# ENHANCING THE ACCURACY OF EMOTION RECOGNITION SYSTEM USING NOVEL CONVOLUTIONAL NEURAL NETWORK OVER ARTIFICIAL NEURAL NETWORK

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**Article History: Received:** 12.12.2022 **Revised:** 29.01.2023 **Accepted:** 15.03.2023

**Abstract**

**Aim:** To Enhance the Accuracy of Emotion Recognition System by novel detection using Novel Convolutional Neural networks over Artificial Neural networks**.**

**Materials and Methods:** This study contains 2 groups: A novel convolutional neural network and Artificial Neural Network. Each group consists of a sample size of 10 and the study parameters using G-power setting parameters: ($\alpha$ = 0.05 and power = 0.75) and the power value is 0.8. Their accuracies are compared with each other using different sample sizes also and a significance value of 0.881 ($p>0.05$).

**Results:** The Novel convolutional neural network is 98.85% more accurate than the Artificial Neural Network of 87.45% in the Emotion Recognition System.

**Conclusion:** The CNN model is significantly better than the ANN in identifying Emotions.

**Keywords:** Emotion Recognition, Accuracy, Artificial Neural Network, Novel Convolutional Neural Network, Detection.

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## 1. Introduction

In the past few years, the sector of device learning has gone through a few main trends (Tursunov, 2021). One crucial advancement is a technique called "deep getting to know" that aims to version the high-degree information abstractions by means of employing deep networked architectures composed of more than one linear/non-linear modification (Y.-X. Yang, 2018). Deep gaining knowledge of systems are sensible systems that mimic the workings of a human mind in representing complicated data from real-global eventualities, and help in making shrewd selections (Mayor-Torres, 2021). Deep learning, also known as deeply based getting to know or hierarchical mastering, belongs to the family of the system getting to know techniques that are based on information facts illustration. Applications are Crowd, keep an eye out for suspicious activity by recording residents' identities, ages, genders, and present emotional states (Gonzalez, Yoo, and Elfadel, 2019). It has made an outstanding effect on computer vision overall performance formerly unattainable on many duties together with photograph class and novel detection (Y.-H. Yang and Chen, 2011).

There were several diverse CNN and basic Artificial Neural Network Technique performances. Approximately 188 relevant publications were discovered in IEEE Xplore, while 195 were discovered in the ScienceDirect database. The convolutional neural network (CNN) demonstrated its high efficiency in image classification, novel detection, and voiceprint recognition (Rodriguez, 2016). Through deep architecture. It can learn abstract expressions close to human cognition (J. Yang, 2021). Recent studies showed that CNNs trained on large and diverse datasets like Image Net can be used to solve tasks for which they are yet to receive training. Many works adopted the solution of ready-made features based on pre-trained CNN extraction, which achieved good results in popular benchmark tests (Stathopoulou and Tsihrintzis, 2010).

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 CNN is skilled in the usage of the again-propagation set of rules in batch mode with a batch size of 2 for 500 epochs and evaluated using five-fold cross-validation. The plot of classification overall performance against the number of education epochs is proven. A common class overall performance of 87.45% is received for the proposed approach. Facial expressions and novel detection are non-stop entities with numerous variations. Consequently, they can't be limited best to seven specific predefined instances. For instance, current structures can discover a happy and amazing face (Mahrishi, 2020). The aim of emotion identification is to detect human emotions. Emotions may be captured through either facial expressions or vocal communication. The goal of this project is to determine human emotion from facial expressions.

## 2. Materials and Methods

Research work was carried out at Machine learning, Saveetha Institute of Medical and Technical Science. The study consists of two sample groups i.e Novel convolutional neural network and Artificial Neural Network. Each group consists of 10 samples with a pre-test power of 0.881. The sample size 10 kept the threshold at 0.05, G power of 80%, confidence interval at 95% and enrolment ratio as 1. The dataset used for classification is taken from the Kaggle Inc (https://www.kaggle.com/therealsampat/fake-review-detection). Database, an open-source data repository for Emotion Recognition System using various machine learning techniques.

