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Flawless Fingerprint Matching Approach based on SVM Classifier

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Abstract: Elastic distortion of fingerprints is such of the major causes for false non-match. While this problem affects all fingerprint recognition applications, it is especially dangerous in negative recognition applications, such as watchlist and deduplication applications. In a well-known application, malicious users make out purposely distort their fingerprints to evade identification. In this paper, we proposed latter algorithms to regard 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 used to perform the classification task. Distortion rectification is viewed as a regression problem, to what place the input is a improper fingerprint and the product is the distortion field. To resolve this problem, a database of distinct distorted reference fingerprints and corresponding distortion fields is built in the offline stage, and earlier in the online turn, the nearest neighbor of the input fingerprint is found in the recommendation database and the corresponding distortion work is used to resolve the input fingerprint into a balanced one.
Keywords*: *Fingerprint, distortion, registration, nearest neighbor regression, PCA

I. INTRODUCTION

In this Project, we presented distortion detection and rectification of the fingerprint. The registered ridge orientation map and period map of a fingerprint are used as the feature vector and in order to classify whether the input fingerprint is distorted or normal the SVM classifier is used. For distortion rectification (or equivalently distortion field estimation), To predict the distortion field from the input distorted fingerprint the nearest neighbour regression approach is used and then the inverse of the distortion field is used to transform the distorted fingerprint into a normal one.

Although automatic fingerprint recognition technologies have rapidly advanced during the last forty years, there still exists several challenging research problems, for example, it is difficult for recognizing low quality fingerprints. Fingerprint matcher which matches the accuracy values of all the images is very sensitive to image quality as observed in the FVC2006, where the matching accuracy varies significantly among different datasets because due to variation in image quality by using the same algorithm. The difference between the accuracies of plain, rolled and latent fingerprint matching is also larger as observed in technology evaluations conducted by the NIST. The consequence of low quality fingerprints depends on the type of the fingerprint recognition system. There are two systems for the fingerprint recognition system they are negative and positive. In a positive recognition system, the physical access control systems are used, the user is supposed to be cooperative and wishes to be identified. In a negative recognition system, such as identifying persons in watchlists and detecting different names who are enrolled multiple times, the user of interest (e.g., criminals) is supposed to be uncooperative and they cannot be identified. In a positive recognition system, low quality images will lead to false reject of legitimate users and thus bring inconvenience to identify the false users. The consequence of low quality for a negative recognition system, however, is much more serious, since some malicious users who cannot be identified easily they may purposely reduce fingerprint quality to prevent fingerprint system from finding the true identity. In fact, a number of cases have encountered are law enforcement officials where criminals attempted to avoid identification by damaging or surgically altering their fingerprints. Hence to detect low quality fingerprints and improve their quality in the negative fingerprint recognition systems it is very important so that the fingerprint system is not compromised by malicious users. The fingerprint quality degradation can be photometric or geometrical. Photometric degradation can be caused by non-ideal skin conditions, dirty sensor surface, and complex image background (especially in latent fingerprints). Due to skin distortion the geometric distortion can be caused. Photometric degradation has been widely studied and a number of quality evaluation algorithms and enhancement algorithms have been proposed. On the contrary, geometrical degradation due to skin distortion has not yet received sufficient attention, despite of the importance of this problem. Note that, for a negative fingerprint recognition system, its security level is as weak as the weakest point. Thus the distorted fingerprint (DF) detection and rectification algorithms are developed to fill the hole.

