IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

Facial Emotion Detection Using Neural Network

Suchethana H C
Assistant Professor
Department of Information Science and Technology
Jawaharlal Nehru New College of Engineering,
Shivamogga

***Abstract*- Facial expression recognition is a rapidly growing field within pattern recognition and computer vision, finding applications in diverse areas such as artificial intelligence, human-computer interaction and security monitoring. Its significance has increased in recent years due to its potential in various domains. The project investigates the effectiveness of pretrained CNN model weights for facial expression (FER) and explores their potential for emotion based recommendations. By transferring learned weights from a pretrained CNN model trained on a large-scale FER dataset, the model chives improved accuracy and efficiency. Fine tuning with a smaller FER dataset further enhances adaptability.**

1. INTRODUCTION TO FACIAL EMOTION AND DETECTION

Facial expression of a human being plays in important role in decision making perception and identifying one's emotion [1]. As the emotions keep changing based on the situation, circumstances, the instantaneous recognition of right emotion would help to communicate effectively with each other. Facial expressions communicate non-verbal cues felt by brains, captured either in photos or videos can be approximated [2]. Emotion Recognition through facial expressions can play a significant role in the field of social communication, law enforcement, and human-machine interactions. Detecting emotions from photos or video is a simple operation for the human eye, but it's a tough proposition for machines, and it necessitates a variety of image processing approaches for feature extraction [2].

Facial expression recognition is a hot research direction of pattern recognition and computer vision. It has been increasingly used in artificial intelligence, human-computer interaction and security monitoring in recent years. Emotion detection is considered the most important technique used in many applications such as smart card applications, surveillance, image database investigation, criminal, video indexing, civilian applications, security, and adaptive human-computer interface with multimedia environments.

Increase in technology for digital signal processing and other effective feature extraction algorithms, automated emotion detection in multimedia attributes like movies and activities is growing rapidly and this system can play an important role in many potential applications like human-computer interaction systems and movie entertainment and if the emotion is positive, a specific recommendation will be presented which contains different types.

Any inter-personal relationship involves emotions. These may be expressed through facial expressions, conversation, gestures, and even attitude. Faces are the most apparent and information-rich options for Emotion Recognition. Faces are also easier to gather and process than other expressions. A facial expression is a complex movement of the face muscles that conveys the subject's feelings to others. Expressions convey a person's inner feelings. For these reasons, researchers in psychology, animation, HCI, linguistics, neurology, medicine, and security are becoming interested in a human-computer interaction system for autonomous face recognition. Face and expression analysis using computers is a new area. Emotion analysis is matching a face to an emotion. So, the goal is to read a person's feelings from their face. Automated face expression analysis systems facilitate human-machine interaction. But this is not an easy process. Many characteristics of facial expressions can now be retrieved and evaluated for good sentiment analysis using deep learning and convolutional neural networks (CNN). Our goal is to create a deep learning-based model for face sentiment analysis. Using a convolutional network architecture, face characteristics can classify emotions into Disgust, Fear, Anger, Surprise, Happiness, Sadness, and Neutral [3]. In this study, a typical neural network with data augmentation is used to recognise face expressions. This method can categorise images into Anger, Disgust, Fear, Happy, Sad, Surprise, and Neutral [3]. Due to their huge number of filters, CNNs are superior for image identification tasks.

Figure 1.1 Different Facial Expressions

1.1 Problem Description :

Human emotions and intentions are expressed through facial expressions and deriving an efficient and effective feature is the fundamental component of facial expression system. Face recognition is important for the interpretation of facial expressions in applications such as intelligent, man-machine interface and communication from live motion images. The facial expressions are useful for efficient interaction Most research and system in facial expression recognition are limited to six basic expressions.

To recognize human emotion by processing their facial expression using neural network the facial expression is to be captured using the webcam of the computer. This system aims to capture the person's emotion through facial expressions. The user's current emotion is used to generate an automatic movies playlist and suggest activities according to their mood. Thus, capturing and recognizing a person's emotion and displaying appropriate movies and activities matching the user's mood.

1.2 Objectives :

Following are the Objectives of the project undertaken to develop a facial expression recognition system.

- To experiment machine learning algorithm in computer vision fields.
- To detect emotion thus facilitating Intelligent Human-Computer Interaction.
- Improving and optimizing both feature extraction and selection methods for facial expression recognition.

1.3 Organization of the report :

The information in this report is organized into the following chapters, Chapter 1: presents the brief introduction about the Facial Emotion Detection, problem description and objectives. Chapter 2: presents the literature survey, where Advantages and Drawbacks of the survey papers are mentioned.
Chapter 3: presents the System Design and Architecture.
Chapter 4: Conclusion for the solution is defined.

2. LITERATURE SURVEY

This chapter gives information about the journals and papers referred [1]. "Emotion Detection with Facial Feature Recognition Using CNN & OpenCV"

Authors: Sarwesh Giri, Gurchetan Singh, Babul Kumar, Mehakpreet Singh, Deepanker Vashisht, Sonu Sharma, Prince Jain

Description of the work:

Facial expression plays an important role in decision making, perception, and identifying one's emotions. Although the key is to understand human behaviour and how it interacts within the environment from time to time. Emotion Detection through Facial feature recognition is an active domain of research in the field of human-computer interaction (HCI). Humans are able to share multiple emotions and feelings through their facial gestures and body language. In order to detect the live emotions from the human facial gesture, we will be using an algorithm that allows the computer to automatically detect the facial recognition of human emotions with the help of Convolution Neural Network (CNN) and OpenCV.

