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Biometric Identification with Improved Efficiency Using Sift Algorithm

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Abstract: Biometric technologies are automated methods of identification or verification. The shortest identification time is the vital need. The identity of a person is based on behavioral and physiological characteristics. Biometric authentication techniques are generally done by machine generally (but not always). This paper explains increasing the efficiency of a biometric system using SIFT algorithm. SIFT guarantees the highest potential detection efficiency than all other existing techniques.

Keywords: Biometrics, Fingerprint, SIFT, Efficiency, Identification Time.

I. INTRODUCTION

Biometrics has become a crucial need of today's era. It is the science of establishing the identity of person based on physiological or behavioral traits. It is stimulating substitute to traditional validation systems like passwords etc. To enhance the security, we can combine different biometric traits called multi biometrics like face and fingerprint or speech and signature and so on.

Fig 1.Instances of few biometric traits related to any individual (a) Fingerprint (b) Hand geometry (c) Iris (d) Speech (e) Teeth (f) Face

Our main objective is to reduce the identification time and increase the efficiency. And we are working on fingerprint identification using SIFT features. The fingerprint is one of the dominant traits that keeps spreading out due to its uniqueness, acceptability and low cost. Due to high demand on fingerprint deployments, fingerprint database is supposed to contain a huge number of enrolled users. In the large identification deployment, the database size becomes larger and then the identification time will be longer. Due to related system's performance issues, reducing the identification time is a highly demanding issue.

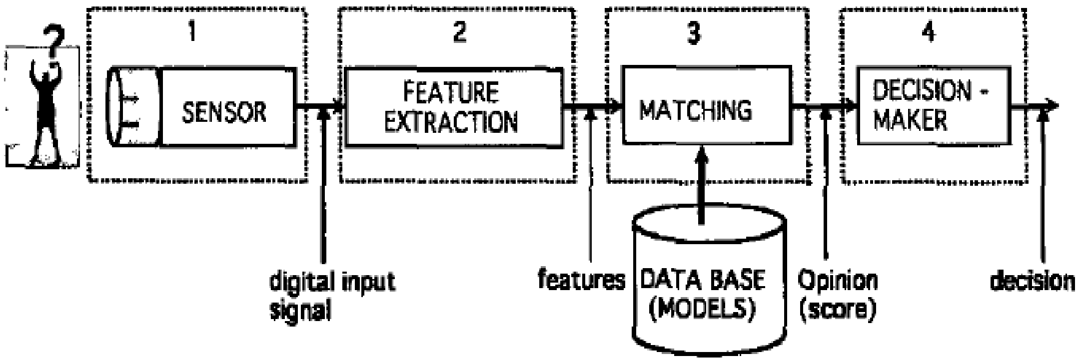


Fig 2.General Scheme of Biometric System

Finally, we apply SIFT for the same. SIFT stands for Scale Invariance Feature Transform. It efficiently extracts reliable features and so it is used to overcome different image degradations such as noise, partiality, and rotations. Since Sift does not need any prior knowledge about traits, the results of the evaluation with SIFT features are expected to show general properties. The authentication of the results is based on correspondence between features of test image and those of original image in the database

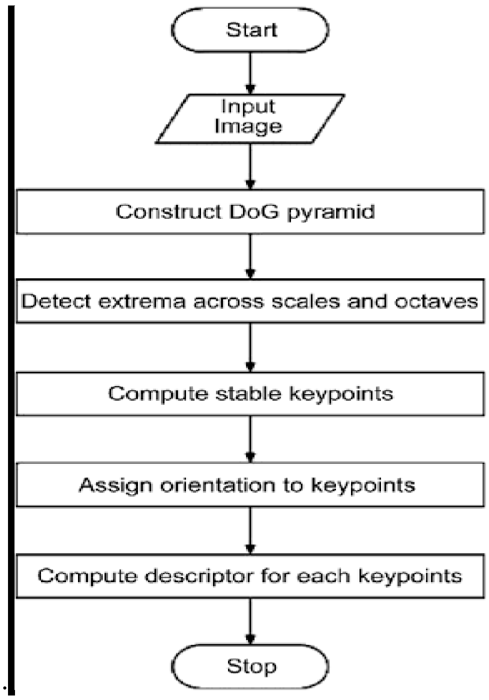


Fig 3 Flowchart of SIFT Algorithm

LITERATURE SURVEY

I. Mouad M.H. Ali et al. (2016) is an overview of current research based on fingerprint recognition. The paper is a brief review of the conceptual and structure of fingerprint recognition. The aim of this paper is to review various recent works on fingerprint recognition stages step by step and gives summaries of fingerprint databases with characteristics.

