Journal of Image Processing and Intelligent Remote Sensing
ISSN: 2815-0953
Vol: 04, No.03, April-May 2024
http://journal.hmjournals.com/index.php/JIPIRS
DOI: https://doi.org/10.55529/jipirs.43.26.36

Face Emotional Detection Using Neural Network

Mrs. R. Bharathi[1*], Hariharan V[2], Kaviraj S. M. G[3], Jayaprakash. M[4]

[1]Assistant Professor Department of Information Technology, Mahendra Engineering College, Namakkal, India.*
[2,3,4]Third Year Students of Information Technology, Mahendra Engineering College, Namakkal, India.

Corresponding Email: [1]harivibee@gmail.com*

Received: 28 November 2023 **Accepted:** 14 February 2024 **Published:** 01 April 2024

Abstract: ***The face reaction detection using neural network is a very much popular topic in the artificial intelligence and compute vision field. The main goal of this research is to develop a system that can accurately detect the emotional system of a person based on these facial expression. The proposed system consists of so many stages, including face detection, feature extraction, and classification. In the first stage, the face is detected and cropped from the input image using a pre-trained face detection model. Then, the relevant facial features are, like, extracted, such as the position and shape of the eyebrows, mouth, and eyes, and other stuff. The extracted features are then fed into a neural network model, which is trained on a large dataset of labeled facial expressions to learn the relationship between the facial features and emotional states. To evaluate the performance of the proposed system, several metrics are used, like, accuracy, precision, recall, and F1-score. The system is tested on a large dataset of images with labeled emotional states, and the results show that, woah, the system achieves high accuracy and precision in detecting emotions. In conclusion, the proposed system is, you know, an effective approach for face emotional detection using neural networks. The system can be used in a variety of applications, such as human-computer interaction and social robotics and emotion-based marketing, all those cool things.***

Keywords: ***Emotions, Neural Network, Emotion Recognition, Emotion Detection, Facial Recognition.***

1. INTRODUCTION

FACIAL reaction play quite a big part in finding and detect the emotion! Indeed the factor" linkage" tells how veritably is essential role by plays a part in communication connecting two different realities. Our research has, shown that measuring of facial reaction can surely important another the interpretation of what's told, to control the inflow of a discussion. Emotion discovery using neural networks is quite a fleetly growing exploration area that has

Journal of Image Processing and Intelligent Remote Sensing
ISSN: 2815-0953
Vol: 04, No.03, April-May 2024
http://journal.hmjournals.com/index.php/JIPIRS
DOI: https://doi.org/10.55529/jipirs.43.26.36

entered considerable attention in recent times! The field of affective computing really is concentrated on developing intelligent systems that can descry and respond to mortal feelings, and neural networks have really surfaced as quite a important tool for this thing. One of the foremost workshop on emotion discovery using neural networks was by Picard and associates in 1995, who did use a neural network to descry facial expressions of feelings. Since also, there has been surely a significant quantum of exploration in this area, with veritably numerous different neural network infrastructures being proposed for emotion discovery. During the once decades, colorful styles has been principally proposed for emotion finder. Numerous Algorithms was really suggest to develop model of operations that can surely descry feelings veritably well. Computer operations could surely more intact by changing feedback according to the emotional level of mortal druggies in really colorful relations. Hence the reaction of a men can relatively be intent on by way of talking or his/her face, or indeed single sign language. our work presented in our paper principally explores the detection of reaction from the face. For facial emotion identification, The older approaches surely generally think about a face pixel that's veritably important differentiate from an information picture, and face parts, mileposts are surely honored from the face sections. Next that, different spatial and worldly important are separated from these face parts. At last our project shows that, dependent on the separated important, a separated, for illustration, Keras Library, arbitrary timber, really is train to produce assumed results. This work is an applied, deep literacy model. Deep literacy is a relatively well-set model in the pattern recognition sphere. CNN is a veritably specific kind of artificial neural network that uses a machine- learning unit. CNN used for objects finding like, face recognition, image processing, etc.!

