the PC with the hardware setup with the system configuration of intel core with i5 processor 9th gen provided by 8GB ram which has 64-bit operating system with internal storage of 917 GB of HDD. It uses Microsoft visual studio, tool used was jupyter notebook using python. Calculation used by SPSS statistical software. The images of eye and face were collected in the form of a dataset from kaggle which is used for the testing process.

Statistical analysis

The Statistical analysis was done using the IBM SPSS tool (Stehlik-Barry and Babinec 2017). For both CNN and RNN algorithms the data analysis is done. For both proposed and existing calculations, The anticipated accuracy was observed for examination in the SPSS tool. The dependent variables are accuracy and the independent variables are samples. Independent samples T-test was done in this research work to compare the means.

Results

This analysis observes the improved accuracy in percentage by using different samples and by using different algorithms which says that CNN has greater preferences than RNN in Fig. 2. It is observed that accuracy of data models varies from CNN to RNN as shown in Fig. 3. The mean value and standard deviation of accuracy obtained from the study as shown in Table 2. CNN has greater accuracy with 95.65% which is significantly greater when compared with recurrent neural network algorithms based on novel non rapid eye movement detection. The mean accuracy obtained for the RNN based algorithm is 90.7 and the standard deviation is about 1.08900.

Table 1. shows the difference in accuracy by comparing CNN with the RNN. Different samples of eye images are given as input and the accuracy is obtained by the proposed model. The accuracy is calculated in terms of % (percentage).

Table 2. describes the percentage of accuracy acquired between CNN and RNN at each number of Samples with mean accuracy of 94.2% for Convolutional Neural Network and 90.7% for RNN. The group statistical analysis of mean and standard deviation and the standard error of accuracy for Group 1 and Group 2 is calculated using the SPSS tool.

Table 3. The data obtained from the samples are tabulated based on an independent sample T-test where there is a statistical significance observed as 0.013($p < 0.005$) and the values depict the accuracy of CNN and RNN. In this survey the improved accuracy of the CNN algorithm is obtained. Hence, the accuracy of CNN is greater than RNN with the concluding survey of these two algorithms. The finding from the survey says that CNN has more accuracy than RNN.

Fig. 3. Bar Chart Comparison between CNN and RNN algorithm. Mean accuracy value of the CNN algorithm is better than the RNN algorithm. X-Axis : Groups and Y-Axis : Mean Accuracy, SD ± 1 .

Discussion

Non rapid eye movement was detected based on the training module which is trained by the number of eye images that is taken as a group of samples which is involved in improving accuracy rate by the process of image processing technique. Thus the CNN which has an accuracy rate of 95.65% is significantly improved than the RNN with 92.1%. This system will be helpful for researchers to predict the sleep rate of a person with more accuracy in future (Guo and Markoni 2019).

The previous research on this study indicates that the author investigated the presentation of the framework that has been tried utilizing the public sleepy driver through the dataset gathered (Guo and Markoni 2019). The new non-obstructive detection system involved in DNN consuming vehicle based calculation and CNN has an accuracy of 93.3% has been described by (Arefnezhad et al. 2020). This existing approaches fail to transmit the data upto time though, it is a slow process it is difficult to transmit the data when the time step was too long for this image processing technique (Guo and Markoni 2019). In this study they have implemented different image processing algorithms KNN, CNN, MTCNN, RNN and LSTM classifiers (Zhang, Luo, and Gao 2020). The performance comparison between CNN and RNN with its necessary packages are discussed and CNN is good compared to RNN (Vishesh et al. 2021). The CNN is proposed as a classifier. As the size of the images in the dataset increases, it may lead to increased computations to detect the NREM. This increased time for the detection may not be acceptable in most cases.

This Study limits the encoding of the position and orientation of objects in which the image processing algorithm is a slow process operation and it takes more time to execute the program with definite accuracy. In order to overcome this, different eye image samples are trained in this testing module to attain its improved accuracy. The future scope of this proposed work can capture multiple images and its expression to detect fraudulent behavior done in ATM machines, money robbery, and can detect the sleep rate of a person while driving a vehicle.

Conclusion

Based on the tabulations and results, Convolutional Neural Network has accuracy of 95.65% respectively. Recurrent Neural Network has accuracy of 92.1% respectively. Hence, the accuracy rate of

Convolutional Neural Network is improved in terms of accuracy with better skewness. Hence Convolutional Neural Network is better when compared to Recurrent Neural Network.

DECLARATIONS

Conflicts of Interest

No conflict of interest in this manuscript.

Authors Contributions

Author SS was involved in data collection, data analysis, and manuscript writing. Author SSS was involved in conceptualization, guidance and critical review of the manuscript.

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Tables and Figures

Table 1. Percentage of accuracy between CNN and RNN at each samples with an accuracy of 95% for CNN and 92.5% for RNN

S.NO	ACCURACY(%)	
	CNN	RNN
1	93.72	91.82
2	93.06	91.54
3	93.96	90.35
4	95.19	91.33
5	93.39	89.73
6	94.38	91.7
7	95.44	89.18
8	93.72	90.21
9	95.65	92.1
10	94.13	89.68
11	93.66	89.08
12	94.64	91.76
13	94.65	89.54

14	93.69	91.68
15	94.47	91.48

Table 2. Statistical analysis of CNN and RNN algorithms with its mean accuracy, standard deviation and standard error mean were noted. It is noticed that the innovative CNN algorithm performed significantly better than the RNN algorithm.

