A Survey on Facial Expression Recognition Techniques

Tejaswi Satepuri[1*], P. Chandrasekar Reddy[2]

[1,2]Gokaraju Rangaraju institute of Engineering and Technology, Telangana, India

Abstract- Facial image analysis is a important and mainstream research point and it incorporates face detection, face recognition, facial expression analysis, and a few other related applications. LBP is a non-parametric descriptor whose point is to proficiently condense the neighborhood structures of images. As of late, it has stirred expanding enthusiasm for some territories of image processing and computer vision, and has demonstrated its viability in various applications, specifically for facial image analysis, including undertakings as assorted as face detection, face recognition, facial expression analysis, statistic classification, and so on. This paper presents a comprehensive overview of Gabor Filter and SVM, Genetic Algorithms and Neural Network and at long last CNN including a few later variations. LBP-based facial image analysis is widely checked on, while its fruitful expansions in managing different errands of facial image analysis are likewise featured.

Keywords: Facial expressions recognition, LBP, human cognition, emotion model, machine learning.

1. INTRODUCTION

Facial emotions are essential factors in human correspondence that assistance us understand the aims of others. As a rule, individuals construe, for example joy, sadness, and anger, using facial expressions and vocal tone. As indicated by various reviews [1, 2], verbal components pass on 33% of human correspondence, and nonverbal components pass on 66%. Among a few nonverbal components, via conveying emotional significance, facial expressions are one of the primary data channels in relational correspondence. Consequently, it is characteristic that examination of facial emotion has been picking up parcel of consideration over the previous decades with applications in the perceptual and subjective sciences, yet in addition in full of feeling registering and PC activities [2].
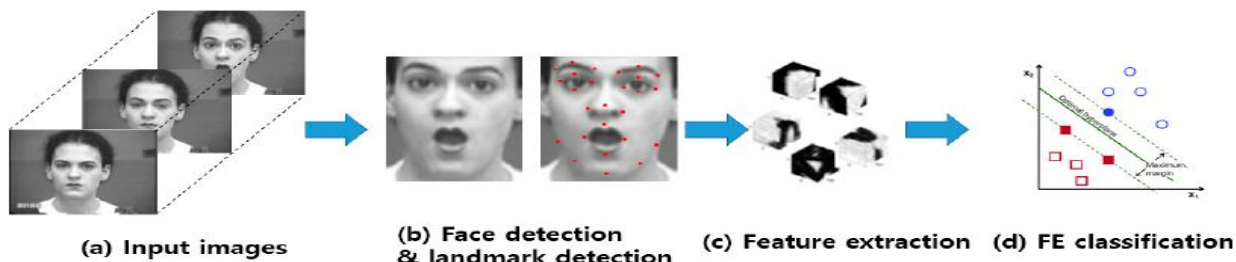

Fig1: Feature Classification Stages

As opposed to customary methodologies using handcrafted features, deep learning has developed as a general way to deal with AI, yielding best in class results in numerous PC vision contemplates with the accessibility of huge information [11].

Deep-learning-based FER approaches exceedingly diminish the reliance on face-material science based models and other pre-processing systems by empowering "start to finish" figuring out how to happen in the pipeline straightforwardly from the info pictures [12]. FER can likewise be isolated into two gatherings as indicated by whether it utilizes casing or video pictures [13]. To start with, static (outline based) FER depends entirely on static facial features gotten by separating handcrafted features from chosen top expression edges of picture successions. For instance, the extricated dynamic features have distinctive progress terms and diverse feature attributes of the facial expression relying upon the specific faces. Additionally, worldly standardization used to get expression successions with a fixed number of edges may result in lost fleeting scale data.
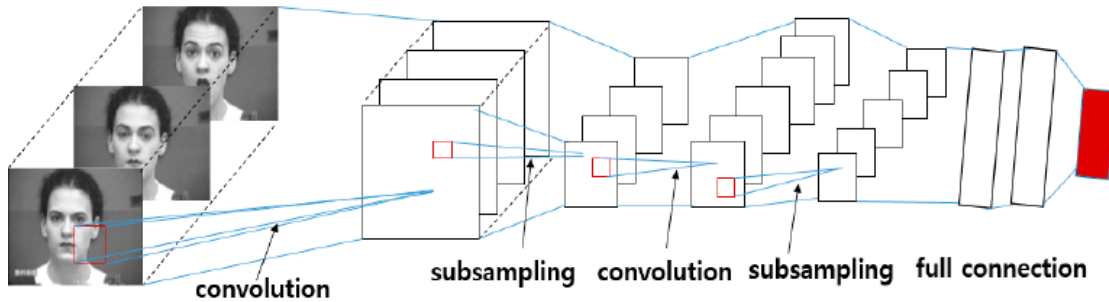
Fig.2: Procedure of CNN-based FER approaches

