



Locating Singular Points in fingerprints classification Using Noval Algorithms

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Abstract: Fingerprints are collected for any number of reasons: job applications, visas, international border crossings, access control to secure facilities, computer logins, as well as matching a suspect to a crime. In this existing Paper for Detection is one of the most reliable methods of personal verification. The widespread deployment of Automated Fingerprint Identification Systems (AFIS) in law enforcement and border control applications has heightened the need for ensuring that these systems are not compromised. While several issues related to fingerprint system security have been investigated, including the use of fake fingerprints for masquerading identity, the problem of fingerprint alteration or obfuscation has received very little attention. In this paper we have classify using the categories of distortion to alter the fingerprint and to develop methods to automatically detect altered fingerprints by using singular point detection methods.

Keywords: Fingerprints, AFIS, Ridge Patterns, Image Quality, Minutiae Distribution

I. INTRODUCTION

The correctly locating singular points are crucial for most fingerprint classification and recognition applications. The singular point area is defined as a region where the ridge curvature is higher than normal and the direction of the ridge changes speedily. These singular points not only represent the characteristics of local ridge patterns but also determine the topological structure. Each fingerprint contains two kinds of singular points there are cores and deltas. In this paper proposed a novel algorithm for singular points detection and an initial detection using the conventional Poincare' Index method it is called DORIC feature [1]. In this method is used to remove forged singular points. In the orientation field some spurious detections are actually have nearly the same local patterns as true singular points.

To accurately differentiate the honest singular points global discriminative information should be combined into the detection. Then Minimize the difference between the original orientation field and model-based orientation field reconstructed using the singular points [2]. The optimal combination is designed for doing the above process and also a core-delta relation is used as a global constraint for the final selection of singular points. In this proposed algorithm is effective for singular point detection and the result is better than earlier methods.

Image processing methods are used for change the images into the digital format. It executes a number of processes on that image to get an improved image or used to

take out the useful information from the image. Image processing is a kind of signal dispensation in which the input may be given as image, video frame or photograph and the output will be an image or the characteristics connected with that image.

While applying signal processing, in Image Processing method it consider the image as a two dimensional signal [3]. Nowadays, the image processing method is considered as a speedily improving method in various application fields

The Image processing is divides as three stages,

- The image is import with scanners or digital photography.
- The image was analyzed and controlled which contains compression data, image enhancement and spotting.

The image analysis is used to analyze the input fingerprint images that are altered image. The image analysis is the final stage of fingerprint recognition. Image processing algorithms are used to improve the relevant applications in fingerprint identification. And also used in real time applications such as cameras in cell phones, Smartphone's, movable media players, HD televisions, image spectral system, robots and embedded video etc.

The automatic image annotation method was referred as multi class image type because it contains large number of sessions larger than the vocabulary size. The features extracted vector is a method for image analysis. The machine learning method use note words and in this method



it automatically apply the note words to new images. In this, first it studies the relation between the image features and note words. Then it is improved by conversion machine to convert the literal vocabulary with visual vocabulary. This paper takes many classification methods, complexity methods etc.

The identification and matching of finger print is a critical one in identification systems. The fingerprint matching was used in the forensic field to identify the criminal activities. And it is used to identify the individual because every fingerprint present in individuals gets varied. So it is very useful to identify a person who involved in crime or illegal activity. The fingerprint identification technique [4] uses several methods to detect the edges in fingerprints. And also used to correctly identify the prints by using a camera. In this, no need for a special equipped device to identify the prints only a small camera image is enough. So this technique should implement even in a small camera phones. The issues which affect the fingerprint technique were a low illumination, noise, climate features and the condition of image.

There are different types of fingerprint techniques are used in this to provide various image improvement methods. And it removes the noise present in images and increases the quality of image. The contour based technique in fingerprint was used to detect and match the edges within the contour.

