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PERIODICITY OF FACIAL PATTERN: A REVIEW

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ABSTRACT

Human perceive and sense the world around them by using their brains and eyes whereas computer vision is a science which provides all these capabilities to machines. It is a discipline in which a machine learns how to see and visualize environment around it. In this paper, we describe what Periodicity of Facial Patterns are, their advantages and limitations.

KEYWORDS: video surveillance & literature review related to face detection.

INTRODUCTION

This chapter contains an overview of existing methods of face recognition system. The literature survey describes some of existing methods and proposed approaches of face recognition and detection in videos and images. We divided the review in 4 sections in which section first analyses the methodology used in our system, section second presents a detailed review on Video Surveillance, section third describes some known different approaches of face detection and last section represents a detailed review on face recognition methods.

RELATED WORK

We have implemented an existing effective approach local binary pattern for our system which used shape and texture information to represent a face. This method is also compared with two approaches Gradientface and Histogram of Oriented Gradients to show the accuracy of these algorithms in respect to face recognition rate. A literature survey on these methods for face recognition is presented below in this report.

Ahonen et al. (2004) introduced a new approach for face recognition by using LBP. LBP used shape and texture information to represent face images. The performance of proposed method is much better than all considered methods (PCA, LDA, ICA and EBGM). LBP is used to describe the micro pattern of faces. In this approach initially a face is divided into several facial regions and then local LBP are extracted which in return used to create a facial histogram. Face Recognition is performed by nearest neighbor classifier with Chi square distance as a dissimilarity measure. The experimental results showed its robustness with respect to facial expression, ageing and illumination. They also demonstrated some drawbacks of this method as dimensionality reduction is possible.

Ahonen et al. (2006) proposed an efficient and robust facial representation based on LBP(Local Binary Pattern) .In LBP image is divided into several blocks and from these blocks LBP features are extracted .Using these features an enhanced feature vector is created(face descriptor).Experiments are performed under difficult challenges for face recognition. According to Authors facial images are a composition of micro patterns such at flat areas, edges and lines.LBP has emerged as a powerful method to extract facial features in face recognition.

Liu and Tao (2009) developed a new image representation derived from PCA which transform upon the hybrid configuration of different color components. The new image representation is more invariable than the gray scale image because it inherited advantages from most of color components. LBP is used to extract multi resolution LBP features and it was used by fisher discriminant analysis for face recognition. According to the experimental

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results, method achieved 83.41% results at 0.1% false acceptance rate.
Zhang et al. (2009) introduced a novel approach of face recognition which can extract illumination insensitive measure from features of a face. According to the studies Gradientface is derived from image gradient domain, so it is much powerful to extract illumination insensitive measure from pixel level. According to their experimental results, it has 99.83% recognition rate on PIE Database, 98.96% on Yale Database and 95.61% on outdoor database. To compute illumination insensitive measure, they used Reflectance Model of images. They also compared this method with other illumination invariant methods (SQI, LTV and MSR) and studies shows that it is an efficient and effective method for illumination problem.

Deniz et al. (2011) introduced HOG features for face Recognition. Basically HOG is a feature descriptor. There are three main contributions of work are:

i. Uniform sampling of HOG features.
ii. Dimension Reduction in HOG representation.
iii. A decision level combination of results using HOG features extracted from different images patch size.

Lee et al. (2011) studied LBP and its variant. They tested it on family face database. The combination of LBP and other features were also tested. The combination of several normalization methods and distance measure were also tested.

Malkapurkar et al. (2011) introduced a new face recognition method based on LBP. The proposed algorithm was for color as well as monochrome images which used LBP histogram. For matching they used minimum distance criteria between histograms. The study showed that the processing time of LBP was much less than other traditional methods.

VIDEO SURVEILLANCE

From many years Face Recognition based on videos has emerged as a hot and active research topic in computer vision. In comparison to the traditional methods, Video based Face Recognition has a great advantage over image based methods. Due to its difficulties, many researchers are working in this area. Here we have presented a review on some different approaches for video surveillance or video based face recognition.

