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A Survey on Techniques of Facial Expression Recognition

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Abstract*: Capacity of recognizing facial expression is essential piece of behavioral science, which facilitates the communication. This capacity can serve in numerous unique circumstances. Henceforth, facial expression is a critical research zone in the course of the most recent two decades. In this paper, we have reviewed different feature extraction techniques, which is the achievement key to Facial Expression Recognition (FER). Facial Expression Recognition has light volume on the grounds that the facial picture, facial impediment, faces shading/shape and so on isn't a simple to manage. This paper includes the introduction of the face recognition and facial expression recognition and an investigation on the recent previous researches for extracting the effective and efficient method for facial expression recognition.
Keywords: Facial Expression Recognition, Face Detection, Face Extraction and Expression Classification.

I. INTRODUCTION

In recent years, although much advance has been done in the field of human computer interaction (HCI) facial appearance acknowledgment with high acknowledgment rate is as yet an exceptionally difficult issue and turn into a center point in the field of computer science and HCI. Facial behavior is the wellspring of data to decide individual's state of mind and feelings. Facial expression have been sorted in the mid-1970s by Ekman's examinations. He has expressed that people have six detects where each sense speaks to a particular feeling, for example, outrage, glad, miserable, dread, shock and sicken [11].
There is much application that utilizations Facial Expression Recognition, for example, Robotics, security, Health care, human-machine communication, human behavior detector and so on. For the most part, Facial Expression Recognition fundamentally performed in three noteworthy advances:

Fig 1: Three steps for facial expression recognition

1) *Face Detection:* Face detection is to confirm that a specific picture contains a face we should have the capacity to characterize the general structure of face. Fortunately, human faces don't incredibly contrast from each other; we as a whole have noses, eyes, brows, jaws and mouths; and these make the general structure out of a face. It is an concept of two-class classification: face versus non-face.
2) *Feature Extraction:* the key parameters that productively speak to the specific facial expression should be extracted from the pictures. These parameters are utilized to separate between expressions.
3) *Facial Expression Classification:* Feature vector of test picture is analyzed with highlight vector of the trained database and classify them in like manner.

The essential need of Face Expression Recognition system is Face Detection which is utilized to identify the face. The following stage is include extraction which is utilized to choose and remove important highlights, for example, eyes, eyebrow, nose, and mouth from the face. It is exceptionally fundamental that only those highlights ought to be separated from an image that have high commitment in expression identification. The last advance is facial expression classification that classifies the facial expression in light of extracted relevant features.

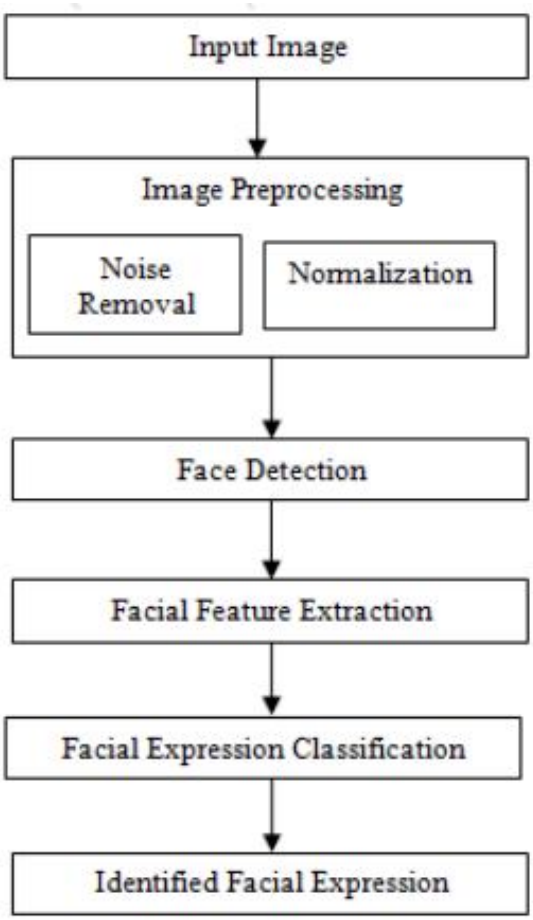

Fig 2: Steps involved in Facial Expression Recognition System

There are distinctive techniques for highlights extraction, for example, appearance based strategy, geometric based strategy, surface based strategy and so on and in current examine for the most part utilized strategies are geometric based strategy and appearance based strategy. Geometric based feature extraction strategy, extricate include data utilizing shape, separation and position of facial segments and appearance based component extraction technique utilizes appearance data, for example, pixel intensity of face image. In the wake of getting the highlights, arrangement techniques are applied to recognize facial expression.

