Applied Science and Engineering Journal for Advanced Research *Peer Reviewed and Refereed Journal*
ISSN (Online): 2583-2468
Volume-2 Issue-6 || November 2023 || PP. 8-14 DOI: 10.54741/asejar.2.6.2

Analysis and Recognition of Face Recognition analysis using Bezier Curve

A.Divya[1] and R.G.Udayasuriyan[2]
[1]*M.Phil Research Scholar, Department of Computer Science, AVC College (Autonomous), Mannampandal, India*
[2]*M.Phil. Research Scholar, Department of Computer Science, AVC College (Autonomous), Mannampandal, India*

[1]*Corresponding Author: adivyaa42@gmail.com*

Received: 11-10-2023 Revised: 29-10-2023 Accepted: 18-11-2023

ABSTRACT
Since faces cannot be compromised as a means of security, face recognition is the burgeoning field of biometrics for security. Face detection has practical uses in face registration, face recognition as a preliminary step, facial expression analysis, and more. The groundbreaking Viola-Jones Face Detector Methodology is where real-world face detection technology advancements start. This strategy can be divided into two categories: boosting-based methods and rigid templates. Face recognition to take advantage of various emotional states such as grief, happiness, and anger. This work introduces a novel method for identifying human emotions in both videos and photos.

Keywords: *face detection, face recognition, facial expressions, images*

I. INTRODUCTION

The Face recognition system is a computer driven application for automatically identifying a person from a digital image processing. It has been comparing selected facial features in the live image and a facial database. Face recognition system is typically used for security system and it can be compare to other biometrics such as finger print or eye iris recognition system. It means human beings to communicate their emotions and intentions.

Computers that can recognize facial expressions and it respond to the emotions of human beings, accordingly enable to better human machine communication development of information communication technology. Recognition of facial expression and emotion is composed of two major steps: first one is detecting and analysis of facial area from original input image, and next is verification of the facial emotion of characteristic features in the region of interest. In the first step for face detection, most method locate and detect a face in a color still image based on the skin color and the region of eye and mouth [1]. First step extract the color pixels by initialized the spatial filtering, based on the result from the lighting compensation. Then, the second step estimates a face position and the region of facial location for eye and mouth by feature map. After obtaining the region of interest, it extract points of the feature map to apply cubic curve on eye and mouth. Then hamming distance is used for matching features.

The based holistic approach [2] and linear method, the whole face region is taken into account as input data into face recognition system. Examples of holistic methods are Eigen faces most widely used method for face recognition, that's why PCA is known as Eigen space projection which is based on linearly projecting the image space to a low dimension feature space that is known as Eigen space.

It tries to find Eigen vectors of Covariance matrix that corresponds to the direction of Principal Components of original data. PCA is an unsupervised technique. In Supervised, category label or cost for each pattern in the training set, means classes of the patterns is already known. In Unsupervised, the system forms clusters or natural groupings of the input patterns, means classes of the patterns not known a prior. The key procedure in PCA is based on Karhunen Loeve transformation (KLT) [3].

Face Recognition, the name suggest is a method to identify and/or verify the identity of a person. In the former process, the preprocessed image of a person is compared with face images of known individual, the algorithms then returns the recognized (and of course correct) identity. While in the later process the preprocessed image of a person is compared with one face image from a database with the claimed identity [1]. The system then returns the verification status by measuring the similarities between the two images. The evolution in the field of pattern analysis and computer vision has now opened new horizons for research in commercialized face recognition systems being used by (PCA), Linear Discriminant Analysis (LDA) and the more recent 2-D PCA proffer consistent results in precise environment but have limitations when variation in several factors occur various organizations. Different comprehensive feature extraction methods like as Principal Component Analysis (PCA) are less accurate due to lightening (and pose) changes and due to variation in facial disguise such as variations in hair

ISSN (Online): 2583-2468
Volume-2 Issue-6 || November 2023 || PP. 8-14 DOI: 10.54741/asejar.2.6.2

style, beard, moustache, lips, eye brows, view point, facial expressions, lightning changes and further more wearing glasses, cap and hat.

