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A Robust Framework for Person Identification using Multimodal Biometrics for Future Technology

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Abstract: ***Now a day's security is very major aspect in every industry and personal life too. Various techniques of biometric are available with extraction of different features. Human body consist of many parts but in which few are very unique. The unique features can help in advanced biometric system development, but in future technologies needs robust and reliable techniques based on multimodal biometric. Hence this paper explains about multimodal robust framework personal identification using facial identity. More number of samples needs more accuracy and fast processing therefore deep learning with optical character recognition may use for this. The proposed system includes raspberry pi with python libraries and advanced packages. After execution of this personal identification using advanced tools a unique method with effective and efficient results appears. This paper helps to find the work done in this area and proposed system with hardware configuration setup details.***

Keywords: Personal. identification, Multi. modal biometrics, face. recognition, finger. print recognition, matching.

I. INTRODUCTION

The biometric authentication method is very trusted and old method. The finger print, Palm print face recognition iris recognition all are very popular methods. But recently technology is growing very fast in that it is need that each appliance or equipment's should have the provision of authentication. The privacy and authentications are very key feature to protect data and to ensure security. The human body consists of very unique features body parts such as finger, palm, iris, face and speech also. But high level security and privacy need robust frame work for data security. Fig: 1 describe the different biometric style that can be used for personal identifications. But the future technology needs more number samples and more data base, once the data base and sample increases it becomes very difficult to analyze.

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The Artificial intelligence and deep learning may help to overcome this problem.

Fig: 1: Types of Biometrics

The raspberry pi board is available with advanced features and advanced libraries that will help to make system efficient.

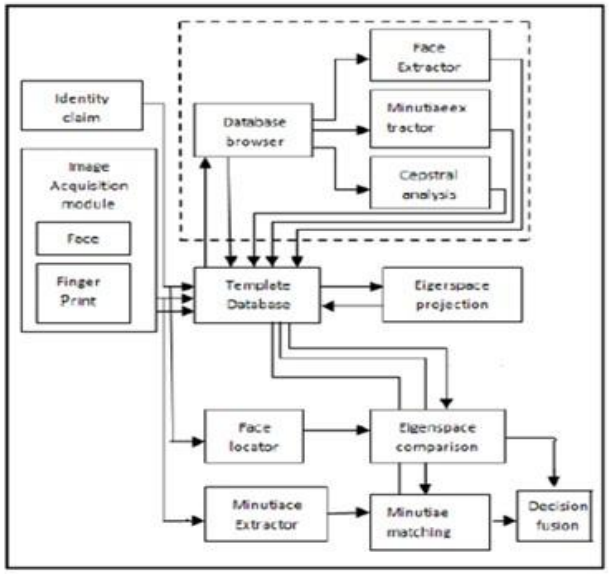

Fig: 2: Working of face recognition system [1]

Fig: 2: explain the working of face recognition system step by step from extraction to decision for personal identification.

II. RELATED WORK

(Xu 2015) proposed a novel image-based totally linear discriminant evaluation (IBLDA) to fuse biometric traits of the same subject in a matrix at the function stage. IBLDA initially integrates a subject's two biometric traits into a complex matrix and directly extracts low-dimensional functions for integrated biometric tendencies. The advanced multimodal biometric device possesses many unique qualities, starting from using principal issue evaluation and Fisher's linear discriminant techniques for character matchers (face, ear, and signature) identification authentication and utilizing the radical rank- degree fusion to consolidate effects from diverse biometric matchers.

(Gables et al. 2018) discuses a fusion at the feature level as follows: (i) For face - fusion of PCA and LDA co-efficient; and fusion of LDA coefficients similar to the R, G, B channels; (ii) feature degree fusion of face and hand modalities.

(Robust Iris and Fingerprint Biometric Fusion in Multimodal Feature Template Matching 2019) presented a template-degree fusion algorithm based on iris and fingerprint tendencies which worked on a unified biometric descriptor for a progressive multimodal biometric identification system. A frequency-based totally codifying method brought about a homogenous vector of fingerprint and iris data.

1. Input Biometric picture (palm print and finger print in this study). 2. For palm print - functions like line, texture is extracted and line and minutiae functions for fingerprint. 3. Features are fused (wavelet records fusion) and feature set is reduced. four. Image classified primarily based on Nearest neighborhood algorithm with distance calculation. five. (Shaikh and D.Kolekar 2017).