**Convolutional Neural Network (CNN)**

The Convolutional Neural Network (CNN) is a basic device for profound learning and is particularly suited for picture acknowledgement. Convolutional neural systems utilize pictures straightforwardly as information. The convolution arrangements play out the capacities that are performed by cells in the visual cortex. for example, extricating basic visual elements like situated edges, end-focuses, corners, and so forth. Convolutional neural systems consist of convolutional layers which remove helpful data from the information and take out superfluous fluctuation. Each phase in a convolutional system is made out of a channel bank and highlights pooling layers. Pseudocode for the SVM algorithm is shown in Table 1. With numerous stages, a convolutional system can learn multi-level chains of the importance of elements. The accuracy for Convolutional neural networks is described in Table 3.

$$S[t]= (x\star w)[t] =\sum_{a=-\infty}^{a=\infty} x[a]\, w\,[a+t] \quad (1)$$

A Convolutional Neural Network (ConvNet/CNN) may be a Deep Learning formula that might soak up associate degree input image, assign importance (learnable weights and biases) to

numerous aspects/objects within the image and be ready to differentiate one from the opposite.

**Pseudocode for Convolutional Neural Network**

**INPUT:** Training Dataset
**OUTPUT:** Classifier accuracy

Step 1: Import the required packages.
Step 2: Convert the Data Sets into numerical values after the extraction feature.
Step 3: Assign the data to X_train, Y_train, X_test and Y_test variables
Step 4: Using the train_test_split() function, pass the training and testing variables.Give test_size
Step 5: and the random_state as parameters for splitting the data using CNN training.
Step 6: Calculate the accuracy of the model.

**Artificial Neural Network**

Artificial neural networks (ANNs), sometimes merely known as neural networks (NNs), are unit computing systems galvanized by the biological neural networks that represent animal brains. An ANN is predicated on a set of connected units or nodes known as artificial neurons, that loosely model the neurons in an exceedingly biological brain.

$$\text{sigmoid}(z) = \frac{1}{1+e^{-z}} \qquad (2)$$

Every association, just like the synapses in an exceedingly biological brain, will transmit a symptom to alternative neurons. a man-made nerve cell receives a symptom then processes it and might signal neurons connected thereto. The "signal" at an association may be a complex quantity, and also the output of every nerve cell is computed by some non-linear operation of the total of its inputs. The connections are units known as edges. Neurons and edges generally have a weight that adjusts as learning takes place. the load will increase or decrease the strength of the signal at an association. Pseudocode for the ANN algorithm is shown in Table 2. Neurons might have a threshold specified when a symptom is shipped as long as the mixture signal crosses that threshold. Typically, neurons unit aggregate into layers. totally {different|completely different} layers might perform different transformations on their inputs. Signals travel from the primary layer (the input layer) to the last layer (the output layer), presumably once traversing the layers multiple times. The Accuracy of Emotional Recognition for ANN is shown in Table 4.

**Pseudocode for Artificial Neural Network**

**INPUT:** Training Dataset
**OUTPUT:** Classifier accuracy

Step 1: Import the required packages.
Step 2: Convert the Data Sets into numerical values after the extraction feature.
Step 3: Assign the data to X_train, Y_train, X_test and Y_test variables.
Step 4: Using the train_test_split() function, pass the training and testing variables.
Step 5: Give test_size and the random_state as parameters for splitting the data.
Step 6: Compiling the model using metrics as accuracy.
Step 7: Evaluate the output using X_test and Y_test functions.
Step 8: Get the accuracy of the model.

**STATISTICAL ANALYSIS**

The minimum requirement to run the software used here is intel core I3 dual core cpu@3.2 GHz, 4GB RAM, 64 bit OS, 1TB hard disk space personal computer and software specification includes Windows 8, 10, 11, Python 3.8 and MS-Office. Emotion Recognition is predicted by the randomized method, a forest of randomized trees is trained and the final predictions are based on the majority vote outcome from each tree. This method allows weak learners to correctly classify data points in an incremental approach that are usually misclassified. SPSS version 26 software tool was used for statistical analysis. An independent sample T-test was conducted for accuracy. Standard deviation, standard mean errors were also calculated using the SPSS software tool. The significance values of proposed and existing algorithms contain group statistical values of proposed and existing algorithms.

