

See discussions, stats, and author profiles for this publication at: <https://www.researchgate.net/publication/343099558>

Multimodal Biometric Authentication System using Deep Learning Method

Conference Paper · March 2020

DOI: 10.1109/ESC148226.2020.9167512

CITATIONS

52

READS

1,846

3 authors:



[Sandeep Singh Sengar](#)

Cardiff Metropolitan University

41 PUBLICATIONS 683 CITATIONS

[SEE PROFILE](#)



[U. Hariharan](#)

Chandigarh University

64 PUBLICATIONS 298 CITATIONS

[SEE PROFILE](#)



[Rajkumar Kotteswaran](#)

SRM Institute of Science and Technology

41 PUBLICATIONS 262 CITATIONS

[SEE PROFILE](#)

Multimodal Biometric Authentication System using Deep Learning Method

Sandeep Singh Sengar
 Department of Computer Science and Engineering
 SRM University-AP, Amaravati
 Andhra Pradesh, INDIA
 sandeep.iitdhanbad@gmail.com

U. Hariharan
 Department of Information Technology
 Galgotias College of Engineering and Technology
 Greater Noida, Uttar Pradesh, India
 *udhayakumarhariharan@gmail.com

K. Rajkumar
 Department of Information Technology
 Galgotias College of Engineering and Technology
 Greater Noida, Uttar Pradesh, India
 rajonline7@gmail.com

Abstract—For specific identification process, Identity Management details an ailment of supplying authorized owners with secure and easy admittance to information and solutions. For choosing the individual's identity, the primary goal is actually executing secured identification feature. PINs, keys, gain access to cards, passwords, tokens are actually the private determining elements which are actually utilized within standard methods which may have a tendency to drawbacks such as cracking, stealing, copying and posting. Biometrics grounded identification is needed having a perspective to stay away from the drawbacks. Due to intra category variants, non-universality, sound as well as spoof strikes are impacted. Multimodal biometrics are actually employed to get rid of the episodes which are actually a grouping of countless modalities. For an authentication supply, Fingerprint and Palmprint identification are popular systems these days. For minutiae thing detection as well as attribute extraction, with this paper, rich neural community (DNN) were definitely projected. The confinements of unimodal biometric structure lead to substantial False Acceptance Rate (FAR) along with False Rejection Rate (FRR), limited splitting up skill, top bound within delivery therefore the multimodal biometric product is designed to satisfy the strict delivery demands. For minutiae corresponding, values of Euclidean distance are actually used. The better identification pace is actually attained throughout the suggested procedure & it's extremely safe only in loud problem.

Keywords—DNN, Biometrics, FAR, FRR, 2D Gabor Filter, Deep Neural Network, Euclidean distance.

I. INTRODUCTION

The zone of unique identification is actually mistreating computer aided devices as a far more protected also progressively impressive way as well as biometrics is actually a standout amidst most reliable characteristics which could be used for specific recognition. For conventional identification method passwords [1,2] ID cards are already used to moderate permission to access restricted methods. Be this since it might, protection could be broken off when an unapproved prospect or maybe fake endeavours to abuse them. Inconvenience with making use of conventional solutions triggered fast increment from the usage of biometrics. Biometrics are actually an instant identification which alludes to a searching of decomposing, estimating as well as evaluating an individual's persona influenced by the social or physiological characteristics associated together with the prospect [3]. You will find two types of biometrics to become Multimodal, Unimodal, and specific. The typical area biometric capabilities are palm prints, hand geometry, discourse designs, iris designs, facial features, and

fingerprints. A biometric confirmation structure works within 2 modes, for instance, enlistment function as well as examine function. Inside enlistment function, the device recognizes an individual by looking the layouts of significant amount of clientele within the data source for a match up. Within the confirmation function, structure approves character of specific by evaluating the found biometric details together with the possession of biometric template(s) that are stored method repository.

