For enhancing accuracy on real-time face mask detection, a novel convolutional neural network algorithm is used instead of a deep neural network algorithm.

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ABSTRACT

Aim: This paper is a comparative study of novel convolutional neural networks (N-CNN) and deep neural network algorithms to enhance the reliability of real time face mask detection. **Materials and Methods:** Sample size of Novel convolutional neural network algorithm (N=20) and deep neural network algorithm (N=20) methods are simulated by varying the NCNN parameter and deep neural parameter to optimise the pH sample size is calculated using G power 80% for just two groups and can find 40 samples utilised in this work. **Result:** According to obtained results, a novel convolutional neural network has significantly better accuracy (94.98%) when compared with deep neural network accuracy (85.41%). The statistical significance difference between novel convolutional neural network and deep neural network was found to be p=0.000 (p<0.05). **Conclusion:** Novel convolutional neural network algorithm produces greater outcomes in predicting face masks to improve accuracy percentage than deep neural network algorithm.

Keywords: Machine Learning, Face Mask Detection, Novel Convolutional Neural Network Algorithm, Deep Neural Network Algorithm, Deep Learning.

INTRODUCTION

In this research work, the public face mask dataset consisted of 853 images with three labels, including "With_Mask" and "Without_Mask" (Ieamsaard, Charoensook, and Yammen 2021). The 853 images from the face mask dataset were divided into three groups: 682 images for model training, 85 images for result validation, and 86 images for model testing (Meng et al. 2021; "[No Title]" n.d.). Open CV for face recognition has built-in face recognizers and it contains a pre-training hair classifier for detection of faces, eye Face mask detection are frequently used in medical applications (Kodali and Dhanekula 2021). Images in training dataset are subjected to pre-processing to break the preprocess and false detections to enhance the quality of images (Ali et al. 2021). In our study, it has introduced an approach for detecting a person is wearing a mask or no mask using state of art YOLOv3 architecture (Bhuiyan, Khushbu, and Islam 2020) face mask recognition system is introduced, which uses concept of object detection, done with the help of deep learning methodologies (Hari and Malathi 2021)

In the last 5 years, more than 120 papers have been published on IEEE Xplore and google scholar on face mask detection which can be detected in crowded areas. A comparative detecting the face mask can reduce spread of covid-19 (Kodali and Dhanekula 2021). In this article (Ieamsaard, Charoensook, and Yammen 2021) analysis of Novel convolutional neural network (N-CNN) and deep neural network algorithm in high performance efficiency has been made using an experimental approach. This article presents the comparative analysis between the accuracy control of novel convolutional neural networks using convolutional controllers like face mask detection. A method for novel convolutional neural networks using deep neural network algorithms and face mask detection has been presented in this article for efficiency improvement (Ali et al. 2021). In a previous study the efficiency improvement of the novel convolutional neural network algorithm with face mask detection was not properly considered to increase accuracy of face mask detection.(Venu and Appavu 2021; Gudipaneni et al. 2020; Sivasamy, Venugopal, and Espinoza-González 2020; Sathish et al. 2020; Reddy et al. 2020; Sathish and Karthick 2020; Benin et al. 2020; Nalini, Selvaraj, and Kumar 2020)

Previously our team has a rich experience in working on various research projects across multiple disciplines(Venu and Appavu 2021; Gudipaneni et al. 2020; Sivasamy, Venugopal, and Espinoza-González 2020; Sathish et al. 2020; Reddy et al. 2020; Sathish and Karthick 2020; Benin et al. 2020; Nalini, Selvaraj, and Kumar 2020).In a previous study efficiency improvement of novel convolutional neural networks (N-CNN) and deep neural network algorithm with face mask prediction was not properly considered to improve accuracy. To overcome this issue a novel convolutional neural network algorithm is implemented to improve accuracy of face mask prediction.

