PERFORMANCE ENHANCEMENT AND DETECTION OF NOVEL NON RAPID EYE MOVEMENT USING YOLO COMPARISON OVER CONVOLUTIONAL NEURAL NETWORK

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Abstract

Aim: The objective of this research is to observe the non-rapid eye movement expressions that have been detected using YOLO algorithm and compared with the Convolutional Neural Network. **Materials and Methods:** A YOLO algorithm is used to detect eye movement. YOLO has the special features which helps in classifying the class like circles, squares, colors and distance of the images. Two groups, containing YOLO and CNN were used to find the accuracy of novel non rapid eye movement detection with 15 samples each to calculate, a total of 30 samples were taken in this work. Sample size calculated using G power with pretest power at 80%, error rate of 0.05. Thus these features will help in finding the expression of NREM (Novel Non Rapid eye movement detection). **Results:** From the result obtained YOLO has accuracy 96.12% and CNN has accuracy 95.65%. YOLO has significantly high accuracy 0.013 ($p<0.05$) **Conclusion:** The detection rate is improved in terms of accuracy in YOLO which gives greater mean accuracy about 95.14% which is significantly better when compared with CNN in facial images.

Keywords: YOLO (You Only Look Once), Convolutional Neural Network (CNN), Novel Non Rapid eye movement detection, Sleep analysis, Image processing, Accuracy.

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1. Introduction

Novel non rapid eye movement detection is expressed by people naturally based on their sleep rate. Today many jobs require a lot of concentration, for example drivers. They have to be vigilant on the road, so that they can respond to sudden emergencies. Though driver's fatigue often causes many accidents. To reduce such events a vision based approach on the novel non rapid eye movement detection system is used with the help of image processing (Jabbar et al. 2020). From observation, the YOLO algorithm is used in novel non rapid eye movement detection of a person and gives a detailed explanation about how it finds the eye movement. YOLO is a great algorithm to be used in deep learning to classify the images. It predicts the entire image which is done in a single algorithmic run by this all images can be covered. As it can run all the samples in one run it can attain a higher accuracy rate and give better results (Kumari et al. 2021). This study is important because the non rapid eye movement of human faces is obtained based on sleep analysis and it can read the slow sleep rate of a person. Novel non rapid eye movement detection can be used in various fields like smartphones, laptops and other camera accessible components for monitoring while attending online class while attending online exams and mainly applicable for fatigue detection of a driver who drives the vehicle and alerting to reduce miscellaneous events. It is also applicable in field monitoring systems like it is used in surveillance, online class monitoring by sleep analysis and bank robbery alert systems (Xiaopan Li et al. 2021; Buric, Pobar, and Ivasic-Kos 2018).

In the last 5 years several articles were published which are helpful for this study. There were about 231 results from google scholar and 11 research articles from science direct. NREM (Novel Non Rapid Eye movement detection) will be recognised using the YOLO algorithm by computer vision and image processing. There are many advanced algorithms that help to detect eye movement like YOLO, SVM, CNN, MTCNN and many more. Novel non rapid eye movement detection can be used for vast applications as it can monitor drowsiness, slow sleep like dreamless sleep of a person while driving the vehicle with an applied alert system these processes are performed with the help of sleep analysis data base. CNN is used to find the eye movement in real time experiments by a multithreaded framework to run (Shiau et al. 2019). Novel non rapid eye movement/sleep detection using SVM over EEG also works based on sleep analysis database (Khalighi et al. 2011). MTCNN has good results in drowsiness detection. It was done by using sampling and training models on datasets of various eyelid images (Bacic and Zhang 2020). Image processing is a technique used to track eye movement with anticipated accuracy level (Mulligan 1997). It has been used for many applications to sharpen the image and for restoration, Remote sensing and color processing and so on (George and Routray 2016). The application is proposed by which image has been imported from the dataset and tested through five stages they were image acquisition which collect the image sample from dataset, image preprocessing is a method which converts normal image into resize images, image segmentation breaks the image into multiple segments, feature extraction is done to differentiate between the images and classification of the module with its algorithm which include computation of the images which gives the output (Rajahrajasingh 2019). Previous research on similar articles based upon this research project form that most relevant working is specified across multiple disciplines (Halász and Bódizs 2013; Ahmad, Ahmed, and Adnan 2019; Arkin 2018; Xicai Li et al. 2020; Brownlee 2019; Singh et al. 2021; Paul and Puvvala 2019; Manssor, Sun, and Elhassan 2021; Zhao et al. 2020; Sikka 2021).

