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Fingerprint Compression Based On Representation Techniques

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Abstract **The primary aim of this project is to implement techniques for fingerprint image enhancement and minutiae extraction. Recognition of people by means of their biometric characteristics very popular among the society. But a fingerprint image consists of enormous amount of data. For a given whole fingerprint, divide it into small blocks called patches. Obtaining an over complete dictionary from a set of fingerprint patches allows us to represent them as a sparse linear combination of dictionary atoms. In the algorithm, we first construct a dictionary for predefined fingerprint image patches. Large volume of fingerprint is collected and stored everyday in a wide range of applications. The experiments demonstrate that this is efficient compared with several competing compression techniques especially at high compression ratios. There are many image compression techniques available. Fingerprint images are rarely of perfect quality. There are many image compression techniques available. JPEG, JPEG 2000, Wavelet Scalar Quantization (WSQ) are the existing image compression techniques. The JPEG, JPEG 2000 methods are for general image compression. Fingerprint identification methods are widely used by police agencies and customhouse to identify criminals or transit passengers since the late nineteenth century. ISO standardized the characteristics of the fingerprint in 2004. After the image enhancement construct a base matrix whose columns represent features of the fingerprint images, referring the matrix dictionary whose columns are called atoms.**

Keywords: **Fingerprint images, Wavelet Scalar Quantization, Compression techniques, Matrix dictionary, Atoms.**

I. INTRODUCTION

Recognition of persons by means of biometric characteristics is an important technology in the society, because biometric identifiers can't be shared and they the individual's bodily identity. Among many biometric recognition technologies, fingerprint recognition is very popular for personal identification due to the uniqueness, universality, collectability and invariance .Large volumes of fingerprint are collected and stored every day in a wide range of applications, including forensics and access control. In 1995, the size of the FBI fingerprint card archive contained over 200 million items and archive size was increasing at the rate of 30000 to 50 000 new cards perday. Large volume of data consumes the amount of memory. Fingerprint image compression is a key technique to solve the problem. Generally, compression technologies can be classed into lossless and lossy.

Lossless compression allows the exact original images to be reconstructed from the compressed data. Lossless compression technologies are used in cases where it is important that the original and the decompressed data are identical. Avoiding distortion limits their compression efficiency. When used in image compression where slight distortion is acceptable, lossless compression technologies are often employed in the output coefficients of lossy compression.

Lossy compression technologies usually transform an image into another domain, quantize and encode its coefficients. During the last three decades, transform based image compression technologies have been extensively researched and some standards have appeared. Two most common options of transformation are the Discrete Cosine Transform (DCT) and the Discrete Wavelet Transform (DWT).

The DCT-based encoder can be thought of as compression of a stream of 8 × 8 small block of images. This transform has been adopted in JPEG. The JPEG compression scheme has many advantages such as simplicity, universality and availability. However, it has a bad performance at low bit-rate mainly because of the underlying block-based DCT scheme. For this reason, as early as 1995, the JPEG-committee began to develop a new wavelet-based compression standard for still images, namely JPEG 2000. In this paper, a novel approach based on sparse representation is given. The proposed method has the ability by updating the dictionary. The specific process is as follows: construct a base matrix whose columns represent features of the fingerprint images, referring the matrix dictionary whose columns are called atoms; for a given whole fingerprint, divide it into small blocks called patches whose number of pixels are equal to the dimension of the atoms; use the method of sparse representation to obtain the coefficients; then, quantize the coefficients; last, encode the coefficients and other related information using lossless coding methods. In most instances, the evaluation of compression performance of the algorithms is restricted to Peak Signal to Noise Ratio (PSNR) computation. The effects on actual fingerprint matching or recognition are not investigated. In this paper, we will take it into consideration. In most Automatic Fingerprint identification System (AFIS), the main feature used to match two fingerprint images are minutiae (ridges endings and bifurcations).Therefore, the difference of the minutiae between pre- and post-compression.

II. SYSTEM ANALYSIS

Motivation:

Accurate automatic personal identification is critical in wide range of application domains such as national ID cards, electronic commerce and automatic banking. Biometrics, which refers to automatic identification of a person based on his or her personal physiological or behavioral characteristics, is inherently more reliable and more capable in differentiating between a reliable person and a fraudulent impostor than traditional methods such as PIN and passwords. Automatic fingerprint identification is one of the most reliable biometric technology among the different major biometric technologies which are either currently available or under investigation. The objective of our project is to implement the image enhancement and minutiae extraction algorithm which is capable of doing the matching between different digitized fingerprints of standard image file formats namely; BMP, JPEG with high level of accuracy and confidence.

***Input Design Objectives*:**

The input design is the link between the information system and the user. It comprises the developing specification and procedures for data preparation and those steps are necessary to put transaction data in to a usable form for processing can be achieved by inspecting the computer to read data from a written or printed document or it can occur by having people keying the data directly into the system. The design of input focuses on controlling the amount of input required, controlling the errors, avoiding delay, avoiding extra steps and keeping the process simple. The input is designed in such a way so that it provides security and ease of use with retaining the privacy. Input Design considered the following things: What data should be given as input?, How the data should be arranged or coded?, The dialog to guide the operating personnel in providing input, Methods for preparing input validations and steps to follow when error occur.
The input form of an information system should accomplish one or more of the following objectives.

