Facial Expression Recognition: A Survey

¹Kamlesh Tiwari, ²Mayank Patel

¹M.Tech Student, ²Associate Professor ¹ Computer Science and Engineering Department, ¹Geetanjali Institute of Technical Studies, Udaipur 313001

Abstract: Facial expression recognition is a latest topic for research. Facial expression recognition (FER) has an important role in human communication. FER uses in many fields like medical science, security and biometric etc. Face image is a 2D object. It is easy for retina to recognize the face but it is difficult task to implement with artificial intelligence. Face is an image capturing object. Many techniques are exist to identify the face. This paper present a survey of previous research on facial expression recognition methods.

IndexTerms - Facial Expression Recognition (FER), Gabor wavelet, Viola Jones, JAFFE, Haris Corner, Feature Extraction, Feature Classification

I. INTRODUCTION

Biometric uses different-different characteristics for recognition like facial image, finger prints, voice and retina. Bio metric recognition is an effective method. Biometric is Singularity (Unique), Universality (for all), Invariant (to capture conditions) and Resistant (to fraud attempts).

Each person have unique face, unique fingerprint, unique voice and unique retina we are uses signature as identity face in bank and other sensitive documents. Now we are using more powerful and high accuracy biometric like retina, fingerprint, face etc. face recognition is based on face images nobody can stolen or forgotten biometric characteristics because they are permanent and their own.

One of the reasons for developing biometric systems has been to complement the use of information known to the user (for example, a secret number or a keyword) or possessed by it (for example, a magnetic card). These traditional methods are based on properties or elements that can be lost, stolen or forgotten. Such problems disappear with the use of biometric characteristics for personal identification, because they are their own and permanent for each individual. This advantage, together with the fact that it can be extracted quickly, makes biometric techniques valuable identification methods and suitable for use in automatic systems. However, these systems currently present problems of precision (in the rates of false acceptance and false rejection), of non-viability for certain disabled individuals who do not have a certain biometric characteristic required by the system, of vulnerability in certain cases and of acceptance by the parties of the users. Despite these drawbacks, biometric recognition constitutes a good additional authentication system. Even the simplest and cheapest biometric solutions can appreciably increase the overall security of a system if they complement traditional recognition methods and adapt flexibly to the characteristics of the particular application for which they are used [2].

The face recognition though being simple to human eyes is a tedious task for computational approaches. The face recognition scheme should possess sufficient parameters to recognize a face and also robust against noise. The easy scheme of face recognition is matching the pixels of test input with database image pixels in their corresponding position. If the total number of pixels matched is larger than the defined threshold percentage of matching, the face is considered to be authentic. But on a practical note, the input images captured are not always in standard position for matching. For example, the images from security cameras placed at higher altitude than the height of a person captures the images that have different face angles. In these input images, the faces are tilt and could not be recognized with easy schemes.

Another problem that arises in face recognition are the quality of images that are given as input. The captured images have variation in actual size of face due to distance from where they are captured and also have varied skin colour tone due to sunlight [1]. Since the quality cannot be assured for input image, the algorithms are expected to perform with high rate of accuracy in given conditions. The solution for first consideration is a secondary step, primary step being the angle of face captured and the computational model used. Since at most of places only 2D face recognition models are installed, hence the accuracy of face recognition is subjected to angle of face or in high rotational cases is dependent of efficiency of observer. The noisy images in 2D computational model, the efficiency of mathematical algorithms are studied in terms of accuracy of detection [2]. Though many researches claim their methods to be robust and having high efficiency, the assumptions they make are not validated in practical world.

II. APPLICATIONS OF BIOMETRICS

Authentication is required in all areas like banking applications, government offices, army, security service etc. Now biometric attendance system is also running in Govt. And private organizations. Thumb impressions and cards are old systems are time consuming. Facial expression is much easy and reliable also there is no need to swap any card or make thumb impression on machine sensors automatically recognize the face and mark present of the employee.

Biometric is also used by police, forensic services, airports, jewelry shops. It is also used to find out the criminals in the crowd and public places.

These days biometric also used for authentication of various web applications and mobile applications, mobile banking, E-commerce etc.