The paper pays attention in detection of singular points in fingerprints and removes the spurious singular points in fingerprints. Since existing fingerprint quality assessment algorithms[5],[6],[7] are designed to examine if an image contains sufficient information for matching, they have limited capability in determining if an image is a natural fingerprint or an altered fingerprint.

Session 1 gives the overview of Fingerprint and its related identification marks. Session 2 describes the analysis and survey. In session 3 is the implementation work the proposed algorithm and Image are implemented in Mat lab based platform for Finger print image analysis and detection. In session 4 is compared with their proposed algorithm and the result of this dissertation is presented and the discussions are made, we have stated about the result and discussion of our work. Finally in session 5 we narrated about the conclusion and future enhancement followed by references gives the summary and conclusion.

II. RELATED WORK

Fingerprint authentication is an automatic method in which the finger prints of two humans were matched

automatically. Fingerprints are used in the biometric field and it is used to identify and verify the particular persons. The ridges of fingerprint contain three fundamental patterns they are the arch, loop, and whorl [10]. In fingerprint the ridges passes from one end of finger, and flow into the center part to form an arc and then pass into the another end of finger. The ridges in fingerprints flow from one end of figure and then pass to the center to form a arc and then again leave from the same direction. In the center part of finger the ridge was in circular shape. And the scientists discovered that the same family members have same pattern of fingerprints. It will make a conclusion that the fingerprints patterns are from birth. The features of minutiae present [9] in fingerprint ridges are ridge ending, bifurcation, and short ridge. The minutiae features such as the position, type and orientations are extracted by a feature vector extractor which is used in the minutiae descriptor. The sharp ending of ridge which is present in the fingerprint is called as ridge ending. The endings where the ridge gets divide or deviates in fingerprints are called as ridge bifurcation. The combination of both these characteristics is called as minutiae. The automated Fingerprint identification is a most important biometric method. It automatically verifies and detects the individual's fingerprints. A normal fingerprint recognition method constitutes some vital steps they are extracting features, preprocessing, matching [8],[10] etc. To recognize an element with its storage details a descriptor is used. In this a fingerprint descriptor is used to recognize and denote a fingerprint image. The descriptor fingerprint was divided into two types they are minutiae based and non-minutiae based. Within these two descriptors a minutia based descriptor is a widely used method to recognize the fingerprints. The fingerprints are matched based on the minutiae features in fingerprints such as ridge ending and bifurcation.

Finger prints are the most dependable shape of identity. Fingerprints are constantly particular and permanent. They are formed during fetal growth and while the man or woman grows the fingerprints gets bigger, then they remained unchanged till death, except barring injury.

For over a century law enforcement and border control were using this fingerprint to discover the criminals from the latent impressions they have got left in the back of at crime scenes. Of direction the most effective manner for the criminals is to wear gloves in order to avoid leaving identifiable finger prints. But a few criminals have taken an extreme measure with the aid of bodily deforming their prints.



The extreme measures taken by the criminals are making surgery, burning, or applying acid to destroy the papillary ridges, so that the law enforcement can't identify the criminal by their fingerprints. Some have even used plastic surgeons as shown in fig 1 (a), (b), (c) and (d).



Fig: 1(a) Transplanted from foot (b) Bitten (c) Burnt with acid (d) Surgically altered

In the long run, these efforts are typically inadequate because this harm is in and of itself, specific but the burns or cuttings transect the friction ridge pores and skin is as particular because the natural ending ridges and bifurcation examiners usually rely upon to make identifications. As you consider, this conduct is uncommon so finding a suspect with altered fingerprints is relatively suggestive that they're involved in criminal interest.

One of the quantity one makes use of distorted fingerprints is to mask one's individual characteristics. Observe that altered fingerprints square measure exclusive from pretend fingerprints. Fake palms is made up of glue, latex, or polymer, and it's a properly publicised methodology to bypass fingerprint systems. Altered fingerprints square measure real hands which might be accustomed conceal one's own identity in order that you'll be able to keep one's distance from their identity with the help of a biometric system, when an individual use pretend hands solely to undertake each different identification.