II. LITERATURE SURVEY

Sisodia P. et al. [1], The Human Facial Expression Recognition is utilized as a part of many fields, for example, disposition identification and Human Computer Interaction (HCI). Gabor Filters are utilized to remove features. Gabor has the helpful property of vigor against slight protest turn, bending and variety in brightening. In the present work the exertion has been made to give the modules of to Human facial expression recognition by diminishing the quantity of parameters use to speak to Gabor feature the space complexity can lessen. SVM classifier has multi-classes. SVM classifies the expression by contrasting it and the prepared information.

Samad R. et al. [2], Author explore the execution of a facial expression recognition framework with a base number of features of the Gabor wavelet. In this exploration, important segment investigation (PCA) is utilized to pack the Gabor features. We also talk about the choice of the base number of Gabor features that will play out the best in a recognition assignment utilizing a multiclass support vector machine (SVM) classifier. The execution of facial expression recognition utilizing our approach is contrasted and those acquired already by different scientists utilizing different methodologies. Trial comes about demonstrated that our proposed strategy is fruitful in perceiving common facial expressions by utilizing few Gabor features with 81.7% recognition rate. Likewise, we distinguish the connection between the human vision and PC vision in perceiving characteristic facial expressions.

Meher et al. [3], proposes a PCA for Face Recognition and FER. For PCA classification is matters for execution. In this paper, aftereffect of recognition rate is 81.36% for CSU dataset and 85.5% for ATT dataset.

Samad R. et al. [4], introduce edge-based feature extraction for perceiving six unique expressions, which are angry, fear, happy, neutral, sadness and surprise. Edge recognition is performed by utilizing Gabor wavelet and convolution filters. In this paper we propose two convolution bits that are particular for the edge discovery of facial segments in two introductions. In this investigation, Principal Component Analysis (PCA) is utilized to decrease the features measurement. To approve the execution of our proposed feature extraction, the created features are arranged utilizing Support Vector Machine. The test comes about exhibited that the proposed feature extraction strategy could create huge facial features and these features can be characterized into every expression.

Abdulrahman M. et al. [5], Author proposed a facial expression recognition approach based on Gabor wavelet change. Gabor wavelet filter is first utilized as pre-preparing stage for extraction of the feature vector portrayal. Dimensionality of the feature vector is decreased utilizing Principal Component Analysis (PCA) and Local parallel example (LBP) algorithms. Trials were completed of utilizing Japanese female facial expression (JAFFE) database. In all tests led utilizing JAFFE database, comes about acquired uncover that GW+LBP has beated different methodologies in this paper with a normal recognition rate of 90% under the same trial setting.

Sabia et al. [6], Author produce a model of a wheelchair summon interface that does not require alternate's hands. It incorporates 3 noteworthy modules. They are face identification, facial expression recognition and order age. The product contains computerized picture handling for face location, important segment investigation for facial expression recognition and creating a charge signals for interfacing the wheelchair. The algorithm is tried in MATLAB. The stale images speak to various people face and facial expressions of a subject, from Indian Face Database and Japanese Female Face Database are utilized to evaluate the adequacy of the algorithm separately.

Thai L.H. et al. [7], Author propose a novel approach utilizing Canny, Principal Component Analysis (PCA) and Artificial Neural Network. Right off the bat, in preprocessing stage, we utilize Canny for local area identification of facial images. At that point each of local district's features will be exhibited based on Principal Component Analysis (PCA). At last, utilizing Artificial Neural Network (ANN) applies for Facial Expression Classification. We apply our proposition technique (Canny_PCA_ANN) for recognition of six essential facial expressions on JAFFE database comprising 213 images postured by 10 Japanese female models. The exploratory outcome demonstrates the achievability of our proposition technique.

Sarawagi V. et al. [8], a human face has an unmistakable and remarkable qualities which influence it to assume an extremely basic part in perceiving facial expression in a "facial expression recognition framework." Identifying or as we say it discovery of expressions plays a major and noteworthy part in a facial expression recognition framework. On the off chance that we discuss a person it turns into a simple errand perceive expression in a specific picture succession, however in the meantime on the off chance that we discuss completely mechanized frameworks relatively few are presently accessible or skilled to do as such. The field of facial expression recognition do have a wide range of utilizations and its significance, it may be utilized to have a connection between a person and a PC, here a client, without utilizing his hands, can give charges or educate to the PC framework with the assistance of facial expression recognition framework. Many alternatives are accessible to distinguish a face in a picture in a productive and exact way, albeit comparable can't be said for features discovery in a video arrangement outline. Most frameworks are as yet reliant on manual operations for same. Here in this paper we have stresses on shading standardization and facial feature extraction which utilizes LBP (Local Binary Pattern) as a compelling feature identification approach, where the current algorithms have been changed to enhance the facial expression recognition exactness. The recognition exactness on the Indian database is seem to be 94.7%.