## 3. Results

The group statistical analysis on the two groups shows Novel convolutional neural network (group 1) has more mean accuracy than Artificial Neural Network (group 2) shown in Table 1 and the standard error mean is slightly less than Novel convolutional neural network. The Novel convolutional neural network algorithm scored an accuracy of 98.85% and Artificial Neural Network has scored 87.45%. The accuracies are recorded by testing the algorithms with 10 different sample sizes and the average accuracy is calculated for each algorithm. Figure 1 shows a comparison of the mean of accuracy and means loss between content-based filtering and keyword map algorithm.

## 4. Discussion

From the results of this study, the Novel convolutional neural network is proved to be having better accuracy than the Artificial Neural Network model. CNN has an accuracy of 98.85% whereas ANN has an accuracy of 87.45% (Leibe, 2016). The group statistical analysis on the two

groups shows that the Novel convolutional neural network has more mean accuracy than Artificial Neural Network and the standard error mean including standard deviation mean is slightly less than Novel convolutional neural network (Gonzalez, Yoo, and Elfadel, 2019).

A similar AI work is used in conjunction with face recognition technology to identify and categorize emotions into these seven universal emotions or a combination thereof depending on facial expressions perceived by the individual. The opposite Emotion detection recognition (EDR) is a method for detecting and recognising human emotions using technical skills such as face identification, speech and voice recognition, biosensing, machine learning, and pattern recognition.

The limitation of this model is that the accuracy of CNN may get affected due to the inconsistent data and difficulty in getting the right datasets for analysis (Kim, Poulose, and Han, 2021). Most of the data is simulated from nature which is far from reality novel Detection. Effective data preprocessing techniques and the combination of CNN with other machine learning algorithms such as ANN and CNN may give better accurate results in the future (Ozdemir, 2020).

## 5. Conclusion

Based on the experimental results, the Novel convolutional neural network (CNN) has been proved to be an Emotion Recognition System more significantly than Artificial Neural Network (ANN). The quality of datasets formed with good models should be adaptive and should not require a lot of fine-tuning on data sets.

**Declarations**

**Author Contributions**

Author VK was involved in data collection, data analysis, data extraction, manuscript writing. Author JV was involved in conceptualization, data validation and critical review of the manuscript.

**Acknowledgement**

The authors would like to express their gratitude towards Saveetha School of Engineering, Saveetha Institute of Medical and Technical Sciences (Formerly known as Saveetha University) for providing the necessary infrastructure to carry out this work successfully.

**Funding**

We thank the following organizations for providing financial support that enabled us to complete the study.

1. Vee Eee Technologies Solution Pvt. Ltd.
2. Saveetha University.
3. Saveetha Institute of Medical and Technical Sciences.
4. Saveetha School of Engineering.

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## TABLES AND FIGURES

Table 1. Accuracy of Emotion Recognition System using convolutional neural network.

| Test size | Accuracy |
|---|---|
| Test 1 | 98.85 |
| Test 2 | 98.5 |
| Test 3 | 97.25 |
| Test 4 | 98.1 |
| Test 5 | 97.25 |
| Test 6 | 98.32 |
| Test 7 | 97.56 |
| Test 8 | 97.42 |
| Test 9 | 98.32 |
| Test 10 | 97.66 |

Table 2. Accuracy of Emotion Recognition System using Artificial Neural Network.

| Test size | Accuracy |
|---|---|
| Test 1 | 87.45 |
| Test 2 | 86.32 |
| Test 3 | 87.31 |
| Test 4 | 86.53 |
| Test 5 | 87.17 |
| Test 6 | 86.30 |
| Test 7 | 86.29 |

| | |
|---|---|
| Test 8 | 87.24 |
| Test 9 | 87.45 |
| Test 10 | 86.55 |

Table 3. Group Statistic analysis, representing convolutional neural network and Artificial Neural Network.