2. RELATED WORKS

In Machine Learning K- means clustering is played a important role is used for separate the pixel of image into several verity of parts Then, the most number of value in the rows is set up out and its normal. also, the less value in all rows is set up out and its normal. Define the base a two points, the pixel values nearer to the average value are grouped into a cluster and the pixel values nearer to the minimal average value are grouped into another cluster. Grounded on the clustering result, the total number of factors in the image is Measured. Grounded on the number of factors, the eye's of the person is segment as first element, by using bounding box function. Since the eyebrow or eye forms the first element while covering the pixel values column-wise, the eyes are segmented first.

Review of Literature

In a exploration field that has to do with emotion discovery, it's like, a donation of different disciplines of machine literacy, natural language, micro science, etc. In former workshop, it like collectively trolled face emotion of a human, voice features, and written data as universal pointers of feelings. Emotion is mentioned into like many sets of groups like happy, sad, nausea, wrathfulness, etc…. In after workshop are bettered by like combining the picture, oral, and written data. This kind of emulsion can be done like in some methods beforehand, after, or mongrel. Like, other morality specification of the rudiments of emotion and the collaborations between emotional feeding.

Journal of Image Processing and Intelligent Remote Sensing
ISSN: 2815-0953
Vol: 04, No.03, April-May 2024
http://journal.hmjournals.com/index.php/JIPIRS
DOI: https://doi.org/10.55529/jipirs.43.26.36

- Violin- Jones waterfall object sensors
- Histogram of acquainted slants(overeater) features birth;
- Support Vector Machines (SVM) to practice the classification into several classes then it has seven abecedarian mortal Facial refractions similar to (wrathfulness, disdain, nausea, , Happy, Sad, Surprise).

2.1 Viola-Jones Algorithm

In Machine Learning Viola-Joned Algorithm is a method for object prediction suggested in 2001, With the paper titled of Paul Viola and Michael Jones .The algorithm is mainly focused thought for face detection. Despise it have less accuracy than modern face detection steps is based on Convolution Neural Networks (CNNs)

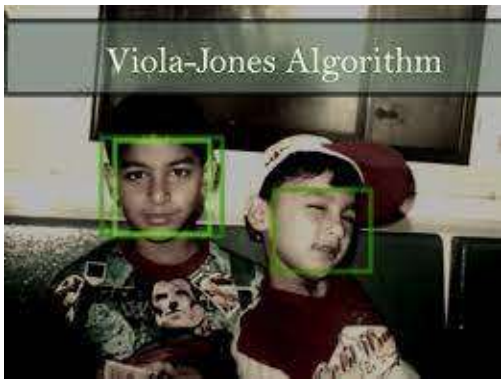

Figure. 1: Working of viola-Jones Algorithm

2.2 Real-time Emotion Detection (SVM):

Our work tackles the emotion recognition with Machine literacy using a waterfall of a multi-class support vector machine (SVM) and a double SVM. This algorithm is found to prize feelings grounded on the movement of 19 point points. These points are located in different regions of the countenance similar as the facial organs. It substantially works un-changeable rigid points on the nose. Its peak into facial recognition and action unit (AU). Computers can fluently fete facial expressions and can find out the motive of a person including in Entertainment, Media field, content analysis, felonious justice, and medical purpose.

A last information for enhancement is the purpose of on - time operation the stoner is to stay on the same point concerning the camera from which the neutral image was taken. else, the proposition follow's the relegation rates is no longer valid; resizing the neutral distances grounded on the movement of the stoner can be a result to this problem. Let's analysis further and understand deeply.

