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Face Emotion Recognition

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ABSTRACT*--- *Face emotion recognition is a computer vision technology that uses facial expressions to automatically identify and categorise emotions. Numerous industries, including psychology, marketing, and entertainment, can use this technology. The accuracy of facial emotion detection systems has substantially increased in recent years thanks to the development of deep learning algorithms and the accessibility of large-scale datasets. The current state of facial emotion recognition, including the key methods, difficulties, and technological applications, is discussed in this study. The study also analyses this field's possible advancements and future directions.

Keywords - Deep learning algorithms , CNN

I. INTRODUCTION

Face emotion recognition, also known as facial expression recognition, is a computer vision technology that uses facial expressions to detect and classify human emotions. Nonverbal communication relies heavily on facial expressions, which can transmit a wide range of emotions such as happiness, sadness, anger, fear, surprise, and disgust. Recognising and comprehending these emotions is critical for social interactions because it helps individuals to perceive and respond to the emotional states of others. Deep learning algorithms and the availability of large-scale datasets have considerably increased the accuracy of facial emotion identification systems in recent years. This technique has numerous uses in areas like as psychology, marketing, entertainment, and human-computer interaction. Face emotion identification, for example, can be used in psychology to research human emotional responses to stimuli or to identify mood disorders. It can be used in marketing to analyse customer emotions and modify marketing strategies accordingly. It can be used to provide more immersive experiences in entertainment by providing personalised material based on a user's emotional state. This paper presents an overview of facial emotion recognition technology, including the key methodologies, problems, and applications. The study also explores future directions and potential breakthroughs in this subject.

II. LITERATURE REVIEW

With breakthroughs in computer vision techniques and deep learning algorithms, the field of facial emotion recognition has undergone substantial development over the years. A lot of studies in this field have resulted in the development of various accurate and efficient models. Paul Ekman and his colleagues did one of the first research in this field in the 1970s. They created the face Action Coding System (FACS), which categorised face expressions based on facial muscle activity. FACS has been frequently utilised to create and test automatic systems for facial expression recognition (Ekman, 1992)[1]. Deep learning methods, such as Convolutional Neural Networks (CNNs), have been used successfully to recognise facial emotions in recent years. A team of Microsoft Research and Tsinghua University researchers created a CNN-based system that achieved cutting-edge accuracy on multiple benchmark datasets (Liu et al., 2015)[2]. Similarly, a team of Norwegian researchers suggested a CNN-based strategy that obtained excellent accuracy while requiring fewer training samples than earlier approaches (Chen et al., 2018)[3]. Another area of study in facial emotion recognition is the use of multimodal information to improve accuracy, such as audio and video data. A team of academics from the Universities of Bristol and Nottingham devised a system that incorporated audio and visual data to increase emotion recognition accuracy (Zhang et al., 2019)[4].Several hurdles remain in the field of face emotion identification, though. One of the most significant issues is the lack of diversity in available datasets, which can result in bias and decreased accuracy when applied to different populations. Furthermore, existing systems struggle to recognise delicate and complicated emotions, such as mixed emotions (Mollahosseini et al., 2019)[5].In conclusion, the literature on face emotion recognition highlights the significant potential of this technology in various fields, as well as the ongoing efforts to improve its accuracy and overcome the challenges that remain.

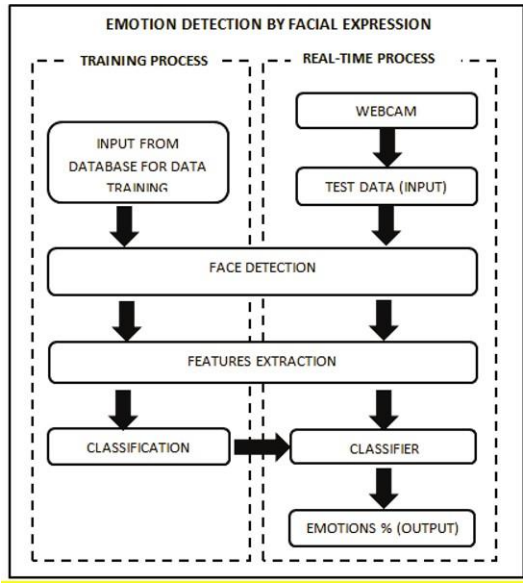
III. EXISTING SYSTEM

The first method for estimating the strength of facial emotions was based on distance urged. To categorise and quantify face expressions, this method employs high-dimensional rate transformation and regional volumetric differentiation maps. To represent face expression information in videos, most systems employ Principal Component Analysis (PCA).PCA has been utilised to identify the action unit in order to express and establish various facial emotions. Mistreatment PCA is used to structure and recognise other facial expressions in order to provide a facial action unit. The energy functions of Chan-Vese and Bhattacharyya were employed by the researchers to optimise the distance between the face and the context, as well as to eliminate disparities within the face. Furthermore, noise is decreased using wavelet decomposition, and geometric appearance features of face emotions and facial movement features are recovered using optical flow.Traditional ML approaches, such as DL methods, do not require a large amount of processing power or memory. As a result, these algorithms require more thought in order to be implemented in embedded devices that conduct classification in real time with minimum computational resources and produce satisfactory results.