Price and Gee (2001) developed a face recognition algorithm which addresses three issues of face recognition – illumination, expression and decoration. It employs a parallel system of LDA based classifier referred as observer. Each observer is trained by one face region and final output of observers is combined to face recognition result. PCA and LDA both are used for face recognition. A new contribution (confidentiality measure) is also used to show correct results.

Aggarwal et al. (2004) modeled a moving face as a linear dynamical system whose appearance changes with pose and time. For representing such system, ARMA (autogressive and moving average) model is used. Subspace angle based distance metrics are used to get the measure of similarity between ARMA models. The obtained results showed that the proposed method is robust against variation in pose, expression and illumination. System can work well in 2D and 3D pose variation.

Feris (2007) proposed a technique to detect, to track a face and then combine a person classifier with a face classifier to generate a person keyframe. Fens uses local features adaption before applying the AdaBoost learning for feature selection. Experiments show that this technique offers better detector rates and fast training than traditional methods in videos.

Zhou et al. (2008) reviewed face recognition techniques in this paper. They also proposed a method for many approaches. This paper presents a detailed analysis on recognition from groups of still images and from video sequences. Zhou defines a general framework called probabilistic identity characterization

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that deals with a group of images. They also proposed an approach for video based face recognition.

Mian (2008) proposed an unsupervised learning approach for video based face recognition. It does not assume prior knowledge of pose and landmarks. It extracts features from automatically detected keypoints which are out of order. Video frames of a probe are sequentially matched to the cluster of all individuals in the gallery and its identity is decided on the basis of best temporarily cohesive cluster matches.

Davis et al. (2010) has demonstrated a system of face recognition from surveillance video. The proposed system is robust against pose, scale, illumination and expression for face recognition. He combined Viola Jones method with skin – tone color information analysis. Irises, nostrils, ear – tips are the local features that they used. They also mentioned that for real world system more features should be selected but it is unknown how many features are required to provide discrimination over a large population

Arandjelovic (2012) introduced a method in which a set of images is used to identify a person. The method is based on generic illumination shape invariant. The key contribution is a personal appearance representation suitable for exploiting the invariant. This paper also presents a novel representation of personal appearance in the form of linked mixture models. Results showed that Recognition rate is high and matching speed is good on large dataset.

Zhou et al. (2013) presented a novel approach for video based face recognition. For illumination invariance, the image enhancement based on local mean and standard deviation is introduced into conventional PCA. The improved PCA and LDA are combined to recognize faces in videos. LDA is used to solve the small sample size problem. This paper also shows that video based face recognition can also tackle with problems of image based face recognition and it can enhance the performance and speed of current image based face recognition.

Little et al. (2013) proposed an integrated multiple computer vision approaches for video surveillance analysis to show human activities. They had also taken part in TRECVid interactive surveillance event detection task 2012 (a benchmarking exercise supported by US NSIT for simulating video information retrieval research), Surveillance Event Detection using CCTV footage has been a TRECVid task for the previous five years. They applied multiple disparate computer vision methods to support event retrieval in surveillance video. They have established better understanding of how to manage challenges presented by this type of data. Their work was carried out upon the feedback gathered from professional users.

LITERATURE REVIEW RELATED TO FACE DETECTION

Face detection is an essential part of a face recognition system. Removal of unnecessary background can reduce the complexity of a system. Presence of long hair, glasses, position, orientation, lighting problem etc are the complications of a face detection system. A review on some of different approaches to the problem has been introduced below. An implementation of one of the identified approach of face detection has been included and used for face recognition system.

Osuna et al. (1997) proposed a novel decomposition algorithm that was used to train support vector machine for large databases. Their algorithm can work with 2500 supporting vectors on 128 MB RAM. They embedded SVM in a face detection system which separated faces and non – faces.SVM is used to handle very high dimensional inputs.