The primary benefit of feature- level fusion is detection of correlated function values generated by means of one of a kind biometric algorithms and, also identifying a salient capabilities set that improves reputation accuracy. Eliciting this selection set requires use of dimensionality reduction methods and, consequently, characteristic-level fusion assumes that a big variety of training facts is available. (Karmakar and Murthy 2013).

(Robust Iris and Fingerprint Biometric Fusion in Multimodal Feature Template Matching 2019) proposes a brand new approach in biometric authentication via fusing palm print and fingerprint with a green dimensionality reduction after function fusion. Feature extraction makes use of 2D Gabor clear out; stationary wavelet transforms and principal component analysis to extract the texture, line and appearance based totally capabilities respectively. These are concatenated for feature fusion, however dimensions of fused feature template become big and so are hard to fit rating computations.

The common problem such methods include noise effects, computational complexity because of huge characteristic units; difficulty in matching, and rotation variance. (Grigoriev 1999)

The blended characteristic vectors are classified the usage of SVM. SVM is useful for information classification. Classification generally involves training and testing data having some facts instances. Each set instance has one target fee and many attributes. To keep away from high computation, a kernel is introduced as the algorithm makes use of simplest the inputs of scalar products. Classification is solved through converting the problem into a convex quadratic optimization trouble with a unique solution being received because of convexity. (M. and H. 2015).

III. PROPOSED MODEL

A. Face recognition as biometrics under multimodal applications:

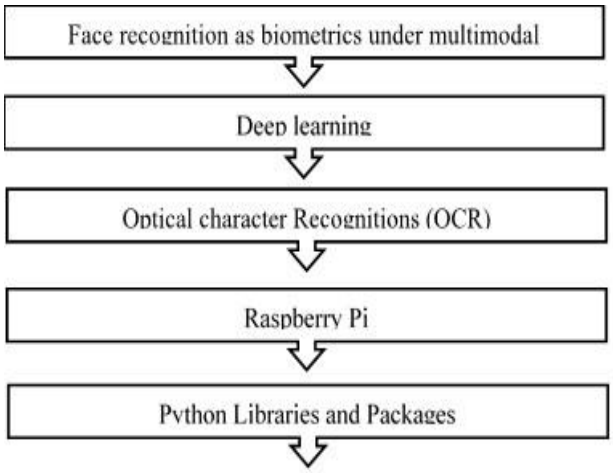

Fig: 3: step for implementation

From detection to recognition of face samples, these computer vision used under applications of facial applications examples.

B. Deep Learning

The intersection of computer vision and deep learning is arguably the foremost popular subfield of computing. It also happens to be one among my favorite topics to write down about! inspect these deep learning methods.

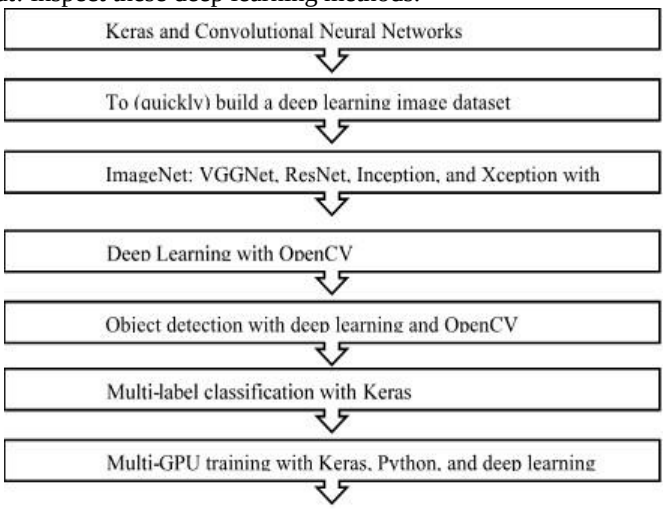

Fig 4: Steps in deep learning

C. Optical. Character Recognition (O C R)

OCR is that the process of automatically detecting and recognizing text, including characters, letters, and digits, in images. ask these tutorials if you're curious about OCR. CBIR and Image Search Engines: Content-Based Image Retrieval (C B I R) is that the process of building image search engines.

