

# A Brief Study on Face Expression Recognition System

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**ABSTRACT-** The most significant type of expressive is body language. Nonverbal communication. Face expression recognition (FER) systems have been developed to serve real-world applications rather than laboratory settings, owing to advances in hardware and sensor technologies. FER is a technique of communicating social information without the need of words. FER may be utilized in a number of settings, including healthcare, education, criminal investigation, and HMI (Human Robot Interface) (HRI). FER systems are being utilized in a variety of industries, including healthcare, robotics, education, and entertainment. In this article, the author discusses Face Expression Recognition and the steps involved in the FER system, such as face detection, extraction, and expression categorization. Everything, like any new technology, has advantages and drawbacks. When utilizing the AFEW dataset, the FER system also has a problem with accuracy, since the accuracy is only 50%. With the advancement of technology, this precision will increase in the future. As a result, the FER system has a promising future.

**KEYWORDS-** Algorithm, Detection, Extraction, Face Expression Recognition (FER), System.

## I. INTRODUCTION

One of its most important aspects of a person's personality is their body language. Important kinds of nonverbal communication. People's emotions are revealed via their facial expression, which allows others to evaluate them. Darwin proposed in 1872 that emotional facial expressions could be related to species evolution. Anatomically, Sir Charles Bell and G.B. Duchenne investigated human facial expressions[1]. FER may be utilized in a variety of fields, including entertainment, virtual reality, augmented reality, education, audience analysis in marketing, and human-computer interface. People use facial expressions to convey social information without having to use words. In this review article, the author discusses FER systems and their algorithms[2]. Figure 1 depicts many facial emotions such as fear, sadness, and pleasure.

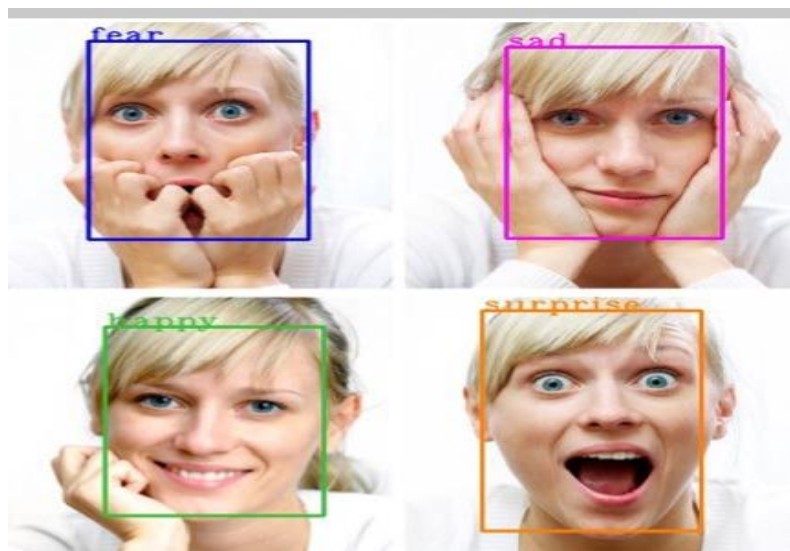


Figure 1: Illustrates different expressions of face such as happy, surprise, sad and fear

### A. Stages in Face Expression Recognition[3]:

Face expression detection have the following stages such as face detection, Feature extraction and Classification as

shown in Figure 2.