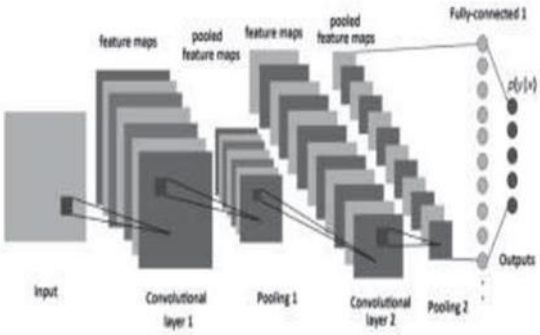

Figure 2.1 Different layers of CNN

Ultimately, Emotion Detection is an integration of obtained information from multiple patterns. If computers will be able to understand more of human emotions, then it will mutually reduce the gap between humans and computers. It demonstrates an effective way to detect emotions like neutral, happy, sad, surprise, angry, fear, and disgust from the frontal facial expression of the human in front of the live webcam.

Advantages:

- If the machine has been programmed to respond in the spirit of human sentiment at the moment. The machine can then act and behave like humans.
- EDR software is capable of providing the actual results of the emotion with a few seconds.
- The emotion detector's accuracy will be close to 80%.

Drawbacks/Demerits:

- The biggest drawback is low accuracy rate of neutral and negative facial expressions.
- Decision tree approaches were implemented, which aid in determining which emotions percentages are high and which emotions percentages are low.

[2]. "Emotion Recognition from Facial Expression using CNN
Authors: Ishika Agrawal, Adarsh Kumar, Swathi DG, Yashwanthi V, Rajeshwari Hegde

Description of the work:

Emotion recognition of a human being plays in important role in developing heartful relationships with others. As the emotions keep changing based on the situation, circumstances, the instantaneous recognition of right emotion would help to communicate effectively with each other. Facial expressions communicate non-verbal cues felt by brains, captured either in photos or videos can be approximated. Emotion Recognition through facial expressions can play a significant role in the field of social communication, law enforcement, and human-machine interactions. Detecting emotions from photos or video is a simple operation for the human eye, but it's a tough proposition for

machines, and it necessitates a variety of image processing approaches for feature extraction.

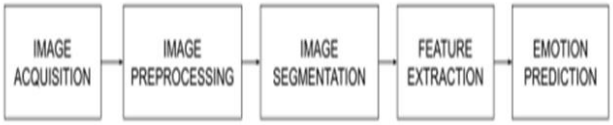

Fig.2.2.1 Flow diagram for emotion prediction.

A time-efficient hybrid design for emotion recognition using facial expression is proposed which uses pre-processing stages and several Convolutional Neural Network (CNN) topologies to improve accuracy and training time. Sadness, happiness, contempt, anger, fear, surprise, and neutral are the seven primary human emotions anticipated. The model will be tested using the MMA Facial Expression database as well as other facial positions. To avoid bias towards a specific group of photos from a database, performance will be evaluated using cross-validation techniques. Proposed system was trained using a huge database consisting of around 35,000 images. Using our personal system, training time for the proposed model was drastically reduced to 30hrs. Finally, a Web application will be developed to make it more user-friendly in real-time.

Advantages:

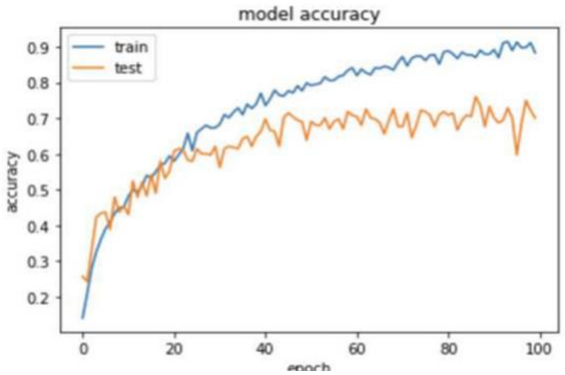

Fig.2.2.2 Accuracy vs Epoch plot.

- Results were obtained independently for females and males which was 77% accurate.
- The emotions get classified accurately even if there are any issues regarding clarity, brightness and contrast. The model also works on an image with beauty filters.
- OpenCV is supported on almost all platforms like windows, Linux, and even android.