Raspberry Pi:

The Raspberry Pi may be a versatile piece of hardware, specifically applied to computer vision. inspect the subsequent Raspberry Pi + computer vision examples.

Raspberry Pi Face-Recognition using OpenCV on the Raspberry Pi
Real-time object/point detection using deep learning and OpenCV
Surveillance in home and detection of motion using the Raspberry Pi, and Python language,
OpenCV library, and Dropbox-Keras with deep learning tool on the Raspberry Pi
Raspberry Pi: landmarks of Facial + detection drowsiness with OpenCV and dlib

Fig 5: working on Raspberry Pi

Raspberry Pi in detection:

Deep learning object detection method using OpenCV
Deep learning with the Raspberry Pi board using OpenCV library
Common errors in the Raspberry Pi and camera module of it
Numerous cameras and the Raspberry Pi and OpenCV

Fig 6: Deep learning with OpenCv

Block Diagram:

Staring with taking input frames from our Raspberry Pi, here workflow consists of faces detecting, finding embedding's, and comparing the vector with the database via a voting technique. Open faces CV, d faces lib, and face recognition are required for this face recognition method

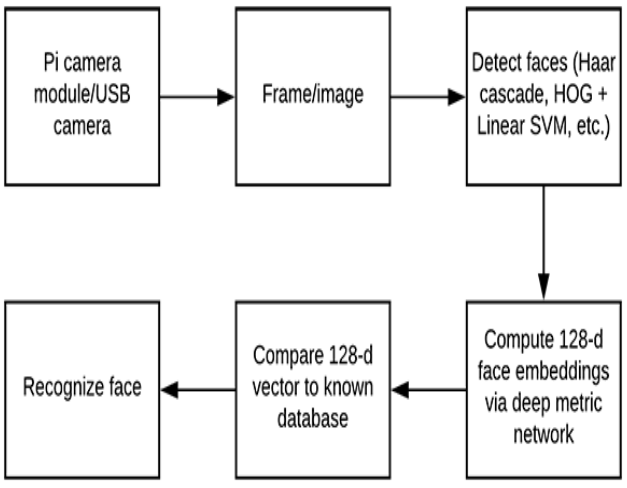

Fig 7: Step in face recognition

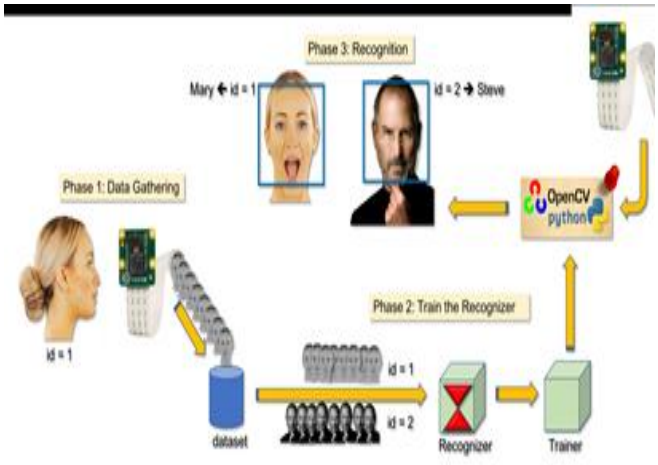

Fig 08: Example of face recognition

(https://towardsdatascience.com/)

D. Python Libraries and Packages

These are the pc vision and deep faces learning Python faces packages. It

is by no means an exhaustive list, but it includes the first libraries

1. Open.CV: Computer vision library widely used and with high efficiency. Mostly suitable for image processing.
2. Imu.tils: Suggested for the helper functions and it make compatible with Open.CV
3. D.lib: Execution of state-of-the-art under C.V and M.L algorithms specially for face recognition.
4. Scikit. learn: ML in the Python. easy. Effective and efficient., simple to use as API.
5. Scikit image: algorithms collection for image-processing under face recognition
6. Tensor-.Flow: Open source library for machine learning tool. Mostly compatible with neural networks, deep learning, and as a backend for Keras for computation.
7. Ke.ras: High-level NN, API, codes making, training neural networks and organizing. Extremely simple with its scikit-learn method A.PI.
8. Mx.net: A accessible deep learning framework. Enormously quick and efficient. Adept of scaling in multiple GP.Us and numerous .machines.