Our team has extensive knowledge and research experience that has translated into high quality publications (Matheswaran et al. 2022; Baker et al. 2022; B et al. 2022; Dutta et al. 2022; Yabalak et al. 2022; Geetha et al. 2022; Arslan et al. 2022; Krishnan et al. 2022; Aravind Kumar et al. 2022; Sai Preethi et al. 2022). From the above analysis the existing research done using non rapid eye movement detection with the help of YOLO gives some low accuracy rate due to low recall and more localization error, as it conflicts to identify the small objects. In the CNN algorithm the process of encoding the position and orientation of the images are difficult and it is spatially invariant to its input due to its lack of ability thus it acts slower. YOLO algorithm provides the required output for a larger dataset by using face and eye images for training. The aim of the study is to find the non- rapid eye movement detection and enhance its performance using YOLO with the comparison over convolutional neural networks(CNN). The proposed module can give significant results when compared with CNN.

2. Materials And Methods

The research was performed at the image processing laboratory in the Department of Electronics and Communication Engineering, Saveetha School of Engineering, SIMATS. Two groups have been obtained from the collected samples. Group 1 is YOLO and group 2 is CNN.

The pretest power analysis taken for the simulation which has the G power of 80%, Threshold of 0.05%, CI 95% with mean and standard deviation. Among these the independent groups are YOLO and CNN algorithms and experimental groups are dependent groups for accuracy prediction in samples. For the taken 15 samples/groups were taken with standard deviation for YOLO=.38992 and CNN= 94.2500 using G power (Kumari et al. 2021).

YOLO is a method used for the detection of objects. It is a PC innovation connected with computer vision and image processing that arranges with distinguishing the examples of semantic objects of a specific class like people, vehicles in computerized pictures (Singh et al. 2021). A well research on this domain of object detection includes eye movement detection. It has many applications in areas like picture recovery and video reconnaissance. It has its own exceptional elements that help in arranging the class like circles. This algorithm studies the images by looking for squares, side length and corners. A comparable methodology is utilized for face ID where eyes, nose and lips can be found and elements like skin tone and distance between eyes can be found (Singh et al. 2021; Vigil et al. 2019). CNN is one of the deep learning method subset of machine learning techniques. In this a group pixels classify the images (Meng and Zhao 2017). They take advantage of the hierarchical pattern in data and assemble more complex patterns using smaller and simpler patterns (Prince et al. 2020). The proposed methods of these algorithms approaches for the detection of Non-rapid eye movement.Thus the intervention of the project does detection of NREM in a single algorithmic run and thus samples more number of images to obtain the actual outcome.

For the testing purpose of the YOLO algorithm, a system with hardware configuration Intel i5 processor 9th gen provided with 8GB ram which has a 64-bit operating system. It uses Microsoft visual studio, tool used was jupyter notebook using python. Calculation used by SPSS statistical software. The dataset is collected in the image format from kaggle which consists of different eye and face images which are used for training and testing purposes.

Statistical Analysis

The Statistical analysis was done using the IBM SPSS tool (McCormick and Salcedo 2017). For both group 1 which is YOLO and group 2 which is CNN algorithms taken for data analysis. For both proposed and existing algorithms, a total of 30 samples were done and for each sample the predicted accuracy was noted in the MS Excel sheet for analysis in the SPSS tool. The dependent variables are accuracy and the independent variables are different sample images which are trained with different dataset that is required. Independent T test analysis is carried out in this research work.

3. Results

The YOLO algorithm gives a higher accuracy rate of about 96.12% which is notably greater when compared to the CNN algorithm. The noticed mean of the YOLO algorithm is 95.14 and the standard deviation is .38992. Then for CNN algorithm the mean obtained is 94.25 and the standard deviation is .76133. This statistical analysis shows that the accuracy of the YOLO algorithm in detecting eye movement has improved significantly. This process demonstrates that YOLO has achieved better accuracy than CNN which has less accuracy when compared in the statistical progress.

Table 1 It differentiates both the algorithms with each sample's accuracy obtained by YOLO and CNN. For different data samples of images which are given as input to this algorithm the accuracy is calculated in terms of % (percentage).

Table 2 describes the percentage accuracy acquired between YOLO and CNN at each sample with the mean accuracy of 95.14% for YOLO and 94.25% for CNN and The standard deviation and the mean value of the accuracy for these algorithms were obtained and these processes are calculated using SPSS tool.

Table 3 The data obtained from the samples are tabulated based on the independent sample T-test, its statistical insignificance observed as 0.013 ($p<0.05$)and the values are noted. From the analysis the accuracy of YOLO is greater than CNN when compared.