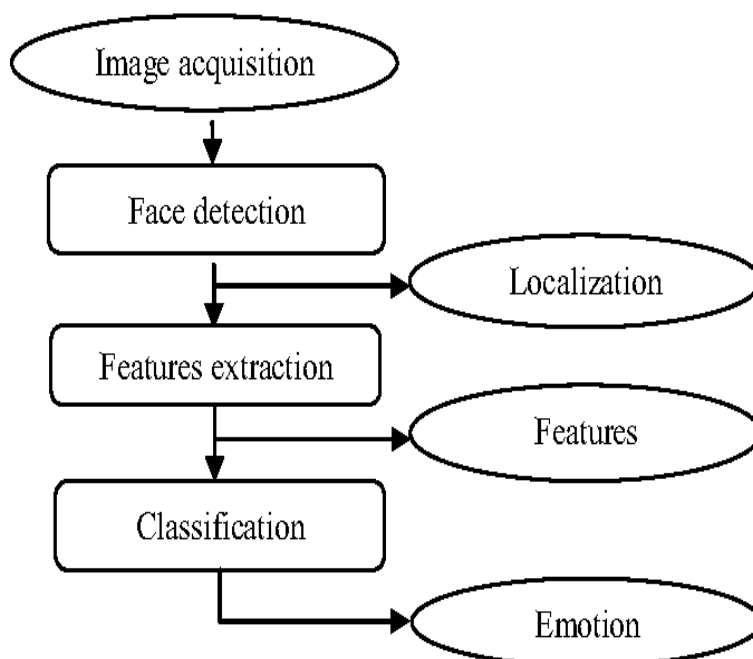


Figure 2: The above diagram shows different stages in Face Expression Recognition.

In the above diagram, When the image is captured with the help of any gadget then face detection process is held by localizing the landmarks of face. After the detection process, features extraction process is held and lastly, classification process is held.

**B. Face Detection:**

Several inputs used to study FER include photographs taken with a camera or video camera, facial action coding, facial electromyogram, electroencephalogram, and

electrocardiogram. Face detection is a stage in the pre-processing process that detects human facial expressions. The faces and other non-face parts of the image are segregated from the rest of the image. Face detection may be accomplished in a number of ways[4]. The emotional highlights of the face, such as the alae of the nose, the corner of the brows, and the corners of the lips, which change with six distinct expressions of emotions, may be utilized to analyze facial expressions recorded by photos. Figure 3 depicts several techniques for detecting faces[5].

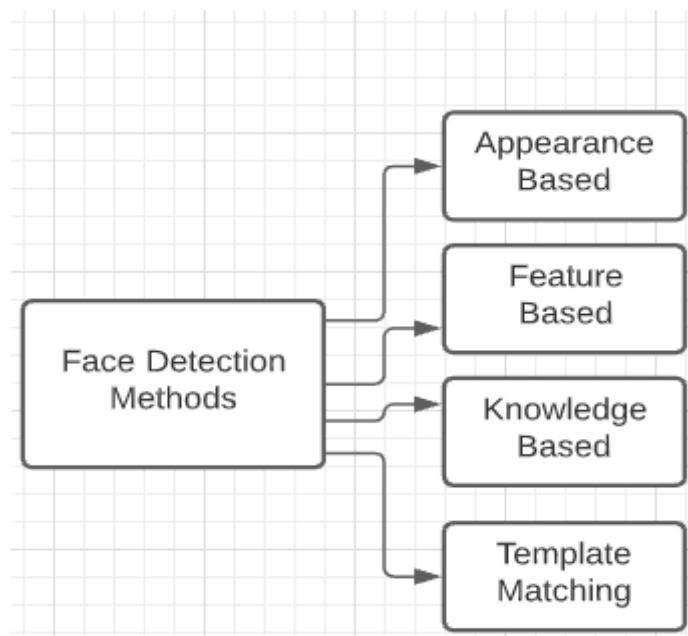


Figure 3: Different methods in face detection to find face expression

**a) Appearance-Based:**

The demeanor technique employs a collection of representative coaching face photographs to find face models. To discover relevant characteristics in face photos,

appearance-based techniques focus on past processing and pattern recognition methodologies.

**b) Event will be held:**

This method of efficiently portraying individuals is predicated on Matrix Factorization.

**c) Distribution-based:**

To establish the subspace that reflects face patterns, techniques such as PCA or Allen's Integrand may be applied. An educated predictor successfully distinguishes the desired motif class first from backdrop picture sequences.

**d) Neural Networks[6]:**

Neural Networks have effectively solved a variety of sensing challenges, including image classification, face recognition, sentiment classification, and face recognition.

**e) Multilayer perceptron (SVM):**

A well-known statistical approach for data analysis in computer science for regression and classification problems, SVM was a very well quantitative tool for data evaluation in learning algorithms. SVMs are polynomial classifiers whose goal is to optimize the similarity in between judgement hyperplane and the training set instances. Osuna et al. first utilized this classifier to recognize faces.