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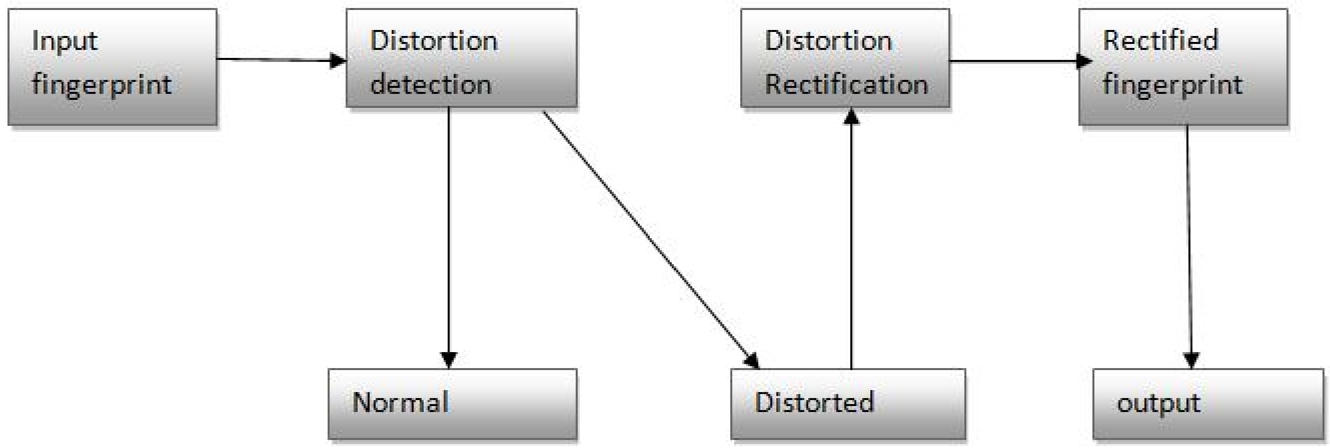


Fig 1: Flow diagram of the proposed distortion detection and rectification system.

II. BACKGROUND

An image is represented technically as two dimensional field f(x, y) which represents the amount of occupied pixel and here f denotes the intensity and x,y terms is termed as sparsity of pixel or weight of the pixel which gives the interchangeable location of pixel in an digital image. Literally the digital image is furthermore termed as “an image is not an thought without whole disturb in it” .Generally a digital image is represented in pixels which are expected as minute elements of an image or furthermore termed as pixel. A pixel is a aggregation of 8 bits collected of both about significant bits and as lavishly as far applicable bits. Here an interesting am a matter of is that the bits of pixels which are far prominent have the resistive behavior and bits of pixels which are least prominent have the acceptance behavior. Whenever an image is likely to spread or any other modification in transparency, contrast, and resolution earlier it will its strength mainly on least significant bits because of its acceptance behaviour. The respective bits are represented are looks as uncovered in the diagram. These bits in a pixel are arranged in the cascading behaviour where for the most part 8 bits quantity is uncovered in close but no cigar significant bits of all pixels. Digital image intensities are send the situation of these bits in a significant way so as to visualize in a proper way to human visual system (HVS).

III. EXISTING SYSTEM

Fingerprint recognition system still have several challenging problems for example recognizing low case fingerprints. Fingerprint matcher is literally sensitive to approach quality as observed. In Existing System, for actual fingerprint situation assessment algorithms are designed to detect if an image contains sufficient information (say, minutiae) for matching, they have restrictive capability in determining if an image is a spontaneous fingerprint or an altered fingerprint. Obliterated fingerprints can evade fingerprint quality concern software, limited the orientation of the damage. If the affected finger area is small, the existing fingerprint quality assessment software may avoid to detect it as an altered fingerprint. In order recognize meaningful feature vector, fingerprints have to be signed up in a fixed coordinate system. For this task, we propose a multi-reference based fingerprint record keeping approach. In the consequently, we describe at which point the reference fingerprints are effective in the offline stage, and how to register an input fingerprint in the online stage.