Biometric methods that rely on the evidence associated with an one particular wellspring of information for validation are actually labelled as Unimodal method [4]. Unimodal biometric methods endure an assortment of problems, for instance, Commotion within detecting information, Intra class variations, Uniqueness capability. The confinements of unimodal biometric structure lead to substantial False Acceptance Rate (FAR) along with False Rejection Rate (FRR), limited splitting up skill, top bound within delivery therefore the multimodal biometric product is designed to satisfy the strict delivery demands. A biometric os and that is determined by the nearness of several pieces of evidence of specific identification is known as multimodal biometric structure [5]. A biometric os and that is determined by the nearness of several pieces of evidence of specific identification is known as multimodal biometric phone system. It fuses some variety of autonomous biometrics as well as overcomes a percentage on the restrictions created by making use of Unimodal biometric. Multimodal biometrics are progressively important to phony advances, since it's a lot more difficult to generate numerous biometric characteristics when compared with fashioning an one particular biometric trademark hence provides larger accuracy fee as well as from spoofing steps by which makes it troublesome for an interloper to simultaneously spoof the a number of biometric attributes of a real customer [6]. The delivery markers for specific recognition feature include things like False Acceptance Rate (FAR) along with False Rejection Rate (FRR).

False Acceptance Rate (FAR): When the biometric telephone system improperly accepts a gain access to try of an unauthorized pc user is actually recognized as False Acceptance Rate (FAR). A system's FAR says when the ratio involving the variety of phony acceptances as well as variety of identification tries.

$$\text{False AR}(\%) = \left(\frac{FA}{N} \right) * 100 \quad (1)$$

Wherever FA - Lots of incidents of phony acceptances, N - Total amount of samples.

False Rejection Rate (FRR): When the biometric telephone system improperly rejects a gain access to try of an authorized pc user is actually recognized as False Rejection Rate (FRR). A system's FRR states since the ratio in between quantity of phony acceptances as well as variety of identification tries.

$$FRR(\%) = \left(\frac{FR}{N} \right) * 100 \quad (2)$$

FR - Lots of incidents of phony acceptances. N - Total amount of samples. Therefore, the equations (one) as well as (two) are actually utilized for general performance analysis within biometric methods.

With this paper, fingerprint or palm print documents biometrics are actually utilized for multimodal biometric phone system. The characteristics are actually extracted making use of the distinction algorithm Deep Neural Networks (DNN). Minutiae based mostly extraction as well as detection is completed by using Multilayer Perceptron (MLP) as well as Backpropagation Algorithm.

II. PROPOSED MODEL

The suggested method depends upon Multimodal biometrics whereby all fingerprint as well as palmprint biometric is actually used like a wellspring of authentication. Fig. 1 suggests multimodal biometrics of palmprint as well as fingerprint. They're viewed as essentially the most popular, reliable as well as top biometrics. Automated Fingerprint Identification System (AFIS) makes use of methods generally determined by specifics concentrates. Palmprint has edges, central lines, wrinkles, for example, and features by what specifics concentrates could be extricated [7]. Because of abundant floor information fingerprint as well as palmprint are believed to be as incredible techniques to come down with around house identification. Artificial Neural Networks

(ANN), one of several Soft Computing methods [8] used for Multimodal biometric identification.

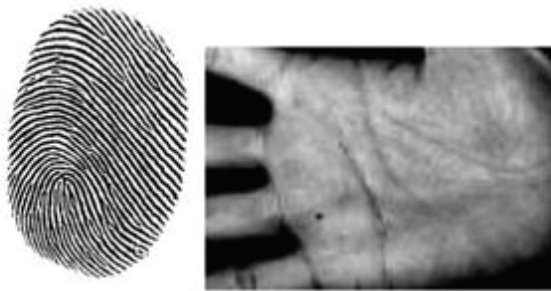


Fig. 1. Multimodal Biometric

A. Image Acquisition

The info impression received is actually for starters standardized to reduce variations to come down with dark dimension esteems on the tips as well as valleys. Histogram feature is actually carried out to enhance the clearness of this picture [15]. Binarization is actually carried out to alter 8 bit dim scope picture directly into twofold picture with zero share for tips as well as one share for valleys. Advantage segmentation is completed to determine advantage finishing, edge department as well as distinguish return on first capital expense. Within that time, the launch treatment is actually

carried out to split up the parallel picture in $w * w$ squares [8]. Fig. 2 shows the information stream chart for picture securing.

