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A Study on Different Descriptors and Classifiers for Face Recognition

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Abstract— *Feature descriptors and classifiers are technique used in face recognition. Face recognition is a computer vision application significant to a man can recognize or confirming from a propelled picture or video from a video source.one of the best approach to do this is by looking at chose facial elements from the picture and a face database and is additionally utilized as a part of security frameworks. The feature descriptors are an algorithm by taking image and its outputs. Feature descriptors can be classified into different type based on their texture, color, frequency etc. Also face recognition technique used different classifier to extract the useful information from images to solve the problems in image processing. This paper is organized as three sections. Face recognition technique and algorithms described in the first section. The second section describes different types of feature descriptors and finally third section describes a comparative study of different classification methods.*

Keywords— *Classifiers, face detection, face recognition, feature descriptors, feature-invariant, multi scale vector.*

I. INTRODUCTION

Humans regularly use faces to recognize individuals and developments in calculating capability over the past few decades now support related recognitions automatically. Early face recognition algorithm utilized straight forward geometric models; however the recognition process now developed into an investigation of complex scientific portrayals and coordinating forms. Significant headways and activities in the previous ten to fifteen years have pushed face recognition into the Spotlight. Face recognition can be utilized for both confirmation and identification.

Face recognition techniques used different feature descriptors and classifiers. Feature descriptors are classified into local feature descriptor and global feature descriptors. Global appearance based feature descriptors are widely used for face recognition. Now most commonly used local feature descriptors these are more effective for face representation. The local feature consist descriptors like Gabor wavelet, local binary pattern [1] scale invariant feature descriptor (SIFT) [2].The local features are compared to global feature the local feature contribute more orientation selectivity and spatial locality. These two properties are robust against variation to aging, illumination condition and face expression variations problems. The face recognition used different classifiers are Bayes, nearest neighbour, neural network, multi scale support vector machine etc.

II. FACE RECOGNITION

In real time application [3] face recognition is an important and interesting method and huge number of recognition algorithms is established in last few years. Principal Component Analysis (PCA), Linear Discriminant Analysis (LDA), Elastic Bunch Graph Matching (EBGM), Independent Component Analysis (ICA), Gabor wavelet is the different type of algorithms developed to the analysis of face recognition. These methods are used to eliminate the expressions, illumination condition, pose variation, facial expression problems occurred in a dataset. In the area of human observation system, this method plays a major role.

A. Face Recognition Algorithms

1. Principal component analysis (PCA)

It is one of the important method used in face recognition and also known as karhuen loeve method. This method is popular to feature selection and dimension reduction. PCA was first done by Turk and Pentland [4] and reconstruction of human faces was done by Kirby and Sirovich [5].This recognition method also known as Eigen face method which define a feature space that reduces the dimensionality of original data space and reduced the space used to recognition. In the PCA strategy display pictures must be a similar size and it standardized to arrange the eyes and mouth of the component inside the pictures. An information pressure fundamental the PCA approach is lessen the measurement of the information and uncovered the best low dimensional structure of facial designs. This measurement diminishment is evacuates data that is not helpful and effectively disintegrates the face structure into uncorrelated segments known as Eigenfaces. Each face image might be spoken to as a component vector of the Eigenfaces, which are put away in a one-dimensional exhibit. A test picture is appeared differently in relation to display picture by measuring the detachment between their specific component vectors. The PCA approach commonly requires the full frontal face to be presented each time; for the most part the photo achieves poor execution [6]. The two key issues occurred in PCA is poor separating power inside class and huge calculation. To conquer these issue utilize a Linear Discriminant Analysis (LDA).

The essential preferred advantage of this strategy is that it can reduce the information expected to recognize the person to 1/1000th of the information exhibited [7].This technique is superior to LDA and ICA under various illumination condition and furthermore less sensitive to incomplete occlusion. Calculating the discriminative feature PCA-LDA is introduced [8].

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2. Linear discriminant analysis (LDA)

LDA is a mathematical method for classifying samples of unknown classes based on training samples with identified classes [6] and also it is a most leading algorithm for feature selection in appearance based methods. This method plans to maximize between-class (across user) change and limit within class (within user) difference. In figure 1 where each block represents a class, there are huge differences between classes, but little variance within classes. When managing high dimensional face information, this strategy faces the small example measure issue that emerges where there are a small number of accessible training sample compared with the dimension of the sample space [9].