The goal of face recognition is to minimize the influence of these factors and design a robust face recognition system. To achieve this scope, LBP technique has been used for the purpose of feature extraction. Also illumination normalization has been implemented through Single Scale Retinex (SSR) algorithm to further improve the performance of the face recognition system.

A face recognition system is normally implemented in three stages, especially dedicated to LBP, its methodology and making use of the uniform LBP and its descriptors is about added extension i.e. normalizing the illumination changes by implementing SSR algorithm.

Face detection and tracking have been the topics of extensive research for the past decades. The goal of a face detection system is to detect all faces in a given image and determine the exact position and size of the faces. The development of a robust face detection system is essential in a variety of applications, such as computer vision, robotics, security systems, intelligent human-computer interfaces, video conferencing, and video surveillance. In fact, it is usually the first task performed in a face recognition system [4]. Therefore, face detection has a vital role in ensuring and obtaining good results in the applications mentioned above. However, face detection from a single image is still a challenging task because of the high degree of spatial variability in scale, location and pose (rotated and frontal), facial expression, occlusion, and lighting conditions. The main problem in developing a robust and reliable face detection system arises from tremendous variability that exists in the overall appearance of a face. Moreover, lighting conditions, noisy images, and complicated background can further increase the complexity of face detection process. It is important to note that accuracy and speed are two significant criteria that are applied in the assessment of the performance of any face detection system.

Progress in the field of hardware and software, computing power enhancement and decrease in hardware prices are some of major reasons for more attentions to the image processing systems (such as face detection and recognition).

Some of biometric systems applications are commercial and legal usages (especially in identifying criminals and guiltiest), to improve safe driving, security systems, visual phones, face recognition, signature detection and also medical applications such as MRI and CT-SCAN. Face detection, usually is one of the first stages of these applications. It is important to note that different light conditions, face direction against the camera, occultation (such as covering face by scarf) and quality of camera can make face detection process more complicated.

Human facial expressions have the ability to communicate emotion and regulate interpersonal behavior and facial expression of emotion was an innate, adaptive, and physiological response which could provide evidence of an individual's internal mental state. The common facial expressions are smile, sadness, surprise and anger where smile indicates happiness, enjoyment or satisfaction and sad indicates depression, gloominess and surprise indicates shock, amazement, astonishment.

There are many application areas of emotion recognition systems in the image processing world. Artificial Intelligence has long relied on the area of facial emotion recognition to gain intelligence on how to model human emotions convincingly in robots. Continuous improvements in this area have encouraged the researchers to extend the applicability of facial emotion recognition to areas like chat room, video conferencing.

The ability to recognize emotions can be valuable in face recognition applications as well. Suspect detection systems and intelligence improvement systems meant for children with mind progress disorders, clients facial expressions can also be collected by service providers as implicit user feedback to boost their service are some other beneficiaries. A new technique for detecting human emotions from images is proposed. A direction to use this algorithm for videos is also proposed. The results are tested against facial database

II. EXISTING METHODS

Ravi Singh et al. proposed an analysis and recognition of facial expression [5] is one of the most powerful and natural tool for human communication process. Facial expression is restricted to only typical expressions like happiness and anger but recognition of facial actions, movements of head, frequent changes on the face, unambiguous actions and uncertain activities of face is important and challenging problem for us. Many analysis of facial expression depends on robust and accurate land marking of face to correctly function research propose to exploit many facial activities like anger, happiness, sad and these activities are characterized to three levels [5].

Priyanka Kumbham et al. proposed a local information on facial image [6] and use them for effective recognition. Local Active Pixel Pattern (LAPP) is one of the approaches capable of supporting face recognition for using conventional and resource constraint environment. Active pixel is one which denotes the essential information of images. Active pixel approach is aimed to consume fairly small amount of memory and processing power for performing face recognition. For computation of active pixel Brody transform is used [7]. Brody transform extracts information from images. Brody transform helps to

ISSN (Online): 2583-2468
Volume-2 Issue-6 || November 2023 || PP. 8-14 DOI: 10.54741/asejar.2.6.2

construct active pixel pattern matrix. Brody Transform provides cyclic shift invariance, dyadic invariance and graphical inverse of input pattern. The transformed data is independent of cyclic shift of input signal.