© 2019 JETIR June 2019, Volume 6, Issue 6

www.jetir.org (ISSN-2349-5162)





III. LITERATURE SURVEY

This survey is the detailed study of existing methods for facial expression recognition. The research works are categorized according to the nature of method and from old to new. At end, a comparative study is presented.

There are 7 standard facial expressions following table shows the standard expressions

	Table 1: Standard Facial Expressions									
	1	An	Angry							
	2	Di	Disgust							
	- 3	Fe	Fear							
2	4	На	Нарру							
	5	Ne	Neutral							
	6	Sa	Sad							
	7	Su	Surprise							

Mehar et al. (2014) presented a framework for face recognition using PCA. The PCA based approach is more accurate rather than the conventional methods. This paper used CSU and ATT databases with five emotions. 85.5 % accuracy is achieved by this method.

Wang et al. (2006) proposed face recognition technique using image enhancement approach and Gabor wavelet transform. Image enhancement is a preprocessing approach which is achieved by using Logarithm transform and Normalization methods. Then the features are extracted by Gabor wavelet from the pre-processed image. This research paper proposes hybrid approach of LDA and PCA method.94.4% maximum accuracy achieved by this method.

Mehta et al. (2016) presented framework for feature extraction using Log Gabor filter which is used for reducing dimensions of extracted features of PCA. Euclidean distance classifier is used for classification of emotions. The Japanese Female Facial Expression (JFFE) database is used.

Rizk et al. (2002) this paper presented different neural network approaches which is applied for face recognition. PCA, DCT, DRT, and DWT is used for Feature extraction. Testing is performed using ORL face database.

Liu et al. (2003) This paper uses an autonomous Gabor features strategy. In this method the curiosity of Insulin-Like Growth Factor (IGF) technique originates from (a) the autonomous Gabor includes in the stage of feature extraction and (b) in the pattern recognition using IGF features based on PRM (probabilistic reasoning model) strategy. It gives 98.5 % accurate results and used FERET dataset.

Rasied et al. (2005) Introduced a face recognition framework. The singular value decomposition technique is utilized for feature extraction. Back-propagation neural network is used as a classifier for classification process.

Wang et al. (2007) This paper presented spectral feature analysis (SFA) approach for unsupervised nonlinear feature extraction. This method is more beneficial to classical method that are: (1) SFA is unaffected by the small-sample-size problem, (2) unfair data from given information can be removed by this approach, and also can be incorporated demonstrating straight discriminant examination under the SFA system, (3) SFA can find hidden nonlinear structure.

Wang et al. (2008) This paper proposed an approach, neural network classifier for face recognition technique using RBF. This paper focused on the three basic issues which are; (1) face image vector, image-size normalization, and the issue of training for hidden layer neural nodes. This paper used ORL face database.

Pritha et al. (2010) This paper used LoG Gabor filter and singular value decomposition for feature extraction and the neural network is used as classifier. The wrinkles and moles from the face images where removes by the LoG Gabor filter. The SVD is used to create basis for the actual dataset. Yale face dataset is used and achieved 84.85% accuracy.

Hussein (2011) presented an face recognition framework using dimension reduction approach by PCA and Euclidian distance classifier, Squared Euclidian Distance Classifier, Squared Chebyshev distance Classifier and City-Block distance classifier are used. The ORL databases is used.

© 2019 JETIR June 2019, Volume 6, Issue 6

Zainudin et al. (2012) Proposed a face recognition framework in which the PCA is applied with LDA approach. This method is find-out main components of the faces and measured the shortest distance between them and achieved higher recognition accuracy. Bashiret al. (2012) Proposed a framework of facial recognition. Using PCA features of face images are extracted. If the face is

not correctly recognized after applying PCA, then the other features like colour and moment invariant are extracted. The final phase i.e. Decision Tree method used as classifier. This paper uses feature extraction in two level which increases 2% recognition accuracy.

Siddiqi et al. (2015), Introduces an robust facial expression recognition (FER) system. It is uses stepwise linear discriminant analysis (SWLDA). The hidden conditional random fields (HCRFs) model is used for recognition. It is uses a hierarchical recognition strategy. Publicly available data sets were used. 96.37% accurate results achieved.