Han et al. (2000) proposed a morphology based face detection technique. Morphology based technique was used to perform eye analogue segmentation. In eye analogue segmentation, eye region was located. These segments were

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(ISRA), Impact Factor: 2.114

then fed into trained back propagation neural network for face detection. This algorithm can detect multiple faces in cluttered environment. The proposed algorithm increased the face detection rate up to 5% to 10%.
Hjelmas and Low (2001) presented an extensive and detailed survey of face detection algorithms. They divided face detection algorithms in to sections: Feature based method and Image based method. Skin color detection was a feature based method. Visual feature or facial features are extracted from faces. It was applicable where color and motion are available. Image based methods were used for grey scale static images. The simplest image based methodology was template matching. They divided it into three categories: linear subspace methods, neural networks and statistical methods.

Feraund et al. (2001) proposed a new Neural Network based model for frontal and side faces. From the two statistical models of face detection they used Generative Model approach for face detection and to reduce false alarm rate and to increase face detection ability, there are three architectures combined several CGMs: an ensemble, a conditional mixture and a conditional ensemble. Ensemble of networks was used to reduce false rate.

Yang et al. (2002) presented a comprehensive and detailed survey on face detection and estimation technologies. They also discussed some important issues such as data collection, evaluation metrics and benchmarking. They classified single image detection methods into four categories: Knowledge based, Feature Invariant based, Template Matching based and Appearance based methods. They presented that a robust face detection system must be effective to pose, lighting, orientation and expression, hair style variations.

Voila and Jones (2004) developed a new face detection framework with high detection rate and minimum computation time. Their first contribution was the new face representation technique referred as “integral image” which reduced the initial image processing required for detecting faces. The second contribution was the simple and efficient classifier based on AdaBoost learning algorithm for feature selection. This classifier selected a small number of features needed to be processed during runtime. The third contribution of the paper was to design classifier in a cascade which discarded the background region of image and focused on face region only.

Abramson et al. (2005) presented a new face detection algorithm integrated with viola Jones face detection method. Feature is insensitive to the variance normalization. Their improved face detection system detected faces in .009 seconds, running on Pentium-4 2.4 GHz. They checked for the threshold that could be inserted to the features.

Kublbeck and Ernst (2006) proposed a real time face detection methodology by using illumination invariant local structure features which was computed with the modified census transform. They used four stage classifier cascades for classification. The tracking was performed by continuous detection approach which leaded to the new solution of tracking problem. Each simple and linear classifier contains a set of look up tables of feature weights. Results showed that the proposed face detection system can be operated on video mode too.
Kollreider et al. (2007) introduced a face detection approach for real time system. They suggested quantized angle features i.e. quangles which were used for illumination invariance. They did not need preprocessing because they were using gradient direction and orientation. For fast evaluation and to reduce features they presented a quantization scheme prior to boosting. They achieved 93% detecting rate at .0000001 False Positive Rate on CMU – MIT dataset.

Kalal et al. (2012) proposed a new methodology for the problem of tracking a new object in video streams. They divided this task into three components: tracking, learning, detection. To train an object detector they evaluated the detector, estimated its error and

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update the classifier. Designed experts were used to acquire stability of learning. It was the original TLD design. Further improvement on original design was also done by Authors

Zhang and Zhang (2010) surveyed some of recent advance technique of face detection. They showed that although face detection is now applied to most of Cameras and software still it needed improvement. It is still a challenging task in pose and lighting variations. Viola Jones method was effective and fast method for frontal faces but they also fails for different and arbitrary pose of faces.

Khokher (2011) suggested an automatic face detection method for color images. They divided their work in three parts: Skin color segmentation, Morphological processing and connected component analysis. Skin color segmentation was used to separate skin and non skin classes to reject non skin color from images. Morphological processing was applied to clean noise and clutter from images then they rejected those connected components which contains hands, arms and region of dress.