**f) Naive Bayes Classifier[7]:**

They calculated the likelihood of reappearance of a sequences of something like the pattern across the training photos to estimate the probability of a face is visible.

**g) Hidden Markov Model:**

The photographer's localities are the face characteristics, which are number of correct as sheets of pixels. HMMs are also used with other approaches to construct detection systems. Then using a three or four state structure with standalone expression or a mixture of presentation leveraging hierarchical component frameworks, the HMM delivers improved categorization [6] [7].

**h) Sparse Connectivity of Based on imp:**

SRM "sparsely" represents and categorizes the facial picture by using a joint distribution of all of the other training dataset. "Sparsely" means that some of the linear combination's coefficients are equal to or negative value. They created a weak link between two matrix multiplications or objective nodes for human and – anti patterning, one for notice two the other for – anti configurations. It is more cost - effective and time [8] [9].

**C. Feature-Based:**

Faces are recognized using the feature-based technique by extracting structural aspects of the face. It is used to distinguish between face and non-facial areas after just being developed as a classifier. This method, which is split down into numerous steps and includes images with many faces, has to have a 94 percent success rate.

**D. Knowledge-Based:**

The understanding technique refers to the set of guidelines to detect faces and thus is associated with human understanding.

**E. Template Matching:**

The Character Recognition technique compares pre-defined or adjustable face shapes to that same input photos to find or identify faces [10].

**F. Feature Extraction:**

The process of turning video signal first from face region into an increased representations of the geometry, color, texture, and layout of the face is known as feature extraction. Feature engineering reduces the size of the input area while keeping the much more critical data.

Edge detection may be divided into two types: touchscreen and demeanor. Euclidean and beauty characteristics are the two types of feature bases. Key facial features such as in the eyeballs, forehead, and etc. mouths will be recognized by the geometric feature. There are two types of geometric characteristics: permanent and transitory. The Appearance function, on the other hand, will identify appearance of the skin, wrinkle, and grooves [11].

**a) Histogram Pattern (LBP):**

A physical descriptor used within video processing classification, Banjo kazoo is a visual descriptor. LBP features maintain racially discriminatory face content in a dataset consisting and can be created quicker in a single assay of images taken plus in close to the bottom feature space, according to the researchers [12].

It is a monitored sub frame learning approach.

**b) Latent Semantic Analysis (LDA):**

It is just a trained substring pedagogical approach. Because it is easy to learn, the research used a basic LDA-based classification strategy for FER. When data points in classifications are separated by a significant distance yet data points within the same group must be near together, the LDA technique is used to identify the projection of axes [13] [14].

**c) Fcn (CNN):**

CNN was among the most common deep neural networks nowadays. It employs a convolutional network that requires little preprocessing. A convolutional layer (CNN) is somewhat of a machine learning algorithm used to identify and analyses images. It was created with the sole purpose of analyzing pixel input. A human brain technology that replicates synapse action in the body [15].

**d) Principal Component Analysis (PCA):**

PCA is also one of the most often used techniques. It's a method for recognizing people based on their linear look. Using an information theory approach, PCA decomposes input face photos into a small collection of unique feature images. Medical imaging analysis, handwriting analysis, lip reading, voice recognition, and hand gesture analysis are all examples of when PCA is used [16].

### G. Expression Classification:

This step is managed by a classifier. Several categorization methods are used to extract expressions, as shown in