Fig. 1. Example of six classes using LDA.

3. Elastic bunch graph matching (EBGM)

EBGM depend on the perception that real face images have many nonlinear characteristics that are not addressed by the linear analysis methods discussed earlier, such as variations in illumination, pose variation and expression variations. A Gabor wavelet transform creates a dynamic link architecture that projects the face onto an elastic grid [6].The Gabor jet is a node on the elastic lattice, composed by circles on the image below, which describes the image behaviour around a given pixel. It is the result of a convolution of the picture with a Gabor filter, which is utilized to distinguish shapes and extract the feature using image processing technique. Recognition depends on the comparability of the Gabor filter response at every Gabor node [6]. This naturally based method using Gabor channels and this procedure executed visual cortex of highly developed creatures. The difficulty with this strategy is the requirement of exact landmark point limitation, which can some of the time be accomplished by joining PCA and LDA techniques.

4. Independent component analysis (ICA)

This is another strategy for discovering free segment or crucial variables from a multidimensional information. The ICA method is like visually impaired source division issues that spots down to recognize a linear representation in which the part is statically free to each other. The autonomous part investigation give better acknowledgment rate contrasted with PCA with a statically free premise picture and related coefficients. In the ICA technique each face picture is changed into a vector and afterward computing the free segment.

5. Gabor wavelet

To enhance confront face recognition high power include vectors removed from Gabor wavelet change of frontal face pictures consolidated together with ICA [10]. Gabor features have been perceived as one of the best representation for face recognition. Gabor wavelets have been generally utilized for face portrayal [11] in light of the fact that the pieces of the Gabor wavelets are like the 2D open field which displays craved qualities of spatial area and introduction selectivity. Past deals with Gabor highlights have likewise give noteworthy outcomes for face acknowledgment. Trademark strategies incorporate Elastic Bunch Graph Matching (EBGM) [12]. Gabor stages are delicate to neighbourhood varieties; they can segregate between examples with comparable sizes they give more itemized data about the nearby picture highlights. The Gabor stages can work equivalently with the extents. Confront pictures utilizing the nearby Gabor paired examples (LGBP), which consolidates Gabor extents with Local Binary Pattern (LBP) [13] operator. The LBP and the GFC is joined it give great outcome. Another strategy for extraction of facial elements was proposed [14] to Gabor wavelet portrayal of face pictures.

III. Review of Feature Descriptors

Feature descriptors are a calculation which takes a picture and yields include descriptors and feature vector. Here encode the interesting data into a progression of number utilizing feature vector and further more acts like a kind of unique finger impression that can be separate one component to another in a perfect world. This data would be invariant under picture change and can likewise discover the element again regardless of the possibility that the picture is changed somehow.

A component is a metric so it is utilized to portray a picture at abnormal state sees point. Features are identified with shading, surface, shapes; corners are contained in a picture. To start with it is to recognize intrigue focuses in the picture having the property of repeatability, means the capacity to distinguish the same physical intrigue focuses under various survey conditions, checked by the portrayal figuring of the intrigue focuses. A substantial descriptor will makes the calculation longer. On the off chance that the descriptor is little then it might dispose of some valuable data.

A. Color Descriptors

Shading is a basic component for picture representation and invariant concerning scaling, interpretation and revolution of a picture [15].

1. Histograms

Histogram is the supply of the quantity of pixels for a picture. The quantity of components in a histogram identifies with the quantity of bits in every pixel of a picture.

1.1. RGB histogram

The RGB histogram is a mix of three one dimensional histograms in view of the R, G, and B channels of the RGB shading space. This sort of histogram having no invariance properties.

1.2 Opponent histogram

This technique is a combination of three one dimensional histograms of the channels of the rival shading space.

1.3 Hue histogram

In the HSV shading space the tone gets to be distinctly slight close to the dim scale pivot. The nature and immersion

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are conversely relative to each other. In this way, the hue histogram is made more powerful by measuring each example of the shade by its immersion. As for light power H shading model is move invariant and scale-invariant.