Cossetin et al. (2016) This approach combines specialized pair wise classifiers trained with different feature subsets for classification. First it detects and extracts faces from images. Then the face is split into several regular zones. A pair wise approach used as classifiers. The out put of all pairwise classifier is combined using a majority voting rule. Publicly available data set (JAFFE, CK and TFEID) is used. Classification rate of 99.05%, 98.07% and 99.63% were achieved respectively.

Salmam et al. (2016) This paper proposed that Supervised Descent Method (SDM) is used for feature extraction it is performed with three stages. at first, the main positions are extracted of face then the related positions are selected. After that it estimates the distance between the various components of the face.

IV. APPLICATIONS OF BIOMETRICS

The table 2 shown below gives a comparison analysis of various research work conducted by different authors:

No. R CH PROCESSI Not EXTRACTION TION Accuracy (%) 1 Mehta et al. 2016 PCA Not Log Gabor filter and PCA Euclidean distance 93.57 2 Meher et al. 2014 PCA Not ATT and CSU Specified Not Specified Patabases 3 Bashir 2012 PCA Not Specified PCA Not Specified PCA Not Specified 96.57 4 Zainudin et al. 2011 Dimensio approach Not Specified PCA Not Specified Full 5 Hussein 2011 Dimensio approach Not specified Not Specified Euclidean distance, squared euclidean 95.2 6 Pritha et al. 2010 Not specified Not specified Log gabor filter and singular Neural networks 84.85 7 Wang et al. 2008 Image enhancem enhancem al. Log arithm normalizatio and Gabor Gabor wavelet transform Fasterssion are categorized into a methods Not Specified 94.2 8 Siddiqi et al. 2015 LDA, HCRF Specified Specified 3 major categorized into a major Specified	No. 1 M 2 M 3 4 Z 5 H 6 P 7 W	R Mehta et al. Meher et al. Bashir Zainudin et al. Hussein	2016 2014 2012 2012 2011	CH PCA PCA PCA PCA with LDA approach Dimensio n reduction approach by PCA	PROCESSI NG Not Specified Not Specified Not Specified	EXTRACTION Log Gabor filter and PCA ATT and CSU Databases PCA PCA PCA Not Specified	TION Euclidean distance Not Specified Decision tree method Not Specified Euclidean	Accuracy (%) 93.57 85.5 96 70
Image: constraint of the second sec	1 M 2 M 3 4 Z 5 H 6 P 7 W	Mehta et al. Meher et al. Bashir Zainudin et al. Hussein	2016 2014 2012 2012 2011	PCA PCA PCA PCA with LDA approach Dimensio n reduction approach by PCA	NG Not Specified Not Specified Not Specified Not Specified	Log Gabor filter and PCA ATT and CSU Databases PCA PCA Not Specified	Euclidean distance Not Specified Decision tree method Not Specified Euclidean	(%) 93.57 85.5 96 70
1 Mehra et al. 2016 PCA Not Specified Log Gabor filter and PCA Euclidean af Stance 93.57 2 Meher et al. 2014 PCA Not Specified ATT and CSU Databases Not Specified 85.5 3 Bashir 2012 PCA Not Specified PCA Not Specified PCA Databases 96 4 Zainudin et al. 2012 PCA with LDA approach Not PCA Not Specified Decision tree method 96 5 Hussein 2011 Dimensio approach by PCA Not Specified Not Specified Euclidean distance, squared 95.2 6 Pritha et al. 2010 Not Not Specified Not Specified Neural and singular value Neural distance, city block distance 84.85 7 Wang et al. 2008 Image enhancem ent aproach fatance Log gabor filter and singular value Gabor wavelet features Fisherface method 94.2 7 Wang et al. 2015 Image transform Log aprice and aproach Gabor wavelet transform Fisherface methods 94.2 8 Siddi	1 M 2 M 3 7 4 Z 5 H 6 P 7 V	Mehta et al. Meher et al. Bashir Zainudin et al. Hussein	2016 2014 2012 2012 2011	PCA PCA PCA PCA with LDA approach Dimensio n reduction approach by PCA	Not Specified Not Specified Not Specified	Log Gabor filter and PCA ATT and CSU Databases PCA PCA Not Specified	Euclidean distance Not Specified Decision tree method Not Specified	93.57 85.5 96 70