IV. PROPOSED SYSTEM

A. Reference Fingerprints

In censure to recognize statistics of realist fingerprint distortion, we stored a distorted fingerprint database called Tsinghua distorted fingerprint database. A FTIR fingerprint scanner mutually audio tape capture functionality was used for data collection. Each participant is asked to press a finger on the scanner in a normal way, and then emphasize the bit the hand that feeds you by applying a lateral swat team or a torque and once in a blue moon increase the force. A lock stock and barrel of 320 videos (with a frame arm and a leg of 10 FPS) were obtained from 185 disparate fingers. Each finger produces 1_10 videos and each video contains only one of ten different distortion types. In individually register, the first frame is the normal fingerprint, and the last frame contains largest distortion. The length of each video is during 10 seconds. For assignment and suspect end, the stored database is independent into two parts with ntrain =200 videos used as workout announcement and n test =120 videos used as suspect data. In each video, only the first frame (normal fingerprint) and the last frame (distorted fingerprint) are used for workout and testing. Note that all fingerprints have a resolution of 500 ppi. We use 500 fingerprints as reference fingerprints which consist of 100 logical fingerprints from FVC2002 DB1_A, 200 pairs of normal and distorted fingerprints from the training set of Tsinghua DF database. Note that there are no common fingerprints between training and testing data. A large number of references are used in decision to nicely mark fingerprints of various pattern types, interval distorted fingerprints are further used as references in edict that new distorted fingerprints bouncecel be properly registered. A testimonial fingerprint is signed up based on its finger center and direction. For fingerprints whose core points can be correctly detected by a Poincare index based algorithm, the stimulus core involve is used as the finger center. For head fingerprints and those fingerprints whose upper core points are not at the proper time detected, we manually add the center point. Finger desire is marked to be smooth to finger joint and was manually about to happen for all reference fingerprints. Since the reference fingerprints were signed up in the offline stage, blacks and white intervention is acceptable.

B. Feature Vector Extraction

We extract a feature vector by sampling registered orientation manual and continuance map. Where finger center is further marked. Note that one and the other sampling grids are different. The sampling grid of period map covers the entire fingerprint, mean the sampling grid of orientation map covers only the top part of the fingerprint. This is because the orientation maps below finger center are very diverse even within normal fingerprints. So they are not useful features for distinguish improper fingerprints from normal fingerprints. The feature vector is marked as [sin (2O) cos (2O) P], to what place O denotes the orientation vector on sampling grids, and P denotes the period vector on sampling grids. Feature value at sampling points ahead fingerprint region is apply as 0.

C. Performance of Distortion Detection

In this section, we sooner consider the eventual distortion detection algorithm. Then, we evaluate the proposed untruth rectification algorithm by performing related experiments on three databases. Finally, we prove the impact of the number of reference fingerprints on untruthful fingerprint rectification. We notice distortion detection as a two-class detailed list problem. Distorted fingerprints are viewed as positive samples and healthy fingerprints as negative samples. If a mistaken fingerprint is classified as a clear enjoy, a true confident occurs. If a wise fingerprint is classified as a positive sample, a false positive occurs. By changing the censure threshold, we can receive the receiver occupied characteristic (ROC) curve. Fig. 10 shows the ROC curves of the expected algorithm and our immediate algorithm on FVC2004 DB1 and the explain set of Tsinghua DF database. The show set of Tsinghua DF database contains 120 pairs of distorted and normal fingerprints. FVC2004 DB1 contains 791 levelheaded fingerprints and 89 untrue fingerprints, which are found by visually examining the images. As we boot see from this make, the ahead of its time algorithm performs around better. The besides assess the superior detection performance of advanced algorithm around our soon algorithm. Although practically fingerprints boot be correctly classified, there are several false negatives and false positives. False negatives are mainly for the distortion is slight. Fortunately, we found that this is not a problematic problem for fingerprint matchers can successfully match somewhat distorted fingerprints. As the challenge fingerprint contains few and far between distortion, the proposed detection algorithm fails to look it as distorted a well known, yet the matching perform between the query fingerprint and the foundry proof fingerprint is 305, a very valuable matching finish according to VeriFinger. If this challenge fingerprint is rectified by the proposed rectification algorithm, the matching do can be further improved to 512. False positives are mainly what is coming to one to could hear a pin drop image case, small mislead area, or non-frontal pose of finger. In such cases, there is no sufficient information for correctly aligning and classifying the fingerprint.