II. Ali Ismail Awad et al. (2012) proposed a methodology of applying MSM to SIFT features. The processing time and accuracy are reported and compared against the linear search. In the evaluation results, it is confirmed that the number of matching processes is reduced and the error rate is not increased by MSM.

III. Subba Reddy Borra et al. (2016) studied on the different features of fingerprint recognition systems. Broad categories of fingerprint patterns and consequently minutae based method is presented. The different approaches that are based on pattern recognition, wavelet and wave atom are studied. Also, different fingerprint image improvement technology is presented.

IV. Florin Alexandru Pavel et al. (2009) proposed a new technique to reduce the number of key points so as to improve the matching efficiency and recognition performance. In addition, in order to further achieve viewpoint independence for reliable recognition,3D object models are constructed to accurately capture the spatial relationship between features.

V. Aythami Morales et al. (2010) systematically examined the issues related to contactless palmprint authentication and presents performance evaluation on two public databases. Results suggest that SIFT performed much better than the most promising approach OLOF (Orthogonal Line Ordinal Features) employed earlier. Further, the combination of robust feature matching scores along with those from OLOF can be applied to achieve more efficiency.

VI. Jian Wu et al. (2013) This paper systematically analyzed the major members of the SIFT family, including SIFT, PCA-SIFT, GSIFT, CSIFT, SURF, and ASIFT. They are image local feature description algorithms based on scale-space. Their performance is evaluated in different situations: scale and rotation change, blur change, illumination change, and affine change. Because of large computation of SIFT and its variants, they investigated their time consumption empirically in different ways.

VII. Sudhakar .K et al. (2014) This paper explains an efficient method to detect Copy-Move Forgery using SIFT features and the volume of these features is heavily reduced by Chan-Vese's Level Set Approach. Multiple forged object detection, invariant to scale and rotation, high speed, its simplicity in implementation and robustness are some of this method's strengths.

VIII. Ramesh Chand Pandey, et al., (2014) In this paper a new method is proposed which uses SURF and SIFT to detect copy-move forgery in an image based on passive forensic scheme. The proposed method uses SURF and SIFT, which makes it very fast and robust in detecting copy moved regions. Experimental results demonstrate commendable performance in image copy-move forgery detection.

IX. Nagesh Kumar et. al. (2010) has taken the above-used algorithms and their methodology for an efficient multimodal biometric face recognition using speech signal into a new application of plastic surgery. In which speaker identity was correlated with the physiological and behavioral characteristics of the speaker. As well as in this it combined plastic surgery face image and speech information in order to improve the problem of multimodal biometric face recognition system.

II. PROPOSED METHODOLOGY

In this paper, we have used SIFT methodology which can be useful to complete the given problem.

A. Scale-space extrema detection

The first stage of computation searches over all scales and image locations. It is implemented efficiently by using a difference-of-Gaussian function to identify potential interest points that are invariant to scale and orientation. The image is convolved with Gaussian filters at different scales and then the difference of successive Gaussian-blurred images are taken. Key points are taken as maxima/minima of the Difference of Gaussians (DoG) that occur at multiple scales.

B. Keypoint Localisation

Scale-space extrema detection produces too many key point candidates, some of which are unstable. The next step is to perform a detailed fit to the nearby data for accurate location, scale, and the ratio of principal curvatures. This information allows points to be rejected that have low contrast (and are therefore sensitive to noise) or are poorly localized along an edge. This includes interpolation of nearby data for accurate position to accurately determine its position. The initial approach was to just locate each key point at the location and scale of the candidate key point. The new approach calculates the interpolated location of the extremum. The second step is discarding low contrast key points using second order Taylor expansion. And finally the elimination of edge responses. The DoG function will have strong responses along edges, even if candidate key point is not robust to small amounts of noise

C. Orientation Assignment

In this step, each key point is assigned one or more orientations based on local image gradient directions. This is the key step in achieving invariance to the rotation as the key point descriptor can be represented relative to this orientation and therefore achieve invariance to image rotation. One or more orientations are assigned to each key point location based on local image gradient directions. All future operations are performed on image data that has been transformed relative to the assigned orientation, scale, and location for each feature, thereby providing invariance to these transformations.