al.Specifiedand PCAdistance2Meher et2014PCANotATT and CSUNot Specified85.53Bashir2012PCANotSpecifiedDatabasesMot Specified85.54Zainudin2012PCA withNotPCANot Specified705Hussein2011DimensioNotSpecifiedNot Specified82.25Hussein2011DimensioNotSpecifiedNot Specified95.26Pritha et2010NotSpecifiedNot SpecifiedSurared6Pritha et2010NotNotSpecifiedNeural7Wang et2008Image enhancem and approachNotSpecifiedLog gabor filter and singular valueNeural networks84.857Wang et2018NotSpecifiedGabor wavelet transform and normalizatioGabor wavelet transform and networksFisherface method94.28Siddiqi et al.2015SW LDA, HCRFNot SpecifiedExpression are categorized into 3 major categorized into 3 majorNot Specified specified96.37	2 M 3 4 Z 5 H 6 P 7 V	al. Meher et al. Bashir Zainudin et al. Hussein	2014 2012 2012 2011	PCA PCA with LDA approach Dimensio n reduction approach by PCA	Specified Not Specified Not Specified Not Specified	and PCA ATT and CSU Databases PCA PCA Not Specified	distance Not Specified Decision tree method Not Specified Euclidean	85.5 96 70
2 Meher et al. 2014 PCA Not Specified ATT and CSU Databases Not Specified 85.5 3 Bashir 2012 PCA Not Specified PCA Decision tree method 96 4 Zainudin et al. 2012 PCA with LDA Not specified PCA Not Specified 70 5 Hussein 2011 Dimensio n approach by PCA Not Specified Not Specified Euclidean distance, squared euclidean distance, city block distance 95.2 6 Pritha et al. 2010 Not Specified Not Specified Log gabor filter and singular value decomposition Neural networks 84.85 7 Wang et al. 2008 Image ent and Gabor Log arithm transform and normalizatio n methods Gabor wavelet features Fisherface method contain LDA and PCA methods 94.2 8 Siddiqi et al. 2015 SW LDA, HCRF Not Specified Expression are categories Not Specified smajor 96.37	2 M 3 4 Z 5 H 6 P 7 W	Meher et al. Bashir Zainudin et al. Hussein	2014 2012 2012 2011	PCA PCA with LDA approach Dimensio n reduction approach by PCA	Not Specified Not Specified Not Specified	ATT and CSU Databases PCA PCA Not Specified	Not Specified Decision tree method Not Specified Euclidean	85.5 96 70
al. Constrained Specified Databases Constrained 3 Bashir 2012 PCA Not PCA Decision tree method 4 Zainudin et al. 2012 PCA with LDA approach Not PCA Not Specified 70 5 Hussein 2011 Dimensio approach by PCA Not Specified Not Specified 95.2 6 Pritha et al. 2010 Not Specified Not Not Specified 95.2 6 Pritha et al. 2010 Not Specified Not Specified Specified Specified 95.2 7 Wang et al. 2008 Image enhancem ent approach and singular value decomposition Not specified Neural networks 84.85 7 Wang et al. 2008 Image enhancem ent approach and Gabor wavelet transform Fisherface features 94.2 7 Wang et al. 2015 LDR, Age of Gabor filter and singular and contain LDA and PCA methods PCA Not Specified 94.2 8 Siddiqi et al. 2015 LDA, HCRF Specified 3 major categories Not Specified 96.37	3 2 4 Z 5 H 6 P 7 V	al. Bashir Zainudin et al. Hussein	2012 2012 2011	PCA with LDA approach Dimensio n reduction approach by PCA	Specified Not Specified Specified	Databases PCA PCA Not Specified	Decision tree method Not Specified Euclidean	96 70
3 Bashir 2012 PCA Not Specified PCA Decision tree method 96 4 Zainudin et al. 2012 PCA with LDA approach Not Specified PCA Not Specified 70 5 Hussein 2011 Dimensio reduction approach by PCA Not Specified Not Specified Euclidean distance, squared chebyshev distance, squared 95.2 6 Pritha et al. 2010 Not Specified Not Specified Log gabor filter and singular value decomposition Neural networks 84.85 7 Wang et al. 2008 Image enhancem ent and Gabor wavelet Logarithm transform and Gabor Gabor wavelet transform Fisherface methods 94.2 8 Siddiqi et al. 2015 SW LDA, HCRF Not Specified Expression are categorized into 3 major categories Not Specified 96.37	3 Z 4 Z 5 H 6 P 7 V	Bashir Zainudin et al. Hussein	2012 2012 2011	PCA PCA with LDA approach Dimensio n reduction approach by PCA	Not Specified Not Specified	PCA PCA Not Specified	Decision tree method Not Specified Euclidean	96 70
