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Comparative Analysis of Face Recognition Techniques: An Overview

Manish Chauhan[1], Dr. Maitreyee Dutta[2]
[1]*M.E. Scholar, Department of Electronics & Communication Engineering, NITTTR, Chandigarh, India.*
[2]*Professor, Department of Computer Science & Engineering, NITTTR, Chandigarh, India.*

Abstract: Face recognition and face detection are important task for computer vision but it will show variation or pattern from human to human, several issues in face recognition across pose still remain open, such as lack of understanding about subspaces of pose variant images, problem intractability in 3D face modeling, complex face surface reflection mechanism, etc. But this task more challenging when use recognition in group then it will increase the pattern overlapping, so use the optimization for identifying individual pattern. In this paper review on pattern recognition approaches of group images has been analyzed.

Keywords: Face Detection, LDA, PCA, Skin Color Models and Face Recognition.

I. INTRODUCTION

Human face detection is to recognize the face area in a picture for additionally preparing, for the most part for face recognition. There are a few methodologies like: skin color, facial segments, surface and different of these components for face detection. Because of basic stance variety and complex foundation the majority of the face detection strategies rejected. Skin color likelihood method for face detection stresses the skin color data and deemphasizes foundation data [1]. Face recognition can be acknowledged as recognizable proof of a man from his facial elements that can be proficient by the utilization of different computational calculations. Face recognition framework is a standout amongst the most cost-effective methods for the utilization of figuring assets in contrast with the verification and ID. Human face passes on a great deal of data about the character and expressional condition of the individual. A face is the most outstanding and particular component of the individual giving a character in the general public. A man can likewise be recognized by his voice, dress, and body shape however the level of data recovery is high if there should be an occurrence of the face. Face recognition is a key perspective identified with picture preparing sorted as confirmation and distinguishing proof [8].

A. Face Recognition System

The way toward coordinating the personality of individual utilizing face recognition can be prepared into three noteworthy strides. These are face detection, feature extraction and characterization or face recognition. General block diagram of face recognition is shown in Fig.1.

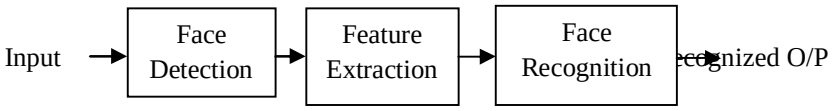

Fig.1 General Block diagram of face recognition system

The initial phase in the process is face detection/representation, which takes picture as information and distinguish the face area. Face detection is trailed by feature extraction in which, interesting and most instructive properties (features) are separated from face picture. Utilizing these features, picture is contrasted and the database images, which is done in arrangement step. The order unit gives the best match of picture with database images [12].

1) Face Detection

Face detection is a standout amongst the most thorough issues in the field of example acknowledgment and PC vision, as a result of the substantial changes and varieties in outward appearances, light and changed signals. The face detection is vital to distinguish whether there are any faces in a picture or video outline, and on the off chance that it is, at that point to restore their individual

positions [3]. Face detection may incorporate face edge detection, segmentation and localization. The face detection is a two-stage process, in which face localization is trailed by face arrangement. Face localization is utilized when there is just face in the picture or edge [15].

2) Feature Extraction

Feature extraction is the way toward getting lessened arrangement of features from input information to speak to unique information without excess. It assumes extremely pivotal part in pattern recognition in light of the fact that excess data in input information influences the execution of recognition. From feature extraction step the applicable facial features are taken out from input picture to frame feature vectors. The information confront is then coordinated with target confront utilizing these feature vectors. To expand the recognition rate a vigorous feature extraction strategy must be utilized all the while [4].

3) Pattern Recognition

Pattern recognition is the way toward coordinating separated features of the face images with test image features. A test image is coordinated against each removed component vector speaking to the database images, which gives a separation portraying the comparability between the test image and the database image. A mark is allotted by the framework to the image, which is most like the layout of the prepared information [15].