MATERIALS AND METHODS

The research work is carried out in the deep learning laboratory lab at Saveetha School of Engineering, Saveetha Institute of Medical and Technical Sciences, Chennai. The sample size has been calculated using the G Power software by comparing both of the controllers in Deep Learning Algorithm (Ieamsaard, Charoensook, and Yammen 2021). Two numbers of groups are selected for comparing the process and their result. In each group, 20 sets of samples and 40 samples in total are selected for this work. The pre-test power value is calculated using G Power 3.1 software g power setting parameters: statistical test difference between two independent means, α=0.05, power=0.80. Two algorithms (N-CNN and Deep neural network algorithm) are implemented using technical analysis software. In this work, no human and animal samples were used so no ethical approval is required (Siegfried, n.d.).

After dataset collection, the unused data values and unused fields are removed by changing with the required fields and sectors as per the referred data sets (Akhil, Praveen Kumar, and Pushpa 2017). After updating the data sets for predicting accuracy the OpenCV file and libraries of algorithms N-CNN and Deep Neural Network are installed and calculated. The learning process of N-CNN and Deep Neural Network algorithms are given below.

Novel Convolutional Neural Network Algorithm

A convolutional neural network is a deep learning algorithm which can take in an input image, assign importance (learnable weights and biases) to various aspects/objects in the image and be able to differentiate one from the other. The preprocessing required in a CNN is much lower as compared to other classification algorithms in machine learning. While in primitive methods filters are hand-engineered, with enough training, CNN has the ability to learn these filters/characteristics. The architecture of a CNN is analogous to that of the connectivity pattern of neurons in the human brain and was inspired by the organisation of the visual cortex. Individual neurons respond to stimuli only in a restricted region of the visual field known as the receptive field. A collection of such fields overlap to cover the entire visual area. A CNN is able to successfully capture the spatial and temporal dependencies in an image through the application of relevant filters. The architecture performs a better fitting to the image dataset due to the reduction in the number of parameters involved and reusability of weights. In other words, the network can be trained to understand the sophistication of the image better. The role of the CNN is to reduce the images into a form which is easier to process, without losing features which are critical for getting a good detection. This is important when designing an architecture which not only has good learning features but also is scalable to massive datasets. The kernel shifts 9 times because of stride Length = 1 (Non-Strided), every time performing a matrix multiplication operation between K and the portion P of the image over which the kernel is hovering. The filter moves to the right with a certain stride value till it parses the complete width. Moving on, it hops down to the beginning (left) of the image with the same stride value and repeats the process until the entire image is transverse.

Pseudocode For Novel Convolutional Neural Network Algorithm

1. **Input** : d1: dataset: dataset true labels, W1: Word2Vec Matrix
2. **Output**: score of CNN trained model on test dataset
3. Let f be the featured matrix.
4. For i in dataset do
5. Let f1 feature matrix of sample i
6. For j in i do
7. Vj is vectorized
8. Append vj and f1 split the feature set and labels
9. Append f1 for f
10. M is Parallel
11. score is evaluate
12. return score

Deep Neural Network Algorithm

A deep neural network consists of several connected units called nodes. These are the smallest part of the deep neural network and act as the neurons in the human brain. When a neuron receives a signal, it triggers a process. The signal is passed from one neuron to another on input received. A complex network is formed that learns from feedback. The nodes are grouped into layers. A task is solved by processing the various layers between the input and output layers. The greater the number of layers to be processed, the deeper the network, therefore the term, deep learning. CAP (credit Assignment Path) sheds light on the number of layers required to solve a problem. When the CAP index is more than

two then the neural network is considered a deep neural network. These applications are very efficient and useful real-life scenarios. Deep neural network AI- robots like Alpha 2 can speak, execute voice commands, write messages, etc. Deep learning is a subset of a machine learning algorithm that uses multiple layers of neural networks to perform in processing data and computations on a large amount of data. Deep learning algorithms work on the function and working of the human brain. The deep learning algorithm is capable of learning without human supervision, and can be used for both structured and unstructured types of data. Deep learning can be used in various industries like healthcare, finance, banking, e-commerce.`A neural network with some level of complexity, usually at least two layers, qualifies as a deep neural network (DNN), or deep net for short. Deep nets process data in complex ways by employing sophisticated maths modelling.