Figure 1 denotes accuracy comparison between YOLO and CNN in line graph format. From Fig. 1. The study observes the improvised accuracy in percentage by using different samples of images and by using different algorithms. Which says that YOLO has greater preferences than the Convolutional Neural Network (CNN).

Figure 2 denotes accuracy comparison between CNN and YOLO in bar chart format using IBM SPSS tool. From Fig. 2 it is observed that accuracy of these algorithms varies with respect to samples and shows the mean accuracy value of YOLO is greater than CNN. X-Axis: YOLO vs CNN and Y-Axis: Mean Accuracy.

4. Discussion

YOLO is better than CNN compared with its accuracy and speed rate as it runs in a single

algorithmic run.YOLO has significant results compared with CNN. The pretest analysis was done with p-value = 0.8 (g-power 80%).

YOLO can be able to detect the non rapid eye movement more clearly while observing the sleep analysis. Computer vision and image processing is used along with this algorithm. Accuracy can be more when compared with YOLO and CNN. YOLO can be used with real time object detection and has about more than 80% accuracy according to (Vigil et al. 2019; Zhang et al. 2019). According to some research YOLO interprets the task of detecting the objects with demand speed and robust face detection (Kumari et al. 2021). Non-rapid eye movement was detected based on the training module which is trained by the number of images that is taken as a group of samples which is involved in improving accuracy rate for sleep analysis. Thus the YOLO which has an maximum accuracy rate of 96.12% is significantly improved than the CNN with 95.65%. This system will be helpful for researchers to predict the sleep analysis rate of a person with more accuracy in future. From (Lu, Zhang, and Xie 2020) real time object detection is proposed by YOLO with use of RFB-module to improve the efficiency of object detection. (Sarda, Dixit, and Bhan 2021) proposed object detection for the purpose of aiding autonomous vehicles while navigation. Eye detection using CNN algorithm is a bit slow approach to Novel Non Rapid eye movement detection since it uses complex methods to solve simple problems (Buric, Pobar, and Ivasic-Kos 2018). This institution is passionate about research and has excelled in various fields (Kumari et al. 2021); (Lu, Zhang, and Xie 2020); (Vigil et al. 2019; Zhang et al. 2019)(Buric, Pobar, and Ivasic-Kos 2018)(Vigil et al. 2019; Zhang et al. 2019). This study adds to this rich legacy.

This analysis limits low recall and localization error. It struggles to detect small objects. In order to overcome this the algorithm is boosted by the samples while training modules and to mix it up with its geometry. Thus the accuracy increases based on its algorithm.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. To improve the process of Accuracy data set image samples can be increased. It can be applied for prediction of non-rapid eye movement and the slow sleep analysis of the human face.

5. Conclusion

Based on the results and tabulation, YOLO algorithm has higher accuracy of about 96.12% and Convolutional Neural Network has accuracy of about 95.65% respectively. Hence, the Accuracy rate of YOLO is greater than that of Convolutional Neural Network when compared and it achieves better skewness.

Declarations

Conflicts of Interest

No conflict of interest in this manuscript.

Author's Contribution

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 YOLO and CNN at each sample with a higher accuracy of 96.12% for YOLO and 95.65% for CNN.

S.NO	ACCURACY (%)	
	YOLO	CNN
1	94.85	93.72
2	94.85	93.06
3	94.57	93.96
4	94.96	95.19
5	95.27	93.39
6	94.97	94.38
7	94.81	95.44
8	95.36	93.72
9	95.13	95.65
10	94.86	94.13
11	95.62	93.66
12	95.08	94.64
13	95.43	94.65
14	96.12	93.69
15	95.35	94.47

Table 2. Statistical analysis of YOLO and CNN algorithms with mean accuracy, Standard deviation and Standard Error Mean. It is observed that the YOLO algorithm performed better than the CNN algorithm.

Group Statistics					
	SAMPLES	N	Mean	Std.Deviation	Std.Error Mean
ACCURACY	YOLO	15	95.1487	.38992	.10068
	CNN	15	94.2500	.76133	.19658

Table 3. Independent Sample t-test for YOLO and Convolutional Neural Network. 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	7.079	.013	4.069	28	.000	.89867	.22086	.44626	1.35107
	Equal variances not assumed			4.069	20.872	.001	.89867	.22086	.43920	1.35814