3. METHODOLOGY

This work thinks about the leading problem faced by machine literacy in the training part, substantially assigned with understanding mortal face reactions. However, it must first acquaint itself with the sad face, If the system needs to identify an angry face. also, for a happy face

Journal of Image Processing and Intelligent Remote Sensing
ISSN: 2815-0953
Vol: 04, No.03, April-May 2024
http://journal.hmjournals.com/index.php/JIPIRS
DOI: https://doi.org/10.55529/jipirs.43.26.36

discovery, the model needs to be acquainted with the fear face. Machine literacy functions as a strong tool easing further complete and briskly data analysis of large databases. This enhances the capability of directly detecting feelings, eventually offering on- time scenario. The system did not stay for unborn results; rather, images need not be stored. Ultra modern- day computers, along with neoteric data mining ways, can fleetly dissect expansive datasets, saving numerous hours.

Proposed Emotion Recognition Fashion

The program proposes a Deep literacy model and computer vision emotion recognition, using the CNN algorithm. This system stands out as further advanced compared to simply feting seven feelings with CNN. Their emotion recognition fashion exercising deep literacy involves four primary ways

- Train the human live face for database with CNN.
- Prize 7 chances for each face frame.
- Aggregate single- picture chances into fixed- length image details for each dataset image.

3.1 Dataset Collection for Motion:

In the data gathering ways, this is used both in on - time media and network media to collect as important data. Actually, real- time captures different types of emotional filmland of musketeers and relatives, cousins, some known unknown people's different kinds of facial expressions. They tagged data was originally saved for a future analysis. This point feed the data set 6 times agone. This point most trusted data set of feelings. This change the data into (48 × 48 pixel) grayscale images of faces. In fact, it contains two sections parts and passions. The feeling area contains a numeric law hen's it's run from 0 to 6. What is further, the pixel section contains a string incorporated in the form of every picture.

3.2 Training a Data Set using (DL):

The meaning of using deep literacy to rank the images is to make a complication model in machine learning .The python has keras library to makes it enough to make a model in CNN. Pixels is the form of computer vision. For illustration, some group of image may signify an features in an image. Complications to find the image. A complication multi number of matrix of pixels with a sludge matrix or 'kernel' and totalities in the addition values. Also the complication from over to the coming cubic of image and repeats the process until.

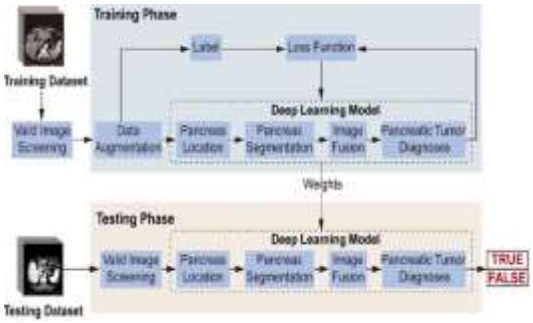

Figure. 2: Training &Testing phases

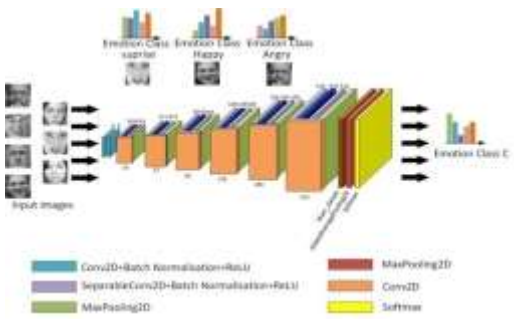

Figure. 3: Emotion detection using Convolution Neural network

Journal of Image Processing and Intelligent Remote Sensing
ISSN: 2815-0953
Vol: 04, No.03, April-May 2024
http://journal.hmjournals.com/index.php/JIPIRS
DOI: https://doi.org/10.55529/jipirs.43.26.36