1.4 RG histogram

In the standardized RGB shading model, the chromaticity segments R and G describe the shading data in the picture. The standardization time frame R and G are scale invariant, in this manner invariant to light power changes, shadows, and shading**.**

1.5 Transformed color distribution

The RGB histogram is not invariant to light changes. Scale invariance and move invariance is accomplished concerning light power by the pixel esteem standardization. Since each channel is freely standardized the descriptor is additionally standardized against changes in light shading and discretionary counterbalances.

2. Color Coherent Vector (CCV)

Color histogram does not talk about the spatial data of pixels hence comparable shading circulation for various pictures comes about. Here every histogram is arranged of two sorts: rational and ambiguous. Intelligent sort contains pixel esteem has a place with an expansive casually hued district. Else it is garbled sort. For each shading in the picture CCV speaks to this characterization.

B. Texture Descriptors

For looking and recovery of pictures, texture can be an exceptionally valuable component. There is no formal definition for surface is known, yet this descriptor gives measures of the properties, for example, smoothness, coarseness, and normality. Factual, basic and otherworldly techniques are utilized to gauge the surface properties of an image .One of the most known surface descriptors now a day is GLCM.

1. GLCM (gray level co-occurrence matrix)

For movement estimation of pictures, this can be utilized to concentrate second request factual surface elements. The four elements named as, Angular second minute, connection, Inverse contrast minute and Entropy are processed in GLCM extraction [16].

1.1 Angular Second Moment

Angular Second Moment is otherwise called Uniformity or Energy. It is the entirety of squares of passages in the GLCM. Angular Second Moment measures the picture equity. Angular Second Moment is high when picture has great similitude or when pixels are fundamentally the same.

1.2 Inverse Difference Moment

Inverse Difference Moment (IDM) is the nearby homogeneity. It is high when local grey level is uniform and opposite GLCM is high.

1.3 Entropy

Entropy demonstrates the measure of data of the picture that is required for the picture pressure. Entropy measures the loss of data or message in a transmitted flag and furthermore measures the picture data.

1.4 Correlation

Relationship measures the straight reliance of dim levels of neighbouring pixels. While extricating the elements of a picture with GLCM approach at the season of RGB to GRAY level transformation the picture pressure time can be incredibly diminished.

2. Haralick Texture Feature

The haralick surfaces are utilized for picture arrangement. These components catch data about the examples that develop in examples of surface. These sorts of elements are ascertained by utilizing co-event grid, which is computationally expensive.13 elements are has a place with this classification. Once the co-event network has been set up figuring of these components will start.

C. MPEG-7 Visual Descriptors

The MPEG-7 Standard a work in progress indicates content-based descriptors that permit clients to quantify closeness in pictures or video in light of visual criteria, and can be utilized to proficiently distinguish, channel or peruse pictures or video in view of visual substance. All the more particularly MPEG-7 determines color, texture, object shape, global motion or object movement for this reason.

1. Visual color descriptors

Color is the most generally utilized visual component in picture and video recovery. Color elements are powerful to changes out of sight hues and are autonomous of introduction and size of picture and can be utilized for characterizing still pictures and video content.

1.1 Color Spaces

This method is used to allow inter-operability between different color descriptors, this is developed to Hue-Saturation Value (HSV) and Hue-Min-Max-Diff (HMMD). HSV is a well-known color space mostly used in image applications. HMMD is a new color space defined by MPEG and is only used in the Color Structure Descriptor (CSD) explained below.

1.2 Scalable Color Descriptor (SCD)

The MPEG-7 SCD method is a color histogram encoded by the Haar transform. It uses the HSV color space uniformly quantized to 255 bins.

1.3 Dominant Color Descriptor

This color descriptor aims to define global as well as local spatial color distribution in images for high-speed retrieval and browsing. In contrast to the Color Histogram this arrives at more compact representation at the expense of lower performance in some applications. This descriptor consists of the agent colors and their rates in an area and also the spatial coherency of the shading and shading difference.

1.4 Color Layout Descriptor (CLD)

This descriptor is considered to define spatial distribution of color in an arbitrarily-shaped region. Color distribution in each region can be described using the Dominant Color Descriptor above.

1.5 CSD (color structure descriptor)

The main purpose of the CSD is to express local color features in images. This type of descriptor defines a structure required for representing color features of a collection of similar or video frames by means of the SCD.