Ali et al. (2012) proposed a new approach where they trained a single classifier that has the ability to deform based on the image. The method consists of a series of pose estimator which was used to compute an orientation in the image plane. Boosting based learning was used to select the best combination of pose estimators and pose indexed features. The produced adaptor was able adapt to appearance and local deformation changes so there was no need to break training data into various sets.

Zhu and Ramanan (2012) created a unified model for multi view face detection, pose estimation and landmark localization (geometric features of faces) which outperforms state of the art methods. They showed results on standard face benchmarks and in a new "in the wild" datasets. Model was based on a mixture of trees with a shared pool of parts. Facial landmarks are modeled as a part and used to capture topological changes due to view points.

LITERATURE REVIEW RELATED TO FACE RECOGNITION

Because of recent changes in multimedia and computer vision, Face Recognition has gained significant attention. A security system which can track human faces is very beneficial so there are many opportunities for face recognition field. Face Recognition Techniques also faces some major challenges like low quality face image or video, uncontrolled environment, lighting problem, appearance problem, covering of faces etc. We developed a literature review on image based face recognition chronologically.

Turk and Pentland (1991) introduced Eigenface method for face recognition. This method was motivated by information theory and physiology. This method was the first successful automated appearance - based system for face recognition. It took whole face into account rather than individual features like the eyes, eyebrows, nose, lips etc. The face image was represented in a low dimension subspace formed by the Principal Component Analysis of the image database. Eigenfaces is the eigenvectors of the covariance matrix of the image set. These Eigenfaces or eigenvectors represented the significant variations amongst the faces of the database. The collection of face images were called training set and eigenvalues of this training set were calculated, corresponding weights were also calculated. The test images undergo into the same process and then the distance between training images and testing images were calculated.

Brunelli and Poggio (1993) proposed two algorithms (a) Geometric feature based (b) Template matching based. The results were obtained on frontal faces. For geometric features they choose width and length of nose, mouth and chin shape and eyes. They also compared the results of these two methods and have shown some advantages and disadvantages of both. They demonstrated that face recognition rate is high by using template matching. Also the feature based strategy

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allowed a high computational speed and smaller memory requirements.

Belhumeur et al. (1997) developed a face recognition algorithm which took a pattern classification approach. They considered each pixel in an image as a coordinate in a high dimensional space. One method based on fisher's linear discriminant produced separate class in low dimension database. On the other hand, Eigenfaces linearly projected the image space to a low resolution subspace. Linear Discriminant Analysis (referred as LDA) maximize the between class scatter while minimizing the within class scatter. Experimental results clearly stated that Fisherface method handled lighting and expression variance best.

Wiskott et al. (1997) suggested an elastic graph bunching method for recognizing faces of known class. Geometric features of face were described by set of wavelet components. By bunch graph methodology image graphs were calculated, which in turns compared for face recognition. A bunch graph was created in two steps. (a). its qualitative structure as a set of nodes & edges (b). as jets and distance. A jet was described as a small patch of grey value in an image around a given pixel. This system was based on a maximum on a general data structure – graphs labeled with wavelet responses. For experiments they used two different databases: first database was ARPA/ARL FERET, second database was collected at the Institute for Neural Computation in Bochum.

Etemad and Chellappa (1997) proposed LDA based feature extraction for face recognition. LDA was a holistic projection based approach for extracting features. In proposed method Eigenvalue analysis was performed on separation matrix rather than on covariance matrix. According to their approach, LDA used the class membership information. It extracted a small set of features which were most relevant information for classification. They also compared proposed LDA method with PCA method. This research was also supported by advanced research projects agency and the US office of naval research.