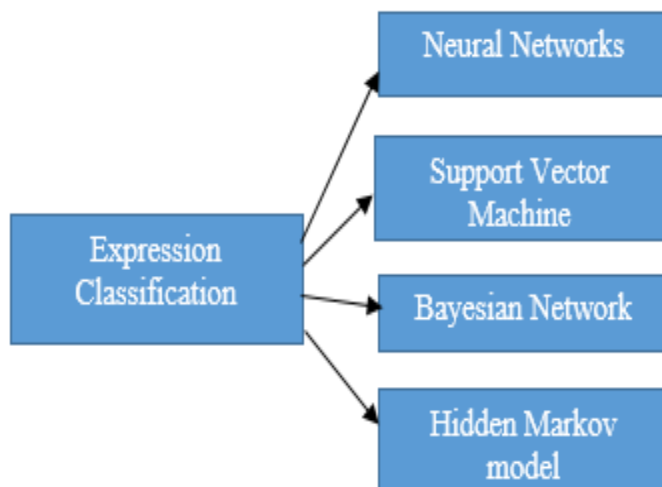


Figure 4: Different algorithms used to classify the expression

## II. LITERATURE REVIEW

C. L. C. Huang et al. discussed about face expression recognition [17]. The authors of this article provide an overview of current Facial Emotion Recognition (FER) stages, methods, and datasets, as well as a comparison of FER research papers. FER may be utilized in a number of settings, including healthcare, education, criminal investigation, and HMI (Human Robot Interface) (HRI). The purpose of this research is to describe the basic principles of FER and to compare current research [18] [19].

Winrich A. et al. discussed about Mammalian and animal retinal scanners systems [9]. Primate communities are built on the basis of human detection. Biometrics systems have been studied most extensively on humanity and adult neurogenesis. Numerous different neural pathways having expertise for social cognition have just been noticed in both species, but rather their bioactivities are also being determined in deeper level, method allows us to seek to solve research question out about commonalities in mouth mechanisms between living things that developed over time over 300 million generations away. Both systems are organized into a number of chin cortical areas with behavioral specialization and know for sure, implying both hierarch and contemporaneous data processing. Concerns about sequence similarity, on the other hand, remain unaddressed. To overcome these challenges, additional research across so many species using similar approaches and conceptual frameworks is needed to identify a putative fundamental primate appearance processing platform and comprehend it. How it differs throughout the primate order's various branches [20].

Muhammad Asyraf Mohd Othman et al. discussed about Computer vision method for real-time online attendance [21] [22]. This main objective is to develop a cloud-based, highly autonomous enrollment system utilizing face recognition. Attendance information, such as

Figure 4. Action units and prototypic facial expressions are the two parts of facial expression recognition.

adherence summary performance as well as visualization techniques in visualizations, will be available via cloud services. The purpose of this study is to create an online attendance of the student's registry that is linked to a Raspberry models B-based biometrics. A frontend (GUI) will be included in the attendance system, making data analysis straightforward. For such a face detection system, this project employs an open video processing library and Python, along with Telnet to interface to a PHP & Making greater network server. According to the results, a legitimate attendance may very well be set up and controlled carefully. Connecting a facial recognition system to a server [23].

## III. DISCUSSION

And for its great academic and economic potential, automatic facial classification (FER) is a hot issue in the domains of video processing and cognitive computing.. Face expression recognition (FER) technologies were developed to serve real-world applications rather than laboratory settings. Communication requires emotion expression, which enhances the quality of human connection. Face expression recognition is now widely used in fields such as human-computer interaction, education, audience analysis, and healthcare. Facial expressions are used to convey human emotions. Face expression detection has been the subject of a lot of study over the last several years. The author of this article discusses facial expression detection, FER system stages such as face recognition, feature extraction, and Expression categorization & its methods, and various facial expressions. Covid-19 is now under progress, and students are taking placement exams using FER systems. Support vector machine, deep learning, and IoT with sensors are some of the algorithms that can be used to create a FER system. As a result, the FER system has a bright future since it is utilized in a variety of industries, including healthcare [24] [25].

#### IV. CONCLUSION

Regardless of the fact that many academics are interested in face expression detection, practical applications have yet to arise. Communication requires emotion expression, which enhances the performance of human connection. The geometric part of the face is the most often utilized to determine mood (eg: eyes, eyebrow, and mouth). Face expression recognition is useful in a variety of fields, including human contact, schooling, audience analysis, and medical. The author of this review article addressed facial expression detection in the FER system, including different stages like face detection with its algorithm, feature extraction, and expression classification with its methods. Variation in light levels, which may affect the accuracy of face features extraction, is a common issue in FER systems. When the system was evaluated using an AFEW dataset, the accuracy was determined to be 50.4 percent when the input data included both audio and video. Currently, technology is developing, and the precision of the FER system will improve in the future. The FER system has a promising future.

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