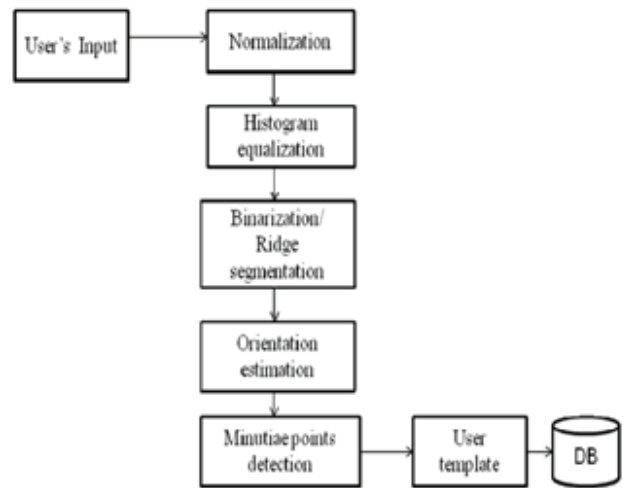


Fig. 2. Flow Sequence of Image Acquisition

B. Feature Extraction

Extraction of appropriate feature of the brother ql is easily the most crucial task. DNN is actually used for element extraction. It's a distinction algorithm which is made up of big amount of neurons (units) interconnected as levels. Information is delivered only one means and possesses absolutely no cycles or even sectors. The information concentrates are actually divided by DNN show in Fig. 3 coming from the edges, valleys, wrinkles [14]. Deep-learning networks and rule lines are actually realized using the much more normal single concealed level neural networks by the profundity of theirs; that's, the volume of hub levels whereby info needs to go within a multistep process of instance acknowledgment. Prior versions of neural networks, for instance, the very first perceptron's had been superficial, produced from 1 info as well as one particular yield level, as well as a maximum of 1 shrouded level within the centre. Several levels (counting info as well as yield) qualifies as "deep" learning [9]. Therefore deeply is not merely a fashionable phrase to affect computations to show up as although they come across Tune and also Sartre directly into organizations you have not understood around just yet. It's a meticulously recognized phrase which suggests greater than a person shrouded level.

Within deep learning networks, every level of nodes preps on an unmistakable plan of spotlights determined by history layer's yield [15]. The additional you progress straight into the neural web, the greater perplexing the spotlights the nodes of yours are able to perceive, as they total as well as recombine spotlights as a result of history coating.

C. Minutiae Detection

Multilayer Perceptron (MLP) strategy is used to distinguish the specifics, regardless of whether it's on advantage department or even edge finishing. It contains several levels, for instance, feedback, covered up as well as yield levels [12]. The networking is actually divided using Back propagation algorithm that is cooking or even mastering algorithm in which a community process is actually done by isolating the picture directly into $3*3$

windowpane square measurement, if the windowpane is actually placed on specifics the self-esteem is actually one or even different zero. If perhaps within pixel worth is actually one and possesses simply 1 one self-esteem neighbor, then simply particulars factor is actually on advantage completing [11]. On the away possibility which center pixel worth is actually one and possesses simply 3 one self-esteem neighbor, then specifics factor is actually on advantage department. With lengthy final, Euclidean splitting up is actually discovered in between specifics concentrates and set away within a repository.