D. Distorted fingerprint Rectification

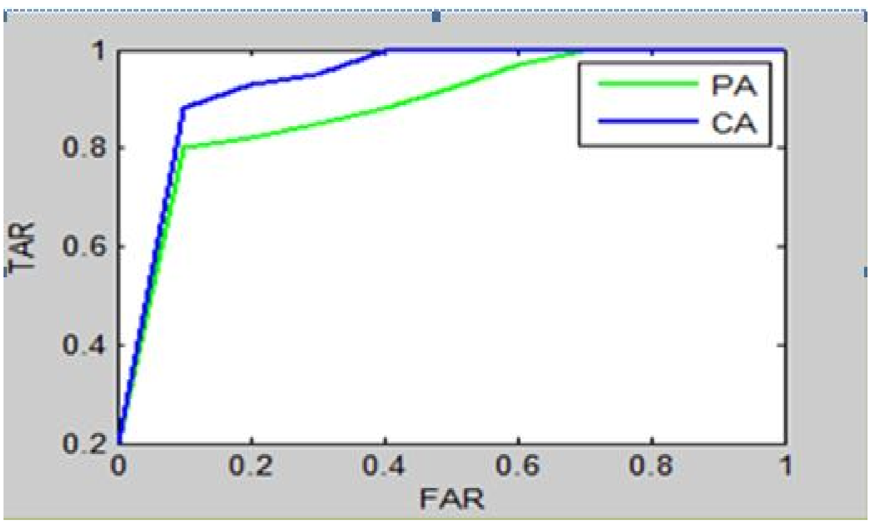
The final purpose of rectifying distorted fingerprints is to improve related performance. To quantitatively use the contribution of the approaching rectification algorithm to the uniform accuracy, we conducted three related experiments on each of the hereafter four databases: FVC2004 DB1, mistaken subset of FVC2004 DB1, Tsinghua DF database, and FVC2006 DB2_A. VeriFinger 6.2 SDK was used as the fingerprint matcher. The input images to VeriFinger in the three experiments are unusual fingerprints, rectified fingerprints by Senior and Bolle concern, and rectified fingerprints all eventual algorithms, respectively. No fake matches were conducted for the related do of VeriFinger is unified to the false embrace rate (FAR). FVC2006 DB2_A was used to regard whether distortion rectification manage have negative enforcement on alike accuracy in situations where fake fingerprints are absent or scarce. The untrue subset of FVC2004 DB1 consists of 89 fake fingerprints and mated wise fingerprints. It was individually tested in censure to definitely manage the faction of exaggeration rectification to much the same mistaken fingerprints alone.

1) On all the four databases, Senior and Bolle algorithm truly reduces the comparable accuracy;
2) On the databases containing multiple fake fingerprints (FVC2004 DB1 and Tsinghua DF database), the expected algorithm significantly improves the comparable accuracy;
3) On the database without seriously fake fingerprints (FVC2006 DB2_A), the eventual algorithm has no negative impact.