B. Face recognition Techniques

Face recognition procedures, for example, principal component analysis, neural networks, machine learning, data hypothesis, geometrical modeling, (deformable) template matching, Hough Transform and shading analysis. The neural system based and see based methodologies require countless and non-face preparing illustrations and are outlined basically to find frontal faces to profile sees. A component based approach that utilizations geometrical facial elements with conviction networks gives face location to non-frontal perspectives [11].

1) Principal Component Analysis

Principal Component Analysis (PCA) a standout amongst the most prevalent strategies utilized for image recognition with dimensionality reduction. The goal of PCA is to drop down the dimensionality of information into diminished dimensional element space that portray the information proficiently. In face recognition with PCA, all the training database images are anticipated on to Eigen space. In like manner each test image is likewise anticipated on to Eigen space. At that point test image is looked at by the training images utilizing either similitude metric or separation metric. The training image which is most like the test image is considered to coordinate the testing image [13].

2) Linear Discriminant Analysis

LDA is likewise one of the all-encompassing FR systems known as fisher face method. The reason for this method to beat the confinements of PCA, which endeavors to streamline the proportion of determinant of between class to the determinant of with-in class disperse network of projection [13]. The LDA approach is like the PCA as it likewise utilizes the projection of training images onto subspace. The test images are distinguished by anticipating itself into same subspace. Similitude metric is utilized for coordinating, in which Euclidean separation is figured for test picture with each training picture and the face which has least separation with test face is named with character. The LDA method segregates the distinctive face classes to get the subspace while PCA extricate the facial features [14].

II. LITERATURE REVIEW

A literature overview is being done to locate an appropriate approach to complete this exploration. It helps in problem formulation and shapes way to conduct examine specifically course. Literature survey of different research papers are given beneath in an arrangement, so a sense can be produced by progression and degree around there. In [1] proposed a face detection system on the premise of skin color probability by means of boosting calculation concentrating especially on data on skin color and decreased data of non-skin color as foundation. To figure the similitude's among a color region and skin color a stochastic model is accommodated. The skin supported classifier concentrate on skin color of face and deemphasizing foundation region for effectively extricates ordinary components. On the premise of their investigations the proposed strategy decreases the half aggregate mistake rate and demonstrates better resilience to face posture variety and troublesome foundation.

In [2] introduced the synchronized image successions of human facial disfigurements brought with multiple aligned cameras from various perspectives. Another technique is proposed in view of affine multi-image slightest squares coordinating where multiple spatial and transient template images are at the same time coordinated against each inquiry image. Amid alteration spatial template images changes. For distinguishing the 3-D focuses which move just inflexibly between back to back casings another strategy is introduced in light of examining worldly changes in the image directions of the followed focuses in multiple perspectives. A novel versatile limit is likewise proposed for mechanized extraction and following of roundabout focuses on a moving calibration object.

In [3] aimed for color images under complex foundation. For recognition and area of human face from color images a face identification calculation in view of skin color segmentation and geometric qualities is sent. Skin region can be gotten by utilizing skin color model and OTSU strategy to consequently optimize threshold segmentation picture. By dissecting the attributes of skin color region, the face position is dictated by foundation of oval zone. Tentatively it has been discovered that the proposed calculation has better vigor.

In [4] proposed a coordinated face recognition framework in light of three innovations: local contrast enhancement, adaptive feature selection and variable measurement for feature vector. For successful recognition rate local contrast enhancement is utilized for changing the uneven brightening varieties. Face recognition framework execution is unequivocally relies upon the way to deal with feature extraction/selection and arrangement. A powerful face recognition motor concentrates the essential features and performs grouping by support vector machines (SVMs). Adaptive feature selection lessens the dimensionality and successfully takes care of the little example measure issue in view of direct discriminant investigation approach. Three face picture databases are utilized to assess execution and trial result demonstrates that the proposed recognition framework has better outcome.