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2. Visual texture descriptors

Texture descriptor refers [17] to the visual models that have properties of homogeneity or not, that outcome from the nearness of different colos or forces in the picture. It is a property of fundamentally any surface, including, squares, trees, hair, surface and cloud. It contains imperative basic data of surfaces and their relationship to the encompassing condition.

3. Visual shape descriptors

In picture information base applications, the state of picture articles gives a valuable insight to closeness coordinating. For picture recovery the shape descriptor needs to be invariant to scaling, rotation and interpretation.

D. Frequency Domain Descriptors

The essential knowledge behind binary descriptors is that each bit in the descriptor is independent and the Hamming distance can be utilized as closeness measure. The four latest and promising parallel element descriptors are (1) Binary Robust Independent Elementary Feature (BRIEF), (2) Oriented Fast and Rotated BRIEF (ORB), (3) Binary Robust Invariant Scalable Key points (BRISK) and (4) Fast Retina Key point (FREAK).

1. Scale Invariant Feature Transform (SIFT)

SIFT [18] is a calculation in computer vision to identify and depict nearby components in pictures. SIFT was initially presented by Lowe as combination of a DoG interest district detector and a relating feature descriptor. This descriptor focuses to accomplish robustness to lighting varieties and little positional moves by encoding the picture data in a limited arrangement of gradient orientation. This technique comprises the following steps.

Step 1: Scale-space extreme Detection – Detect interesting points

Step 2: Key point Localization – Determine location and scale at each applicant location, and select them based on stability.

Step 3: Orientation Assessment – Use local image gradients to assigned orientation to each localized key point.

Step 4: Key point Descriptor - Extract neighbourhood picture slopes at chose scale around key point and frame a local invariant to local shape distortion and illumination them.

2. SURF Descriptor

SURF (Speeded-Up Robust Features) [19] approach, which is a convincing other choice to SIFT. SURF joins its own incline presentation based component descriptor with a Hessian-Laplace zone locator. For the internal estimations, it uses 2D box channels ("Haar wavelets").In these case channels estimated the effects of the auxiliary channel parcels, and can be surveyed using important pictures.

3. Maximally Stable Extremal Regions (MSER)

In pictures the MSER is utilized for the blob recognition. The calculation for MSER extricates co-variation districts from a picture; this is known as MSER's. In this way it is a stable associated part of some dim level arrangements of the picture.

IV. Classifiers

A. Artificial Neural Network

ANN is a sort of Counterfeit insight that emulates a few elements of the individual personality. It has an ordinary propensity for putting away experiential learning. The ANN comprises of a succession of layers, each layer comprises of an arrangement of neurones. All neurones of each layer are connected by weighted associations with all neurones on the going before and succeeding layers. The main characteristics of artificial neural network are it utilizes Non parametric approach and also Execution and precision relies on the system structure and number of sources of inputs.

B. Decision Tree

A decision tree is a decision support apparatus that uses a tree-like chart or model of decisions and their possible outcomes, including chance event comes about, resource costs, and utility. It is one way to deal with demonstrate a figuring. Decision tree figures class enrolment by more than once dividing dataset into uniform subsets. Hierarchical classifier allows the usual meanings and dismissal of class names at every intermediate stage. This technique comprises of 3 sections: Partitioning the nodes, locate the terminal nodes and designation of class name to terminal nodes. The main characteristics of Decision tree are based on hierarchical rule based method and also use Non parametric approach.

C. Fuzzy Measure

In Fuzzy classification, different stochastic affiliations are resolved to portray attributes of a picture. The different sorts of stochastic are consolidated in which the individuals from this set of properties are fuzzy in nature. It gives the chance to describe distinctive classes of stochastic characteristics in the comparable form. It uses stochastic approach and Performance and accuracy depends upon the threshold selection and fuzzy integral.

D. Support Vector Machine (SVM)

This is a standout amongst the most supportive methodology in characterization issues. One clear case is face recognition. SVM can't be associated when the segment vectors describing tests have missing areas. A request figuring that has adequately been used as a part of this structure is the all-known Support Vector Machines (SVM) [20], which can be connected to the first appearance space or a subspace of it acquired in the wake of applying a component extraction strategy. The preferred standpoint of SVM classifier over conventional neural system is that SVMs can accomplish better speculation execution.