Manish Dixit et al., proposed an efficient, intelligent and less complex method of face recognition [8]. A hybrid approach of face recognition is proposed here using the neural networks and Bezier curves. Detection of structural facial features such as eyes, eyebrows, nose, lips and mouth boundaries is an essential process for various image processing task such as face recognition. In introduced a method to denote the landmark on face using Bezier curve and then by further processing of these Bezier curves, image recognition is done [9]. Human beings are normally quite perfect in image identification and recognition but it is fairly complex and difficult task using computer. People see others face as a routine process. They judge the people identity not on the basis of whole face but certain main facial features, mainly this is the facial features extraction. If they see the human recognition characteristic they can identify the faces from vary long distances with shows that only outline structure of human face with its facial characteristics is enough to recognize the face.

Faisal Ahmed et al. proposed an Automatic recognition of a facial expression based on compound binary pattern [10]. Facial expression is an active research topic in computer vision due to its importance in both human-computer and social interaction. One of the critical issues for a successful facial expression recognition system is to design a robust facial feature descriptor. Among the different existing methods, the Local Binary Pattern (LBP) has been proved to be a simple and effective one for facial expression representation. However, the LBP method thresholds P neighbors exactly at the value of the center pixel in a local neighborhood and encodes only the signs of the differences between the gray values it loses some important texture information present a robust facial feature descriptor constructed with the Compound Local Binary Pattern (CLBP) for person-independent facial expression recognition, which overcomes the limitations of LBP. The proposed CLBP operator combines extra P bits with the original LBP code in order to construct a robust feature descriptor that exploits both the sign and the magnitude information of the differences between the center and the neighbor gray values.

Mallikarjuna Rao et al. proposed an LBP [11]. Local Binary Patterns is an accepted technique for efficient face recognition. The local features improve the recognition process. However, high memory and computational resources are needed for LBP required approaches to improve the performance. Many people used LBP for extracting features and Support Vector Machine (SVM), histogram matching, neural networks as recognition tools. These approaches consume considerable computational resources have proposed a fast LBP which uses Two-level Correlation for the classification & recognition.

M.P.Satone et al. proposed a color based technique [12] which is used to detect frontal human faces in images where they appear. The process for face detection , involves template matching, region clustering and color segmentation, works with high accuracy and gives good statistical results with training images. Given the generality of the images and the templates used, the assumption would be that the implementation works well on other images, regardless of the scene lighting, size of faces or type of faces in the pictures. After detecting faces Principle component analysis is used to recognize the face of particular person from the image.

Mandeep Kaur et al.[13] proposed a recognition of facial expressions with principal component analysis and singular value decomposition. A human face in input imagery and recognizing his/her facial expression. The objective of this research is to develop highly intelligent machines or robots that are mind implemented. A Facial Expression Recognition system needs to solve the following problems: detection and location of faces in a cluttered scene, facial feature extraction, and facial expression classification. The universally accepted five principal emotions to be realized are: Angry, Happy, Sad, Disgust and Surprise along with neutral. Principal Component Analysis (PCA) is implemented with Singular value decomposition (SVD) for Feature Extraction to determine principal emotions.

Mehrnaz Niazi et al. proposed an hybrid face detected algorithm for color images [14]. Face detection is an important role in many applications such as face recognition, face tracking, human computer interface and video surveillance research The propose a Hybrid face detection algorithm that could detect faces in color images with different complex backgrounds and lights. Our method, first detect face regions using HAAR classifier over an entire image and generate candidates for next classifier. HAAR classifier, usually detect all the faces in image but also miss classified some none-face object as face.

III. PROPOSED METHOD

This paper presents a new technique for detection and recognition using Cubic curve and Hamming distance. The detection and recognition method for recognition of facial expression and emotion is composed of two major steps: first one is a detecting and analysis of facial area from original input image, and next is a verification of the facial emotion of characteristic features in the region of interest. The block diagram of the method is depicted in Figure 1 and the architectural view is presented in Figure 2.