In [5] proposed a calculation produces a CAPTCHA that offers better human accuracy and lower machine attack rates contrasted with existing methodologies. CAPTCHA, clients effectively recognize outwardly contorted human faces implanted in an unpredictable foundation without choosing any non-human faces. The utilization of content based CAPTCHAs is restricted because of dialect reliance so face image-based CAPTCHA is proposed as a potential arrangement. Information burglary and PC break-ins winding up progressively normal, so verification is utilized to diminish robotized attacks while representing a negligible prevention to honest to goodness clients. CAPTCHA is one of the conceivable approaches to group human clients and robotized contents.

In **[6]** introduced convolutional neural network (CNN) based model for human consideration demonstrating by means of head-posture estimation and coordinate it in low-determination and high-determination application areas. For evaluating human concentration of consideration a human head posture is the most imperative element. They exhibited the head posture estimation in two areas Human Computer Interaction (HCI) and Visual surveillance. They introduced the outcomes in datasets that traverse the scope of high-determination human close up appearances and profundity data information to testing low determination open air surveillance information.

In [7] proposed a structure Transductive Parameter Transfer (TPT) for personalized arrangement models and assessed the proposed approach in various applications: torment characterization from facial expression, gesture recognition utilizing inertial estimations and activity unit location utilizing visual information. To take in the connection between the unlabeled information dispersion of a given individual and her/his parameters of personalized classifier the proposed strategy depends on a relapse system. The proposed strategy indicates better exactness and time as for client free methodologies and to past personalization procedures.

In [8] proposed a CMYK color space technique for identification human skin color. Cyan one of the facilitate of the CMYK space has an exponentially awesome impact for recognizable proof of skin. A few trials have been worked out utilizing four distinct databases Compaq, ECU, SFA and Kawulok. An examination has been done between the proposed technique and surely understood thresholding strategies like RGB, YCbCr and HSV spaces and tentatively the proposed strategy in CMYK color space establishes better.

In [9] investigated approaches for programmed acknowledgment of understudy engagement from facial expressions. Facial expression assumes a critical part for the assessment level of understudy's engagement. It is watched that human eyewitnesses concur while separating low versus high degrees of engagement and reliability is diminished when fine segregation is required. In their trial, understudy post-test execution was anticipated with practically identical accuracy from engagement names ($r = 0.47$) as from pre-test scores ($r = 0.44$).

In [10] considered face ID of people of enthusiasm from assortment of information sources (media gathering). They demonstrate that the utilization of various combination plans, 3-D face models, and incorporation of value measures for combination and video outline determination the proposed approach boosts the likelihood of correctly recognizing the individual of intrigue and conventional face coordinating techniques for the most part take a solitary media (i.e., a still face image, video track, or face sketch) as info.

