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RECOGNITION OF FINGER KNUCKLE PRINT FOR PERSONAL AUTHENTICATION USING PRINCIPAL COMPONENT ANALYSIS

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ABSTRACT
Biometric authentication based on physiological or behavioral attributes is much more reliable compared to an ID card. It is used in buildings, cars, computers and mobiles. In this paper, we focus on identification and verification of a person using FKP images. Finger knuckle print (FKP) image refers to an inherent skin pattern of outer surface around the phalangeal joint of human finger. The system for finger knuckle based biometric identifier has been ingeniously developed. The novelty of the work includes successful implication of appearance based method, namely, principal component analysis (PCA) for feature extraction and use of *k-nn* classifier as identification method for knuckle based biometrics. The system thus proposed has been developed within the python environment and functions from the same platform. Start Video button initiates the input intake, the system had been then subject to testing for finger knuckle based biometric personal identification for several subjects, randomly chosen, who may or may not volunteered for the training data set inputs. Each subject the index finger major knuckle surface has been video graphed through the system camera input. The system makes use of image pre-processing employing techniques like skin filter, grayscale conversion and histogram equivalence

Keywords: *Biometric authentication, Finger knuckle print (FKP), Principal Component Analysis(PCA)*

1.INTRODUCTION
Personal authentication including both identification and verification is important in different applications such as access to buildings, cars, computers and mobiles. Biometric authentication based on physiological or behavioral attributes is much more reliable compared to an ID card or a password, by occurring forged identity cards and hacked passwords. Various physiological traits such as face, fingerprint, iris and voice have been used. Among these, hand based biometric features such as finger print, palm print, hand geometry and finger knuckle print (FKP) attract considerable attention to be more efficient in terms of accuracy and computational complexity.
In this project, we focus on identification and verification of a person using FKP images. FKP image refers to an inherent skin pattern of outer surface around the phalangeal joint of human finger , and it is used as an efficient biometric trait with invariant, measurable, acceptable and permanence properties . The surface of the finger knuckle is extremely rich in lines and creases that are rather rounded but unique to individuals .
A qualitative evaluation of finger knuckle prints and matching of the knuckle prints. The knuckle photos are added in data set and these images region of interest is extracted from the imageand these are matched with the data set. The main motivation of the project to get knuckle insteadof finger prints because there is a lack of flexibility to identify the person in case of a cut or woundor when fingerprints are smudged with dirt or grease.
Fingerprint sensors are sensitive, which works in their favor if the fingers are clean, but these sensors are inefficient for industries like mining, construction, and manufacturing. Dependence on standalone

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machines is one of the significant disadvantages of fingerprint identification. Such attendance systems require dedicated hardware to record attendance. Companies cannot deploy standalone kiosks at fields or remote locations. So finger knuckle print is used as an efficient biometric trait with invariant, measurable, acceptable and permanence properties

2. METHOD

Finger knuckle print (FKP) method of acquisition and easy to use because it uses contactless . In this project the ROI is extracted and the system incorporates principal componentanalysis (PCA) for feature extraction out of pre-processed and enhanced input image as extracted from knuckle surface video capture. This can be implemented by using principal component analysis. The block diagram is given below