Nefian and Hayes (1998) used HMM for face recognition and they reduced the computational complexity of previous HMM based face recognition. For feature vector they applied 2D-DCT feature vector.
Moon and Phillips (2001) presented the performance and computational aspects of PCA (Principal Component Analysis). They proposed a new algorithm based on PCA. The components of proposed algorithm are –

i. Perform illumination normalization
ii. Low pass filter images
iii. Remove the first low order Eigen vector
iv. Angle and mahalanobis similarity measure for matching.

They introduced a generic modular PCA algorithm. In their experiments they changed the components and noted the impact of these changes on system performance. From their experiments they concluded that right selection of nearest neighbor classifier was necessary to obtain best results and wavelet and JPEG compression did not degrade the performance of face recognition system.

Bartlett et al. (2002) introduced Independent component analysis based face recognition. ICA is a generalized method of PCA. It uses the information contained in the high order relationship among pixels. Authors explored two different architectures to develop image representations of faces using ICA. Arc-1 treated images as a random variable and pixels as random trials while Arc-2 treated pixels as random variables and images as random trials. A classifier which combined two ICA representations performed outstanding on all test datasets. They also suggested that ICA representation were more robust and efficient to variations such as lighting conditions, changes in hair, expressions.

Starovoitov et al. (2002) used three approach Geometric Approach, Elastic Approach, Neural Networks for document control, access

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control and database retrieval. Calculated distance between eyes (iris) was used as a normalization factor. For Geometric Features, 37 points at face was selected by them. Neural Networks was used for access control. Number of hidden layer was 30.

Yang (2002) demonstrated that PCA and LDA do not address higher order statistical dependencies. Kernel PCA and kernel LDA used low dimensional representation. They used higher order correlation. He compared kernel PCA and LDA with traditional methods, obtained results showed the outstanding performance of kernel methods over traditional methods.

Moghaddam et al. (2000) introduced Bayesian similarity measure for face recognition task. They used Bayesian (MAP) of image difference and it was a probabilistic matching technique. According to them Bayesian based face recognition was the first work of a non - Euclidean similarity measure used in face recognition. This was the generalized quadratic extension of Linear Discriminant analysis. The computational advantage of this method was that we did not have to compute an Eigenspace for each individual, one global Eigenspaces were sufficient for probabilistic matching.

Weyraunch et al. (2004) combined two approaches of computer vision: component based recognition and 3D morphable models. 3D morphable model was used to create 3D face of a person by using 3 images of that person. Then these images were used by component based method for face recognition so they needed only 3 images per person in the training database. Component based face recognizer used the output of face detector in the form of extracted component. They extracted 14 components by face detector and only 9 points were used for face recognition. Results confirmed that on the database of 1200 images of 6 people it achieved 90% accuracy.

Bach and Jordan (2003) developed a novel system to ICA based on kernel methods. Traditional ICA used contrast functions based on canonical correlations. Canonical correlation analysis was a multivariate statistical technique similar to principal component analysis. PCA worked with single random vector while CCA worked with pair of random vectors. PCA was leaded as an eigenvector problem and CCA as a generalized eigenvector problem. In their work they used the kernel generalized variance to provide a contrast function for a model in which the source is no longer independent.

Srisuk et al. (2003) presented the shape trace transform method to recognize faces in authentication system. XM2VTS database is used for experiments. According to authors, STT offered an alternative representation for faces that has very high discriminatory power. The within class variance of the STT was minimized by reinforcement learning.

He et al. (2005) introduced a new Laplacianface representation for face recognition. It was an appearance based method of face recognition. By using local preserving projection the face image were mapped into a face subspace. They also compared the proposed method with Eigenface and Fisherface methods. The Laplacian faces are obtained by finding the optimal linear approximations to the Eigen function of the Laplace Beltrami operator on the face manifold. According to Authors, this was the first work on face representation and recognition considering the manifold structure.