Chao W. L. et al. [9], Author proposed a novel structure for facial expression recognition is proposed, which enhances the customary feature extraction method to additionally abuse particular characters for each mark. To diminish the impact from random features for facial expression recognition, a denoising system is presented. In the wake of denoising, to keep the association between expression names and brighten features and in addition diminish the measure of calculation, a complex learning algorithm is connected, which finding an important low-dimensional structure covered up in the brighten feature space. At long last, the features in the low-dimensional space are bolstered into the understand classifier, for example, the support vector machine and k-Nearest Neighbors. Simulations demonstrate that the proposed structure accomplishes the best recognition execution against existing techniques in facial expression recognition.

Mollahosseini A. et al. [10], Author proposes a profound neural system engineering to address the FER issue over various surely understood standard face datasets. In particular, our system comprises of two convolutional layers each took after by max pooling and afterward four Inception layers. The system is a solitary part engineering that takes enlisted facial images as the info and classifies them into both of the six fundamental or the neutral expressions. We directed exhaustive examinations on seven freely accessible facial expression databases, viz. MultiPIE, MMI, CK+, DISFA, FERA, SFEW, and FER2013.

TABLE II. Comparisons of various techniques and method used in existing system

Ref. No.	Method Used	Dataset Used	Approach	Strength	Limitation
[1]	Gabor Filter, SVM	Facial expression database	Provide the modules of for Human facial expression recognition by reducing the number of parameters use to represent Gabor feature the space complexity can reduce.	Gabor Filter outperformed then other existing techniques removes variability in lighting and other noise	Need to Select the best Gabor Features which will help to reduce the space complexity of the system.
[2]	Gabor Wavelet, PCA, Multi class SVM	FEEDTUM database	proposed technique is successful in recognizing natural facial expressions by using a small number of Gabor features	Average performance rate: 81.7%	Misclassification between Sad and Neutral expression
[3]	PCA ATT, CSU and MPI	Facial expression database	Analyze the method of PCA and its performance when applied to face recognition.	ATT database: 85.5% CSU database: 81.3%	Classification are matters for recognition rate
[4]	Multiple Edge detection on Gabor features, PCA, SVM	FEEDTUM database	The performance of our proposed feature extraction, the generated features are classified using Support Vector Machine	91.7% for 40 feature vectors	Work with frontal images
[5]	Gabor Wavelet, PCA and LBP	JAFFE database	Using JAFFE database, results obtained reveal that GW+LBP has outperformed other approaches in facial expression recognition	90% average recognition rate	LBP operator is small which cannot capture dominant features
[6]	PCA, FLDA (Fisher LDA)	JAFFE and MUG database	Generate a model of a wheelchair command interface that does not require the other's hands. It includes 3 major modules. They are face detection, facial expression recognition and command generation.	JAFFE: 94.37% MUG:95.24%	Facial images of different classes lead to poor classification
[7]	Canny Edge detection, PCA, ANN	JAFFE database	ANN is used for classifying and the number of hidden nodes is identified by experience.	The average facial expression classification of proposal method (Canny_PCA_ANN) is 85.7%. 85.7%	It required the high calculating costs for the learning process
[8]	LBP for feature extraction	From video frame	Author proposes es-LBP features, which modify the conventional LBP features, consider the symmetry of histogram patterns and further exploits distinctive characters for each label are shown to be more suitable for facial expression recognition than original LBP	Recognition average accuracy is 94.7%	Need to work with real surrounding environment
[9]	Local binary patter feature (LBP) and SVM	Facial expression database	Author proposes a deep neural network architecture to address the FER problem across multiple wellknown standard face datasets.	recognition accuracy is 91.9%	The necessity of the proposed unrelated features for facial expression recognition is verified to be important in facial recognition Framework
[10]	deep neural network	MultiPIE, MMI, CK+, DISFA, FERA, SFEW, and FER2013.	Author proposes a deep neural network architecture to address the FER problem across multiple well-known standard face datasets.	Recognition average accuracy is 73.08%	Need to reduce the number of operations by train the network

III. CONCLUSION

This paper presents examination and executing of Facial Expression Recognition architecture which enhance the Performance of facial expression recognition and decreasing complexity. From Literature review on papers, there are utilizing two strategies for feature extraction and diverse classifier for classification of expression. There is a hybrid approach of Edge identification, feature extraction and fitting classifier utilized based on a database and features parameters of facial images. This hybrid approach having a decent recognition rate looks at to different techniques for Facial expression recognition and execution is high because of segment the facial picture into expression intrigued area, for example, an eye, eyebrows, and mouth, which have less size contrasted with entire image.