4 Zainudin et al. 2012 PCA with LDA approach Not Specified PCA Not Specified method 5 Hussein 2011 Dimensio n eduction approach Not specified Not Specified Not Specified Euclidean distance, squared chebyshev 95.2 6 Pritha et al. 2010 Not specified Not specified Log gabor filter and singular value Neural networks 84.85 7 Wang et al. 2008 Image entancem and Gabor wavelet transform Logarithm nethods Gabor wavelet features Fisherface method contain LDA and PCA 94.2 8 Siddiqi et al. 2015 SW LDA, HCRF Not Specified Expression are categorized into 3 major categories Not Specified 96.37	4 Z 5 H 6 P 7 V	Zainudin et al. Hussein	2012	PCA with LDA approach Dimensio n reduction approach by PCA	Specified Not Specified Not Specified	PCA Not Specified	method Not Specified Euclidean	70
4 Zainudin et al. 2012 PCA with LDA Not Specified PCA Not Specified 70 5 Hussein 2011 Dimensio n reduction approach by PCA Not Specified Not Specified Euclidean distance, squared chebyshev distance, squared euclidean distance, squared 95.2 6 Pritha et al. 2010 Not Specified Not Specified Log gabor filter and singular value Neural networks 84.85 7 Wang et al. 2008 Image enhancem ent approach and Gabor Log gabor filter and singular value Fisherface methods 94.2 8 Siddiqi et al. 2015 SW LDA, HCRF Not Specified Expression are categorized into 3 major categories Not Specified 96.37	4 Z 5 H	Zainudin et al. Hussein	2012	PCA with LDA approach Dimensio n reduction approach by PCA	Not Specified Not Specified	PCA Not Specified	Not Specified	70
et al. LDA approach approach approach Specified neduction approach by PCA Not Specified chebyshev distance, squared chebyshev distance, squared euclidean distance, city block distance chebyshev adistance, city block distance chebyshev adistance, squared euclidean distance, city block distance 6 Pritha et al. 2010 Not Specified Specified al. Log gabor filter and singular value decomposition Neural networks 84.85 7 Wang et al. 2008 Image enhancem ent approach and singular value decomposition Fisherface method contain LDA and PCA methods 94.2 8 Siddiqi et al. 2015 SW LDA, HCRF Not Specified 3 major categories Not Specified 96.37	5 H	et al. Hussein	2011	LDA approach Dimensio n reduction approach by PCA	Specified Not Specified	Not Specified	Euclidean	
5 Hussein 2011 Dimensio n reduction approach by PCA Not Specified Not Specified Euclidean distance, squared chebyshev distance, squared euclidean distance, city block distance 95.2 6 Pritha et al. 2010 Not Specified Not Specified Log gabor filter and singular value decomposition Neural networks 84.85 7 Wang et al. 2008 Image enhancem ent and and distance Log gabor filter and singular value Fisherface method contain LDA and features 94.2 8 Siddiqi et al. 2015 SW LDA, HCRF Not Specified Expression are categorized into 3 major categories Not Specified 96.37	5 H	Hussein	2011	approach Dimensio n reduction approach by PCA	Not Specified	Not Specified	Euclidean	
5 Hussein 2011 Dimensio Not Not Specified Euclidean 95.2 6 Pritha et al. 2010 Not Specified Specified Not Specified Sugared euclidean distance, squared euclidean distance	5 F 6 P 7 V	Hussein	2011	Dimensio n reduction approach by PCA	Not Specified	Not Specified	Euclidean	