Mian et al. (2006) developed a multi model hybrid face recognition algorithm. For 3D faces holistic and geometric matching were used and in 2D faces only holistic matching were used. They demonstrated their performance on the FRGC v 1.0 dataset. They have drawn some important conclusion also. According to them the eyes and forehead region of a face contains the maximum discriminant features. The fusion of inferior classifier with superior classifier did not improve performance and Nose plays a more significant role in 3D images. Results confirmed that the algorithm outperformed

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other traditional methods with 100% accuracy at .0006 False Acceptance Rate.

Tan and Triggs (2007) proposed a new algorithm LTP (local ternary pattern) over LBP (local binary pattern) under uncontrolled lighting condition. LTP is a generalized version of LBP. LBP was less sensitive to noise problem so they developed a new approach to deal with this problem. They also replaced local histogramming with a local distance transform based similarity matrices. The combination of these obtained very promising results on well known dataset. They introduced a new image preprocessing method which provided better results than other normalization methods.

Mendonca et al. (2007) compared three illumination normalization methods. They took logAbout, homomorfic filter and wavelet normalization techniques. The results confirmed that the wavelet method provides the best recognition rate with PCA because it has not only enhanced contrast but also enhanced edges.

Nagi et al. (2008) developed a face recognition technique based on the features derived from DCT coefficient and SOM based classifier for real time hardware system. There were 5 subjects each having five images with different expression. They showed that SOM based face recognition is possible. Face recognition with SOM is carried out by classifying intensity values of grayscale pixel into different groups. According to the experimental results system achieved 81.36 % recognition rate for 10 consecutive trials after 850 epochs. Results confirmed that it achieved high processing speed and low computational requirements.

Sandhu et al. (2009) used PCA (principal component analysis)for feature extraction and for matching Euclidean distance was calculated between the projected test images and all centered training images then Minimum distance with its corresponding training image was selected. This paper also presented limitations of PCA.

Jones (2009) presented the current scenario of the face recognition field and also proposed some promising directions for future research. They presented a detailed analysis of current problems regarding face recognition. Jones suggested that new ideas are needed to improve the accuracy and robustness of face recognition against illumination, pose, expression, ageing and alignment. He addressed the current approaches of these problems to show the scenario of where we are and where we might go from here.

Struc and Pavesic (2009) developed a novel Gabor based KPLSD algorithm (kernel partial least square discrimination) for extracting discriminant features for face recognition. They also compared their results with traditional methods like PCA, LDA, KPCA and GDA and experimental results confirmed that GKPLSD achieved better results. In first step a set of forty Gabor wavelets is used to extract facial features as well as in second step kernel partial least square discrimination technique is used to reduce feature vector. Experiments are performed on XM2VTS and ORL datasets.

Leszczynski (2010) analyzed 14 illumination invariant algorithms. Results confirmed verification rate of face recognition can be improved by using normalization methods before feature extraction. The best result is obtained by using MSQ algorithm.

Singh et al. (2010) presented a review on passive methods which solve the illumination problem by investigating the visible light images in which the face appearance has been altered by varying illumination. Methods are tested on YALE, CMU PIE datasets. They classified illumination invariant face recognition in four categories:

i. Subspace based statistical method (PCA, LDA, and ICA)
ii. Illumination invariant representation (Retinex, Gradient, LBP, LTP)
iii. Model based method (Lambertian Reflectance, Active Appearance and 3D Morphable Model)
iv. Other illumination handling model.

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Lakshmiprabha et al. (2011) developed a multimodal biometric and periocular biometric method. Initially images were preprocessed and features were extracted by using Gabor or LBP. For dimensionality reduction they used PCA. The performance of developed system was tested on MUCT and plastic surgery databases. According to the experimental results periocular biometric are better than face biometric in MUCT database but the results were not satisfactory in case of plastic surgery.
Lone et al. (2011) proposed a multi-algorithmic approach to enhance the performance of face recognition system. It was the combination of 4 algorithms:

i. PCA
ii. DCT
iii. Template matching using correlation
iv. Partitioned Iterative function system (PIFS)

In experiments it was found that combination of PCA-DCT performed well than individual algorithms and combination of PCA-DCT-CORR was better than PCA-DCT.

