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Identification of Identical Twins using Face Recognition with Results

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***Abstract*—** Face recognition is a process used to identify or verify the person based on digital image from unique face of humans. Face recognition is based on individual and unique person identification. This process fully based on comparing the image with other person image for identification. Face Recognition is typically used in security systems and can be compared with other biometrics such as fingerprint or iris recognition systems. Here, the major problem is to identify twins. To overcome this problem we can use different facial recognition algorithms. The facial recognition algorithms should be able to identify the similar-looking individuals or identical Twins with accurate classification. In the proposed system, image of a person is given as a input then different features of image were extracted by using the Gabor and LBP algorithms. Extracted Features of both the images are compared and then classified using multi-SVM classifier. Based on classification method, the persons were identified to be identical twins or they were identified to be same person or not twins. After Identification, Performance of the process is measured.

Keywords: *Face Recognition, Gabor, Identical twins, LBP, Multi-SVM classifier.*

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I. INTRODUCTION

Present face recognition techniques are based on the assumption that every individual has a unique identity that is distinguishable from that of others. Algorithms are designed to distinguish an image of one person from an image of other person to verify either two images are of the single person. Identical twins present a challenging environment since their facial features are near about similar.

The first objective of this project is to check the performance of available face recognition algorithms on a dataset containing face images of identical twins. Face recognition is non-obtrusive. It can be acquired from a distance, and does not require a fully cooperative subject. The use of face recognition in forensic techniques is becoming more and more common, especially because when other biometric modalities may not be available. Identical twins represent the worst case scenario for face recognition where two separate subjects have a very similar appearance. Subjects may have same appearance if one subject is trying to pose as another subject. It is important to test existing face algorithms on the hardest recognition cases. If the algorithms can perform sufficiently well on the hardest problems, then they will be able to solve the simpler problems as well [20].

Many face recognition algorithms and methods are tested in various conditions. Performance is measured with respect to four covariates illumination, expression, gender, and age. There were two acquisition sessions that took place one year apart, under similar conditions. The effect of the four covariates can then be applied to images taken on the same day and one year apart to measure the effect of elapsed time on the recognition of twins. Results have shown that differentiating identical twins is a challenging problem and current face recognition algorithms have problems in accurately differentiating between a pair of identical twins. As expected, images of twins taken one year ago in any circumstances have the poor performance. However, even when images of twins are clicked on the same day at different times, the recognition performance is significantly poor than the base-line scenario when twins are not present. Present face recognition algorithms do not perform well enough on the hardest problems and additional improvement is needed before algorithms can handle the critical problems [20].

II. 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.

System Architecture

Figure 4.1 shows the proposed system architecture which consists following modules

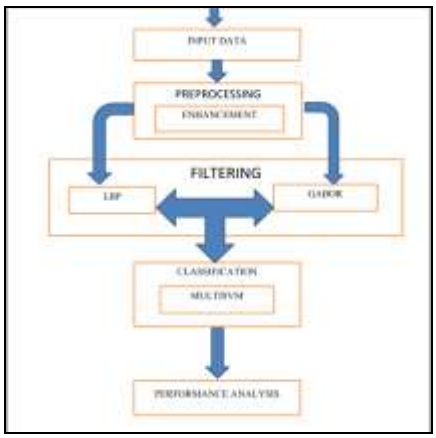

Figure 4.1: Proposed System Architecture

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 are 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-and-white 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 [16].

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 [16, 17].

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

a. LBP (Local Binary Patterns)
b. Gabor Filter

III. SYSTEM DESIGN AND IMPLEMENTATION

Figure 5.1 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.

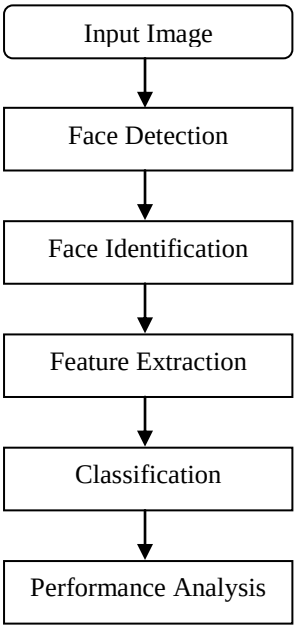

Figure 5.1: Methodology of Proposed System

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 [18].

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 gray-scale 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 [17].

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.

One versus the Rest: To get M-class classifiers, construct set of binary classifiers that each trained to separate one class from rest. Combine them to get a multi-class classification according to the maximal output before applying the function. Algorithm returns a signed real-valued value which can be interpreted as the distance from the separation (hyper) plane to the point x. Value can also be interpreted as a confidence value. The larger the value the more confident one is that the point x belong to the positive class. Hence, assign point x to the class whose confidence value is largest for this point [19].