Input Design is the process of converting a user-oriented description of the input into a computer-based system. This design is important to avoid errors in the data input process and show the correct direction to the management for getting correct information from the computerized system.

It is achieved by creating user-friendly screens for the data entry to handle large volume of data. The goal of designing input is to make data entry easier and to be free from errors. The data entry screen is designed in such a way that all the data manipulates can be performed. It also provides record viewing facilities.

When the data is entered it will check for its validity. Data can be entered with the help of screens. Appropriate messages are provided as when needed so that the user will not be in maize of instant. Thus the objective of input design is to create an input layout that is easy to follow.

Output Design Objectives:

A quality output is one, which meets the requirements of the end user and presents the information clearly. In any system results of processing are communicated to the users and to other system through outputs. In output design it is determined how the information is to be displaced for immediate need and also the hard copy output. It is the most important and direct source information to the user. Efficient and intelligent output design improves the system's relationship to help user decision-making.

Designing computer output should proceed in an organized, well thought out manner; the right output must be developed while ensuring that each output element is designed so that people will find the system can use easily and effectively. When analysis design computer output, they should Identify the specific output that is needed to meet the requirements. Select methods for presenting information. Create document, report, or other formats that contain information produced by the system.

The output form of an information system should accomplish one or more of the following objectives.Convey information about past activities, current status or projections of the Future, Signal important events, opportunities, problems, or warnings, Trigger an action and Confirm an action.

Existing System:

In existing finger print compression algorithms and to test the robustness of our algorithm to extract minutiae. Since existing fingerprint quality assessment algorithms are designed to examine if an image contains sufficient information (say, minutiae) for matching, they have limited capability in determining if an image is a natural fingerprint or an altered fingerprint. Obliterated fingerprints can evade fingerprint quality control software, depending on the area of the damage. If the affected finger area is small, the existing fingerprint quality assessment software may fail to detect it as a fingerprint.

Proposed System:

In proposed system, construct a base matrix whose columns represent features of the fingerprint images, referring the matrix dictionary whose columns are called atoms; for a given whole fingerprint, divide it into small blocks called patches whose number of pixels are equal to the dimension of the atoms; use the method of sparse representation to obtain the coefficients; then, quantize the coefficients; last, encode the coefficients and other related information using lossless coding methods. In most instances, the evaluation of compression performance of the algorithms is restricted to Peak Signal to Noise Ratio (PSNR) computation. The effects on actual fingerprint matching or recognition are not investigated. In this paper, we will take it into consideration. In most Automatic Fingerprint identification System (AFIS), the main feature used to match two fingerprint images are minutiae (ridges endings and bifurcations). Therefore, the difference of the minutiae betweenpre- and post-compression is considered in the paper. .

III. SYSTEM DESIGN

Implementation is the stage of the project when the theoretical design is turned out into a working system. Thus it can be considered to be the most critical stage in achieving a successful new system and in giving the user, confidence that the new system will work and be effective. The implementation stage involves careful planning, investigation of the existing system and it's constraints on implementation, designing of methods to achieve changeover and evaluation of changeover methods.

The main modules involved in the system are Detection of Fingerprints (Normalization, Orientation field estimation, Orientation field approximation and Feature extraction), Analysis of Minutiae Distribution, Wavelet Scalar Quantization (WSQ) Compression and Compression Based on Sparse Representation

1. Detection of Fingerprints

A. Normalization

An input fingerprint image is normalized by cropping a rectangular region of the fingerprint, which is located at the center of the fingerprint and aligned along the longitudinal direction of the finger, using the NISTBiometric Image Software (NBIS). This step ensures that the features extracted in the subsequent steps are invariant with respect to translation and rotation of finger.

B. Orientation Field Estimation

The orientation field of the fingerprint is computed using the gradient-based method. The initial orientation field is smoothed averaging filter, followed by averaging the orientations in pixel blocks. A foreground mask is obtained by measuring the dynamic range of gray values of the fingerprint image in local blocks and morphological process for filling holes and removing isolated blocks is performed.

C. Orientation Field Approximation

The orientation field is approximated by a polynomial model to obtain.

D. Feature Extraction

The error map is computed as the absolute difference between and used to construct the feature vector.

2. Analysis of Minutiae Distribution

In this module, a minutia in the fingerprint indicates ridge characteristics such as ridge ending or ridge bifurcation. Almost all fingerprint recognition systems use minutiae for matching. In addition to the abnormality observed in orientation field, we also noted that minutiae distribution of altered fingerprints often differs from that of natural fingerprints. Based on the minutiae extracted from a fingerprint by the open source minutiae extractor in NBIS, a minutiae density map is constructed by using the Parzen window method with uniform kernel function.