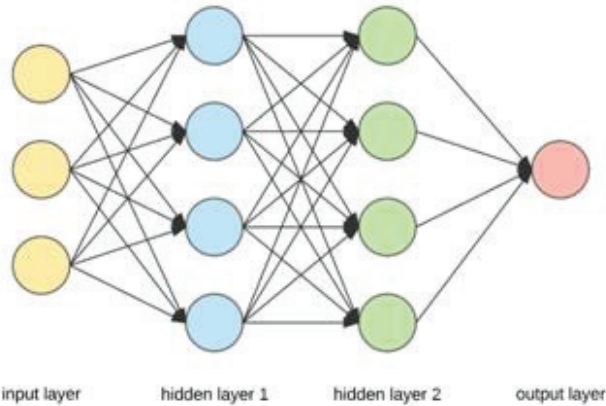


Fig. 3. A Sample DNN

D. Minutiae Matching

Specifics coordinating are actually completed by evaluating the specifics esteems place at bay within data source using the specified info picture. Specifics scores are actually produced having a stove someplace inside all the different zero as well as one. If perhaps the coordinating score is much more noteworthy compared to predefined cap worth, the prospect is actually accredited mostly is a faker [5].

III. SYSTEM IMPLEMENTATION

The structure consists of 2 phase forms: Identification and also Enlistment. Fig. 4 suggests System Design for Particulars Coordinating Based Individual Identification System. Amid enlistment procedure, the prospect enlists equally palmprint as well as fingerprint as character. The functions, for instance, tips, valleys, main collections, lines and wrinkles are actually extricated of specifics concentrates are actually acquired. With, specifics recognition, the information concentrates are actually divided as end as well as bifurcation (edge endings) concentrates [10,11]. At this point together with the information concentrates, the Euclidean splitting up esteems are actually computed and set away inside repository. Amid identification process, fingerprint as well as palmprint are actually procured for identification. Similar process occurs till particulars recognition. With specifics coordinating, the coordinating score esteems are actually computed by evaluating the specifics contained in the specified information and also the camera put away inside repository. The option is performed influenced by the coordinating score. On the away possibility which coordinating score tends to be more noteworthy compared to the advantage worth, the prospect is actually accredited as well as recognized. Another thing, prospect is actually unapproved as well as rejected.

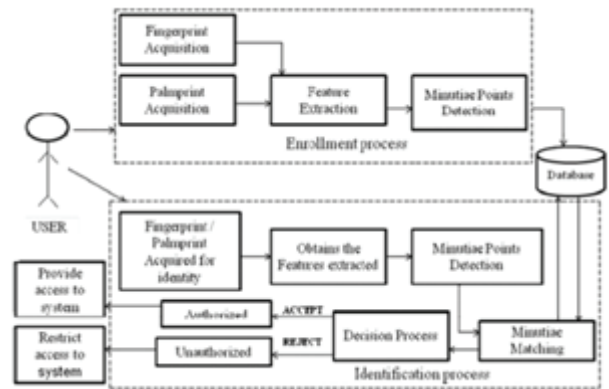


Fig. 4. System Architecture

IV. RESULTS AND DISCUSSIONS

Making use of Matlab, the pictures of all fingerprint as well as palmprint are actually selected and set away within an MS - Access repository. At this point amid the identification process, the pictures are actually packed for picture enhancement in which standardization, histogram getting used to as well as advantage launch are actually performed [10]. With the much better photos, the specifics concentration are actually divided. Within the first coat level the bifurcation as well as advantage endings are actually realized by executing community process. Euclidean splitting up computation is actually performed [13]. The information esteems coordinating are actually completed by computing the scores as well as validation is actually examined. The delivery of Gabor channel switches for both real component as well as fanciful component as much as FAR and also FRR influenced by the amount of assessments. The variations are showing up Table I as well as Table II. The delivery on the suggested means with different limitations, Tar, and they limit the phony accept pace as well as bogus refuse pace is actually been seen [3]. Therefore, the suggested strategy grounded techniques to enhance distinction exactness involving frauds and also genuine clientele the prediction of FAR and FRR shown in Table III.

