Identical Twins Differentiation Using Image Processing

S J Parvathi [1], Khateeja Ambareen [2], Kavana M D [3], Asha Rani M[4]

[1,2,3,4] *Assistant Professor Dept of CSE, GSSS Institute of Engineering and Technology for Women, Mysuru, Karnataka*

Abstract- **in the last few decades the birth rate of twins has been increased, thus the need for an accurate biometric system to precisely determine the identity of a person who has an identical twin became of great interest especially in criminal cases. Recent researches have showed the performance of automatic face recognition technology fails drastically in case of identical twin siblings compared with other unrelated persons. In this paper, we propose a new technique for identifying identical twins using their time series which is unique feature for image. The characteristic time series dimensionality reduced by using Piecewise Linear Approximation (PLA) method. A recognition and matching experiment conducted on an identical twins of high-similarity correlation coefficient score 0.96 and the methodology was able to distinguish between them even with fewer number of features; 8-features.**

I. INTRODUCTION

The increase of multiple births in the last few decades associated with the increase in the use of fertility therapies and the older age of childbearing. The twin birth rate increased at an average rate of 3% between years 1990 and 2004. This increase has created a big demand for biometric identification systems, which can accurately determine twin's identity. Recognition of facial images of identical twin siblings poses a considerable challenge for any face recognition algorithm because of the strong similarity between the face images. Some researchers have showed that the performance of automated face recognition systems fails drastically in case of twin images compared with unrelated persons. The degradation is shown to be far more drastic for face than other biometrics like, iris and fingerprints. Recent studies have proved that facial recognition is also advantageous in distinguishing identical twins. The concept of time series motifs was first proposed in 2002 by J. Lin, at the same time, clear descriptions and definitions of the related concepts about time series motifs was given in details; e.g., k-motifs, the

trivial match and son. Subsequently, more researchers begin to focus on the study of time series motifs mining. In recent years many sophisticated papers on the topic were published in top journals and conferences, e.g., Knowledge Discovery and Data Mining (KDD) journal, The Very Large Data Bases(VLDB) journal, IEEE International Conference on Data Mining(ICDM), ...etc. Furthermore, research results have also been applied in medicine, environmental studies, biology, telemedicine as well as weather prediction and other fields.

Time series motifs first appeared in the biomedical sequence analysis and were used to describe structural characteristics of biological sequences. Its significance lies in that frequently occurring patterns are often able to reflect some important features of the original sequences, such as the special structures of biological sequences, important words in the voice sequences and special behaviours of robot activities. In this paper, we utilize the time series motif to develop an efficient method for recognition and matching of identical twin images. First the facial part is extracted, using an appropriate compression method to reduce its dimensionality. To judge the efficiency of the method a simulation test conducted using a very similar twin images and the result was satisfactory. The paper is organized as follows; introduce the proposed system, Viola-Jones Face detection, Time series of an image, section Dimensionality reduction, and Motif discovery algorithm.

II. OVERVIEW

A. Face Recognition

Face Recognition is biometric identification by scanning a person's face and matching it against a stored template. Face Recognition can be used for

both identification and verification of a person. Maintaining the Integrity of the Specifications

B. Iris Recognition

Iris is small circle surrounding the pupil of the human eye. The structure of human eye is unique for every individual even this pattern is different for both the iris. Iris texture has a complex pattern that remains stable over time. Distance between public and the boundary of iris is unique for every individual and hence can be used for recognition purpose.

C. Retina Recognition

Retina recognition biometric model is used to identify the individual's. There is no way to replicate a retina and the pattern of the blood vessels at the back of the eye is totally unique and never changes.

D. Fingerprint Recognition

Fingerprint form during the gestational process. The ever changing fetal environment guarantees that each finger will have a different print and different formation.

E. Speaker or Voice Recognition

Automatic speaker recognition (ASR) system use both physical and behavior based biometric traits to identify individuals. The physical properties of speech are determined by the shape of the mouth and the length and quality of the vocal chords, while the behavioral aspects of speech include pitch, volume as well as conversational mannerism.

Mimicry constitutes a primary challenge for ASR systems. A professional can imitate another person's voice or speaking style, but an identical twin can sound like a sibling simple because their voices have the same acoustic properties.