V. Conclusion

This paper has attempted to review number of papers to cover the current improvement in the field of face recognition. Here also presents a comparative study of face recognition and face recognition algorithms. Face recognition commonly used in videos and images. Different type of feature descriptors and classifiers used in face recognition techniques are detaily

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explained in this paper. The list of references to give more detailed comprehension of the methodologies is explained.

REFERENCES

[1] D. Chen, X. Cao, F. Wen, and J. Sun, "Blessing of dimensionality: High dimensional feature and its efficient compression for face verification," *IEEE Comput. Soc. Conf. Comput. Vis. Pattern Recognit.*, pp. 3025–3032, 2013.

[2] D. G. Lowe, "Object recognition from local scale-invariant features," in *Proc. IEEE Int. Conf. Comput.* Vis., pp. 1150–1157, Sep. 1999.

[3] *International Journal of Advanced Research in Computer Engineering and Technology (IJARCET*), vol. 1, issue 8, 2012

[4] M. Turk and A. pentland, "Eigen faces for recognition," *J. Cognitive Neuroscience*, vol. 3, pp. 71-86, 1991.

[5] D. L Swets and J. J. Weng, "using discriminant Eigen features for image retrieval," *IEEE Trans*, vol. 18, no. 8, pp. 831-836, 1996.

[6] D. Bolme, R. Beveridge, M. Teixeira, and B. Draper, "The face identification evaluation system: Its purpose, features and structure," *International Conference on Vision Systems*, pp. 304-311, 2003.

[7] A. Hyvarinen and E. Oja. "Independent component analysis: algorithms and applications neural networks research Centre Helsinki University of Technology, 13(4-5), pp. 411-430, 2000.

[8] I. Dagher, "Incremental PCA-LDA algorithm" *International Journal of Biometrics and Bioinformatics (IJBB)*, volume 4, issue 2, pp. 86-99, 2010.

[9] J. Lu, "Boosting linear discriminant analysis for facial recognition," 2002.

[10] A. Kar, D. Bhattacharjee, D. Kumar Basu, M. Nasipuri, M. Kundu, "High performance human face recognition using independent high intensity Gabor wavelet responses: A statistical approach," *International Journal of Computer Science & Emerging Technologies*, 178, vol. 2, issue 1, 2011.

[11] M. Lades, J. Vorbruggen, J. Buhmann, J. Lange, C. V. D. Malsburg, R. P. Wurtz, and W. Konen, "Distortion invariant object recognition in the dynamic link architecture," *IEEE Trans Comput*, 42(3), pp. 300–311, 1993.

[12] L. Wiskott, J. N. Fellous, N. Kruger, and C. V. D. Malsburg, "Face recogniton by elastic bunch graph matching," *IEEE Trans PAMI*, 19(7), pp. 775–779, 1997.

[13] T. Ahonen, A. Hadid, and M. Pietikainen, "Face recognition with local binary patterns," in *Proceeding of European conference on computer vision (ECCV2004)*, LNCS 3021, pp. 469–481, 2004.

[14] V. Struc and N. Pavesic, "Gabor-based kernel partial-least-squares discrimination features for face recognition," *Informatica*, vol. 20, no. 1, pp. 115–138, 2009.

[15] MPEG-7 Visual Shape Descriptors Miroslaw Bober, *IEEE transactions on circuits and systems for video technology*, vol. 11, no. 6, 2001.

[16] The MPEG-7 Visual Standard for Content Description—an Overview Thomas Sikora, Senior Member, *IEEE*.

[17] B. S. Manjunath and V. V. Vasudevan, "Color and Texture Descriptors Member, *IEEE*, Jens-Rainer Ohm, Member, *IEEE*, , Member, *IEEE*, and Akio Yamada, *IEEE Transactions on Circuits and Systems for Video Technology*, vol. 11, no. 6, 2001.

[18] D. G. Lowe, "Object recognition from local scale-invariant features," *Int. Conf. on Computer Vision, Corfu, Greece*, pp. 1150-1157, 1999.

[19] N. Dalal and B. Triggs, "Histograms of oriented gradients for human detection," *Int. Conf. on Computer Vision & Pattern Recognition*, vol. 2, pp. 886–893, 2005.

[20] John Wiley and Sons, Vapnik, *Statistical Learning Theory*, New York, 1998.