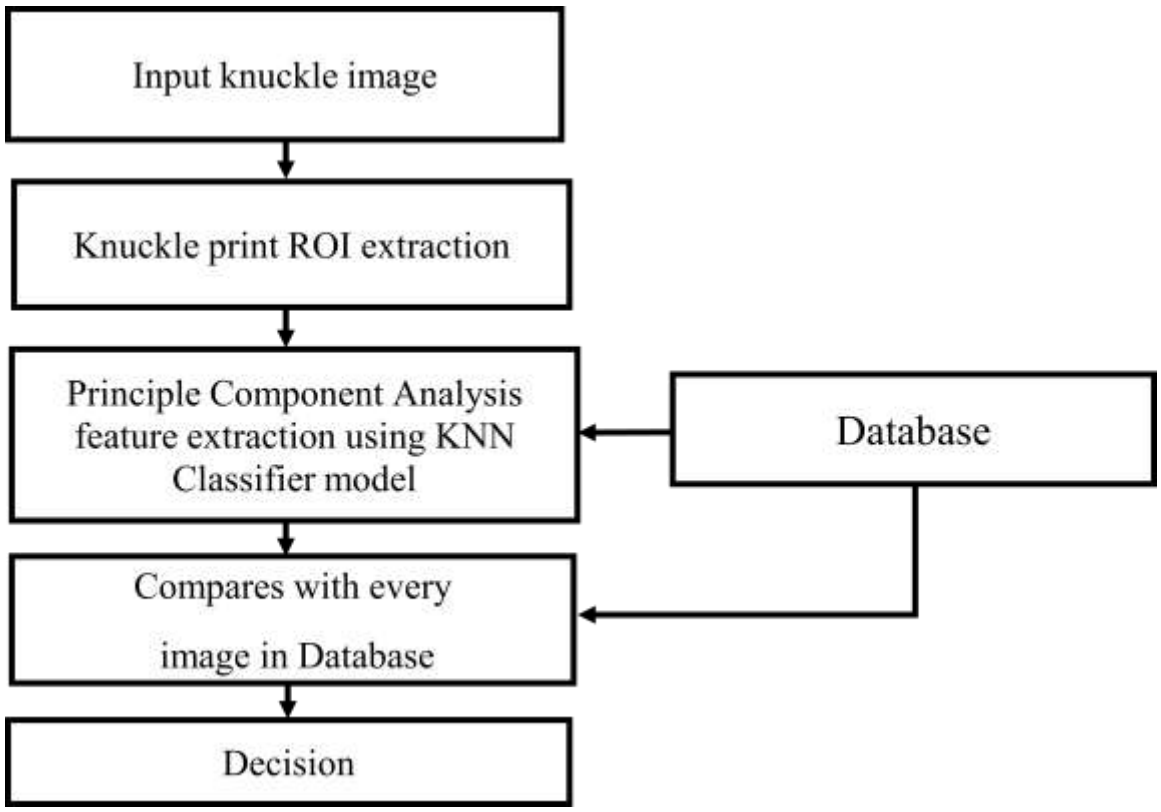

Fig 1: Block diagram of the Project

2.1 Data Acquisition

For data input, subject figure is video captured using a video web camera with white platform as evidently demonstrated from photograph. For training data acquisition, in prior six different subjects volunteered. For each subject knuckle video capture, multiple distinct images are accepted/inputted toassure the accuracy of the training data independent on the finger positioning,light etc

2.2 ROI Extraction

A region of interest (often abbreviated ROI) is a sample within a data set identified for a particular purpose. The concept of a ROI is commonly used in many application areas. For example, in medical imaging, the boundaries of a tumor may be defined on an image or in a volume, for thepurpose

of measuring its size. a ROI can be taken literally as a polygonal selection from a 2D map. In computer vision and optical character recognition,

2.3 Feature Extraction Using Principal Component Analysis (PCA):

The Principal component analysis (PCA) is a very well know computational methodology for statistical analysis of a given data system moreover PCA is also finding its application in pattern recognition tools for the systems commonly used for face recognition or finger print recognition for that matter. Moreover one has to appreciate the fact that when it comes to a large dimensional data PCA finds its most suitable application for pattern recognition of such data. PCA extract information from a knuckle image [Principal Components] and encodes that information in a suitable data structure. In mathematical terms we find Eigen vectors and Eigen values of a covariance matrix of images.

Principal component analysis, or PCA, is a dimensionality-reduction method that is often used to reduce the dimensionality of large data sets, by transforming a large set of variables into a smaller one that still contains most of the information in the large set. Reducing the number of variables of a data set naturally comes at the expense of accuracy, but the trick in dimensionality reduction is to trade a little accuracy for simplicity. Because smaller data sets are easier to explore and visualize and make analyzing data much easier and faster for machine learning algorithms without extraneous variables to process.

2.4 Classification and decision

Classification is the process of detecting a pattern and comparing it with the predefined pattern in the database and identifies the matching features. Training has to be done to the predefined features and the trained and test features are compared. The test feature is our input image. When the features match, and then it is recognized. Here, the k-nn classifier is used. K-nearest neighbor classifier is a robust method used for matching. The k- nearest neighbor (k-nn) pattern classifier is an effective learner for general pattern recognition domains. In this way the finger knuckle is recognized.

3. RESULTS

This section presents the implementation results. Several different images from the database are given as input for the algorithm.

Fig 2: Input image

In the input image the finger knuckle photo is captured with a camera. The six different snapshots of a single subject knuckle surface image samples. These samples are stored in the training data.

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Fig 3 : ROI extraction

In this stage of processing the input image is cropped or reduced in such a way the required knuckleimage is obatained .

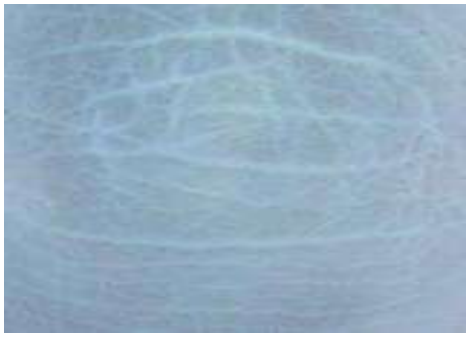

Fig 4: PCA analysis

Fig 5: Image matching

In this stage the ROI extracted image is converted into PCA. Principal component analysis, or PCA, is a dimensionality-reduction method that is often used to reduce the dimensionality of large data sets.

Training has to be done to the predefined features and the trained and test features are compared.The test feature is our input image.When the features match, and then it is recognized.

4. CONCLUSION

This project conclude that, the development of the finger knuckle biometric system with the following considerations may lead to its suitability in a real time environment with large population. The recommended considerations are (i) development of texture analysis techniques which makes use of subset of finger knuckle features for the generation of feature templates and,
incorporating knuckle shape information along with its angular. The system for finger knuckle based biometric identifier has been ingeniously developed. The novelty of the work includes successful implication of appearance based method, namely,principal component analysis (PCA) for feature extraction and use of knnclassifier as identification method for knuckle based biometrics. The system for finger knuckle based biometric identifier has been ingeniously developed.. The system makes use of image preprocessing employing techniques like skin filter, grayscale conversion and histogram equivalence. The overall system performance as tested had been found satisfactorily accurate. The system response time and performance is comparably fast to that of many state of the art systems as

reported in literature. Also, the system testing which hadbeen efficiently carried out with limited training dataset at present can be very well scaled to orderof magnitude larger data points.

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