IV. RESULT AND DISCUSSION

(False. Rejection. Ratio) F.R.R:

The final Cascade. classifier is trained on 1000 samples faces and 1000 non-faces samples from the training set and therefore the final Cascade classifier has 9 stages. While testing on 420 remaining sample of faces and other 1000 non-faces from the training sample set, the detector effectively detects 420 faces and mis. classifies 0 non-faces. The false. negative rate is below 1% and therefore the false-negative rate is zero. The results shown at Figure 11, therefore, when testing on the C.MU Test Set with 470 faces of samples and 1000 non-faces samples, 17 non-faces are classified as faces, which yields a reasonably low false. positive rate of 2%,

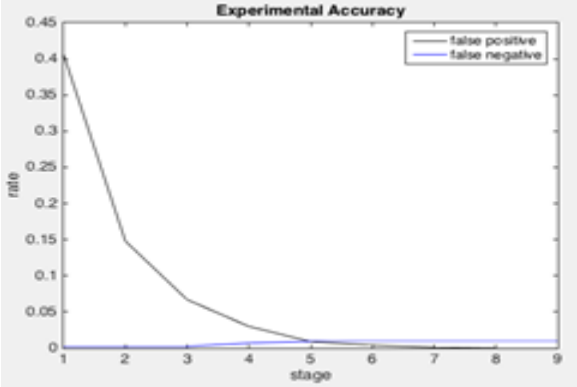

Fig 11. Testing on training data

but the detector not find 270 faces which shows a false. negative rate up-to 50% and 30% detection rate. The result's shown at Figure 11

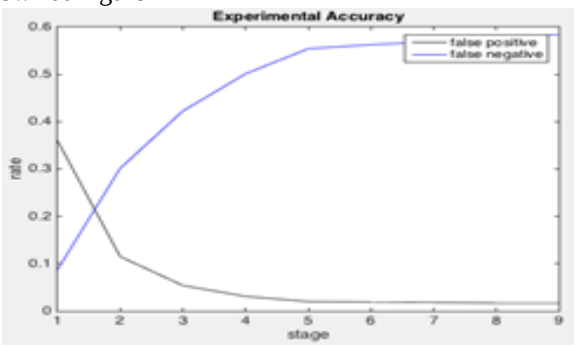

Fig 12. Testing on subset of CMU Test set

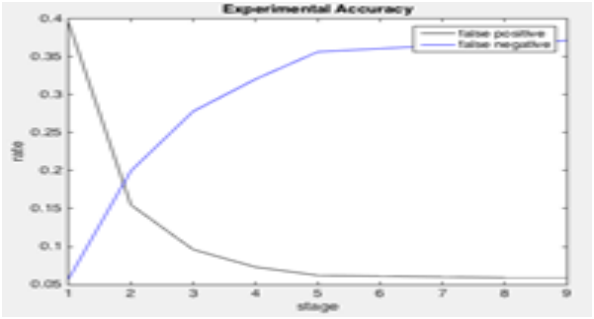

Fig 13. Testing combined classifier on CMU Test set

When testing with the last classifier by merging the cascade. classifier and S.VM classifier on an equivalent 471 faces of sample and 1000 non-faces sample data sets, the detection rate improve from 40% to 90% (approx) also the false positive rate also increases from 2% to 6% (approx). As shown in Figure 8, the final results, the mixture of Ada.Boost+ Cascade and HO.G+ SV.M successfully increases the performance by a 20% increase in detection rate but also with a trade.off of a 5% increase in false-positive rate, which is comparatively acceptable. The test Classifier script contains the code for testing all the classifiers.

V. CONCLUSION

The improving count of criminal-attacks, effective with trustable personal. identification has become an important requirement of these days. The previous method of cryptographic methods couldn't be useful for giant populations. the higher enhancement/improvement of identification can by using the multi. modal biometrics. a replacement way from old methods, personal. identification are often done supported the distinctive physiological/behavioral features of a person's. This multi.modal-biometric system provides enhanced solutions with reliability. Under this paper, it's given a replacement model with advanced features of the multi. modal biometric system using Raspberry. Pi and deep. learning for personal. identification using facial fusion at the match score level, it's an efficient practical solution for the face recognition. The proposed system and hardware are going to be considerably applicable for reducing time in identifying a private. Multi. modal-biometric identifications end in the advantages of accuracy and security.

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