Pseudocode For Deep Neural Network Algorithm

1. Start program
2. Import the data from the required library
3. Give the path of the dataset in the image extension
4. From Yolo library importing the classification
5. Now the use model selection for importing use test image and test split
6. Use the Deep Neural Network for the importing and Yolo library
7. Give the sample size (Deep Neural Network)
8. Give the image size and tarin size then fit the train and test
9. Then print the reliability
10. End the program

Statistical Analysis

SPSS software is used for statistical analysis of novel convolutional neural networks and deep neural network algorithm methods. The independent variable is novel convolutional neural network reliability and the dependent variable is efficiency. The independent T test analyses are carried out to calculate the accuracy of the Novel convolutional neural network for both methods.

RESULTS

Table 1 shows the simulation result of proposed algorithm convolutional neural network and the existing system is deep neural network were run at different times in the google colab with a sample size of 20. It is observed that the mean accuracy of the novel convolutional neural network algorithm is better when compared with deep neural network algorithms for the sample size of 20.

Table 2 represents the mean accuracy of the novel convolution neural network algorithm which is better compared with Deep neural network algorithm with a standard deviation of 0.98241 and 0.46143 respectively. From the results, the NCNN algorithm (94.98%) gives better accuracy than the deep neural network algorithm (85.41%).

Table 3 represents the T-test comparison of both novel convolutional neural network algorithm and deep neural network algorithm. The mean, standard deviation and standard error mean were calculated by taking an independent variable T test among the study groups. The significance value between two groups is 0.000.

Figure 1 gives the comparison chart of novel convolutional neural networks of deep neural network algorithms in terms of mean and accuracy. The mean accuracy of the novel convolutional neural network algorithm is better than deep neural networks.

DISCUSSION

Novel convolutional neural network and deep neural network algorithms are implemented with the help of machine learning and compared for face mask detection to improve the accuracy by mask detection. From obtained results it is concluded that the deep neural network algorithm provides better accuracy results compared to the novel convolutional neural network algorithm with the significance value of p= 0.000.

In the recent survey, the proposed (Mangmang 2020) showed that the novel convolutional neural network algorithm is a promising option for face mask detection with root mean square value 0.04 (Ghosh et al. 2021) proposed a novel convolutional neural network model for different companies belonging to the banking sector on historical data and observed that the error level comes down drastically with the data for longer periods (Heydarzadeh, Haghighat, and Fazeli 2010) proposed novel convolutional neural network algorithm for detecting face mask by comparing the face mask movement in various sectors. (Biswas, Paudel, and Sarkar 2022) implemented six machine learning techniques i.e., ANN, MLP, RBF, SVM, Decision tree and Naive Bayes and by comparing them concluded that MLP works better with accuracy 77%. Major research contribution supports Implementation and comparative analysis of deep neural network algorithms to optimise the face mask of novel convolutional neural network drives with reduced efficiency improvement. Even though few articles listed the disadvantages of proposed deep neural network algorithms (Maiti and Pushparaj 2020). Further, the deep neural network algorithm is not suitable for improving accuracy of face mask detection.

From the above discussion, only a few articles ensure that they provide better performance than the proposed novel convolutional neural network and deep neural network algorithm for improving the accuracy of face mask detection. Also the present mask detection requires no additional prediction and therefore received intense attention in recent years. So, the proposed novel convolutional neural network and deep neural network algorithm can be used to improve the accuracy of face mask detection by regulating the face mask. Face mask detection has limited mask detection ability on future significant detection which makes better mask detection in future. Deep learning algorithms can address future mask detection.

CONCLUSION

The work involves a convolutional neural network algorithm to find the face mask detection to be improved with a better accuracy of 94.98% when compared to deep neural network accuracy is 85.41%.

DECLARATION

Conflict of Interests

No conflict of Interest in this manuscript.

Authors Contributions

Author AP was involved in data collection, data analysis and manuscript writing. Author KL was involved in the conceptualization, data validation and critical review of manuscript.