III. COMPARATIVE ANALYSIS

AUTHOR NAME	YEAR	TECHNOLOGY USED	DESCRIPTIONS
Yuseok Ban et al.	2014	Local Binary Pattern and Haar- like feature	Proposed a face detection system on the premise of skin color probability by means of boosting calculation concentrating especially on data on skin color and decreased data of non-skin color as foundation. To figure the similitude among a color region and skin color a stochastic model is accommodated.
Olli Jokinen et al.	2013	Rigid Motion of the Head	Introduced the synchronized image successions of human facial disfigurements brought with multiple aligned cameras from various perspectives. Another technique is proposed in view of affine multi-image slightest squares coordinating where multiple spatial and transient template images are at the same time coordinated against each inquiry image.
Shi Lei et al.	2013	Skin Color Segmentation	Aimed for color images under complex foundation. For recognition and area of human face from color images a face identification calculation in view of skin color segmentation and geometric qualities is sent. Skin region can be gotten by utilizing skin color model and OTSU strategy to consequently optimize threshold segmentation picture.
Wen-Chung Kao et al.	2010	Local Contrast Enhancement and Adaptive Feature Extraction	Proposed a coordinated face recognition framework in light of three innovations: local contrast enhancement, adaptive feature selection and variable measurement for feature vector. For successful recognition rate local contrast enhancement is utilized for changing the uneven brightening varieties.
Gaurav Goswami et al.	2014	Face DCAPTCHA	Proposed a calculation produces a CAPTCHA that offers better human accuracy and lower machine attack rates contrasted with existing methodologies. CAPTCHA, clients effectively recognize outwardly contorted human faces implanted in an unpredictable foundation without choosing any non-human faces.
Sankha S. Mukherjee et al.	2015	Gaze-Direction Estimation	Introduced convolutional neural network (CNN) based model for human consideration demonstrating by means of head-posture estimation and coordinate it in low-determination and high-determination application areas. For evaluating human concentration of consideration a human head posture is the most imperative element.
Gloria Zen et al.	2016	Transductive Parameter Transfer	Proposed a structure Transductive Parameter Transfer (TPT) for personalized arrangement models and assessed the proposed approach in various applications: torment characterization from facial expression, gesture recognition utilizing inertial estimations and activity unit location utilizing visual information.
Dariusz J. Sawicki et al.	2015	CMYK color space technique	Proposed a CMYK color space technique for identification human skin color. Cyan one of the facilitate of the CMYK space has an exponentially awesome impact for recognizable proof of skin.
Jacob Whitehill et al.	2014	Automatic Recognition	Investigated approaches for programmed acknowledgment of understudy engagement from facial expressions. Facial expression assumes a critical part for the assessment level of understudy's engagement. It is watched that human eye witnesses concur while separating low versus high degrees of engagement and reliability

			is diminished when fine segregation is required.
Lacey Best-Rowden et al.	2014	Unconstrained Face Recognition	Considered face ID of people of enthusiasm from assortment of information sources (media gathering). They demonstrate that the utilization of various combination plans, 3-D face models, and incorporation of value measures for combination and video outline determination the proposed approach boosts the likelihood of correctly recognizing the individual of intrigue and conventional face coordinating techniques for the most part take a solitary media (i.e., a still face image, video track, or face sketch) as info.

IV. CONCLUSION

The problem in group face recognition, pose variation received extensive attentions in the research community of computer vision and pattern recognition. A number of promising techniques have been proposed to tolerate and/or compensate image variations brought by pose changes. However, achieving pose invariance in face recognition still remains an unsolved challenge, which requires continuing attentions and efforts. This paper first reviewed these techniques, providing a comprehensive survey and critical discussions on major challenges and possible future research directions towards pose-invariant face recognition. This paper started on discussions of the problem of face recognition across pose, with elaborations on the challenges, current evaluation methodologies, and performances of different approaches. Face recognition techniques relevant to handling pose variations were then classified into three broad categories, i.e., general algorithms, 2D techniques and 3D approaches. Representative general algorithms have been reviewed with an emphasis on their sensitivities to pose variations. 2D techniques and 3D approaches which actively compensate pose variations have been comprehensively reviewed in the last two sections with discussions on their advantages and limitations.