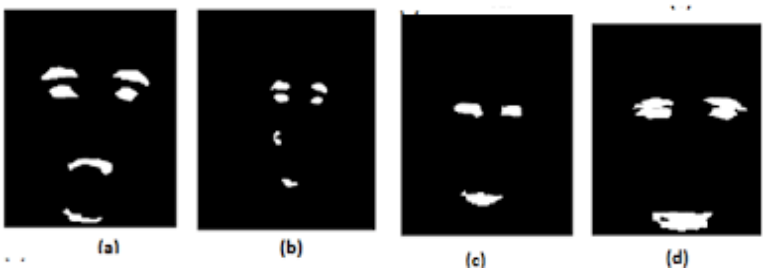

Figure. 4: Working of Cluster Algorithm

The algorithm (VIOLA-JONS) is a extensively use as medium for model discovery. This algorithm training performance is little slow, but prediction is fast. This method is uses the Haar base point. Haar features are the applicable property for face discovery. Thart are colorful kind of specification similar to the human vison,

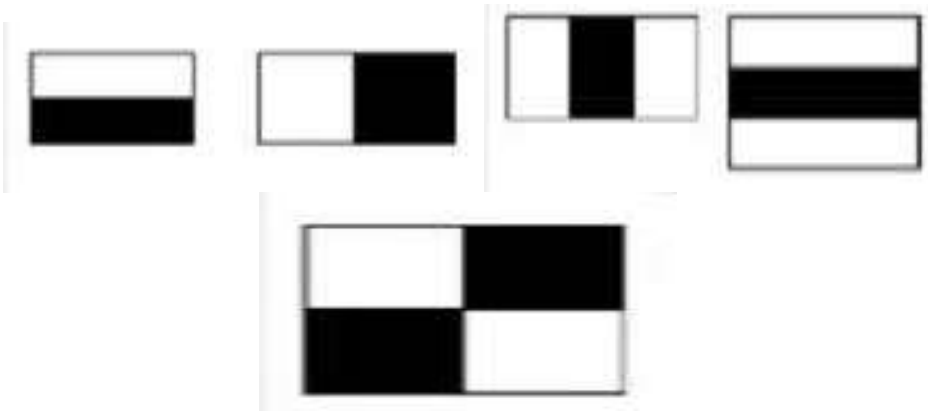

Figure. 5: Feature specification of cluster algorithm

For instance, when we take a person's face, it is necessary to convert the image into a grayscale format. Subsequently, segmentation is processed (refer to Figure-5). Suppose we aim to detect the eyebrows; in that case, we utilize edge features. Conversely, if the goal is to identify the nose, then line features and rectangle features are employed to detect the nose or any other rectangular part on our face (see Figure-6)."

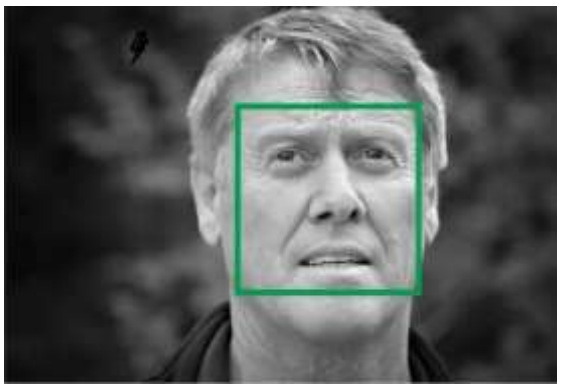

Figure. 6: Landmark image

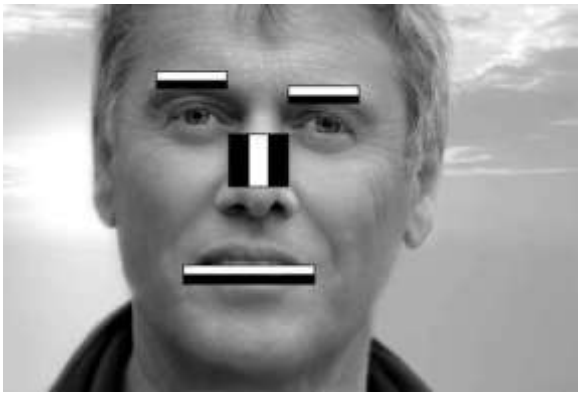

Figure. 7: Haar features image

Journal of Image Processing and Intelligent Remote Sensing
ISSN: 2815-0953
Vol: 04, No.03, April-May 2024
http://journal.hmjournals.com/index.php/JIPIRS
DOI: https://doi.org/10.55529/jipirs.43.26.36