IV. TEST CASE DESIGN

Test Case Design

The Proposed system is to be verified with different types of images, like identical twins, same persons, non-Identical twins, same person with different age, different people. The result is to be verified as per the Test cases shown in Table 6.1

Table 6.1: Test Cases

Test Case Id	Input Image	Expected Output	Actual Output	Test Case Result
T01	Identical Twins	Twins	Twins	Pass
T02	Non-Identical Twins	Not Twins	Not Twins	Pass
T03	Same Person	Same Person	Same Person	Pass
T04	Same Person	Not Twins	Not Twins	Pass (5 years gap images of same person)
T05	Same Person	Same Person	Same Parson	Pass (2 years gap images of same person)

V. RESULT AND DISCUSSION

In existing system there is particular interest in using biometrics to distinguish identical. The proposed system identifies and verify the person based on digital image from unique face humans. The Gabor and LBP Algorithms were taken together and proposed the algorithm that produces the accuracy of classification better than the algorithms used individually. The performance of the process is measured and analyzed. The system identifies the identical twins and non-identical twins and same person images efficiently.

7.1 Snapshots

Input

Image 01: Home Page of the System

Above Image 01 shows the Home page of the system, in which it provides the option to take image as input, which we want to identify or differntiate. And further image is processed for exracting features from the image by using Gabor and LBP algorithms.

Image 02: Selecting Image as Input

The above mentioned Image 02 shows the panel for selecting image for preprocessing.

Preprocessing

Image 03: Input Second Image

Image 04: Preprocessing of First Image

Image 05: Preprocessing of Second Image

The above **Image 04 and Image 05** shows the preprocesssing of the images taken as input, and preprocessing the images for feature extraction.

Image 06: Gray Scale Conversion of Input Images

The preprocessed images are converted into Gray Scale images as shown in Image 06.

Image 07: Filtration of Gray Scale Images

The filtration of Gray Scale Images is done for enhancement process as shown in Image 07.

Image 08: Enhancement of Gray Scale Image

The enhancement of filtered gray scale images is done for capturing the details on the face, shown in Image 08.

Image 09: Feature Extraction Page

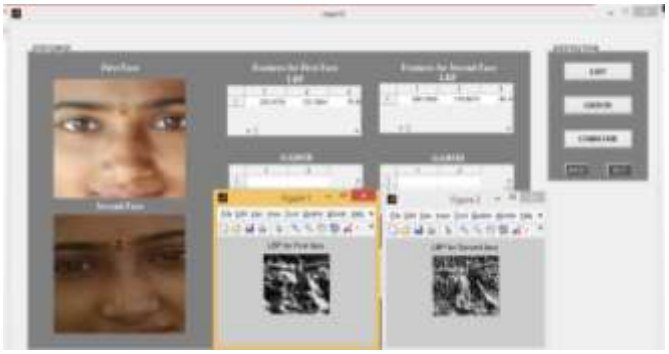

Image 10: Feature extraction by using LBP Algorithm

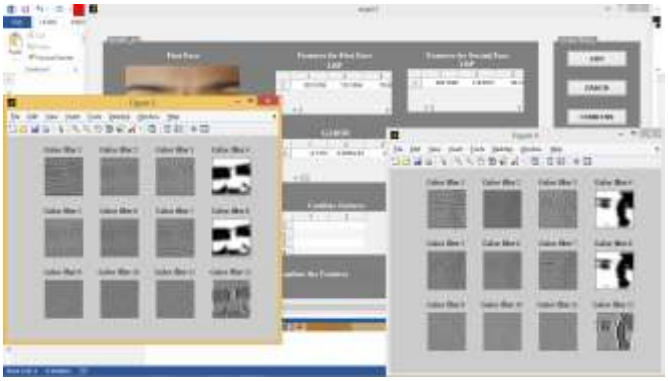

Image 11: Feature extraction by using Gabor Algorithm

Image 12: Combining of extracted features

The feature extraction process extracts features from the enhanced images of input image. As shown in Image 10 the features are extracted by using LBP algorithm and values are shown, and then Image 11 shows extraction by using Gabor algorithm, values are shown and stored. Image 12 shows the process of combining the features extracted by using LBP and Gabor algorithm and then processed these values for identification process.

CLASSIFICATION

Image 13: Process of Classification

Image 14: Result

Image 13 and 14 shows the process of identification, this process uses the SVM Classifier for classifying and identifying the inputed images. As shown in Image 13, it shows that input images are of same person.

VI. CONCLUSIONS

The proposed system identified or verified the person based on digital image from unique face humans. The Gabor and LBP Algorithms were taken together and proposed the algorithm that produces the accuracy of classification better

than the algorithms used individually. The performance of the process is measured and analyzed. The algorithm identifies the identical twins and non-identical twins and same person images efficiently. The results show that the proposed system performs satisfactorily in classifying identical twins and non-identical twins with high accuracy than the existing algorithms.

REFERENCES

[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, "Three-dimensional 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.