Drawbacks/Demerits:

- Accuracy for emotions like Happy, Surprise and Neutral is very high. Medium accuracy for Angry and Fear emotions. For Disgust and Sad, accuracy is low.
- While Grayscale conversion It decreases the data's dimensionality.:

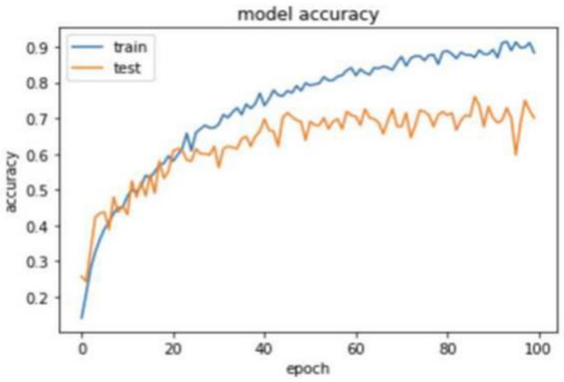

Fig.2.2.3 Loss vs Epoch plot

3]. "Deep Learning and Machine Learning based Facial Emotion Detection using CNN"

Authors: Shubham Kumar Singh, Revant Kumar Thakur, Satish Kumar, Rohit Anand

Description of the work:

Connect with each other predominantly through voice and yet additionally by tokens of body, to feature specific pieces of their correspondence and to show emotions. Human emotions are the psychological conditions of sentiments that are encountered impulsively which imply the expressions on the face. By using Machine Learning and Deep Learning in this proposed paper, the emotions will be detected and human behaviour will be extracted. The various body language approaches like idiomatic expressions, eye stirring and body movement are significant while applying for the association between machines and people. Out of these methods, facial emotion is most commonly employed as it refers to the mental sentiments and frame of person's mind.

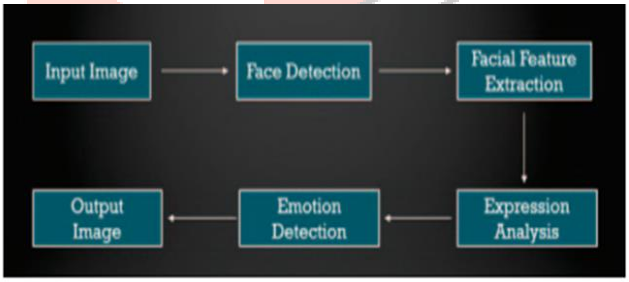

Fig.2.3.1 Flowchart for the proposed work.

The identification of the various emotions is sometimes a very difficult job as no specified prototype or framework is there to differentiate the various kinds of sentiments and also there are various complications while recognizing the facial emotion expression.

Facial emotions are so much crucial in non-verbal type communication which appears to the internal feelings of an individual that reflects on the faces. Machine Learning techniques, Deep learning and Neural Network algorithms are used for emotion recognition. The work proposes an efficient technique using Convolutional Neural Networks (CNNs) to detect anger, disgust, happiness, fear, sadness, calmness and surprisingness.

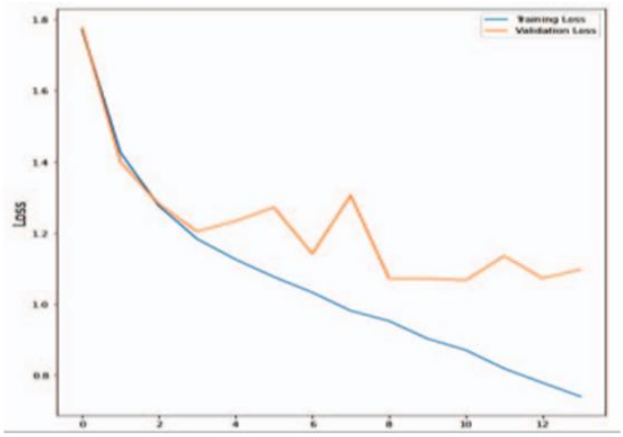

Fig.2.3.2 Comparison of training loss & validation

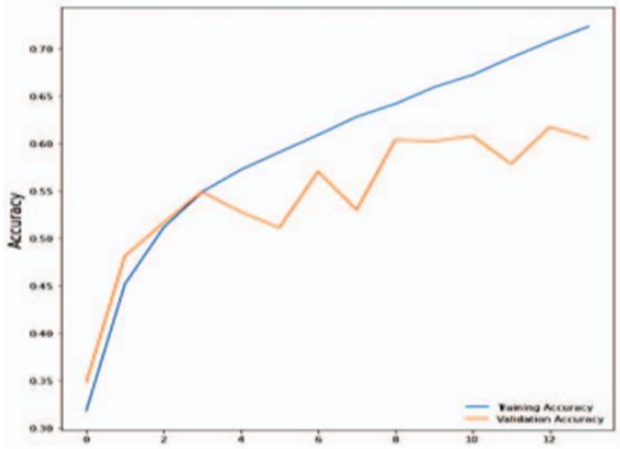

Fig.2.3.3 Comparison of training accuracy & validation accuracy.

Advantages:

- The algorithm recognizes the facial region regardless of the raw input image's size, brightness, background, or spatial transformation.
- The data mining tools, if correctly adjusted, can produce better results than a human being.
- Machine learning improves the accuracy with which emotions may be detected.

Drawbacks/Demerits:

- The rate of learning, a slower learning rate refers to the precise weights (to some extent), but it will also take longer time to calculate the weights.
- Person's face has to be identified then we must first change the image to grayscale before moving on to image segmentation.

[4]. "Facial Expression Recognition with Convolutional Neural Networks"
Authors: Shekhar Singh, Fatma Nasoz

Description of the work:

Facial expressions are one aspect of non-verbal communication, as the face expresses prominent signals of communication, which includes eye contact. Other aspects of non-verbal communication are gestures and body language. It is easy for humans to notice and understand faces and facial expressions. However, it still proves difficult to develop an automated system that accomplishes the same understanding.

