Fault Fingerprint Identification Using Convolution Neural Networks

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ABSTRACT-

As the world enters the information age, the need for identity verification becomes more and more urgent. Therefore, fingerprint identification technology is widely used in the field of personal authentication.In such applications, malicious users may purposely distort their fingerprints to evade identification. In this paper, we proposed novel algorithms to detect and rectify skin distortion based on a single fingerprint image. Distortion detection is viewed as a two-class classification problem, for which the registered ridge orientation map and period map of a fingerprint are used as the feature vector and a SVM classifier is trained to perform the classification task. Distortion rectification (or equivalently distortion field estimation) is viewed as a regression problem, where the input is a distorted fingerprint and the output is the distortion field. To solve this problem, a database (called reference database) of various distorted reference fingerprints and corresponding distortion fields is built in the offline stage, and then in the online stage, the nearest neighbor of the input fingerprint is found in the reference database and the corresponding distortion field is used to transform the input fingerprint into a normal one. Deep Learning is compared with the fingerprint identification algorithm based on Kernel Principal Component Analysis (KPCA) and k-Nearest Neighbor (KNN). Experiments' results show that fingerprint recognition based on Deep Learning has a higher recognition rate.

KEYWORDS-

Identification, convolution neural networks (CNN),
fuzzy feature point,
recognition rate.

1.INTRODUCTION:

With the rapid development of social information, identification of personal identity has become an effective measure to safeguard national security and maintain social order. Traditional identification methods generally use the markers (such as keys and ID card) and knowledge (such as passwords and codes) to achieve the purpose of identity authentication and identification. However, these identification methods are carried out by means of object recognition, in which always exists the risk of loss, theft, or even be forged. Therefore, the biological identification technology is used to overcome these shortcomings of traditional authentication methods.

Traditional fingerprint identification methods include two ways: supervision and semi-supervision. Supervision is the way that provided the classification of all samples is known as much as possible to mark the data out of the training samples, therefore the ambiguity of the training samples is low while the cost of manpower and material resources is high Fingerprint matcher is very sensitive to image quality where the matching accuracy of the same algorithm varies significantly among different datasets due to variation in image quality. The difference between the accuracies of plain, rolled and latent fingerprint matching is even larger as observed in technology evaluations conducted by the NIST. Imaging sensor imperfections can be considered as a unique fingerprint identifying a specific acquisition device, enabling various important forensic tasks, such as device identification, device linking, recovery of processing history, detection of digital forgeries. The consequence of low quality fingerprints depends on the type of the fingerprint recognition system. A fingerprint recognition system can be classified as either a positive or negative system. In a positive recognition system, such as physical access control systems, the user is supposed to be cooperative and wishes to be identified. In a negative recognition system, such as identifying persons in watch lists and detecting multiple enrollments under different names, the user of interest (e.g., criminals) is supposed to be uncooperative and does not wish to be identified. In a positive recognition system, low quality will lead to false reject of legitimate users and thus bring inconvenience.

The consequence of low quality for a negative recognition system, however, is much more serious, since malicious users may purposely reduce fingerprint quality to prevent fingerprint system from finding the true identity. In fact, law enforcement officials have encountered a number of cases where criminals attempted to avoid identification by damaging or surgically altering their fingerprints. Elastic distortion is introduced due to the inherent flexibility of fingertips, contact-based fingerprint acquisition procedure, and a purposely lateral force or torque, etc. Skin distortion increases the intra-class variations (difference among fingerprints from the same finger) and thus leads to false non-matches due to limited capability of existing fingerprint matchers in recognizing severely distorted fingerprints. According to Verification Finger, the match score between the left two is much higher than the match score between the right two. This huge difference is due to distortion rather than overlapping area. While it is possible to make the matching algorithms tolerate large skin distortion, this will lead to more false matches and slow down matching speed.

2.EXISTING SYSTEM:

- Most of the fingerprint identification systems are able to reach high accuracy with fast speed when handling the fingerprint image with high quality.
- In Existing System, 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 an altered fingerprint.

2.1DISADVANTAGES OF EXISTING SYSTEM:

- The authentication of low quality fingerprint still needs further improvement.
- They require special force sensors or fingerprint sensors with video capturing capability.
- They cannot detect distorted fingerprint images in existing fingerprint databases.
- They cannot detect fingerprints distorted before pressing on the sensor.
- However, allowing larger distortion in matching will inevitably result in higher false match rate.

  For example, if we increased the bounding zone around a minutia, many non-mated minutiae will have a chance to get paired.
- In addition, allowing larger distortion in matching will also slow down the matching speed

3.PROPOSED SYSTEM:

Aiming at imperfect fingerprints, we propose an improved damaged fingerprint recognition algorithm by feature points, based on Convolution Neural Network (CNN) of Deep Learning. In this paper we put forward a fuzzy process of fingerprint feature points, in which a fuzzy image of fingerprint feature points represents the training sample. It greatly simplifies the steps of finding a specific number of matched feature points, but also improves the recognition rate towards the damaged and blurred fingerprint identification. Finally, the CNN algorithm is used to simulate the human brain, which automatically extracts the inherent features from the fuzzy graphs of feature points, and then recognizes and classifies the training samples. Experiment results show that the proposed method can greatly improve the recognition rate.