3. Wavelet Scalar Quantization (WSQ) Compression

In this module, it is used for gray-scale fingerprint images. It is based on wavelet theory and has become a standard for the exchange and storage of fingerprint images. This compression method is preferred over standard compression algorithms like JPEG because at the same compression ratios WSQ doesn't present the "blocking artifacts" and loss of fine-scale features that are not acceptable for identification. After processing the appropriate files for the encoder and decoder, a certification request containing the test report, test results, and all generated compressed and reconstructed files (cmp000xx with extensions '.wsq' and '.pgm') are forwarded to the FBI for review and evaluation.

4. Compression Based on Sparse Representation

In this module, for a given fingerprint, slice into small patches. For each patch its mean is calculated and subtracted from the patch. For each patch solve the minimization problem by those coefficients whose absolute value are less than a given threshold are treated as zero. Record the remaining coefficients and their locations. Encode the atom number of each patch.

Activity Diagram:

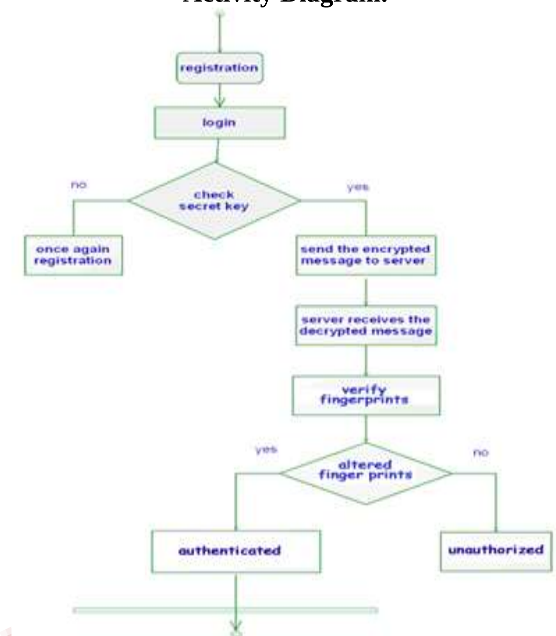

Fig 1: Activity Diagram

Activity diagram describes the flow of control in a system. So it consists of activities and links. The flow can be sequential, concurrent or branched. Activities are nothing but the functions of a system. Numbers of activity diagrams are prepared to capture the entire flow in a system. Activity diagrams are used to visualize the flow of controls in a system. This is prepared to have an idea of how the system will work when executed.

IV. SYSTEM IMPLEMENTATION

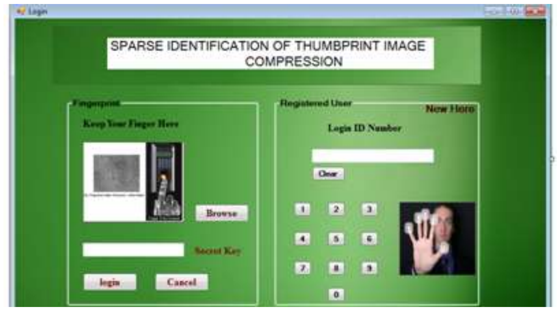

Fig 2: Registration page

Fig 3: New registration form

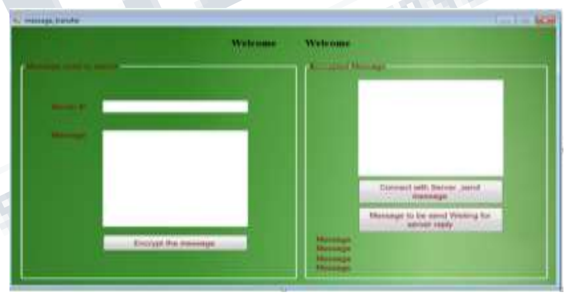

Fig 4 : Message send to server

Fig 5: Login Form

Fig 6 : Message From Client

Fig 7 : FVC Experiment form

Fig 8 : Remote server

V. CONCLUSION

A new compression algorithm adapted to fingerprint images is introduced. Despite the simplicity of our proposed algorithms, they compare favorably with existing more sophisticated algorithms, especially at high compression ratios. Due to the block-by-block processing mechanism, however, the algorithm has higher complexities.The experiments show that the block effect of our algoritm is less serious than that of JPEG. We consider the effect ofthree different dictionaries on fingerprint compression. The experiments reflect that the dictionary obtained by the K-SVD algorithm works best. Moreover, the larger the number of the training set is, the better the compression result is.One of the main difficulties in developing compression algorithms for fingerprints resides in the need for preserving the minutiae which are used in the identification. The experiments show that our algorithm can hold most of the minutiae robustly during the compression and reconstruction. There are many intriguing questions that future work should consider. First, the features and the methods for constructing dictionaries should be thought over. Secondly, the training samples should include fingerprints with different quality ("good", "bad", "ugly"). Thirdly, the optimization algorithms for solving the sparse representation need to be investigated. Fourthly, optimize the code to reduce complexity of our proposed method.

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