3.4 Feature Detection:

Generally a Neural network organized in Steps or surface. Layers are make up of several inter connected layer that contain an active layers. The input is presented as Patterns, which interact to one or further retired layers , where the factual processing is done by a system of weighted connections. Facial expression recognition system is separated into three stages (Images -Pre Processing) which involves Face and facial corridor discovery using the (viola- Jones algorithm)

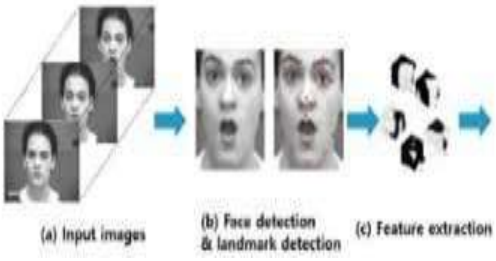

Figure.8: Feature Extraction

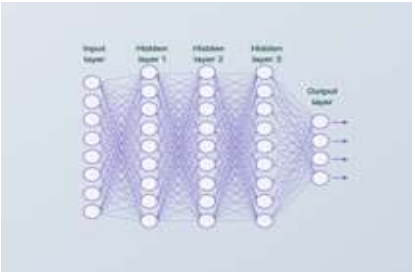

Figure. 9: Different Layers in CNN

3.5 Overall Functions Used:

Basically in Python Keras is define as free to use, Neural network, which is used for the assessing, preprocessing, separating, and optimization. It's used for making a mode with fit function. For backside, it's make a model with loss and changeable function, training process with function. For coding side; it designed for complication and lower- position calculation under tensors or TensorFlow. It uses a successional model and some layers similar as image pre-processing, complication subcaste, pooling subcaste, flatten layers, and thick layers, activation, ReLU. Image pre processing is the first phase of the proposed system and it involves the Face Discovery and FPs discovery and birth. The Viola- Jones face discovery frame(Figure- 1), which is a robust algorithm able of recycling images extremely fleetly for real- time situations, issued. This algorithm detects face region irrespective of friction in size, background, brilliance, and spatial metamorphosis of the un labeled input image. The face FP discovery is achieved by combining classifiers in a waterfall structure that's able to adding a discovery performance while reducing computational complexity. The face is first detected, cropped, uprooted and. regularized to a quality of 64x64, and also facial corridor (both eyes and mouth) are detected, cropped and uprooted from the regularized face image. The uprooted facial corridor are resized to equal size of (32 x 64) pixels. Convolution layers will be added for better delicacy for large datasets

Figure. 10: Basic Human Emotions

Journal of Image Processing and Intelligent Remote Sensing
ISSN: 2815-0953
Vol: 04, No.03, April-May 2024
http://journal.hmjournals.com/index.php/JIPIRS
DOI: https://doi.org/10.55529/jipirs.43.26.36

The large dataset was trained to enhance accuracy and results, which are the model classes for an trained data. Pooling is also a concept of Convolutional Neural Networks (CNNs). It's used for technique in Deep Learning (DL) for rial -time object recognition that complements convolution. The process involves a Convolution, or in a local Neural Network feature detector, mapping a group of an image onto a feature map. For instance, a (5x5) pixel array might be mapped to oriented edge features. Flattening is the process of reducing all Photoshop layers to a solid background layer.