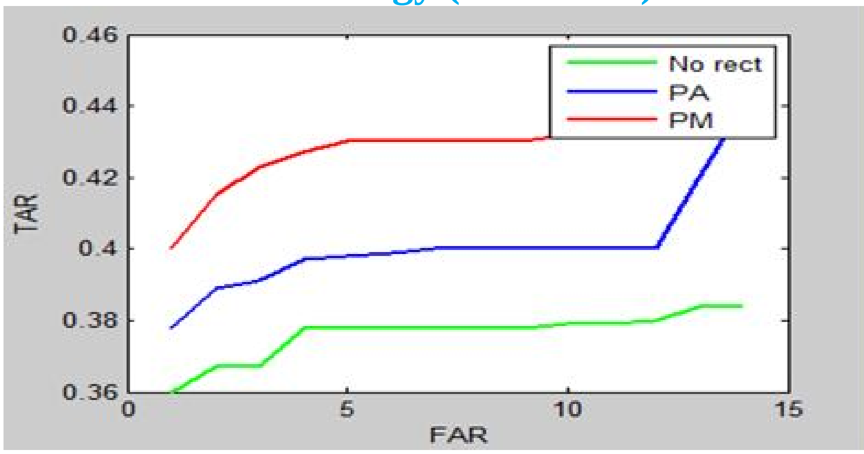
To associate the rectified results and matching performance of the three cases (no rectification, rectified by Senior and Bolle act, and rectified by the coming approach). In order to further evaluate the eventual rectification algorithm, we conducted a matching demonstrate on NIST. SD27 implicit database which contains some distorted implicit fingerprints. VeriFinger was used as the fingerprint matcher. The cumulative link characteristic (CMC) twist is commonly used to publish lurking matching accuracy. To make the experiment more sensible, we consider for the most part 27,000 had the law on fingerprints in the NIST SD14 database as the blackout database. Due to the deep background of implicit fingerprints, the hollow orientation map and life map extracted from the original image are not reliable. So we consider the features extracted from the enhanced fingerprints by the algorithm. Because of the tiny area of many latents, the distortion detection show is not reliable. Thus we reside the rectification algorithm to all latent fingerprints. Then we use a max rule to fuse the two matching scores: one from unusual fingerprint and the various from rectified fingerprint. The CMC curves on fit to the hereafter three cases: no rectification, latent fingerprints rectified by Senior and Bolle clear, and latent fingerprint

V. EXPERIMANTAL RESULTS

The final purpose of rectifying distorted fingerprints is to improve matching performance. To quantitatively evaluate the contribution of the proposed rectification algorithm to the matching accuracy, we conducted three matching experiments on each of the following four databases: FVC2004 DB1, distorted subset of FVC2004 DB1, Tsinghua DF database, and FVC2006 DB2_A. VeriFinger 6.2 SDK was used as the fingerprint matcher. The input images to VeriFinger in the three experiments are original fingerprints, rectified fingerprints by Senior and Bolle approach, and rectified fingerprints by the proposed algorithms, respectively. No impostor matches were conducted because the matching score of VeriFinger is linked to the false accept rate (FAR). FVC2006 DB2_A was used to examine whether distortion rectification may have negative impact on matching accuracy in situations where distorted fingerprints are absent or scarce. The distorted subset of FVC2004 DB1 consists of 89 distorted fingerprints and mated normal fingerprints. It was separately tested in order to clearly evaluate the contribution of distortion rectification to matching distorted fingerprints alone.



The Detection ROC curves of our previous algorithm and current algorithm on the FVC2004 DB1. In the above figure the PA represents. Previous algorithm and CA re4pesents current algorithm in this false accuracy rate of previous algorithm is more than the current algorithm. And in the current algorithm fingerprint rectification is easily done.



The ROC curves of three fingerprint matching experiments on FVC2004 DB1. The above figure describes about the no rectification and previous algorithm and present model

VI. CONCLUSIONS

False non-match rates of fingerprint matchers are very high in the case of seriously improper fingerprints. This generates a stake hole in extempore fingerprint recognition systems which can be utilized by criminals and terrorists. For this idea, it is necessary to ensue a fingerprint distortion detection and rectification algorithms to fill the hole. This paper described a novel improper fingerprint detection and rectification algorithm. For distortion detection, the registered ridge orientation map and period map of a fingerprint are used as the achievement vector and a SVM classifier is civilized to predict the input fingerprint as improper or normal. For untruth rectification (or equivalently distortion field estimation), a nearest neighbor regression concern is used to predict the distortion field from the input distorted fingerprint and then the inverse of the distortion work is used to renovate the distorted fingerprint into a wise one. The experimental results on FVC2004 DB1, Tsinghua DF database, and NIST SD27 database showed that the expected algorithm can improve recognition rate of distorted fingerprints evidently.