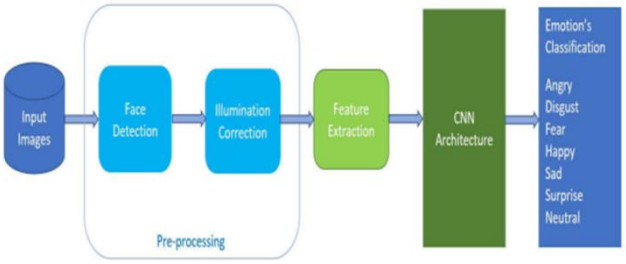

Fig.2.4 Future work pipeline of FER.loss.

Emotions are a powerful tool in communication and one way that humans show their emotions is through their facial expressions. One of the challenging and powerful tasks in social communications is facial expression recognition, as in non-verbal communication, facial expressions are key. In the field of Artificial Intelligence, Facial Expression Recognition (FER) is an active research area, with several recent studies using Convolutional Neural Networks (CNNs). It demonstrates the classification of FER based on static images, using CNNs, without requiring any pre-processing or feature extraction tasks. It also illustrates techniques to improve future accuracy in this area by using pre-processing, which includes face detection and illumination correction. Feature extraction is used to extract the most prominent parts of the face, including the jaw, mouth, eyes, nose, and eyebrows. Furthermore, we also discuss the literature review and present our CNN architecture, and the challenges of using max-pooling and dropout, which eventually aided in better performance.

Advantages:

- Face detection to capture most of the face and implement various techniques on the face image in order to improve accuracy in the future.
- Feature extraction can reduce an immense amount of data down to a relatively small set, which allows for faster computation.

Drawbacks/Demerits:

- When images are captured in various types of light, expression features are sometimes inaccurately detected, and therefore, the expression recognition rate can be low and make feature extraction more difficult.
- There is no place for correction once the message is sent.

[5]. "Fast Facial emotion recognition Using Convolutional Neural Networks and Gabor Filters"
Authors: Milad Mohammad Taghi Zadeh, Maryam Imani, Babak Majidi

Description of the work:

Emotions have an important role in our everyday lives, and directly affect decisions, reasoning, attention, prosperity, and quality of life of human. Establishing communication between people is through emotions and facial expressions. Nowadays, with the influence of computers on human lives and the mechanization of lives of individuals, establishment of human and computer interaction (HCI) has played a crucial and very important role. There is a strong interest in improving the interaction between humans and computers. Many people believe in this theory and there is a positive and useful emotional response for establishing a good and useful cognitive link between computers with users.

Fig.2.5.1 The proposed filter.

The emotions evolved in human face have a great influence on decisions and arguments about various subjects. In psychological theory, emotional states of a person can be classified into six main categories: surprise, fear, disgust, anger, happiness and sadness. Automatic extraction of these emotions from the face images can help in human computer interaction as well as many other applications. Machine learning algorithms and especially deep neural network can learn complex features and classify the extracted patterns. A deep learning-based framework is proposed for human emotion recognition. The proposed framework uses the Gabor filters for feature extraction and then a Convolutional Neural Network (CNN) for classification. The experimental results show that the proposed methodology increases both of the speed training process of CNN and the recognition accuracy.

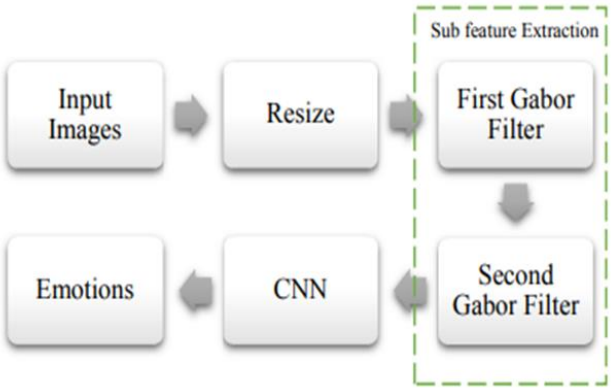

Fig.2.5.2 The proposed method.

Advantages:

- After the Gabor filter applied, the system learning became faster and the accuracy has improved.
- The learning speed of Convolution Neural Network has increased profoundly.
- The convolutional neural network receives a number of sub feature and takes one step further in extracting the emotions from the faces.

Drawbacks/Demerits:

- It takes too high time for performing features due to its dimension of feature vector is very long.
- The existing face databases are not reliable for real world applications.

[6]. "Efficient Facial Expression Recognition Algorithm Based on Hierarchical Deep Neural Network Structure"

Authors: Ji-hae kim, Byung-gyu kim, Partha pratim roy, De-mi jeong

Description of the work:

Technologies for communication have traditionally been developed based on the senses that play a major role in human interaction. In particular, artificial intelligence voice recognition technology using the sense of hearing and AI speakers has been commercialized because of improvements in artificial intelligence (AI) technology. Facial expression recognition (FER) is an important type of visual information that can be used to understand a human's emotional situation. In particular, the importance of AI systems has recently increased due to advancements in research on AI systems applied to AI robots. Proposes a new scheme for FER system based on a hierarchical deep learning. The feature extracted from the appearance feature-based network is fused with the geometric feature in a hierarchical structure.