3.6 ReLU (Rectified Linear Unit)

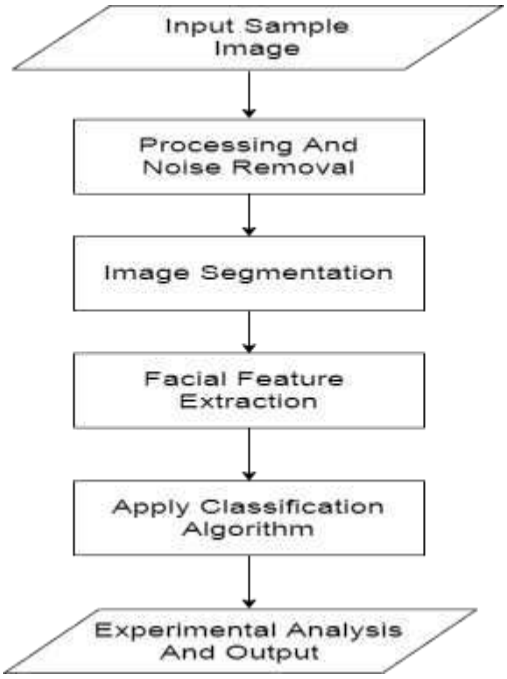

Figure. 11: Step By Step Process of Emotion Detection

The ReLU full form is remedied direct unit. It's a type of activation function that's used in deep literacy. The ReLU function takes a real- valued input and labors a value between 0 and 1. Rectified linear unit is the maximum function (x,0) with input x, matrix from a convolved image. Rectified linear unit is reckoned after the complication and thus a nonlinear activation function like than or sigmoid. Adam is an optimization algorithm that can be used rather of the classical stochastic grade descent procedure to modernize network weights iterative grounded on training data.

Initially, obtain the image from the user and eliminate any noise. Subsequently, isolate the individual's face using Haar features. Proceed to compare the picture with an existing input dataset utilizing the in Python(Keras library), which operates in conjunction with a Convolutional Neural Network (CNNs). Following this process, this layers determine the human reaction from the label set, which constitutes the predicted output. If needed, after some pre-processing, the normalized facial image undergoes feature extraction to identify key

Journal of Image Processing and Intelligent Remote Sensing
ISSN: 2815-0953
Vol: 04, No.03, April-May 2024
http://journal.hmjournals.com/index.php/JIPIRS
DOI: https://doi.org/10.55529/jipirs.43.26.36

features for classification. In other words, this module constructs a feature vector that adequately represents the face image. Subsequent to this make a difference, the facial picture is categorized into a common human emotions : Anger, Contempt, Fear, Happiness, Sadness, Surprise."

4. RESULT AND DISCUSSION

Let's start with significant difficulties encountered was the limited amount the data available to training an extensive medium. This framework need a adept at learning from nature. Motion literacy represents the most recent solution to this issue. In this method, which originated from a pre-trained strategy, the model is fine-tuned using data collected from the real time face emotions of a human. There are instances where similar methodologies have been successfully applied.