II. SURVEY ON BASIC FACIAL FEATURES EXTRACTION

Facial expressions are a standout amongst the most prevalently utilized methods of emotion

recognition. Extraction of facial features from face is significant advance towards structuring of emotion classifier. This area talks about the classifications of facial expressions, steps engaged with facial features extraction.
Fundamentally C. Shan, S. Gong presented A tale low-calculation discriminative feature space presented for facial expression recognition fit for powerful execution over a scope of picture goals. Our methodology   depends on the

basic LBP for representing striking small scale examples of face pictures. Contrasted with Gabor wavelets, the LBP features can be separated quicker in a solitary sweep through the crude picture and lie in a lower dimensional space, while as yet holding facial data effectively.

Categories of Facial Expressions
Comprehensiveness of six essential emotions and unbiased temperament are recognized and acknowledged around the world. So the facial expressions are ordered in seven essential classes. The emotions are marked as happy,fear,anger,surprise,disgust sad, neutral.

Fig.3: Different Facial Expressions

III. STEPS OF FACIAL FEATURE EXTRACTION

Automatic recognition of facial expressions from static face image is very mind boggling in perspective on the difficulties like variations in introduction of face, occlusion, illumination variation, age and so forth, The essential advances engaged with facial features extraction are as shown in howl figure. The extricated features are additionally nourished to classifier for facial expressions/emotion classification.
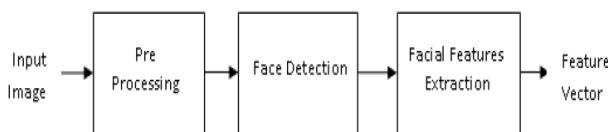

Fig.4: Basic steps in facial Features Extraction

Pre processing can likewise manage posture and occlusion and so forth preceding face detection.
The vital advance in this procedure is face detection and one of the mainstream strategies utilized for this is Color Based Segmentation. Shading put together division strategy works with respect to the rule that shade of the skin isn't white, green, red, or any unnatural shade of that nature. While diverse ethnic gatherings have distinctive dimensions of melanin and pigmentation, the scope of hues that human facial skin takes on is plainly a subspace of the all out shading space. This face-shading connection helps in restricting face seek/detection in information image.
The HSV shading space is significantly more instinctive and gives shading data in a way more in line to human's impression of hues and the manner in which specialists normally blend hues. Shade depicts the essential unadulterated shade of the image, immersion gives the way by which this unadulterated shading (tone) is weakened by

white light and esteem gives a colorless idea of the power of the shading. H-shade and S-immersion give valuable separating data in regards to skin. H esteems will in general involve exceptionally slender reaches towards both the base and top of its conceivable qualities. This is the most detectable pattern and is utilized to infer the range for H as 19-240. In the event that the H esteem falls in this range, at that point it is considered as not skin generally skin.

IV. APPROACHES OF FACIAL EXPRESSION RECOGNITION

Utilization of static images just as image arrangement generally into three classes: 1) Appearance based strategy, represented as Eigen faces, Fisher Faces and other AI procedures, for example, neural networks and Support Vector machine and so forth 2) Model Based strategies represented as chart coordinating, optical stream based technique and so on. 3) Hybrid of Appearance based and demonstrates based techniques, for example, AAM – Active Appearance Model. Appearance based techniques which utilizes for the most part worldwide features are better than model based strategies, the one which utilizes nearby features, as far as framework intricacy and execution reproducibility [18] - [19].

In all encompassing methodology the total face is considered as information and then comparing features of expressions are removed using PCA Analysis or Eigen faces, ICA - Independent Component Analysis and LDA - Linear Discriminate Analysis or Fisher faces, Gabor channels, Wavelet change and so forth.. The Local methodology partitions the face image into certain little squares and the feature extraction algorithms are connected on the equivalent. A portion of these algorithms are LBP, SIFT – Scale [10]. The objective expression for each arrangement is completely FACS coded and emotion marks have been modified and approved. Likewise, non-presented groupings for a few kinds of grins and their related metadata have been included.

The extricated features are additionally nourished to display the classifier for facial expression classification. A portion of the prevalently utilized classifiers are SVM, NN and its variations, KNN, random backwoods, and guideline based methods and so etc.