ISSN (Online): 2583-2468
Volume-2 Issue-6 || November 2023 || PP. 8-14 DOI: 10.54741/asejar.2.6.2

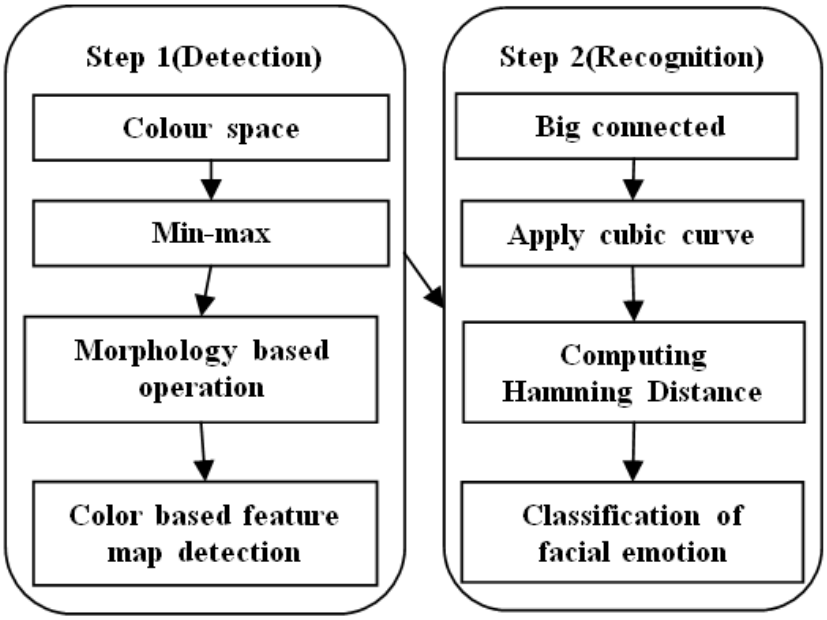

Figure 1: Block diagram of Detection and Recognition

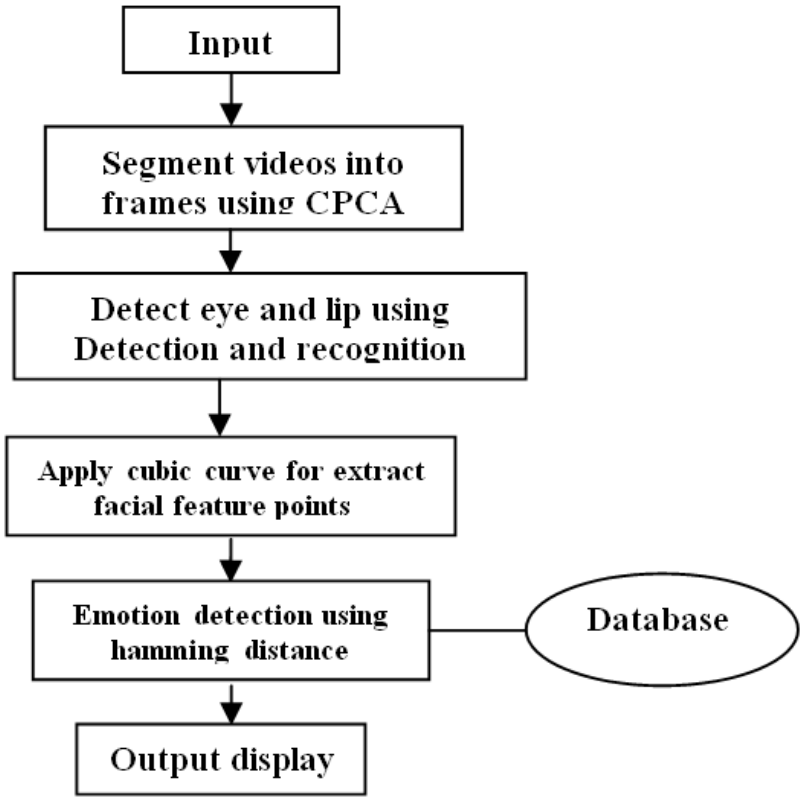

Figure 2: Architectural view of DR using Cubic curve and hamming distance

In the first step for face detection, the proposed method locates and detects a face in a color still image based on the skin color and the region of eye and mouth. Thus, the algorithm first extract the skin color pixels by initialized spatial filtering, based on the result from the lighting compensation. Then, the method estimates a face position and the region of facial location

ISSN (Online): 2583-2468
Volume-2 Issue-6 || November 2023 || PP. 8-14 DOI: 10.54741/asejar.2.6.2

for eye and mouth by feature map. After obtaining the region of interest, extract points of the feature map to apply Cubic curve on eye and mouth. The Hamming distance is used as a measure for classification of facial emotion.