Shermina (2011) proposed a method for illumination invariant face recognition using PCA and DCT. Low frequency components of DCT were used to normalize the illuminated image. Odd and even components of DCT were used for compensation in illumination variances. PCA was used for face recognition task.

Wang et al. (2011) described that the right selection of feature extractor and classifier can raise the recognition rate and accuracy of a face recognition system so they took PCA and SVM to do experiments on ORL face database. They compared this combination with PCA - NN and SVM and experimental results confirms that combination of PCA and SVM classifier is feasible.

Ravi J. et al. (2012) proposed a face recognition using DT-CWT and LBP for different database. The five levels dual – tree complex wavelet transform is applied on face image. After obtaining DT – CWT coefficients, LBP is applied on 3*3 matrix of DT – CWT coefficients to obtain final features. Euclidean distance is used for matching.

Pu et al. (2012) suggested a multi resolution with multi scale LBP feature based algorithm for face recognition. Partial and holistic features are extracted from various facial regions and these features were concatenated to build a feature vector. Local Margin Alignment was used for dimensionality reduction because face recognition is still a great challenging task due to curse of dimensionality. Support Vector Machine was applied to classify images. The developed scheme was robust against different facial expressions and postures of the subjects and experimental results on ORL and CMU databases also showed the outstanding performance of proposed method over traditional methods.

Shet et al. (2012) presented face recognition system which used DCT and multilevel illumination normalization. DCT was used for normalization of illumination as well as for feature extraction. DWT- MIN with SF = 3.0 produced the best recognition rate. They also used BPSO as a feature selection method. According to paper, the proposed method can work well in uncontrolled and unknown surroundings.
Gurumurthy and Tripathi (2012) presented an automatic, robust and accurate lips segmentation method. It was a suitable method in situation where we needed lips reading such as speaker identification problem. They also proposed that the lips feature could be joining with audio to improve the performance of speaker identification system.

Wang et al. (2012) proposed wavelet decomposition which was less sensitive to facial expression limitations to extract features from human faces. These extracted features are composed as an input to SVM. There are 3 different kernel function which were used at training time named Radial basis function, Polynomial and linear kernel function. Ren FEdb database was used for experiments.

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RESEARCH GAP ANALYSIS AND PROBLEM FORMULATION

Gap Analysis is a formal study of what a research work and algorithms are doing and where it wants to go in the future. In the literature review, algorithms and approaches related to these areas have been extensively studied and reviewed. It has been observed that in the area of Face Detection, work has been done in all aspects. In this thesis work, well known algorithm Viola Jones has been used, however for the cases where absolute side faces are under context, new techniques like landmark localization can be explored by new researchers. Video based face recognition and finding person appearance have been a challenging area which covers the research area related to computer vision and data stream and it has a great application in security surveillance and online monitoring, The research work related to these areas have been explored to device an integrated approach for the solution of finding periodicity of a subject in video data. Many algorithms and approaches have been explored related to face detection and face recognition; however, no direct paper could be found which addresses these problems in reference. In this work, an integrated approach is developed where the efficient and effective algorithms of face detection and recognitions are integrated on an incremental fashion to get effective results. From the review of papers related to these areas, some problems are still a challenging issue. There are so many algorithms to deal with challenges of face recognition but there are very limited numbers of algorithms which can handle challenges of face recognition properly. Issues related to big volume of data is still remains. In Geometric based algorithms, selecting number of features for robust face recognition is still a research issue. Finding a geometric feature of the face which is robust against expression variation, is still a challenge in face recognition field.

CONCLUSION

This paper gives a brief overview about Periodicity of Facial Pattern. There are lots of advancements that are going on in this specific domain. Continuous evolution in this area has added various dimensions in base atoms of concerned area. This study will be helpful for those working in the area of Periodicity of Facial Pattern.

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