According to the Jian Feng, Anil K. Jain, Arun Ross [15], the popular coaching of laptop-driven Fingerprint Identification systems (AFIS) in social control and border administration functions has precipitated some individuals with crook historical past to steer clear of identification through option neutering their fingerprints. Available on the market fingerprint high-quality assessment code cannot find many of the altered fingerprints because the implicit image excellent would not constantly degrade caused by alteration.

Here [16] the methodologies used area unit Automatic extraction, Image pre-processing, advanced Filtering, Certainty map post-processing. The Parameters area unit FVC2002 DB1 information and FVC testing protocol area unit used. A systematic study of the impact of the supply of high-confidence core and delta points on matching performance for time and accuracy has not been tried to this point. A changed graph based mostly matching

formula that may run in time once the reference points area unit on the market. during this paper mentioned for improved singular purpose detection formula supported complexfiltering to extend the accuracy of automatic detection. Find out the position of the singular points are detected by using lots of methods. There are Poincare index and the irregularities then heuristics in fingerprint identification. The fingerprint matching methods are used for fingerprint identification process.

Fingerprints area unit sometimes divided into six main categories [17] per their macro-singularities i.e., arch, tented arch, left loop, right loop, twin loop and whorl. A worldwide feature of fingerprints the orientation field is extremely vital for automatic fingerprint recognition. Fingerprint recognition system consists of 2 components there area unit process half and matching half, and also the process half in the main includes the effective region segmentation, orientation field estimation, ridge improvement, ridge cutting and trivia extraction. Effective region segmentation is performed the fingerprint image is split into several blocks. A filter bank [3][4] is employed during this to capture data, the knowledge, the data within the specific band pass channels and decompose this information into biorthogonal parts in terms of spacial frequencies. Here the methodologies used area unit the mixture model, world approximation and Gabor filter-bank (64 filters) technique. The Parameters area unit Automatic fingerprint recognition, combination model, world approximation, orientation field, singular purpose.

Once the two fingerprints area unit aligned will match the native structure sure points on the idea of the neighborhood self-satisfied further powerfully than by extracting trivia positions and matching on the idea of the geometric position distribution of the trivia [20]. Also mentioned and current the idea and experimental results for automatic extraction of SPs together with their spacial orientation from the worldwide structure mistreatment complicated filters designed to sight motion symmetries. The 2 filters area unit used there area unit core kind and one for the delta kind symmetry and therefore the filtering is said to complicated pictures.

The performance of fingerprint verification systems has reached a satisfactory level for applications involving tiny databases then the event of algorithms [11][12]for fingerprint identification systems that may search moderately large record for an identical fingerprint. The second is that the texture primarily based approach. For matching it uses texture primarily based methodology and perform well in poor quality prints. It needs correct



alignment of the two prints and not invariant to translation, orientation and non-linear distortion. The minutiae-based approach is that the last approach. In this, the trivia was extracted and hold on in an exceedingly example for matching. Here the Fingerprint recognition, directional field, orientation estimation, singular purpose extraction, principal element analysis, averaged sq. gradient methodology, ancient methodology is used. The parameters in the fingerprint recognition, directional field, orientation estimation, singular purpose extraction, principal element analysis.

III. PROPOSED WORK

The singular points are used in fingerprints to minimize the search space. To detect the change in gradient ridge vector a singular point is used. In the field direction the Singular points is describe as discontinues. A new algorithm was used to evaluate the local ridge gradient. The customized method called squared average gradients is used to detect the path of smooth gradient vectors. The extraction of fingerprint singularity points has three types they are directional image extraction, core and delta extraction and Poincare index calculation. In the singular point detection technique an index Poincare method is used to identify the false minutiae detection. The detection of false minutiae is used in several applications. But this method has to face some limitations like the Poincare method is not able to identify the singular points and the preprocessing method use only a local feature of singular points while matching fingerprints. The main drawback is it did not have the ability to identify the false and true minutiae points due to the smudges, scars and distortion happened in fingerprints. The false singular points is detected as same as the true singular point in the orientation field. To identify the true singular points correctly global information is used in fingerprint identification systems. In dynamic diffusion process the global features are used to extract the fingerprint in fingerprint identification systems.