Hamming Distance

The Hamming distance determines how similar two images are. A value of 0 indicates a likely similar picture. A value between 1 and 10 is potentially a variation. A value greater than 10 is likely a different image.

The Hamming distance is a metric expressing the distance between two objects by the number of mismatches among their pair of variables. It is mainly used for string and bitwise analyses but can also for numeric variables.

$$D^{HAD}(i,j) = \sum_{K=0}^{n-1} [y_{i,k} \neq y_{i,k}] \quad \text{... [1]}$$

In the equation 1 D^{HAD} is the hamming distance between the images i and j , k is the is the index of the respective variable reading y out of the total number of variables n. The hamming distance itself gives the number of mismatches between the variables paired by k.

Cubic Curve

A cubic curve is an algebraic curve of curve order. An algebraic curve over a field is an equation where is a polynomial in and with coefficients degree of is the maximum degree of each of its terms (monomials).

Singular cubic $y2 = x2 . (x+1) . A$ …… [2]

Parameterization is given by

$t \rightarrow (t2 - 1, t. (t2 - 1))$ ……[3]

Algorithm

Step 1: Live Streaming or Input image: Image acquisition.
Step 2: Segmentation: Segment videos into frames using CPCA algorithm. (optional)
Step 3: Eye Detection: Identifies position of eyes in the image frame.
Step 4: Lip Detection: Determines lip coordinates on face.
Step 5: Cubic Curve: Applies Cubic curve equation on the facial feature points.
Step 6: Emotion Detection: Emotion is detected by pattern matching using values from database by computing hamming distance.
Step 7: Output Display: Renders output from detection phase on screen.

IV. EXPERIMENTAL RESULTS

The proposed method is implemented in MATLAB and the Datasets are downloaded from extended Yale Face Database B (B+) and JAFFE dataset [15]. The Yale face database contains 5760 images of a facial expressions. The JAFFE database contains 213 images of 7 facial expressions [16].

Algorithm is measured by calculating recognition rate

Recognition rate = (Number of Correctly identified images/ total number of images)*100

The misses usually included regions with a similar skin likelihood values and regions that certainly were skin regions, but corresponds to other parts of the body such as arm and legs. The table 1 shows the recognition rate for proposed and existing methods and figure 3 shows the graph for the same.

METHOD	TOTAL IMAGES	RECOGNITION RATE	
		TRUE	FALSE
FSPP	70	40	30
LBP	50	35	15
CPCA	60	47	13
DR using CUBIC CURVE	80	55	25

Table 1: Recognition rate

ISSN (Online): 2583-2468
Volume-2 Issue-6 || November 2023 || PP. 8-14 DOI: 10.54741/asejar.2.6.2

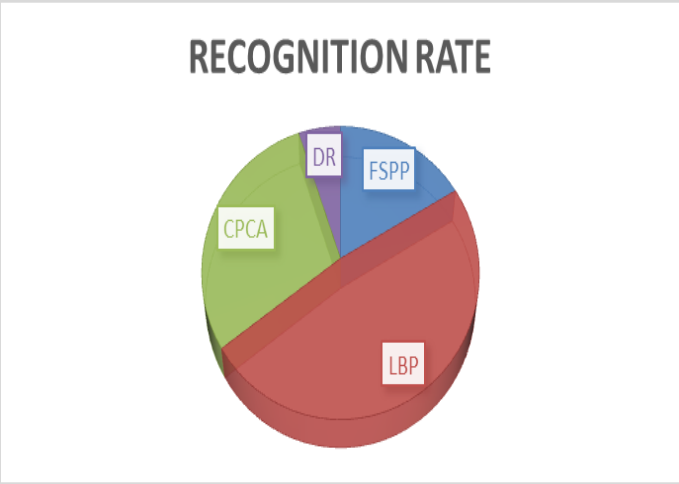

Figure 3: Recognition rate

The table 2 shows the Computation time of required for the existing [17] and proposed methods.