F. Abbreviations and Acronyms

Define abbreviations and acronyms the first time they are used in the text, even after they have been defined in the abstract. Abbreviations such as IEEE, SI, MKS, CGS, sc, dc, and rms do not have to be defined. Do not use abbreviations in the title or heads unless they are unavoidable.

III. MOTIVATION AND SCOPE

A. Motivation

These experiments showed that there will be a need for better techniques to differentiate between twins. While current technologies can distinguish between twins most of the time under near ideal conditions, as the imaging variables between probe and gallery vary, the accuracy of these systems can decrease, as seen here and as seen in with the Face VACS system. In addition, the false accept rate under which one obtains these recognition rates is very high. The most significant variables that can affect recognition systems seems to be expression and lighting. By using marks on the face as recognition features, however, these variables would be less noticeable. The glasses would not be as much of a problem either since the eye area is masked. There is a lot of scope for matlab which can make everything revolutionary. We can obtain an high secure world in future with lot effort in the fields of image processing as we can observe in today's technologies that are replacing the past.

B. Scope

Face recognition is a biometric identification by scanning a person's face and matching it against a stored template. Face recognition can be used for both identification and verification. Shadows in images create lots of problems on image analysis. There is no need of shadow in an image i.e. shadow is unwanted part in images. Shadow affects the images because of shadow lots of data and information is lost from images. Security related an issue has become an important aspect in each and every organization. Every organization requires that there security methods should be as efficient as possible. Development are being made day by day to enhance and improve the security. One such efficient method that is brought forward by means of this paper is biometric. Biometric refers to the use of psychological or biological. Characteristics of human beings to determine the identity of the person. Identification of person is very important and is done is the most of the important sites such as banks, airports, companies and many more to identify the identity of the person. There are various methods to do the job such as assigning Id and password which is also called as knowledge based processing. But these approaches have limitation. Face recognition and speech recognition have also been widely studied over the last 30 year, whereas this recognition is a newly emergent approach to personal identification in the last decade among all biometrics (such as finger print, face, print, giant, voice, iris, dental radiographs etc.),iris recognition is the most consistent one. The iris is a thin circular diaphragm, which lies between the cornea and the lens of the

human eye. The pattern the human iris differs from person to person there are not ever two iris alike not even for genetically identical twins. The iris is considered one of the most stable biometrics as it is believed to not change significantly during a person's life time and its physiological response to light which provides the detection of a dead or artificial iris, avoiding this kid of counterfeit? Other properties of Some Common Mistakes the human iris that increase its suitability for use in automatic identification include its inherent isolation and protection from the external environment, being an internal organ of the eye, behind the cornea and the aqueous humans.

IV. EXISTING SYSTEM & PROPOSED SYSTEM

It was long assumed the MZ twins could not be distinguished by DNA matching; e.g., "By definition, identical twins cannot be distinguished based on DNA". However, in recent years it has become clear that DNA analysis does have the potential to distinguish between MZ twins. A technique called "ultra-deep next-generation sequencing" was used to resolve a paternity test between MZ twins as possible parents. The essential point is that random mutations accumulate over time and can be mapped by the new technique and used to distinguish MZ twins. At least four reasons contribute to interest in using biometrics to distinguish between MZ twins. One is that MZ twins are rare, even exotic, so that the topic naturally attracts curiosity. A second reason is that the legal system sometimes finds it is necessary to reliably distinguish between MZ twins. A third reason is that distinguishing between MZ twins is seen as a "hardest possible case" for biometrics, and so it becomes a strong argument for the more general validity of a biometric. Lastly, twin births are increasing in frequency, so that these issues are becoming more important over time. This paper summarizes the research literature to date on distinguishing between MZ twins using face, fingerprint,

EXISTING SYSTEM

I. Fingerprint and palmprint matching: In the context of fingerprint, "level one features" are the overall flow pattern of the ridges. Recognition keys on matching "level two" features, which are the "minutia points", the points where ridges terminate or bifurcate. Palmprint is a recent topic of substantial interest in the forensic and biometric research communities, and there has also been work on palmprint of MZ twins. The pattern of ridges and minutiae on fingers and palms appears to have a coarse genetic basis influencing print type but a significant random element as well; this tends to make the prints of MZ twins distinguishable.