| | **Group** | **N** | **Mean** | **Std Deviation** | **Std.Error Mean** |
|---|---|---|---|---|---|
| **Accuracy** | CNN | 10 | 97.9230 | .56751 | .17946 |
| | ANN | 10 | 86.8800 | .53026 | .16768 |
| **Error** | CNN | 10 | 2.0770 | .56751 | .17946 |
| | ANN | 10 | 13.1200 | .53026 | .16768 |

Table 4. Independent sample T-test t is performed on two groups for significance and standard error determination. The p-value is greater than .881 (convolutional neural network appears to perform significantly better than Artificial Neural Network with the value of p=0.363).

| | | **Levene's Test for Equality of variance** | | **T-Test for equality of mean** | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | **t** | **df** | **Sig(2-tailed)** | **Mean difference** | **Std.Error Difference** | **95% confidence of Difference** | |
| | | **F** | **Sig** | | | | | | **Lower** | **Upper** |
| **Error** | **Equal variances assumed** | .023 | .881 | -44.961 | 18 | .000 | 11.04300 | .24561 | -11.55901 | -10.25699 |
| | **Equal Variances not assumed** | | | -44.961 | 17.918 | .000 | 11.04300 | .24561 | -11.55918 | -10.52682 |
| **Accuracy** | **Equal variances assumed** | .023 | .881 | 44.961 | 18 | .000 | 11.04300 | .24561 | 10.52699 | 11.55901 |
| | **Equal Variances not assumed** | | | 44.961 | 17.918 | .000 | 11.04300 | .24561 | 10.52682 | 11.55918 |

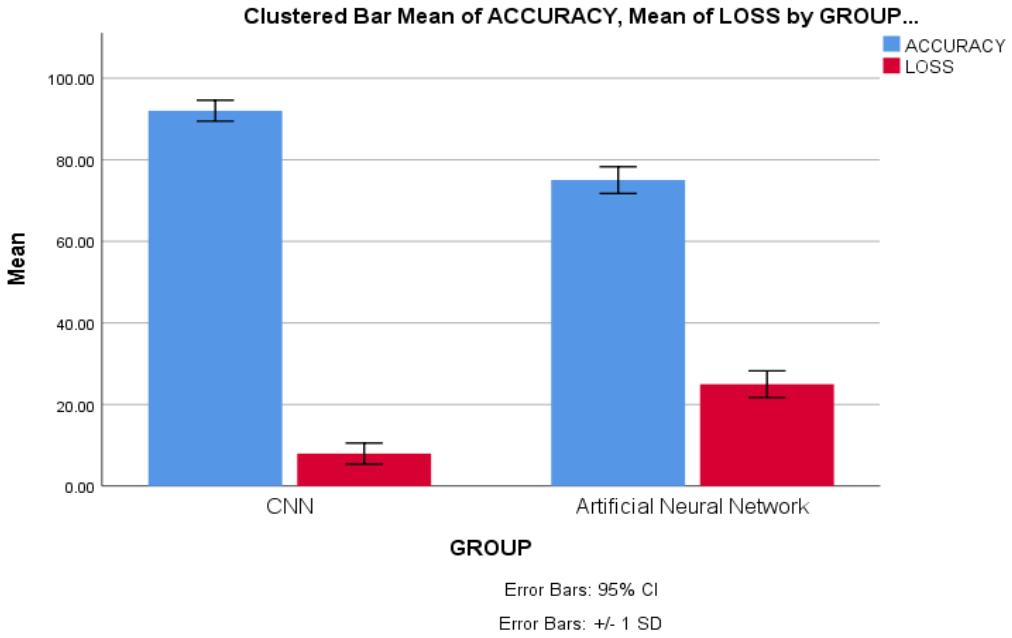


Fig. 1. Comparison of Novel convolutional neural network and Artificial Neural Network in terms of accuracy. The mean accuracy of the Novel convolutional neural network is greater than Artificial Neural Network and the standard deviation is also slightly higher than Artificial Neural Network. X-axis: Novel convolutional neural network vs Artificial Neural Network. Y-axis: Mean accuracy of novel detection + 1 SD.