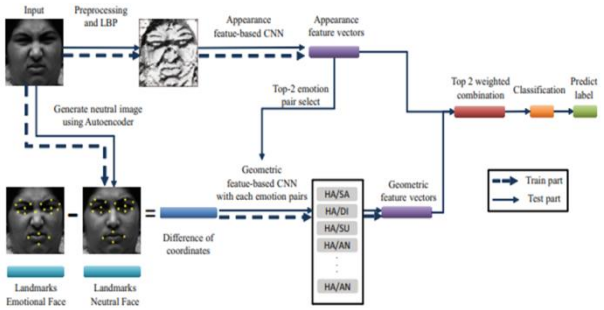

Fig.2.6.1 The overall procedure of the proposed FER algorithm.

features of the face using the pre-processed LBP image, while the geometric feature-based network learns the coordinate change of action units (AUs) landmark, which is a muscle that moves mainly when making facial expressions. The proposed method combines the result of the SoftMax function of two features by considering the error associated with the second highest emotion prediction result. In addition, proposes a technique to generate facial images with neutral emotion using the autoencoder technique. By this technique, we can extract the dynamic facial features between the neutral and emotional images without sequence data.

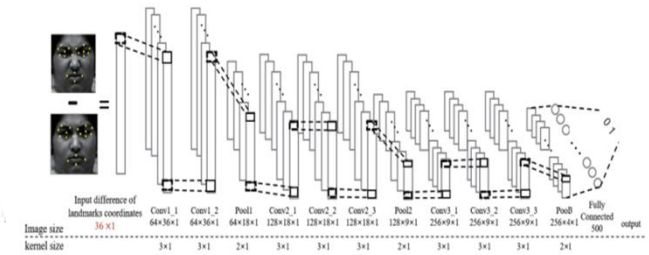

Fig.2.6.2 Geometric feature-based CNN structure.

Advantages:

- More accurate and efficient facial expression recognition.
- It extracts holistic features of LBP features containing AU's information.
- Six emotions are enhanced significantly.

Drawbacks/Demerits:

- Very labour intensive.
- Duration of development is more, thus time consuming.
- This method is expensive to perform experiments.

"Convolution Neural Network for Automatic Facial Expression Recognition"

Authors: Xiaoguang Chen, Xuan Yang, Maosen Wang, Jiancheng Zou

Description of the work:

Face expression recognition system can detect and recognize face expression in real time, and can be used in everyday applications such as access control systems, intelligent service equipment and so on. Facial expression recognition is a hot research direction of pattern recognition and computer vision. It has been increasingly used in artificial intelligence, human-

computer interaction and security monitoring in recent years. Convolution neural network (CNN) as a depth learning architecture can extract the essential features of the image, and in the case of large changes in shooting conditions, its effect is better than the traditional methods of Support Vector Machines (SVM) and Principal Component Analysis (PCA). Therefore, an improved method of facial expression recognition based on CNN is proposed. The purpose is to classify each facial image as one of the seven facial expressions considered in this study.

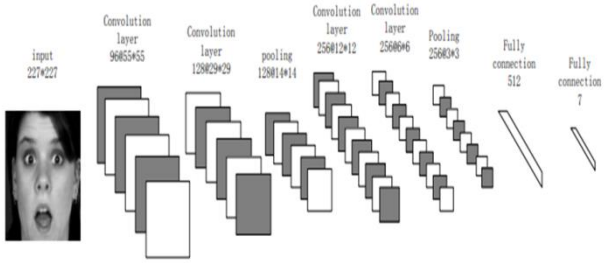

Fig.2.7.1 Facial expression recognition network

According to the characteristics of facial expression recognition, a new convolution neural network structure is designed which uses convolution kernel to extract implicit features and max pooling to reduce the dimensions of the extracted implicit features. In comparison to AlexNet network, we can improve the recognition accuracy about 4% higher on the CK+ facial expression database by the aid of Batch Normalization (BN) layer to our network. A facial expression recognition system is constructed for the convenience of application, and the experimental results show that the system could reach the real-time needs. Facial expression recognition algorithm combining appearance feature and geometric feature based on deep neural networks for more accurate and efficient facial expression recognition.

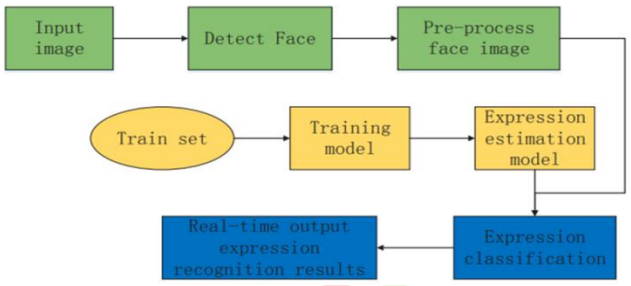

Fig.2.7.2 Face recognition system flow chart structure.

Advantages:

- The experimental results in both instantaneity and efficiency is improved by adding the pre-processing step before training data and adding BN layers to the network.
- It is efficient.
- Increase the robustness of facial expression.

Drawbacks/Demerits:

- Threatens privacy.
- Technology is still new.
- Errors can implicate innocent people.