D. Keypoint Descriptor

Previous steps found key point locations at particular scales and assigned orientations to them. This ensured invariance to image location, scale, and rotation. Now we want to compute a descriptor vector for each key point such that the descriptor is highly distinctive and partially invariant to the remaining variations such as illumination,3D viewpoint etc. The local image gradients are measured at the selected scale in the region around each key point. These are transformed into a representation that allows for significant levels of local shape distortion and change in illumination.

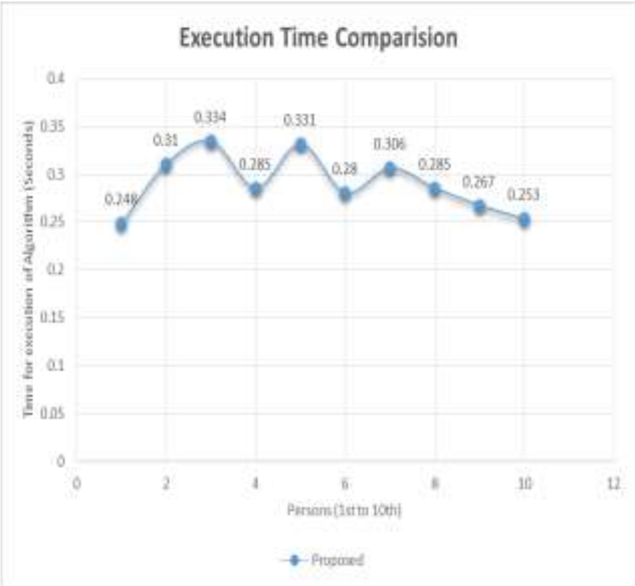
DEVELOPMENT OF THE SIFT ALGORITHM

It is done by applying the following steps in a serial manner:

1. Compilation of different images i.e.80 images (here in this case) and creation of the database.
2. Abstraction of the database made by establishing different features like the difference of Gaussian, metric, scale, orientation.
3. SIFT feature recognition using corresponding computations.
4. Selecting input image that we want to predict.
5. Generation of Tbr file of that specific input image.
6. Now start the mapping of the features of that Tbr file with the stored database.
7. Final result calculation of SIFT function.

III. CONCLUSION AND RESULT

Biometric identification using SIFT features has been developed. The main objective behind this is to increase the efficiency by decreasing the identification time. The average mean square error has also been reduced. As SIFT is one of the popular methods of image matching and object recognition, so it efficiently extracts reliable features and hence is used to overcome different image degradations such as noise, partiality, and rotations. And the plots of efficiency and identification time have been shown.



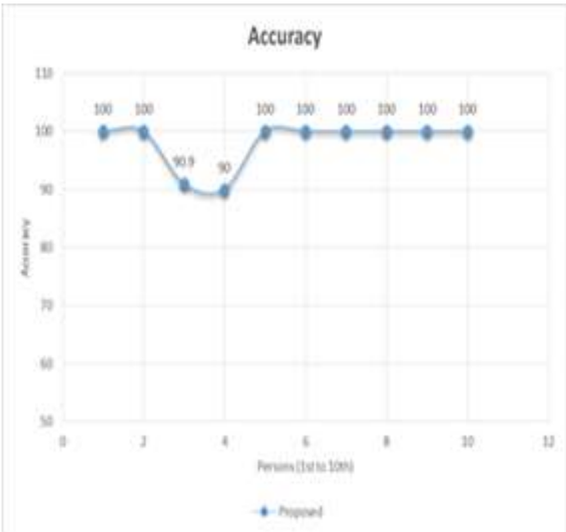


Fig 4.Execution Time and Accuracy plots of first 10 persons

FUTURE SCOPE

As there are numerous weak points in the system, which can be a topic of concern for the future research work. Some of them are listed below as the future aspects:

(a) Currently, there is no adjustment in zoom or direction of the camera during operation.

(b) Present work is considering the case when the fingerprint is made using a white background. However, the use of black background may help in improved efficiency and better response.

(c) To make the system more robust, adaptive binarization may be used.

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