Image: Specified approach by PCASpecified approach by PCASpecified approach by PCASpecified approach by PCASpecified approach distance, squared euclidean distance, squared euclidean distance, siguared euclidean distance, city block distance6Pritha et al.2010NotNotLog gabor filter and singular value decompositionNeural networks7Wang et al.2008Image enhancem ent and and approach and and approach and and Gabor wavelet transformGabor wavelet featuresFisherface method contain LDA and PCA methods8Siddiqi et al.2015SWNotExpression are categorized into 3 major categoriesNot Specified90LDA, HCRFSpecifiedSpecified3 major categoriesNot Specified96.37	6 P 7 V			n reduction approach by PCA	Specified			95.2
8 Siddiqi et 2015 SW Logarithm Gabor Gabor Fisherface 94.2 8 Siddiqi et 2015 Image Logarithm Categorized into Superside into Superside into 8 Siddiqi et 2015 Image Sw Not Specified Superside into 8 Siddiqi et 2015 Image Sw Not Specified Superside into 8 Siddiqi et 2015 Image Sw Not Specified Superside into 9 Image Sw Image Superside into Superside into Superside into Superside into 10 Image Sw Image Superside into Superside into Superside into 10 Image Image <td>6 P 7 V</td> <td></td> <td></td> <td>approach</td> <td></td> <td></td> <td>distance,</td> <td></td>	6 P 7 V			approach			distance,	
approach by PCAapproach by PCAapproach by PCAapproach by PCAapproach chebyshev distance, squared euclidean distance, city block distance6Pritha et al.2010Not SpecifiedNot SpecifiedLog gabor filter and singular value decompositionNeural networks84.857Wang et al.2008Image enhancem ent and and methodsLogarithm featuresGabor wavelet featuresFisherface method contain LDA and PCA methods94.28Siddiqi et al.2015SW LDA, HCRFNot SpecifiedExpression are categorized into 3 major categories96.37	6 P 7 V			approach			squared	
6 Pritha et al. 2010 Not Specified Not Specified Log gabor filter and singular value decomposition Neural networks 84.85 7 Wang et al. 2008 Image enhancem ent al. Logarithm rransform ent and approach and singular Gabor wavelet features Fisherface method contain LDA and PCA methods 94.2 8 Siddiqi et al. 2015 SW LDA, HCRF Not Specified Expression are categorized into 3 major Not Specified 96.37	6 P 7 V			by PCA			chebyshev	
6Pritha et al.2010Not SpecifiedNot SpecifiedLog gabor filter and singular value decompositionNeural networks84.85 networks7Wang et al.2008Image enhancem ent and approach and gabor nethodsLogarithm featuresGabor wavelet featuresFisherface method contain LDA and PCA methods94.28Siddiqi et al.2015SW LDA, HCRFNot SpecifiedExpression are categoriesNot Specified9000000	6 P 7 V			5,1011			distance,	
6 Pritha et al. 2010 Not Specified Not Specified Log gabor filter and singular value decomposition Neural networks 84.85 7 Wang et al. 2008 Image enhancem ent approach and Gabor wavelet transform Logarithm transform and normalizatio n methods Gabor wavelet features Fisherface method contain LDA and PCA methods 94.2 8 Siddiqi et al. 2015 SW LDA, HCRF Not Specified Expression are categorized into 3 major Not Specified 96.37	6 P 7 V						squared	
6 Pritha et al. 2010 Not Specified Not Specified Not Specified Log gabor filter and singular value decomposition Neural networks 84.85 7 Wang et al. 2008 Image enhancem ent approach and approach and source Logarithm transform ent and normalizatio n methods Gabor wavelet features Fisherface method contain LDA and PCA methods 94.2 8 Siddiqi et al. 2015 SW LDA, HCRF Not Specified Expression are categorizes Not Specified 96.37	6 P 7 V						euclidean	
6 Pritha et al. 2010 Not Specified Not Specified Log gabor filter and singular value decomposition Neural networks 84.85 7 Wang et al. 2008 Image enhancem ent approach and Gabor wavelet transform Logarithm features Gabor wavelet features Fisherface method contain LDA and PCA methods 94.2 8 Siddiqi et al. 2015 Image enhancem ent and Gabor wavelet transform SW Not Specified Sw Not Specified Expression are categorized into 3 major Not Specified 96.37	6 P 7 V						block distance	