[8]. "A Facial Expression Recognition Algorithm based on CNN and LBP Feature"
Authors: Qintao Xu, Najing Zhao

Description of the work:

In recent years, facial expression recognition technology has been widely used in computer vision, security monitoring and image classification. However, in practical application, it is difficult to solve the rotation problem of facial expression image, which leads to the decrease of expression recognition rate and is difficult to meet the actual demand. Although the convolutional neural network (CNN) can extract the high-dimensional features of the image and has the invariance of gray scale, it does not have the invariance of rotation. Local binary model (LBP) is a feature extraction algorithm with rotation invariance, which can solve the rotation problem to some extent. To solve the above problems a face expression recognition algorithm based on CNN and LBP is proposed, and compares this algorithm with other algorithms.

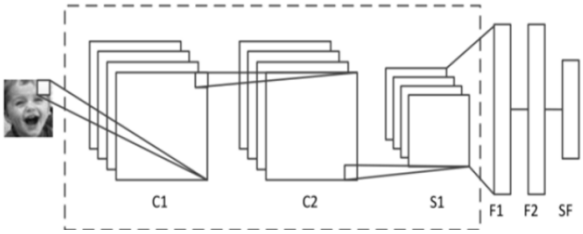

Fig.2.8.1 The improved convolutional neural network structure diagram.

An improved convolutional neural network model based on AlexNet model is designed and named as EmotionNet. It mainly lies in replacing the single-layer convolution in AlexNet with continuous convolution, and replacing the three single-layer convolution in AlexNet with two continuous convolutions. In order to solve the effect of image rotation on recognition, a feature fusion algorithm based on EmotionNet and LBP was designed and named lbp-cnn algorithm.

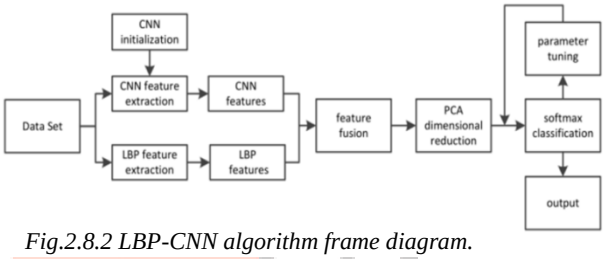

Fig.2.8.2 LBP-CNN algorithm frame diagram.

Advantages:

- The CNN can extract the high dimensional features of the image and has invariance of grayscale.
- PCA dimensionality reduction is used to remove redundant features and obtain most important features.
- LBP-CNN has higher accuracy rate than Emotion Net and AlexNet different rotation angles excluding 0 degree.

Drawbacks/Demerits:

- The existing facial expression image are generally obtained by posing. Which are characterised by a single background, no change in light and no blocking of face. However, in practical the FER is often interfered by complex background, uneven illumination etc.
- To improve the expression recognition algorithm further complex scenes still needs further research.

[9]. "Facial Emotion Recognition using Deep Convolutional Networks"
Authors: Mostafa Mohammadpour, Hossein Khaliliardali, Seyyed Mohammad. R Hashemi, Mohammad. M AlyanNezhadi

Description of the work:

Emotions are an important property of humans and are essential for effective interactions among the society. Humans' communication can be either verbal of nonverbal. Facial emotion recognition is an emerging field which use in many nowadays application including social robots, neuromarketing and games. Non-verbal communication methods like facial expressions, eye

movement and gestures are used in many applications of human computer interaction, which among them facial emotion is widely used because it conveys the emotional states and feelings of persons. The emotion recognition is not an easy task because there is no landmark distinction between the emotions on the face and also there are a lot of complexity and variability. In the traditional machine learning algorithm, some important extracted features used for modelling the face, so, it cannot achieve high accuracy rate for recognition of emotion because the features are hand-engineered and depend on prior knowledge.

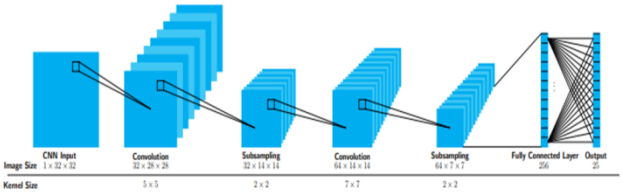

Fig.2.9 Architecture of proposed CNN for detecting AUs.

Convolutional neural networks (CNN) are developed for recognition of facial emotion expression and classify them into seven basic categories. Instead of calculating hand-engineered features, CNN calculates features by learning automatically. The novelty of the proposed method is using facial action units (AUs) of the face which first these units are recognized by CNN and incorporate to recognizing the seven basic emotion states.

Advantages:

- The novel approach for detection action using (AUs) which is a coding of facial movements in psychological framework.
- A CNN is developed for optimal feature extraction and detecting AUs by means of detecting 7 expresses emotion.
- It proves that deep CNN are able to learn characteristics of facial expression and increase facial emotion recognition accuracy.

Drawbacks/Demerits:

- Needs very large amount of data to perform better than other techniques.
- It's computationally expensive.