The singular points are detected by using a feature like differences of the orientation value in a circle and the global features. This method is compare with the earlier methods will result some features. It eradicates the false singular point detection in the fingerprints and the topological relation of the singular points in fingerprint was taken as overall control. And the difference of orientation value in circle contains orientation field. By reducing the difference between field orientation and model field orientation the finest singular points are detected. The

DORIAC method is used for the identification of singular points.

3.1. Feature Extraction

Feature extraction is a new special type of reduction in the form of dimensions. While transforming the input knowledge into the set of options is termed feature extraction. If the options extracted square measure rigorously chosen it is expected that the features set can extract the relevant data from the input file so as to perform the required task mistreatment this reduced illustration rather than the total size input. Feature extraction involves simplifying the amount of resources needed to explain an outsized set of knowledge accurately.

The Enhancement Process removes the ridges discontinuous that would otherwise interfere within the correct location of the singularpoints. The algorithmic rule additionally offer a mask that permits U.S. to distinction between foreground and background regions.

3.2 Region Segmentation

Region Segmentation sub divides an input image into its constituent elements or objects. The level to which the subdivision is carried depends on the matter being resolved. Autonomous segmentation is one of the major difficult tasks in image process. Monochrome images usually or based mostly on the segmentation algorithms for one amongst to the basic properties of grey level values like separation and similarity. The core is currently known as a brand new node n1. The Delta happens as a saddle S1 within the square orientation image. The method of singularpoint detection is currently less to the determination of the points that detect in the finger points. The node and the saddle samples can be created by some mathematical calculation.

$$\frac{\partial u}{\partial x} = \frac{x}{y}, \frac{\partial v}{\partial y} = \frac{y}{x} \quad (1)$$

3.2.3 Minutiae and Ridge Extraction

The minutia extraction is difficult in low image quality image, therefore, other information such as ridge shape and texture could be used to match the fingerprints, although they are not too distinctive as the minutiae. There has been proposed method that explores the ridge feature. In this subsection is presented the extraction of finger code. The finger code is a vector of fingerprint feature obtained by applying a convolution to the original image with a Gabor filter. In this vector are stored the value of the standard deviation of each region.

- Ridge finishing – the abrupt end of a ridge
- Ridge bifurcation – one ridge that divides into 2 ridges



- Short ridge, or freelance ridge – a ridge that commences, travels a brief distance so ends.
- Island – one little ridge within a brief ridge or ridge ending that's not connected to all or any alternative ridges
- Ridge enclosure – one ridge that bifurcates and reunites shortly later to continue as one ridge
- Spur – a bifurcation with a brief ridge branching off a extended ridge
- Crossover or bridge – a brief ridge that runs between 2 parallel ridges
- Delta – a formed ridge meeting
- Core – a reversion within the ridge pattern

3.2.4 Orientation Field Estimation

Also the algorithm used to evaluate the large database of altered fingerprints. Further the proposed algorithm is to examine the fingerprint. Fingerprint recognition refers to automated method for verifying and to identify the person by using their Fingerprints. This system is to handle the problems such as false non-matching and distorted Fingerprints. Distorted Fingerprints are Detected and Rectified by using Novel algorithm and it will also used to detect the malicious users. Malicious users will provide the duplicate and distort finger prints to escape from the identification process.