6 Printia et al. 2010 Not Not Log gabor finter and singular and singular networks Nethal al. 84.83 7 Wang et al. 2008 Image enhancem ent and approach and and singular and normalizatio and normalizatio and normalizatio and and and first ransform Gabor wavelet transform Fisherface method contain LDA and PCA methods 94.2 8 Siddiqi et al. 2015 SW LDA, HCRF Not Expression are categorized into 3 major categories Not Specified 96.37	7 V	Dritha at	2010	Not	Not	Log och or filter	Nourol	01 05
al.SpecifiedSpecifiedand singular value decompositionnetworks7Wang et al.2008Image enhancem ent and approach and normalizatio and normalizatio and n methodsGabor wavelet featuresFisherface method contain LDA and PCA methods94.28Siddiqi et al.2015SW LDA, HCRFNot SpecifiedExpression are categorized into 3 major categoriesNot Specified96.37	7 V		2010	Not	Not Specified	Log gabor liner	neural	84.83
Number of the second state	7 V	al.		specified	specified		networks	
7Wang et al.2008Image enhancem ent and approach and normalizatio n methodsLogarithm featuresGabor wavelet featuresFisherface method contain LDA and PCA methods94.28Siddiqi et al.2015SW LDA, HCRFNot SpecifiedExpression are categoriesNot Specified96.37	7 V					decomposition		
7 Wang et al. 2000 Image enhancem ent and approach and and Gabor wavelet transform Dogatimin features Outoor witclet features Tistefface method contain LDA and PCA methods 8 Siddiqi et al. 2015 SW LDA, HCRF Not Specified Expression are categorized into 3 major Not Specified 96.37		Wang et	2008	Image	Logarithm	Gabor wavelet	Fisherface	94.2
all containeent ent approach and Gabor wavelet transform and normalizatio n methods reatures Intended contain LDA and PCA methods 8 Siddiqi et al. 2015 SW LDA, HCRF Not Expression are categorized into 3 major Not Specified 96.37		al	2000	enhancem	transform	features	method	74.2
8 Siddiqi et al. 2015 SW LDA, HCRF Not Expression are categorized into Specified Not Specified 96.37		ui.		ent	and	Touturos	contain LDA	
8 Siddiqi et al. 2015 SW LDA, HCRF Not Expression are categorized into Specified Not Specified 96.37				approach	normalizatio		and PCA	
8 Siddiqi et al. 2015 SW LDA, HCRF Not Expression are categorized into Specified Not Specified 96.37				and	n methods		methods	
8 Siddiqi et 2015 SW Not Expression are categorized into Not Specified 96.37 9 9 9 9 9 9 9 9 9				Gabor				
8 Siddiqi et 2015 SW Not Expression are categorized into Not Specified 96.37 9 9 9 9 9 9 9 9 9				wavelet				
8 Siddiqi et 2015 SW Not Expression are categorized into Not Specified 96.37 9 9 9 9 9 9 9 9 9				transform				
Siddiqi et al. SW 2015 Not LDA, HCRF Not Specified categorized into 3 major categories Not Specified 96.37	8					Expression are		
Biddig et 2015 LDA, HCRF Not Specified 96.37 9 Image: Statistic structure Specified Specified Specified Specified 96.37	S	Siddiai et		SW	Not	categorized into		
al. HCRF Specified 3 major 9 Each pair wise Fach pair wise		siddigi ol	2015	LDA,	1.01	cutogonized into	Not Specified	96.37
9 Fach pair wise		al.		HCRF	Specified	3 major	-	
9 Each pair wise						categories		
Constin LDD Deirwise	9			IDD	Doimuiac	Each pair wise		
2016 Cosseul 2016 Classifier uses a SDM, CART 98.91		Cossetin	2016	LDP,	r all wise	classifier uses a	SDM, CART	98.91
et al. WLD Classifier		Cossetin		WLD	Classifier		,	
particular subset		Cossetin et al.				particular subset		
10 Salmam 2016 SDM Not Decision tree for CART 89.9	10 S	Cossetin et al.		SDM	Not	Decision tree for	CART	89.9
at al Crasified training CART 07.7		Cossetin et al. Salmam	2016	SDM	Specified	training	Critti	07.7