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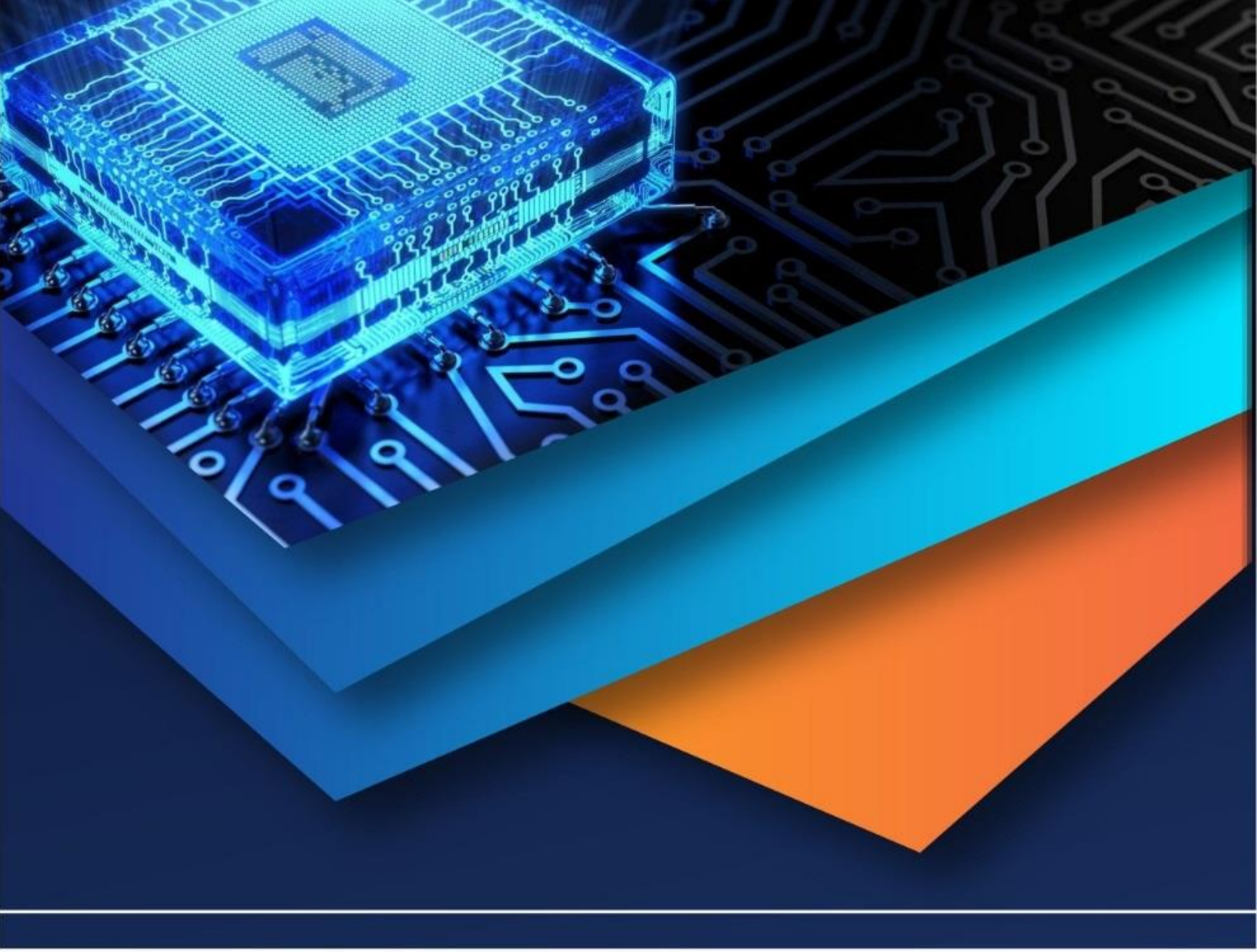
AUTHORS

Manish Chauhan has been working as Lecturer in Electronics & Communication Department at Atal Bihari Vajpayee Govt. Institute of Engg. and Technology Pragatinagar, Shimla. He received the B.Tech degree in Electronics and communication from P.T.U, Jalandhar, India in 2010. He is pursuing his M.E in Electronics & Communication from National Institute of Technical Teachers Training & Research, Chandigarh India. His current research interests focus on Image Processing.

Dr. Maitreyee Dutta has been working as Professor, Computer Science & Engineering department at NITTTR, Chandigarh. She received the Bachelor of Engineering degree from Guwahati University, Master of Technology and Ph.D from Panjab University, Chandigarh. Her research work focused on Digital Signal Processing, Image Processing, Advanced Computer Architecture and Data Warehousing & Mining. She is author and coauthor of more than 50 scientific papers, published in peer-reviewed national or international journals and conferences, guided more than 100 M.Tech dissertations so far. She has guided more than 5 Ph.D students. She is a member of various professional bodies.



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