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TABLES AND FIGURES

Table 1. Predicted Accuracy of face mask detection (Accuracy of novel convolutional neural network algorithm is 94.98% and Deep neural network algorithm is 85.41%).

S.No	Novel convolutional neural networks algorithm accuracy in percentage	Deep neural networks accuracy in percentage
1	95.40	85.41
2	96.01	85.57
3	96.02	85.63
4	96.03	85.75
5	96.04	85.89
6	94.05	85.94
7	94.06	86.07
8	94.07	86.76
9	94.08	86.88
10	94.09	87.56
11	85.70	87.98

12	86.70	88.30
13	86.40	88.75
14	86.70	89.11
15	86.80	89.45
16	86.50	89.81
17	86.70	90.29
18	86.70	90.84
19	86.10	91.09
20	85.98	91.26

Table 2. Statistical analysis of Novel convolutional neural network and Deep neural network. Mean accuracy standard deviation and standard error values are obtained for 20 sample data sets.

	Algorithm	**N**	**Mean**	**Std.deviation**	**Std.Error mean**
Accuracy	NCNN	20	94.9850	.98241	.31067
	DNN	20	85.4150	.46143	.14592
Loss	NCNN	20	4.0150	.20716	.06551
	DNN	20	13.9850	.11365	.03594

Table 3. Independent sample T-test is performed for the two groups for significance and standard error determination. P<0.05 for wet basis.

		F	**Sig**	**t**	**df**	**Sig.(2-tailed)**	**Mean Difference**	**Std Error Difference**	**Lower**	**Upper**
Accuracy	Equal variances assumed	47.297	.000	27.882	18	.000	9.57000	.34323	8.84890	10.29110
	Equal			27.88	12.78	.000	9.570	.3432	8.827	10.31276

	variances not assumed			2	7		00	3	24	
	Equal variances assumed	.779	.389	-133.428	18	.000	-9.97000	.07472	-10.12698	-9.81302
	Equal variances not assumed			-133.428	13.968	.000	-9.97000	.07472	-10.13030	-9.80970

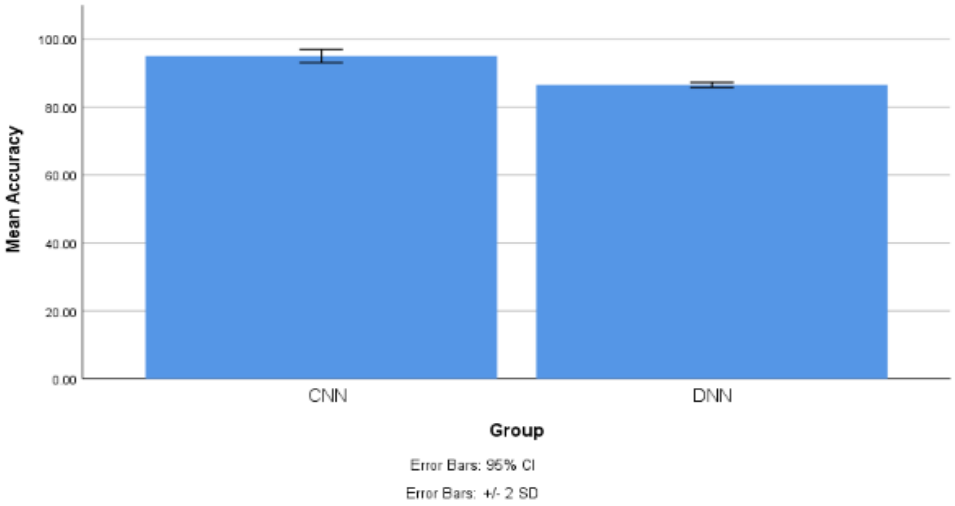

Fig. 1. Comparison of Novel convolutional neural network algorithm and deep neural network algorithm in terms of mean and accuracy. The mean accuracy of the novel convolutional neural network algorithm is better than deep neural network algorithm. X-axis: Novel convolutional neural network algorithm Vs deep neural network algorithm, Y-axis: Mean accuracy. Error Bar ±2 SD.