Method	Time taken (sec)
FSPP	0.0008
LBP	1.0144
CPCA	1.004
CUBIC CURVE	1.15

Table 2: computational time

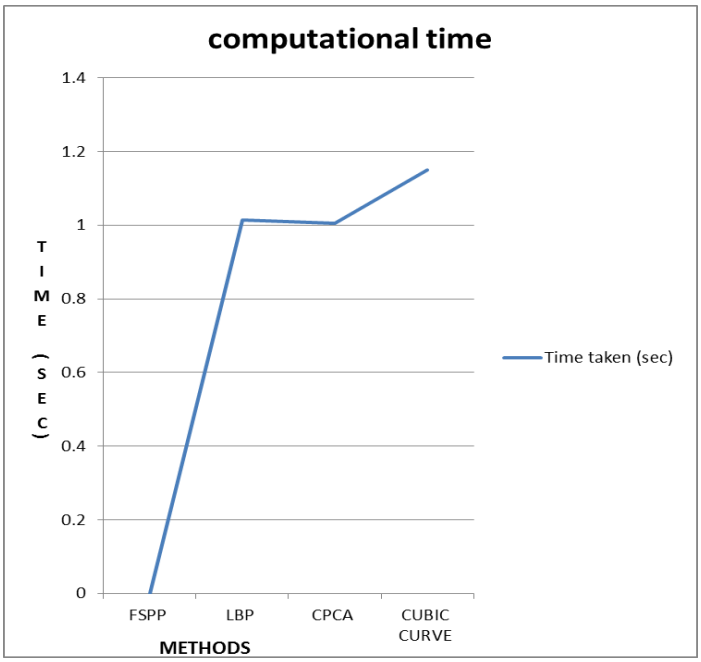

Figure 4: Computational time

ISSN (Online): 2583-2468
Volume-2 Issue-6 || November 2023 || PP. 8-14 DOI: 10.54741/asejar.2.6.2

V. CONCLUSION

This research proposes a straightforward method for face expression analysis recognition. The accuracy of face recognition is higher than that of other techniques. The cubic curve approach is also applicable to video. The background image has no bearing on the outcome. It has a higher memory need and requires more processing time. The technology detects basic emotional expressions and functions effectively on faces of various shapes, complexions, and skin tones. The disadvantages are longer execution times and a higher memory need. Future extensions call for the use of cubic plane curves, faster computation times, and less memory use.

REFERENCES

1. Ravi Singh, & Sushil Kushwaha. (2016). Analysis and recognition of facial feature expressions. *International Journal of Advanced Research in Computer Science and Software Engineering, 6*(4).
2. Priyanka Kumbham, & Dr. G. R. Sakthidharan. (2015). Face recognition using lapp algorithm. *International Journal of Engineering Trends and Applications, 2*(5).
3. Manish Dixit, & Sanjay Silakari. (2014). A hybrid approach of face recognition using bezier curve. *International Journal of Advanced Science and Technology, 71*, 41-48.
4. Faisal Ahmed, & Hossain Bari. (2014). Person-independent facial expression recognition based on compound local binary pattern (CLBP). *The International Arab Journal of Information Technology, 11*(2).
5. Kenz Ahmed Bozed, Osei Adjei, & Ali Mansour. (2013). *Detection of facial expressions based on Morphological face features and Minimum Distance Classifier*. 14th International Conference on Sciences and Techniques of Automatic Control and Computer Engineering (STA).
6. Mostafa K. Abd El Meguid, & Martin D. Levine. (2014). Fully automated recognition of spontaneous facial expressions in videos using random forest classifiers. *Pattern Recognition (ICPR)*.
7. Roberto Valenti, & Nicu Sebe. (2007). Theo gevers. *Image Analysis and Processing Workshops*.
8. Kiyoshi Nosu, & Tomoya Kurokawa. (2006). facial tracking for an emotion-diagnosis robot to support e-learning. *International Conference on Machine Learning and Cybernetics*.
9. S M Zahid Ishraque, A. K. M. Hasanul Banna, & Oksam Chae. (2012). *Local gabor directional pattern for facial expression recognition*.
10. H. Wechsler et al. (1998). *Face recognition: From theory to applications*. Springer-Verlag.