II. Iris recognition: The formation and layout of tissue and tissue irregularities in the iris is driven by a gestational process with significant randomness in the finer details. The limited research to date suggests that iris recognition is not noticeably challenged by distinguishing MZ twins. Daugman first observed this on images from three sets of twins – "A set of six pairwise comparisons among the eyes of actual monozygotic twins also yielded a result (mean HD = 0.507) expected for unrelated eyes. It appears that the phenotypic random patterns visible in the human iris are almost entirely epigenetic". Sun et al. experimented with iris images from 51 sets of MZ twins, using a different matching algorithm than Daugman. They conclude that the identical twin impostor distribution is very similar to the general impostor distribution. However, the peaks that are present in the identical twin impostor distribution tail may indicate that the irises of identical twins have some correlation.

III. Speaker Recognition: The gross anatomy of the larynx and vocal cords is determined genetically, and so MZ twins tend to have similar speaking fundamental frequencies. Speech formation similarities may have both genetic and developmental components due to proximity during childhood. Thus, in identical voice capture environments we would anticipate that MZ twins would be more challenging to distinguish than unrelated individuals . The limited research conducted to date suggests that the error rate for automatic speaker recognition in distinguishing MZ twins is higher than the error rate for the general population. Speaker recognition has a rich research history. The earliest work known to us using automated speaker ID on more than one set of MZ twins is they used data from nine sets of male, Hebrew-speaking, MZ twins. For each person, the data included three sets of two approximately 20-second segments of reading different prescribed text. Recordings for a given person were acquired in a single session. Six features were computed from the speech samples, a minimum distance classifier used,

and 100% correct identification of twins was possible. They also report that, "preliminary tests with human expert listeners, in a closed experiment of five twins, yielded 100% identification".

IV. Handwriting: The limited research to date suggests that there may be a performance degradation for MZ twins in handwriting-based authentication. Various studies looked at the similarity of twins' handwriting before automated analysis was introduced. The first study using automated handwriting analysis for verification of twins' identity appears to be Srihari et al. The operating parameters of their CEDAR-FOX system were tuned on handwriting samples from 1,000 persons not involved in the twins study. A sample is an intentionally-designed English text called the "CEDAR letter". The letter is designed so that the "top half" and "bottom half" can be used as separate samples. Samples were acquired for 31 pairs of self-identified MZ twins, 169 pairs of fraternal twins, and six pairs who were uncertain. (At different places in the paper, the numbers of MZ and fraternal twins are reversed). The error rate in distinguishing MZ twins using automatic handwriting analysis was 17% when matching samples with the same content (e.g., top half of CEDAR letter to top half) and 24% when matching samples with different content (e.g., top half to bottom half). For fraternal twins, the error rate was 11% in both cases. This compares to an error rate for non-twins of 3.15% and 4.24%, respectively. Thus the error rate for fraternal twins is more than twice that of non-twins, and the error rate for MZ twins is about twice that of fraternal twins.

PROPOSED SYSTEM

Biometrics and facial recognition are based on the assumption of every individual. In proposed system, a face image is taken as an input. Gabor Filter and LBP methods are used to extract features from the images. After comparing the feature values for both the images, it is decided that whether the image is of a twin or an image of the same person. This classification is done using the Multi SVM classifier. Finally the performance of the process is measured and analyzed.

Modules Preprocessing:

The aim of preprocessing is improvement of the image data that suppresses unwanted distortions or enhances some images features important for further processing.

Gray scale image:

A grayscale or grayscale digital image is an image in which the value of each pixel is a single sample, means it carries only intensity information. This type of images is also known as black-and-white and they are exclusively composed of shades of gray, varying from black at the weakest intensity to white at the strongest.

Grayscale images are distinct from one-bit black-andwhite images, which in the context of computer imaging are images with only the two colors, black, and white. Grayscale images have many shades of gray in between. Grayscale images are also called monochromatic, denoting the absence of any chromatic variation.