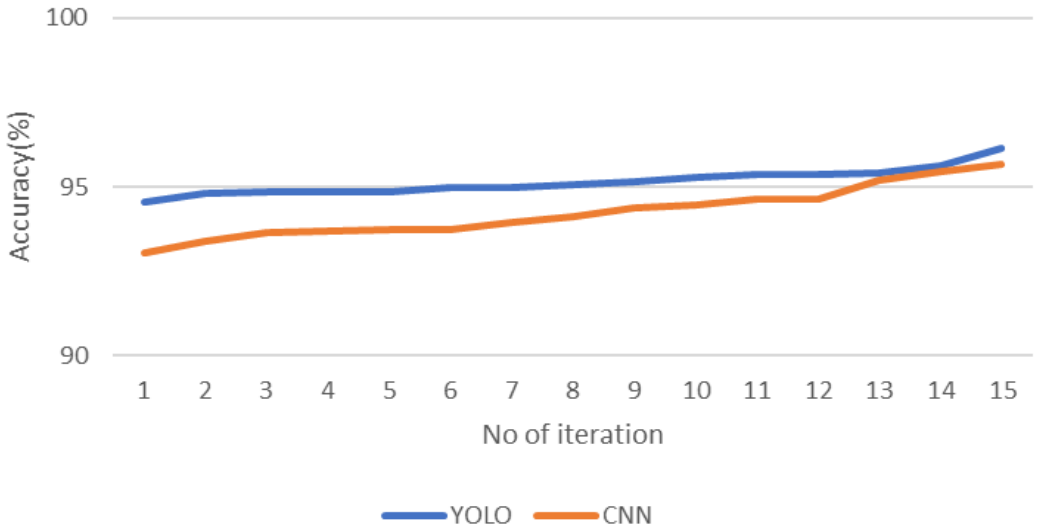

Fig. 1. In this line graph the statistical analysis of comparison between YOLO and CNN were found and marked. Blue line indicates the YOLO and the Orange line represents the CNN.

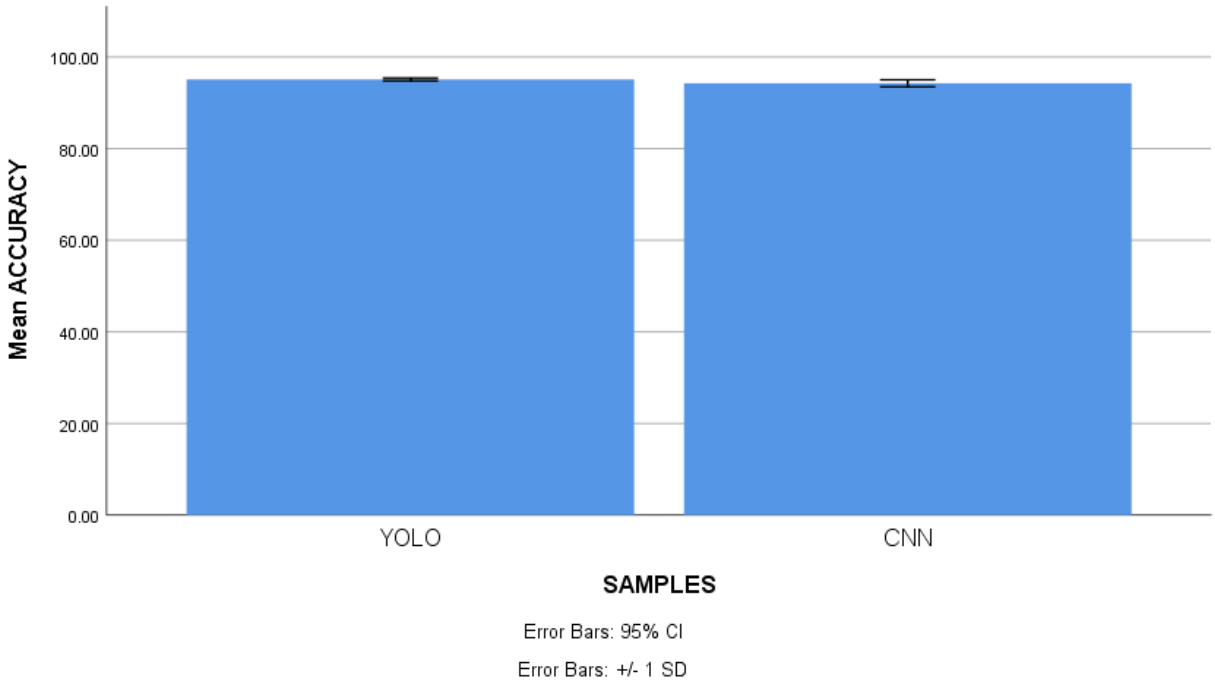

Fig. 2**.** Bar Chart Comparison between YOLO and CNN algorithm. Mean accuracy value of the YOLO algorithm is better than the CNN algorithm. X-Axis : YOLO vs CNN and Y-Axis: Mean Accuracy, SD ± 1.