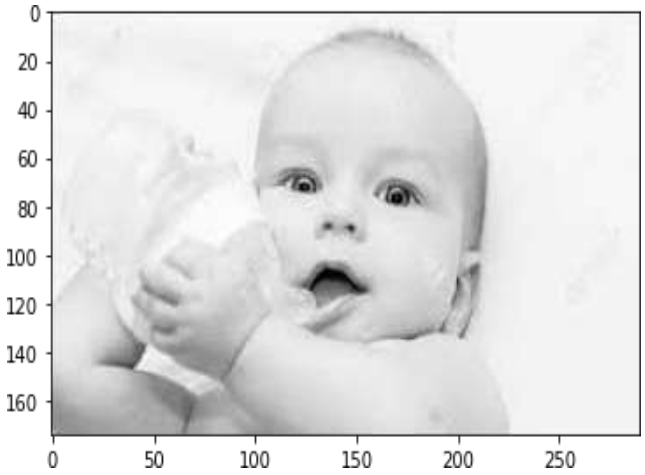

Figure. 12: Input image

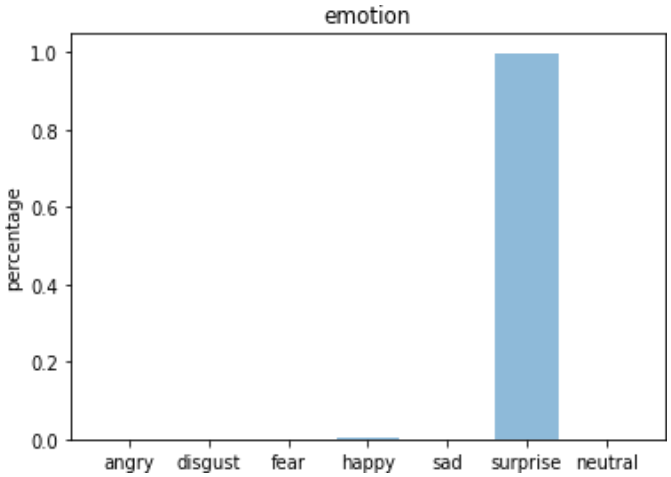

Figure. 13: Emotion Detected

Journal of Image Processing and Intelligent Remote Sensing
ISSN: 2815-0953
Vol: 04, No.03, April-May 2024
http://journal.hmjournals.com/index.php/JIPIRS
DOI: https://doi.org/10.55529/jipirs.43.26.36

Data Collection and Preprocessing: Start by assessing the perfection and diversity of the data used for training and testing the neural network. Consider factors similar as the number of images, variety of feelings represented, and demographic representation. insure that the dataset is duly labeled and preprocessed to exclude any bias or noise.

Model Performance Metrics: Assess the performance of the neural network model using applicable criteria. Common criteria for emotion discovery include delicacy, perfection, recall, and F1 score. delicacy measures the overall correctness of the prognostications, while perfection and recall give perceptivity into the model's capability to rightly identify specific feelings.

Confusion Matrix: Construct a Confusion Matrix to fantasize the model's actual performance in classifying different feelings. The confusion matrix shows the number of prognostications for each emotion class, both correct and incorrect. It helps identify specific feelings that may be challenging for the model to fete directly.

Error Analysis: Dive deeper into the crimes made by the model. Examine misclassified exemplifications to identify any patterns or common characteristics that may have led to misclassifications. This analysis can help pinpoint areas for enhancement, similar as nebulous expressions or underrepresented feelings in the dataset.
Evaluation of impulses Assess the neural network for any impulses it may parade. impulses can arise from imbalanced training data or essential impulses in the dataset reflections. estimate the model's performance across different demographic groups to insure fairness and inclusivity in emotion discovery.

Comparison with Baselines: The Work of the neural network model is checked with existing baselines or other cutting-edge approaches in the field. This benchmarking is crucial for evaluating the model's effectiveness and pinpointing areas for enhancement.

Real-World Testing: The model's performance is evaluated using real-world data, sourced from various environments. Such testing is essential to determine the model's generalizability and its capability to manage variations in lighting, facial expressions, and backgrounds.

Iterative Improvement: The model is refined iteratively, taking into account user feedback and making necessary modifications to enhance accuracy and reliability. This process may include fine-tuning the model parameters, augmenting the dataset, or adjusting hyperparameters.
During this research, it was discovered that achieving higher accuracy necessitates a substantial amount of test data and keywords. Additionally, a considerable volume of raw data is essential for extending the research. A high-performance computer with a powerful graphics processing unit (GPU) is also indispensable for processing large datasets swiftly. With sufficient data and a high-performance computing system, it becomes feasible to elevate the accuracy beyond 97%. Moreover, such a system could be utilized across various platforms to yield diverse outcomes and aid in discerning patterns of emotional expression.