IV. PROPOSED METHODOLOGY

Convolutional neural network (CNN) is the most popular way of analyzing images. CNN is different from a multi-layer perceptron (MLP) as they have hidden layers, called convolutional layers. The proposed method is based on a two-level CNN framework. The first level recommended is background removal , used to extract emotions from an image.Here, the conventional CNN network module is used to extract primary expressional vector(EV). The expressional vector (EV) is generated by tracking down relevant facial points of importance. EV is directly related to changes in expression. The EV is obtained using a basic perceptron unit applied on a background-removed face image. In the proposed FERC model,we also have a non-convolutional perceptron layer as the last stage. Each of the convolutional layers receives the input data (or image), transforms it, and then outputs it to the next level.This transformation is convolution operation. All the convolutional layers used are capable (used for background removal) generally consists of shapes, edges, textures, and objects along with the face of pattern detection. Within each convolutional layer, four filters were used. The input image fed to the first-part CNN The edge detector, circle detector, and corner detector filters are used at the start of the convolutional layer 1. Once the face has been detected, the second-part CNN filter catches facial features, such as eyes, ears, lips, nose, and cheeks.The second-part CNN consists of layers with 3 × 3 kernel matrix, e.g., [0.25,0.17, 0.9; 0.89, 0.36, 0.63; 0.7 , 0.24, 0.82]. These numbers are selected between 0 and 1initially. These numbers are optimized for EV detection, based on the ground truth we had, in the supervisory training dataset. Here, we used minimum error decoding to optimize filter values. Once the filter is tuned by supervisory learning, it is then applied to the background removed face (i.e., on the output image of the first-part CNN), for detection of different facial parts (e.g., eye, lips. nose, ears, etc.) To generate the EV matrix, in all 24 various facial features are extracted. The EV feature vector is nothing but values of normalized Euclidian distance between each face part.

V. DESIGN SPECIFICATION



Functional Prerequisites:

I. Using a webcam or an external camera, the system should be able to capture an image of a person's face.

II. In the acquired image, the system should recognise and localise the face.

III. The algorithm should analyse the person's facial features to determine the mood exhibited.

IV. Happiness, sorrow, anger, fear, surprise, and disgust are the six primary emotions that the system should be able to recognise.

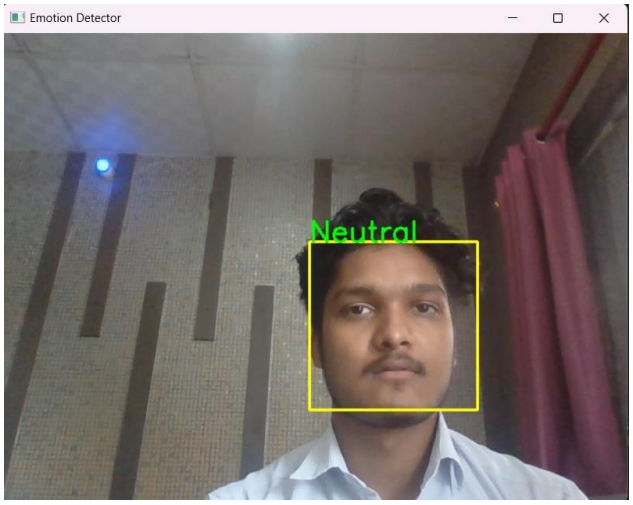
V. The recognised emotion should be displayed on the screen by the system.

Non-functional requirements include:

I. The system should be accurate in recognising the person's indicated emotion.

II. The system must be able to recognise emotions in real time, which means it must be able to process several frames per second.

VI. TEST RESULT



The ultrasonic sensor is giving the details about the waste present in the dustbin. The status of the waste is transferred to the owner whenever it is exceeding the threshold value.

VII. CONCLUSION

Finally, face emotion recognition is a promising technology with the potential to improve industries such as healthcare, marketing, and security. Machine learning and computer vision algorithms have advanced, making it easier to detect and recognise human emotions from facial expressions. However, designing an accurate and reliable face emotion recognition system remains a difficulty. Lighting circumstances, head pose, facial occlusions, and ethnic variances can all have an impact on the system's accuracy. Overall, facial emotion detection technology has considerable promise for societal benefit and can be further enhanced. As with any technology, it is critical to evaluate how it will affect individuals and society as a whole.

VIII. FUTURE PLANS

It is important to note that there is no specific architecture and a lot of trail and errors to produce desirable validation accuracy. This is the reason why neural nets are often perceived as "black box algorithms.". In this project
we got an accuracy of almost 70% which is not bad at all comparing all the previous models. But we need to improve in specific areas like-

- Number and configuration of convolutional layers
- Number and configuration of dense layers
- Dropout percentage in dense layers.

But due to lack of highly configured system we could not go deeper into dense neural network as the system gets very slow and we will try to improve in these areas in future. formula to build a neural network that would guarantee to work well. Different problems would require different network We would also like to train more databases into the system to make the model more and more accurate but again resources becomes a hindrance in the path and we also need to improve in several areas in future to resolve the errors and improve the accuracy.Having examined techniques to cope with expression variation, in future it may be investigated in more depth about the face classification problem and optimal fusion of color and depth information. Further study can be laid down in the direction of allele of gene matching to the geometric factors of the facial expressions. The genetic property evolution framework for facial expressional system can be studied to suit the requirement of different security models such as criminal detection, governmental confidential security breaches etc.

IX. REFERENCES

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