Analysis of Facial Expression Recognition Techniques
This section reveals the details of some of the facial expressions recognition techniques experimented by different authors.

Discrete Wavelet Transform Technique
One of the proficient apparatuses for feature extraction is Discrete Wavelet Transform which permits the image investigation at different goals. DWT inalienably utilizes high pass channel and low pass channel to give detail of image and surmised image individually. Surmised image can be additionally part into next dimension of guess and detail contingent on application.

Gabor Filters and SVM Technique
This system pursues the customary methodology of separating the facial expressions through Gabor channels and further classification is finished using bolster vector machine. The strategy gives awesome recognition rate and low FAR-False Acceptance Rate and FRR-False Rejection Rate.

Genetic Algorithms and Neural Network Technique
This system utilizes the methodology of Genetic Algorithm which assumes the vital job of advancement of feature determination with the utilization of fitting wellness work and further improves the execution of emotion classifier. This procedure utilizes the exceptionally pertinent image processing systems for distinguishing facial features under uneven lighting condition. The wellness work utilized is oval as state of eyes and mouth looks like with oval. Mouth and eye district assume noteworthy job in emotion recognition.

Gabor Filters and Neural Networks Technique
The strong motivation to utilize Gabor channels [8] is because of the biological relevance that the open field profiles of neurons in the essential visual cortex of person are arranged and have spatial frequencies. Essential visual properties like spatial confinement, introduction, selectivity and spatial recurrence qualities are very much misused by Gabor channels. In this examination Gabor channel coefficient based neural network approach is proposed for face recognition just as expression recognition. Structure and utilization of fuzzily skewed channel for clamor end is one of the key elements of this strategy. Different techniques like EBGM, log-polar and rms scaling Gabor are tested to assess the execution parameters like right recognition and right dismissal.

Table 1: Facial Expression Extraction Methods

Extraction	Geometric Feature	Appearance Feature
Deformation image based	Gabor filter	Local gabor filter bank, Fisher's linear decompositions, singular value decomposition
Deformation model based	Point distribution model	Feature point tracking
Motion frame based	Active contour	Gabor filter bank
Motion sequence based	PCA, gabor filter bank & AdaBoost	Haar like feature, multimodal feature tracking

Table2: Different Methods for processing Facial Expression Reorganization

Sr.No	Author Name	Year	Extraction Method	Classifier	Result
1	Ketkipatil, Prof S D Giripujem, DR. Preety Bajaj	2010	Gabor filter	Neural network	96.2%
2	Ruchir Srivastava, sujoy roy, shuicheng yan and Terence sim	2009	AIM & PHOG	SVM	79%
3	Laszlo A. Jeni, Danial Takacs, AndrasLorincz	2011	AAM & CLM	SVM	86.7%
4	Sander Koelstra, studenmember IEEE, Maja Pantic, Senior Member, IEEE, oainns Patras	2010	Quad tree Decomposition	Hidden Markov model	94.3%
5	Irene Kotsia and Ioannis Pitas, Senior member, IEEE	2010	Local gabor filter	PCA+LDA	97.3%
6	VarshaSarawagi, K>V. Arya	2013	LBP+ASM	SVM	94.2%

V. FUTURE DIRECTIONS

A few promising examination headings for developing more and more viable models and benchmarks are talked regarding here.This mentioned what has been achieved to this point, focusing specifically on the foremost productive algorithms, and overviews the successes and failures of those algorithms to the topic. It additionally proposes many doable future directions for face recognition. Thus, it will be an honest start line for analysis comes on face recognition as helpful techniques are often isolated and past errors are often avoided.

VI. CONCLUSION

Emotion recognition has huge potential in application spaces like subjective evaluation, medicinal services, clinical practices, e-learning, activity, driver ready frameworks, intelligent Television and so on. The investigation completed gives subtleties of different facial feature extraction and classification strategies which can be utilized as prepared reference by specialist network for further improvement around there. The noteworthy structure square of emotion recognition is extraction of facial features.

Efficient execution of this progression helps in accomplishing decrease in classification time while improves the classification accuracy. There is a need to choose proper blend of facial feature extraction method and emotion classifier to acquire wanted execution parameters in relevance to the application under thought.

The papers outlined under this investigation don't give many subtleties of algorithms to address occlusion and posture variation, as the vast majority of the creators have managed frontal faces. The investigation can be additionally reached out for consideration of algorithms used to address present variation and occlusion just as lopsided facial features.

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