Grayscale images are often the result of measuring the intensity of light at each pixel in a single band of the electromagnetic spectrum (e.g. infrared, visible light, ultraviolet, etc.), and in such cases they are monochromatic proper when only a given frequency is captured. But also they can be synthesized from a full color image.

Image Enhancement:

The dark shadows phase in images can be highlighted while the intensity of contrast will be degraded because the nonlinear dynamic range compression decreases the intensity variation when highlighted pixels are brightened more with a larger „accelerate factor" than those of lighter pixels. The reduction of image contrast compared to that of original due to the dynamic range compression. In order to improve the visual quality of images developed through the dynamic range compression, a contrast enhancement method is used to enhance the local contrast of these images. Therefore, after contrast enhancement and dynamic range compression, high dynamic range scenes creates the visual quality of the original images with shadows can be largely improved. Furthermore, enhancing the local contrast can also be beneficial for improving the performance of convolution face finder, which is sensitive to local intensity variation.

Filtering:

Feature Extraction is the main purpose of this process. Feature extraction is a special form of dimensional reduction. Transforming the input data into the set of features is nothing but the feature extraction. Two kinds of features are used in pattern recognition problems. One is face alignment and second one is face landmark. The similar facial

components are placed into one groups while the others in different group. To encode this similarity, there is descriptor, which is useful for classification of similar facial feature.

The following Algorithms are being used to extract the features from the given images.

- LBP (Local Binary Patterns)
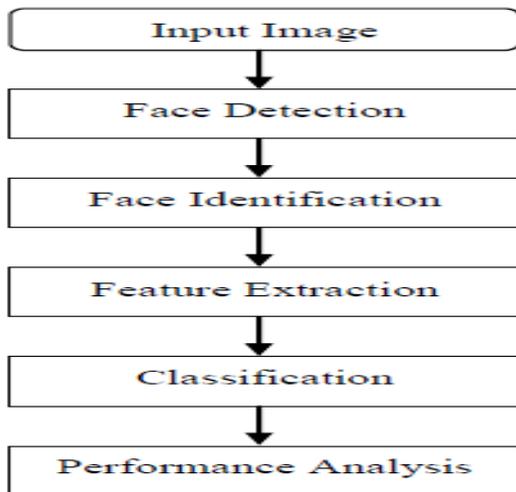- Gabor Filter

V. SYSTEM DESIGN AND IMPLEMENTATION

Figure shows the methodology of proposed methodology which is explained below.

Input Image: First phase is to input the image for identification.

Face Detection: This second phase detects the face in the given input image. Feature Extraction: This phase extracts features from the images which are classified as possible twins.

Face Classification: The detected face is compared with the face images available in the Database. The threshold values are calculated then the images are classified as twins or not. Multi SVM classifier algorithm classifies the images whether both the images are of same person or whether they are identical twins.

Performance Analysis: This phase verifies how the proposed system gives better accuracy for the classification of identical twins than the other existing Algorithms.

Algorithms

Different filtering and classification algorithms are used for differentiating identical twins.

Gabor Filter

In image processing, a Gabor filter is a linear filter used for edge detection. Gabor filters are band pass filters which are used in image processing for feature extraction, texture analysis, and stereo disparity estimation. The impulse response of these filters is created by multiplying a Gaussian envelope function with a complex oscillation. Gabor show that these elementary functions minimize the space (time)-uncertainty product. By extending these functions to two dimensions it is possible to create filters which are selective for orientation. Under certain conditions the phase of the response of Gabor filters is approximately linear. This property is exploited by stereo approaches which use the phase-difference of the left and right filter responses to estimate the disparity in the stereo images. It was shown by several researchers that the profile of simple-cell receptive fields in the mammalian cortex can by described by oriented two-dimensional Gabor functions.

The principal motivation to use Gabor filters is biological relevance that the receptive field profiles of neurons in the primary visual cortex of mammals are oriented and have characteristic spatial frequencies. Gabor filters can exploit salient visual properties such as spatial localization, orientation selectivity, and spatial frequency characteristics.

Algorithm

Step 1: Pre-Processing Each face image is edited in 10 different ways and each no face image is edited in 4 different ways.