3.1 ADVANTAGES OF PROPOSED SYSTEM:

- Effective and accurate.
- Fingerprint rectification algorithm consists of an offline stage and an online stage. In the offline stage, a database of distorted reference fingerprints is generated by transforming several normal reference fingerprints with various distortion fields sampled from the statistical model of distortion fields.
- It greatly simplifies the steps of finding a specific number of matched feature points, but also improves the recognition rate towards the damaged and blurred fingerprint identification.
- The proposed algorithm performs well in matching experiments on various databases.
- The proposed algorithm can improve recognition rate.

ARCHITECTURE:

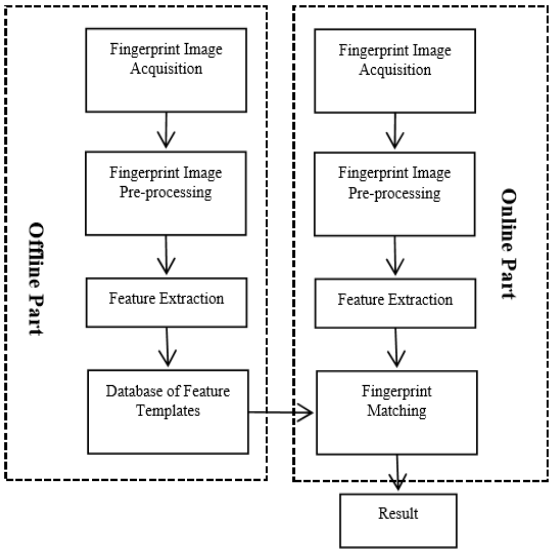

FIG3.0 system architecture

4.MODULE:

1.Pre-processing of Fingerprint Image
- Fingerprint enhancement
- Fingerprint image binarization
- Fingerprint image

thinning 2.Fingerprint Feature Extraction
3.Fingerprint matching

4.1MODULES DESCRIPTION:

1.PRE-PROCESSING OF FINGERPRINT IMAGE

Fingerprint image pre-processing is a comprehensive application of various digital image processing techniques, and it is usually the first task to be done by the algorithm of fingerprint identification.

- **Fingerprint enhancement**

This step makes the fingerprint ridges much clearer and improves the convenience and accuracy of fingerprint feature extraction, avoiding the appearance of pseudo feature points.

- **Fingerprint image binarization**

This step can effectively remove the large number of adhesion to facilitate subsequent fingerprint image thinning and reduce the complexity in fingerprint feature extraction and calculation.

- **Fingerprint image thinning**

This step can refine the width of the ridge and make it more convenient to extract the details of the feature points, improving the accuracy of fingerprint matching.

2.FINGERPRINT FEATURE EXTRACTION

- Fingerprint feature points include: core, delta, ending bifurcation, et al. The shape features of fingerprint include six major categories: arch,

  tented arch, right loop, left loop, whorl and twin loop.

- Fingerprint feature extraction is an important part of the whole fingerprint identification system, its main task is to obtain the number, position and local ridge direction of fingerprint feature points by detecting two fingerprint images through a certain algorithm, which can facilitates subsequent fingerprint matching process.

3.FINGERPRINT MATCHING

- Fingerprint matching mainly compares the new collection of fingerprint images with the fingerprint database, judging whether they are from the same finger, or from the same person by calculating the fingerprint similarity.

Collecting data Because data collection is not very frequent inmost mobile data gathering applications, message overhead is certainly manageable within a cluster.

5.SOFTWARE ENVIRONMENT:

5.1 FEATURES OF .NET:

- Microsoft.NET is a set of Microsoft software technologies for rapidly building and integrating XML Web services, Microsoft Windows-based applications, and Web solutions. The .NET Framework is a language-neutral platform for writing programs that can easily and securely interoperate. There's no language barrier with
  .NET: there are numerous languages available to the developer including Managed C++, C#, Visual Basic and Java Script.
- The .NET framework provides the foundation for components to interact seamlessly, whether locally or remotely on different platforms. It standardizes common data types and communications protocols so that components created in different languages can easily interoperate.
- ".NET" is also the collective name given to various software components built upon the
  .NET platform. These will be both products

(Visual Studio.NET and Windows.NET Server, for instance) and services (like Passport, .NET My Services, and so on).

5.2HE .NET FRAMEWORK:

The .NET Framework has two main parts:

- **The Common Language Runtime (CLR).**
- **A hierarchical set of class libraries**.

- The CLR is described as the "execution engine" of .NET. It provides the environment within which programs run. The most important features are
- Conversion from a low-level assembler-style language, called Intermediate Language (IL), into code native to the platform being executed on.
- Memory management, notably including garbage collection.
- Checking and enforcing security restrictions on the running code.
- Loading and executing programs, with version control and other such features.