V. CONCLUSION

Application area of Facial Expression Recognition is increases and it requires more reliable and accurate system. In this survey we are compared the results of 10 papers of facial expression recognition. The highest recognition accuracy is 98.91% of Cossetin et al. so there is more work is required in this research. We are needed 100% accurate results for a robust and reliable biometric system.

REFERENCES

- [1] Meher SS, Maben P. "Face recognition and facial expression identification using PCA", IEEE International Conference In Advance Computing (IACC), pp. 1093-1098, 2014.
- [2] G. Wang and Z. Ou, "Face Recognition Based on Image Enhancement and Gabor Features", Proceedings 6th World Congress on Intelligent Control and Automation, (2006), pp. 9761-9764.
- [3] Mehta, Neelum, and Sangeeta Jadhav. "Facial Emotion recognition using Log Gabor filter and PCA." In Computing Communication Control and automation (ICCUBEA), 2016 International Conference on, pp. 1-5. IEEE, 2016.
- [4] M.R.M. Rizk and A. Taha, "Analysis of Neural Networks for Face Recognition Systems with Feature Extraction to Develop an Eye Localization Based Method", IEEE, 2002.
- [5] C. Liu and H. Wechsler: "Independent Component Analysis of Gabor Features for Face Recognition", IEEE Trans. Neural Networks, vol. 14, no. 4, pp. 919-928, 2003.
- [6] A. Rida and DrBoukelifAoued, "Artificial Neural Network-Based Face Recognition", IEEE, 2004.
- [7] T. S. M. Rasied, O. O. Khalifa and Y. B. Kamarudin, "Face Recognition Based On Singular Valued Decomposition and Back Propagation Neural Network", IEEE, 2005.
- [8] Y. Song, Y. Kim, U. Chang and H. B. Kwon, "Face Recognition Robust To Left-Right Shadows Facial Symmetry", Elsevier, 2006.
- [9] A. H. Boualleg, Ch. Bencheriet and H. Tebbikh, "Automatic Face Recognition Using Neural Network-PCA", IEEE, 2006.
- [10] F. Wang, J. Wang, C. Zhang and J, Kwok, "Face Recognition Using Spectral Features", Elsevier, Sciencedirect, Pattern Recognition, 2007.
- [11] K. Youssef and P. Woo, "A New Method for Face Recognition Based on Colour Information and a Neural Network", IEEE, 2007.
- [12] Z. Mu-chun, "Face Recognition Based on Fast ICA and RBF Neural Networks", IEEE, 20-22 Dec. 2008.
- [13] W. Wang, "Face Recognition Based On Radial Basis Function Neural Networks", IEEE, 20-20 Nov. 2008.
- [14] J. Youyi and L. Xiao, "A Method for Face Recognition Based On Wavelet Neural Network", IEEE, 2010.
- [15] D.N Pritha, L. Savitha and S.S. Shylaja, "Face Recognition by Feed forward Neural Network Using Laplacian of Gaussian Filter and Singular Value Decomposition", IEEE, 5-7 Aug. 2010.
- [16] Hussein Rady, "Face Recognition using Principle Component Analysis with Different Distance Classifiers", IJCSNS International Journal of Computer Science and Network Security, VOL.11 No.10, October 2011.
- [17] Sukhvinder Singh, Meenakshi Sharma and Dr. N Suresh Rao, "Accurate Face Recognition Using PCA and LDA", International Conference on Emerging Trends in Computer and Image Processing (ICETCIP'2011) Bangkok Dec., 2011.
- [18] V. P. Kshirsagar, M. R. Baviskar, M. E. Gaikwad, "Face recognition using Eigenfaces", IEEE 3rd International Conference on Computer Research and Development (ICCRD), Vol. 2, March 2011.
- [19] M. N. Shah Zainudin., Radi H. R., S. Muniroh Abdullah., RosmanAbd. Rahim. M. Muzafar Ismail., M. IdzdiharIdris., H. A. Sulaiman., Jaafar A., "Face Recognition using Principle Component Analysis (PCA) and Linear Discriminant Analysis (LDA)", International Journal of Electrical & Computer Sciences IJECS-IJENS Vol:12 No:05, 2012.
- [20] Mohammad Said El-Bashir, "Face Recognition Using Multi-Classifier", IEEE, 2012.
- [21] Jeffreys, Alec J., Victoria Wilson, and Swee Lay Thein. "Hypervariable 'minisatellite' regions in human DNA." Nature 314, no. 6006, pp. 67-73, 1985.