Group Statistics					
ACCURACY	SAMPLES	N	Mean	Std. Deviation	Std. Error Mean
	CNN	15	94.2500	.76133	.19658
	RNN	15	90.7453	1.08900	.28118

Table 3. Independent Sample t-test for CNN and RNN. There is a significant difference observed in this study with $p=0.013(p<0.05)$.

Independent Samples Test										
		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	7.004	.013	10.215	28	.000	3.50467	.34308	2.80190	4.20743
	Equal Variances not assumed			10.215	25.046	.000	3.50467	.34308	2.79815	4.21118

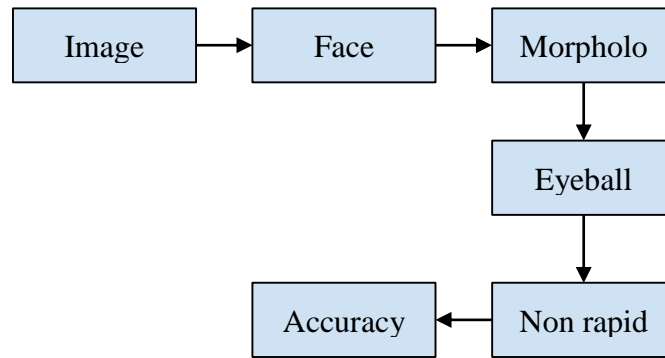


Fig. 1. The above fig shows the flow chart to detect the Novel Non Rapid Eye movement using CNN algorithm.

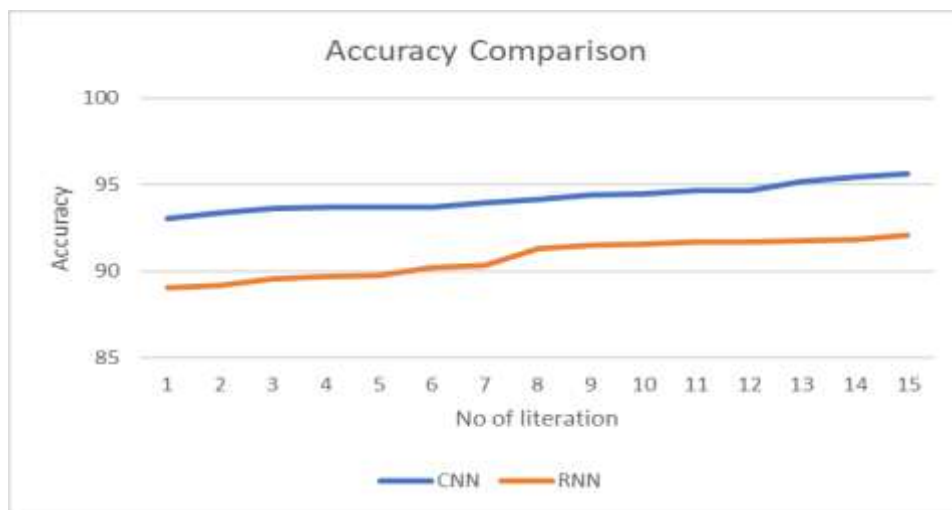


Fig. 2. In this line graph statistical analysis of comparison between CNN and RNN were found and marked. Blue line indicates the CNN algorithm and Orange line indicates the RNN algorithm

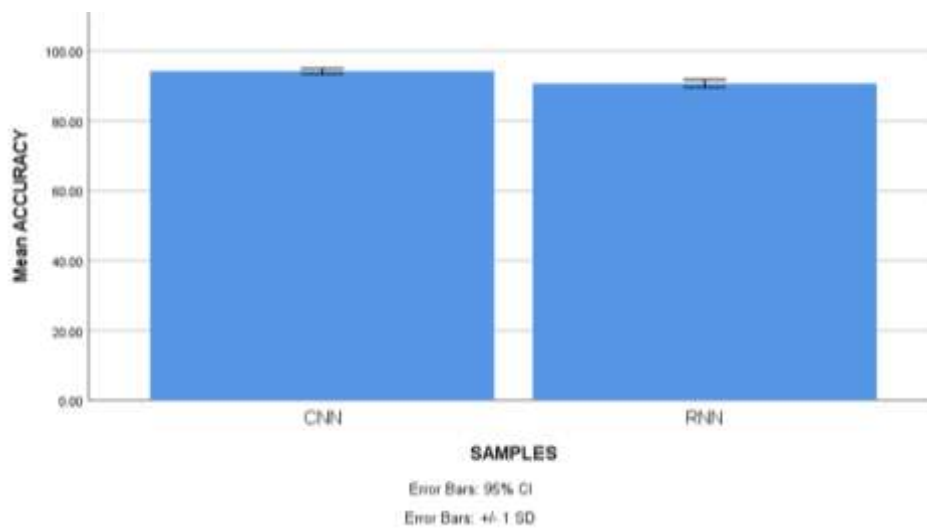


Fig. 3. Bar Chart Comparison between CNN and RNN algorithm. Mean accuracy value of the CNN algorithm is better than the RNN algorithm. X-Axis : CNN vs RNN as Samples and Y-Axis : Mean Accuracy, $SD \pm 1$.