3.2.5 Orientation Field Approximation

Feature extraction is a new special type of reduction in the form of dimensions. While transforming the input knowledge into the set of options is termed feature extraction. If the options extracted square measure rigorously chosen it is expected that the features set can extract the relevant data from the input file so as to perform the required task mistreatment this reduced illustration rather than the total size input. Feature extraction involves simplifying the amount of resources needed to explain an outsized set of knowledge accurately. Then, the cosine and circular function aspect of the doubled orientation at $\delta x; yP$ can be diagrammatical by way of polynomials of order n :

$$g_c^n(x, y) \triangleq \cos 2\theta(x, y) = \sum_{i=0}^n \sum_{j=0}^i a_{i,j} x^i y^{i-j} \quad (2)$$

$$g_s^n(x, y) \triangleq \sin 2\theta(x, y) = \sum_{i=0}^n \sum_{j=0}^i b_{i,j} x^i y^{i-j} \quad (3)$$

Where $a(i,j)$ and $b(i,j)$ are the polynomial coefficients for $g_c \delta x; yP$ and $g_s \delta x; yP$, respectively. For simplicity, it represents (1) and (2) in matrix kind:

$$g_c(x, y) = x^T a, g_s(x, y) = x^T b \quad (4)$$

3.2.6. Singular core and delta point location

It depends upon the observation that the singularities equivalent to the loop, whorl and delta presumptuous the values are 90, 180 and 360 respectively. These area unit terribly closely to discover the false singularities in calibre pictures. The core points area unit placed by deciding the position of the utmost worth within the certainty maps. The core and delta points area unit accepted as long as the worth of the response crosses a precise threshold value. The detection of the secondary core and delta may be a more difficult downside. A straightforward thresholding on the response of the secondary peak within the certainty map was found to be terribly ineffective resulting in plenty of spurious detections. So as to get rid of such false positives here add the following observations:

- The second core has associate degree orientation that's nearly opposite to the first core and
- The second delta has nearly a similar orientation because the primary delta. The worth of the second outside response area unit changed victimization the weighing terms.

The singular purpose therefore detected by the algorithmic rule was thought about to be false if the position were quite thirty pixels from verify location as marked manually. The metrics area unit rumored at the minimum total error rate (FAR+FRR of the core detection).

Following a counterclockwise closed contour around a core within the orientation field and adding the variations between the next angles ends up in a additive modification within the orientation of and polishing off this procedure around a delta results. But the additive orientation modification are zero once the procedure is applied to nonsingular points. supported the on top of rules, a tiny low two-dimensional filter is developed to extract all singular points, as well as some false singular points caused by irregular orientation field. Then some steps area unit any taken to verify the detected purpose and tell whether or not it's a core, a delta or a false singular purpose.

IV. EXPERIMENTAL RESULT

For this experiment take 360 fingerprints are taken from NIU staff fingerprints and 40 fingerprints from the HVMHSS Database, which is only used for the proposed methods implementation. The fingerprints in the two different databases are different fingerprints.

The proposed method is valued at two different phases.



- 1) Finger level – It means valued by one finger. It analysis the performance between the original and altered fingerprints
- 2) Discipline level – It means valued by all ten fingers. It represents the competence of making a alternative on between subjects with average fingerprints and people with altered fingerprints.

The structure of ridge in the fingerprint may be very between the boundaries of altered average prints within the mock case. ROC curves of the deliberate algorithmic software and the proposed algorithmic application in step with alteration style. Both blotted out and an identical accuracy of the distorted fingerprints can be detected through the proposed algorithm. At the same time proposed will solely examine blotted out circumstances. However, imitated fingerprints are problematic for each and every algorithm.

With different threshold values the false rejection rate (FRR) and false acceptance rate (FAR) of two systems are calculated and the receiver operating curves (ROC) plotting FAR versus FRR are given in Fig. 2. The percentage of true matchings are as the false rejection rate is defined. (i.e. two fingerprints belonging to a same finger) The matching score of fingerprint is less than the threshold value. The wrong matchings is defined as the percentage of the false acceptance (i.e. two fingerprints belonging to different fingers) with the matching score more than the threshold.