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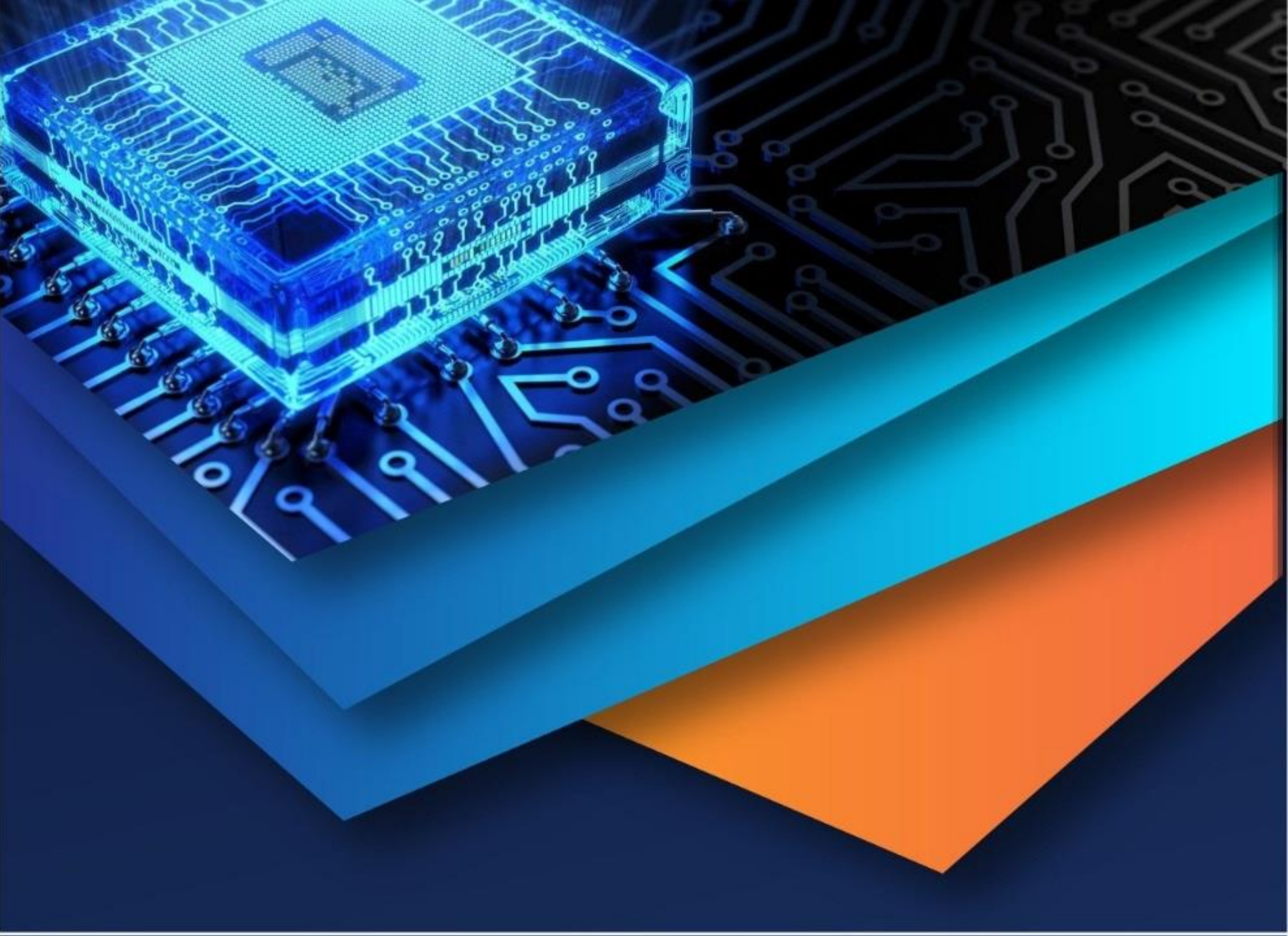

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