6.The following features of the .NET framework are also worth description:

6.1 Managed Code:

The code that targets.NET, and which contains certain extra Information - "metadata" - to describe itself. Whilst both managed and unmanaged code can run in the runtime, only managed code contains the information that allows the CLR to guarantee, for instance, safe execution and interoperability.

6.2 Managed Data:

With Managed Code comes Managed Data. CLR provides memory allocation and Deal location facilities, and garbage collection. Some .NET languages use Managed Data by default, such as C#, Visual Basic.NET and JScript.NET, whereas others, namely C++, do not. Targeting CLR can, depending on the language you're using, impose certain constraints on the features available. As with managed and unmanaged code, one can have both managed and unmanaged data in .NET applications - data that doesn't get garbage collected but instead is looked after by unmanaged code.

6.3Common Type System

The CLR uses something called the Common Type System (CTS) to strictly enforce type-safety. This ensures that all classes are compatible with each other, by describing types in a common way. CTS define how types work within the runtime, which enables types in one language to interoperate with types in another language, including cross-language exception handling. As well as ensuring that types are only used in appropriate ways, the runtime *also* ensures that code doesn't attempt to access memory that hasn't been allocated to it.

6.4Common Language Specification

The CLR provides built-in support for language interoperability. To ensure that you can develop managed code that can be fully used by developers using any programming language, a set of language features and rules for using them called the Common Language Specification (CLS) has been defined. Components that follow these rules and expose only CLS features are considered CLS-compliant.

7.1 THE CLASS LIBRARY:

.NET provides a single-rooted hierarchy of classes, containing over 7000 types. The root of the namespace is called System; this contains basic types like Byte, Double, Boolean, and String, as well as Object. All objects derive from System. Object. As well as objects, there are value types. Value types can be allocated on the stack, which can provide useful flexibility. There are also efficient means of converting value types to object types if and when necessary.

The set of classes is pretty comprehensive, providing collections, file, screen, and network I/O, threading, and so on, as well as XML and database connectivity.

The class library is subdivided into a number of sets (or namespaces), each providing distinct areas of functionality, with dependencies between the namespaces kept to a minimum.

7.2LANGUAGES SUPPORTED BY .NET

The multi-language capability of the .NET Framework and Visual Studio .NET enables developers to use their existing programming skills to build all types of applications and XML Web services. The .NET framework supports new versions of Microsoft's old favorites Visual Basic and C++ (as VB.NET and Managed C++), but there are also a number of new additions to the family.

Visual Basic .NET has been updated to include many new and improved language features that make it a powerful object-oriented programming language. These features include inheritance, interfaces, and overloading, among others. Visual Basic also now supports structured exception

handling, custom attributes and also supports multi-threading.
Visual Basic .NET is also CLS compliant, which means that any CLS-compliant language can use the classes, objects, and components you create in Visual Basic
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Managed Extensions for C++ and attributed
programming are just some of the enhancements made to the C++ language. Managed Extensions simplify the task of migrating existing C++ applications to the new
.NET Framework.
C# is Microsoft's new language. It's a C-style language
that is essentially "C++ for Rapid Application
Development". Unlike other languages, its specification is just the grammar of the language. It has no standard library of its own, and instead has been designed with the intention of using the .NET libraries as its own. Microsoft Visual J# .NET provides the easiest transition for Java-language developers into the world of XML Web Services and dramatically improves the interoperability of Java-language programs with existing software written in a variety of other programming languages.
Active State has created Visual Perl and Visual Python, which enable .NET-aware applications to be built in either Perl or Python. Both products can be integrated into the Visual Studio .NET environment. Visual Perl includes support for Active State's Perl Dev Kit.

7. Other languages for which .NET compilers are available include

- **FORTRAN**
- **COBOL**
- **Eiffel**

ASP.NET XML WEB SERVICES	Windo ws
Base Class Libraries	
Common Language Runtime	
Operating System	

Table6.0 Net Framework

C#.NET is also compliant with CLS (Common Language Specification) and supports structured exception handling. CLS is set of rules and constructs that are supported by the CLR (Common Language Runtime). CLR is the runtime environment provided by the .NET Framework; it manages the execution of the code and also makes the development process easier by providing services.
C#.NET is a CLS-compliant language. Any objects, classes, or components that created in C#.NET can be used in any other CLS-compliant language. In addition, can use objects, classes, and components created in other CLS-compliant languages in C#.NET .The use of CLS ensures complete interoperability among applications, regardless of the languages used to create the application.

CONCLUSION:

Based on our proposed algorithm, the experiments in this paper are divided into three steps: (i) Pre-process the original image, such as enhancement binarization, denoising and thinning; (2) Extract the entire feature points from the pre-processed image. (iii) Input the
fuzzy image into CNN for training and recognition; obtain the recognition rate. The automatic fingerprint identification method, namely CNN algorithm, not only improves the recognition rate, but saves processing time. The effective processing of the input images is the key step to improve the recognition rate. In future study, we need to conduct comprehensive researches on the processing of the input images, as well as strengthening the improvement of the algorithm.

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