[10]. "A Deep Neural Network Driven Feature Learning Method for Multi-view Facial Expression Recognition"

Authors: Tong Zhang, Wenming Zheng, Member, Zhen Cui, Yuan Zong, Jingwei Yan and Keyu Yan

Description of the work:

A novel deep neural network (DNN) driven feature learning method is proposed and applied to multi-view facial expression recognition (FER). Scale invariant feature transform (SIFT) features corresponding to a set of landmark points of each facial image are firstly extracted from each facial image. Then, a feature matrix consisting of the extracted SIFT feature vectors is used as input data and sent to a well-designed DNN model for learning optimal discriminative features for expression classification [10]. The proposed DNN model employs several layers to characterize the corresponding relationship between the SIFT feature vectors and their corresponding high-level semantic information.

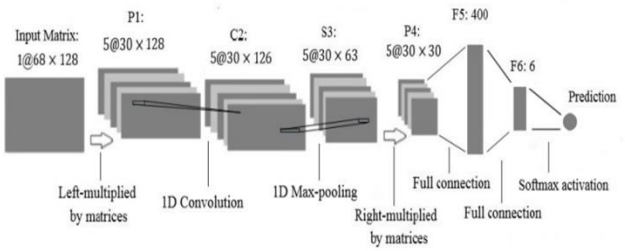

Fig.2.10 The structure of the DNN-driven feature learning framework for FER. This framework consists of two projection layers, two full connected layers, one convolution layer, one max-pooling layer and one SoftMax layer. Detailed descriptions are given in the text.

By training the DNN model, we are able to learn a set of optimal features that are well suitable for classifying the facial expressions across different facial views. To evaluate the effectiveness of the proposed method, two non-frontal facial expression databases, namely BU-3DFE and multi-PIE, are respectively used to testify our method and the experimental results show that our algorithm outperforms the state-of-the-art methods.

Advantages:

- Two novel layers including the projecting layer and convolutional layer are designed based on the structure of the low-level input feature to adaptively learn spatial discriminative information as well as extract more robust high-level features, which is very different from CNNs and DBNs.
- The two layers can largely reduce the space complexity of parameters and further alleviate the overfitting phenomenon especially on those small datasets.

Drawbacks/Demerits:

- It requires very large amount of data in order to perform better than other techniques.
- It is extremely expensive to train due to complex data models. Moreover, deep learning requires expensive GPUs and hundreds of machines. This increases cost to the use.

3. SYSTEM DESIGN

The work considers the leading challenge faced by machine learning and the entire system is the training part. Where the system has to train by using real data of human face reactions.

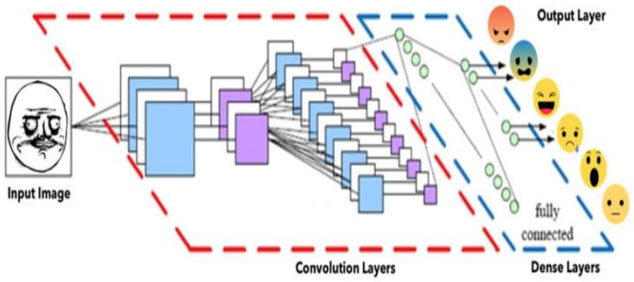

Fig.3.1 General CNN Architecture.

For example, if the system has to detect an angry face, then the first system has to be acquainted with the angry face. Also, if the system has to detect a happy face, then the first system has to be acquainted with the happy face. To antecedents the system with this emotion types, the re-training process has been used.

This proposed method uses the CNN algorithm for emotion recognition method using deep learning. The steps are as follows:

i. Face capturing module
ii. Pre-processing module
iii. Training module
iv. Face recognition module
v. Expression recognition module

SYSTEM DIAGRAM:

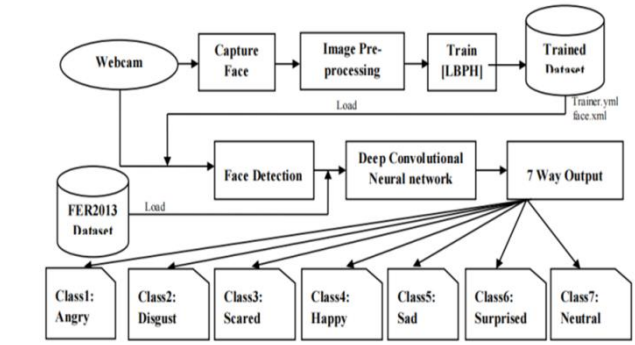

Figure 3.2: System diagram of facial emotion detection.

i. Face Capturing Module: During this phase, the pictures of people's faces are taken for further processing with the help of webcam or an external web camera for this purpose. There is no way to complete the procedure without first taking the image, and there is no way to identify the emotions without first capturing the image.

ii. Pre-processing Module: Following the capture of photos, image processing is done on the captured images. The grey scale photos will be created by converting the colour photographs to grey scale.

iii. Training module: This step will involve the preparation of a dataset, which will consist of a binary array of all the photographs that have been taken. The collected photographs will be saved in a YML file, which will contain all of the face data that was obtained. The YML file allows us to process the collected photos more quickly because of its compressed nature.

iv. Face Recognition Module: The first phase in the face recognition process is to train the host system on the facial data that has been collected. The face is photographed using the web camera on the computer system.

v. Face Expression Recognition Module: Facial expression recognition software is a system that detects emotions in human faces by using biometric indicators. Because it collects and analyses information from images, it is possible to offer an unfiltered, unbiased emotional reaction or data that is unfiltered and impartial.