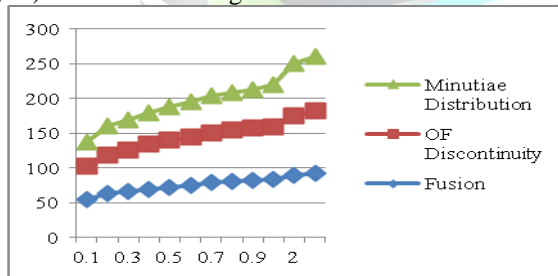


Fig 2 Mythical Creature Curves

The given set is compared with rulebased method with the pparameter core and delta. It is manually set the points with the help of the Poincaré Index-based method, singular points method. It is labeled as true or spurious and then used for the database set. The singular points of all of the fingerprints in the testing database are manually labeled before hand to obtain ground truth. For a manually set the core and delta for the ground truth the singular point, p_x and p_y are detected. The singular point p_x and p_y , satisfies $t_{\frac{1}{4}}, t_0$, where t_x & t_y is refered a s $x < j < 5$ (pixels), and $j_y - y$

$< j < 5$ (pixels), it is said to be naturally detected and, otherwise, it is called a altered one. The detection rate is defined as the ratio of truly detected singular points. The miss rate is defined as the ratio of the number of missed singular points. The sum of detection rate in the FAR and miss rate in FRR is 1 or 100 percent. The false alarm rate is defined as the number singular points which falsely occurred vs the number of all natural singular points as shown in the Table 1 and 2.

Detection Rate	Proposed	Rule Based
Singular Point	96.10	93.02
Delta	95.18	90.19
Core	96.98	89.45
Fingerprints	88.88	80.23

Table 1 Table for Detection Rate

False Rate	Proposed	Rule Based
Singular Point	4.30	5.67
Delta	2.27	4.32
Core	3.43	4.54
Fingerprints	10.12	18.97

Table 2 Table for False Rate

To give a completely analysis of the altered and fake fingerprint, also compare the proposed algorithm with that of rule based algorithm. The comparison results are listed in Tables 1 and 2. The proposed algorithm has a better performance as shown in the experimental result. The proposed algorithm has a higher detection rate and lower false alarm rate for singular points cores and deltas, and a much higher correct rate for whole fingerprints. Based on these results, this algorithm shows a satisfactory performance for real applications.

V. SUMMARY AND CONCLUSION

The success of automated fingerprint identification systems has caused some criminals to take extreme measures to ward off identification through sterilization their fingerprints. It is imperative to boost a procedure that may routinely to find altered fingerprints. To be had fingerprint great management computer code modules weren't designed to inform apart altered from average fingerprints. It has developed an algorithmic rule to robotically to find altered fingerprints. The underlying notion is that altered fingerprints regularly show uncommon ridge patterns. A collection of elements is extracted from the ridge orientation subject and so a support vector classifier is employed to classify the fingerprint as typical or altered.



The proposed algorithmic rule used to be established victimization altered fingerprints synthesized in methods that by and large found out in operational circumstances and a bit variety of obtainable real altered fingerprints. It have not yet concept-a few imperative clue for detection altered fingerprints, namely scars, which ordinarily appear on the cuts on finger dermis. It's currently functioning on combining orientation area and scar information to extra beef up the detection cost of altered fingerprints. In this paper focused on the main detection of the method singular points in fingerprints. The contributions about this paper in to the real world especially Police department. This papers act as two main areas.

- 1) This paper creates a new method with the help of DORIC [5], in addition to the Poincaré Index algorithm. It is successfully remove the fake detection.
- 2) A global parameter and relations of singular points is proposed for the algorithm using the finger prints in orientation field. The optimal singular points can be selected and by minimizing the difference between the original orientation field.

Here the experimental results show that this proposed algorithm is effective for singular point detection for the altered and fake fingerprints. It present a best report for this methods. The proposed approach in detecting altered and fake fingerprints results shows the probability and compared with the exiting methods. Several approaches are planned for singular purpose extraction and during this paper add additional calculation to closely scan the ridge character like core, delta, ridge ending, island, etc.

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