Journal of Image Processing and Intelligent Remote Sensing
ISSN: 2815-0953
Vol: 04, No.03, April-May 2024
http://journal.hmjournals.com/index.php/JIPIRS
DOI: https://doi.org/10.55529/jipirs.43.26.36

5. CONCLUSION

An educated person can often discern another individual's emotions by observing and examining them. Still, in this new age era, hardware are becoming increasingly and think like human. Currently, If a machine has been trained to respond to human emotions at that moment, then it can understand and act like a human. Additionally, a confusion matrix can be utilized to visualize the distribution of correct and incorrect predictions across emotional categories. Through error analysis, it is possible to discern common patterns or challenges that the model encounters in recognizing specific emotions. This analysis can inform improvements in the model or dataset by addressing these challenges and reducing errors. It is crucial to consider potential biases in the model, especially those related to imbalanced training data or biases in dataset representations. Assessing the model's performance across diverse demographic groups ensures fairness and inclusivity in emotion recognition. Comparing the neural network model's performance with existing benchmarks or state-of-the-art approaches provides a measure for evaluating its efficacy. Real-world testing is essential to assess this model's generalizability and its ability to adapt to variations in face-time scenarios.

6. REFERENCES

1. Raghav Puri, Archit Gupta, Manas Sikri, , Emotion Detection using Image Processing in Python,” in IEEE Conference ID: 42835 2018 5th International Conference, 14th -16th March 2018
2. Wout Swinkels, Luc Claesen, Feng Xiao, Haibin Shen, SVM Point-based Real-time Emotion Detection,‘ in IEEE, 19 October 2017
3. Chu Wang, Jiabei Zeng, Shiguang Shan, Xilin Chen, RECOGNITION AND FACIAL ACTION UNIT DETECTION WITH ADAPTIVELY WEIGHTS SHARING NETWORK,‘ in IEEE, 2019
4. Ninad Mehendale, ‚Facial emotion recognition using convolutional neural networks (FERC),‘ 18 February 2020
5. James Pao, ‚Emotion Detection Through Facial Feature Recognition,‘ in International Journal of Multimedia and Ubiquitous Engineering, November 2017
6. Aitor Azcarate, Felix Hageloh, Koen van de Sande, Roberto Valenti, ‚Automatic facial emotion recognition,‘ January 2005
7. Dan Duncan, Gautam Shine, Chris English, "Facial Emotion Recognition in Real-Time," November 2016
8. Aneta Kartali, Miloš Roglić, Marko Barjaktarović, Milica Đurić-Jovičić, Milica M. Janković, Real-time Algorithms for Facial Emotion Recognition: A Comparison of Different Approaches,‘ in 2018 14th Symposium on Neural Networks and Applications (NEURAL),Nov 2018
9. Jonathan, Andreas Pangestu Lim, Paoline, Gede Putra Kusuma, Amalia Zahra, ‚Facial Emotion Recognition Using Computer Vision,‘ in Indonesian Association for Pattern Recognition International Conference (INAPR) IEEE, 31 January 2019

Journal of Image Processing and Intelligent Remote Sensing
ISSN: 2815-0953
Vol: 04, No.03, April-May 2024
http://journal.hmjournals.com/index.php/JIPIRS
DOI: https://doi.org/10.55529/jipirs.43.26.36

10. Renuka S. Deshmukh, Vandana Jagtap, Shilpa Paygude, Facial emotion recognition system through machine learning approach,‘ in International Conference on Intelligent Computing and Control Systems (ICICCS) IEEE, 11 January 2018
11. Hyeon-Jung Lee, Kwang-Seok Hong, ,A Study onEmotion Recognition Method and Its Application using Face Image,‘ in International Conference on Information and Communication Technology Convergence (ICTC) IEEE, 14 December 2017
12. T. K. Senthilkumar, S. Rajalingam, S. Manimegalai, V. Giridhar Srinivasan ,Human Facial Emotion Recognition Through Automatic Clustering Based Morphological Segmentation And Shape/Orientation Feature Analysis,‘ in IEEE International Conference on Computational Intelligence and Computing Research (ICCIC), 08 May 2017.