Step 2: Feature Extraction For extracting features apply 2D Fast Fourier transform in all edited face and non-face image, and also in all Gabor filter. After that calculate Ok (z) using convolution between face and non-face images

Step 3: Training This is to assign the desired output -0.9 to non-face feature vector and 0.9 to face feature vector these will be the network desired output, face and non-face feature as the input of network.

Step 4: Testing of Face Detection Detecting all the face as much as possible in immediate time. So, first our RGB test image should be converted into grayscale level and after that finding region in the test image where the possibility of getting a face is high

Step 5: Check the surrounding three pixels and cut the image of 27X18 as consider its centre and do as STEP3. If OUPUT >0.95 set all 27X18 pixel to normal one.

Step 6: If OUTPUT >0.5 than in image set there corresponding pixel to 1. Repeat STEP 1 to STEP 6 until all yellow pixels will not be normal.

Local Binary Pattern (LBP)

The standard way of using LBP-based feature extraction is to evenly distribute patches across an image, so that the whole image is covered. Each patch is of uniform size, and no patches overlap. For the LBP method, typically a grayscale image of a subject is initially segmented into a number of uniform, evenly distributed patches that cover the entire image. LBP is then applied to each pixel of a patch resulting in a histogram representing the feature characteristics for that particular patch.

A feature vector is created by simply concatenating all of the histograms associated with each patch. The original LBP operator labels the pixels of an image by thresholding the 3-by-3 neighborhood of each pixel with the center pixel value and considering the result as a binary number.

Algorithm

Step 1: Preprocessing

Begin by applying the Tan and Triggs" illumination normalization algorithm to compensate for illumination variation in the face image. No further preprocessing, such as face alignment, is performed.

Step 2: LBP operator application

In the second stage LBP are computed for each pixel, creating a fine scale textural description of the image.

Step 3: Local feature extraction

Local features are created by computing histograms of LBP over local image regions.

Step 4: Classification

Each face image in test set is classified by comparing it against the face images in the training set. The comparison is performed using the local features obtained in the previous step.

Multi-SVM (Multi Support Vector Machine) This defines a grouping of all the classes in two disjoint groups of classes. This grouping is then used to train a SVM classifier in the root node of the decision tree, using the samples of the first group as positive examples and the samples of the second group as negative examples. The classes from the first clustering group are being assigned to the first (left) sub tree, while the classes of the second clustering group are being assigned to the (right) second sub tree. The process continues recursively until there is only one class per group which defines a leaf in the decision tree.

A SVM is a binary classifier means the class labels can only take two values: ± 1. Many real-world problems have more than two classes. subheads should be introduced. Styles named "Heading 1," "Heading 2," "Heading 3," and "Heading 4" are prescribed.

VI.SOFTWARE AND HARDWARE

A.   Software
•   Matlab 2013a
•   Image processing toolbox
•   OS 7/10
B.   Hardware
•   Webcam

REFERENCE

[1] Aladdin Ariyaeeinia, Christopher. Morrison, Amit Malegaonkara, and Sue Black, "A test of the effectiveness of speaker verification for differentiating between identical twins," Sci. Justice, vol. 48, no. 4, pp. 182–186, Dec. 2008.

[2] S. Biswas, K. W. Bowyer, and P. J. Flynn, "A study of face recognition of identical twins by humans," in Proc. IEEE WIFS, Dec. 2011, pp. 1–6.

[3] A. M. Bronstein, M. M. Bronstein, and R. Kimmel, "Threedimensional face recognition," Int. J. Computer Vis., vol. 64, no. 1, pp. 5–30, Aug. 2005.

[4] P. J. Grother, G. W. Quinn, and P. J. Phillips, "MBE 2010: Report on the evaluation of 2D still-image face recognition algorithms," NIST, Gaithersburg, MD, USA, Tech. Rep. NISTIR 7709, 2010.

[5] K. Hollingsworth, K. Bowyer, and P. Flynn, "Similarity of iris texture between identical twins," in Proc. IEEE Computer Soc. Conf. CVPRW, Jun. 2010, pp. 22–29.

[6] A. Jain, S. Prabhakar, and S. Pankanti, "On the similarity of identical twin fingerprints," Pattern Recognition, vol. 35, no. 11, pp. 2653–2663, Nov. 2002.