With the goal to improve the process of facial sentiment analysis systems, a classification mechanism is proposed using a CNN architecture. Due to the need of large data required for training of deep networks, FER2013 dataset which is available publicly is utilized here. In the subsequent section, the features of our chosen dataset are listed out, followed by the description of our network architecture and finally the performance measures used for evaluation.

Proposed system advantages: High picture quality improves the effectiveness of facial recognition; even low-resolution photographs are usable with the suggested method; and Higher accuracy while being more computationally efficient.

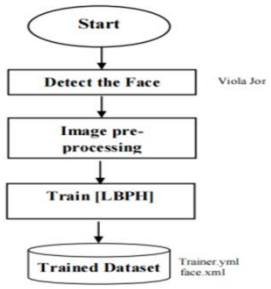

Fig 3.3: Flowchart of training.

During training Phase, the system received a training data comprising grayscale images of faces with their respective expression label and learns a set of weights for the network. The training step took as input an image with a face. Thereafter, an intensity normalization is applied to the image. The normalized images are used to train the Convolutional Network. To ensure that the training performance is not affected by the order of presentation of the examples, validation dataset is used to choose the final best set of weights out of a set of trainings performed with samples presented in different orders.

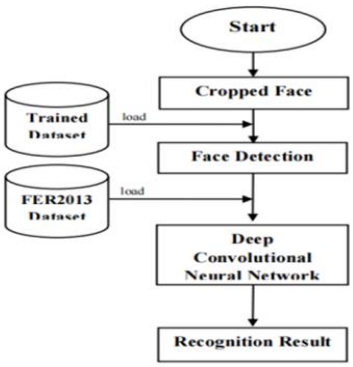

Figure 3.4: Flowchart of testing.

The output of the training step is a set of weights that achieve the best result with the training data. During test, the system received a grayscale image of a face from test dataset, and output the predicted expression by using the final network weights learned during training. Its output is a single number that represents one of the seven basic expressions.

4. CONCLUSION

When it comes to communication, facial emotion plays a crucial part, and so finding the appropriate expression is just as important as knowing what is being said. This project provides a method for distinguishing the category of face emotion, which is defined as follows: Achieving good face detection and emotion extraction from facial photos has been accomplished, and this technology is beneficial in a variety of applications, including robots vision, video surveillance, digital cameras, security, and human-computer interface. Face recognition and emotion recognition are the goals of this project, which will use computer vision to accomplish facial recognition and emotion identification while also improving advanced feature extraction and classification in face expression recognition.

A convolution neural network is described for the purpose of classifying face pictures into the seven regular emotions.

5. REFERENCES

[1] S. Giri et al., "Emotion Detection with Facial Feature Recognition Using CNN & OpenCV," 2022 2nd International Conference on Advance Computing and Innovative Technologies in Engineering (ICACITE), 2022, pp. 230-232.

[2] Ishika Agrawal, Adarsh Kumar, Swathi DG, Yashwanthi V, Rajeshwari Hegde, "Emotion Recognition from Facial Expression using CNN", 2021 IEEE 9th Region 10 Humanitarian Technology Conference (R10-HTC), 2021, pp. 01-06

[3] S. K. Singh, R. K. Thakur, S. Kumar and R. Anand, "Deep Learning and Machine Learning based Facial Emotion Detection using CNN," 2022 9th International Conference on Computing for Sustainable Global Development (INDIACom), 2022, pp. 530-535

[4] S. Singh and F. Nasoz, "Facial Expression Recognition with Convolutional Neural Networks," 2020 10th Annual Computing and Communication Workshop and Conference (CCWC), 2020, pp. 0324-0328

[5] M. M. Taghi Zadeh, M. Imani and B. Majidi, "Fast Facial emotion recognition Using Convolutional Neural Networks and Gabor Filters," 2019 5th Conference on Knowledge Based Engineering and Innovation (KBEI), 2019, pp. 577-581

[6] J. -H. Kim, B. -G. Kim, P. P. Roy and D. -M. Jeong, "Efficient Facial Expression Recognition Algorithm Based on Hierarchical Deep Neural Network Structure," in IEEE Access, vol. 7, pp. 41273-41285, 2019

[7] X. Chen, X. Yang, M. Wang and J. Zou, "Convolution neural network for automatic facial expression recognition," 2017 International Conference on Applied System Innovation (ICASI), 2017, pp. 814-817

[8] Q. Xu and N. Zhao, "A Facial Expression Recognition Algorithm based on CNN and LBP Feature," 2020 IEEE 4th Information Technology, Networking, Electronic and Automation Control Conference (ITNEC), 2020, pp. 2304-2308

[9] M. Mohammadpour, H. Khaliliardali, S. M. R. Hashemi and M. M. AlyanNezhadi, "Facial emotion recognition using deep convolutional networks," 2017 IEEE 4th International Conference on Knowledge-Based Engineering and Innovation (KBEI), 2017, pp. 0017-0021

[10] T. Zhang, W. Zheng, Z. Cui, Y. Zong, J. Yan and K. Yan, "A Deep Neural Network-Driven Feature Learning Method for Multi-view Facial Expression Recognition," in IEEE Transactions on Multimedia, vol. 18, no. 12, pp. 2528-2536