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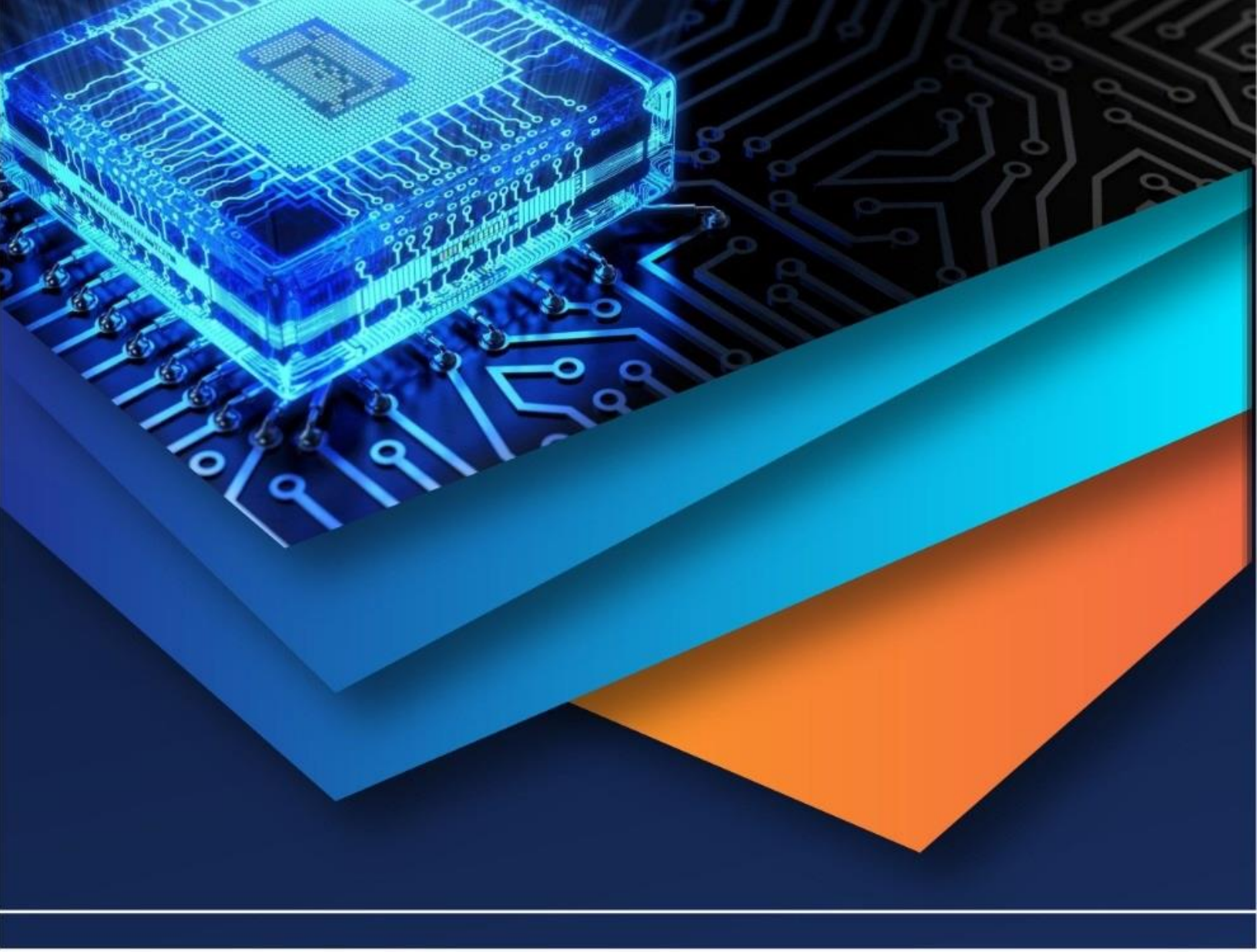

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