[7] K. Kodate, R. Inaba, E. Watanabe, and T. Watanabe, "Facial recognition by a compact

parallel optical correlator," Meas. Sci. Technol., vol. 13, no. 11, pp. 1756– 1766, Nov. 2002.

[8] A. W. Kong, D. Zhang, and G. Lu, "A study of identical twins" palmprints for personal verification," Pattern Recognition., vol. 39, no. 11, pp. 2149–2156, Nov. 2006.

[9] U. Park and A. Jain, "Face matching and retrieval using soft biometrics," IEEE Trans. Inf. Forensics Security, vol. 5, no. 3, pp. 406–415, Sep. 2010.

[10] P. J. Phillips, P. J. Flynn, K. W. Bowyer, R. W. V. Bruegge, P. J. Grother, G. W. Quinn, et al., "Distinguishing identical twins by face recognition," in Proc. IEEE Conf. Autom. Face Gesture Recognition Workshops, Mar. 2011, pp. 185–192.

[11] M. T. Pruitt, J. M. Grant, J. R. Paone, P. J. Flynn, and R. W. V. Bruegge, "Facial recognition of identical twins," in Proc. 1st Int. Joint Conf. Biometrics, Oct. 2011, pp. 185– 192.

[12] Z. Sun, A. A. Paulino, J. Feng, Z. Chai, T. Tan, and A. K. Jain, "A study of multibiometric traits of identical twins," Proc. SPIE, Biometric Technology for Human Identification VII , vol. 7667, pp. 76670T-1–76670T-12, Apr. 2010.

[13] (2013, May 24). CVRL Data Sets [Online]. Available:

http://www.nd.edu/~cvrl/CVRL/Data_Sets.html.

[14] (2013, May 24). Twins Days Festival [Online]. Available: http://www.twinsdays.org

[15] N. Ye and T. Sim, "Combining facial appearance and dynamics for face recognition," in Computer Analysis of Images and Patterns, vol. 5702. X. Jiang and N. Petkov, Eds. Heidelberg, Germany: Springer Verlag, 2009, pp. 133–140.

[16] Joni-Kristian Kamarainen, "Gabor Features in Image Analysis", Machine Vision and Pattern Recognition Laboratory, Lappeenranta University of Technology.

[17] Joseph Shelton, Gerry Dozier, Kelvin Bryant, Joshua Adams, Khary Popplewell, Tamirat Abegaz, Kamilah Purrington, Damon L. Woodard, Karl Ricanek, "Genetic Based LBP Feature Extraction and Selection for Facial Recognition".

[18] Suraj Prakash Sahu, Vibhav Anand, Nitin Kumar, Pavan Chakraborty and G. C. Nandi, "Face Detection by Fine Tuning the Gabor Filter Parameter", International Journal of Computer Science and Information Technologies, Vol. 2 (6) , 2011, 2719-2724.

[19] Shivani Gupta, 2 K. S. Patnaik, "Enhancing Performance of Face Recognition System by Using Near Set Approach for Selecting Facial Features", Journal of Theoretical and Applied Information Technology.

[20] Jeffrey R. Paone, Patrick J. Flynn, P. Jonathon Philips, Kevin W. Bowyer, Richard W. Vorder Bruegge, Patrick J. Grother, George W. Quinn, Matthew T. Pruitt, and Jason M. Grant, "Double Trouble: Differentiating Identical Twins by Face Recognition," IEEE Transactions on Information forensics and Security , Vol. 9, No. 2, Feb 2014.

[21] Nisha Srinivas, Gaurav Aggarwal, Patrick J. Flynn, Fellow, IEEE, and Richard W. Vorder Bruegge, "Analysis of Facial Marks to Distinguish Between Identical Twins", IEEE Transactions On Information Forensics And Security, Vol. 7, No. 5, October 2012.

[22] Selva Mary. G, Likhesh Kolhe, Sandip Patil, "Identification and classification of Twin Images using Gabor Filtering Methods," International Journal of Advanced Research in Computer Science and Software Engineering, Volume 5, Issue 5, 2015, 2277 128X.