TABLE I. RELIABILITY MEASURES FOR GABOR REAL PART

No. of Samples	FRR	FAR	ACCURACY
25	1.10	3.0	91.00
125	0.70	2.3	96.23
600	0.02	1.3	97.60

TABLE II. RELIABILITY MEASURES FOR GABOR IMAGINARY PART

No. of Samples	FRR	FAR	ACCURACY
25	1.10	2.0	91.00
125	0.70	1.4	96.23
600	0.02	01.4	97.60

TABLE III. TEST RESULTS ON DESIGNATED THRESHOLD STANDARDS

Threshold Tar	False Accept Rate(%)	False Reject Rate(%)
0.325	0.00	1.46
0.335	0.00	0.81
0.345	0.27	0.55
0.355	0.82	0.55
0.365	2.40	0.29
0.375	5.26	0.11

V. CONCLUSION

Biometrics assumes a crucial task within around house identification. The goal is actually actualizing a secured unique identification device continues to be dependably achieved by techniques for making use of Multimodal Biometrics. Fingerprint as well as Palmprint that are wealthy within floor information achieves top exactness. DNN grounded distinction becomes excellent identification fee. Together the collections, the recommended technique betters noteworthy delivery as well as distinction accuracy within factors that are fresh . The results provide far better accuracy for your offered approach.

REFERENCES

- [1] Shankar, K., Elhoseny, M., Kumar, R.S., Lakshmanaprabu, S.K. and Yuan, X., 2018. Secret image sharing scheme with encrypted shadow images using optimal homomorphic encryption technique. *Journal of Ambient Intelligence and Humanized Computing*, pp.1-13.
- [2] Shankar, K., Elhoseny, M., Chelvi, E.D., Lakshmanaprabu, S.K. and Wu, W., 2018. An Efficient Optimal Key Based Chaos Function for Medical Image Security. *IEEE Access*, 6, pp.77145-77154.
- [3] A.K. Jain, A. Ross & S. Prabhakar, "An Introduction to Biometric Recognition", In: *IEEE Transactions on Circuits and Systems for Video Technology*, Vol. 14, N. 1, pp 4-20, January 2004.
- [4] Sengar, S.S. and Mukhopadhyay, S. (2017). Moving object detection based on frame difference and W4. *Signal, Image and Video Processing*, 11(7), pp.1357-1364.
- [5] Mir. A.H, Rubab .S, Jhat .Z.A," Biometric Verification: A Literature Survey ", *International Journal of Computing & ICT Research*, Vol.05, No.02, December 2011.
- [6] Fawaz Alsaade," Neuro-Fuzzy Logic Decision in a Multimodal Biometric Fusion System", *Scientific Journal of King Faisal University (Basic and Applied Sciences)*, Vol.11, No.02, 2010.
- [7] MuthuKumar .A, Kasturi .C and Kannan .S, "Multimodal Biometric Authentication using Particle Swarm Optimization Algorithm with Fingerprint and Iris", *ICTACT Journal on Image and Video Processing*, Vol.02, No.03, Feburary 2012.
- [8] Sengar, S.S. and Mukhopadhyay, S. (2016). Moving object area detection using normalized self adaptive optical flow. *Optik*, 127(16), pp.6258-6267.
- [9] K.Shanmugapriyal, M.Karthika, Dr.S.Valarmathy, M.Arunkumar "Performance Evaluation of Contourlet Transform based Palmprint Recognition using Nearest Neighbour Classifier" *International Journal of Emerging Technology and Advanced Engineering* Website: www.ijetae.com (ISSN 2250-2459, ISO 9001:2008 Certified Journal, Volume 3, Issue 1, January 2013.
- [10] Sengar, S.S., Mukhopadhyay, S. (2017). Foreground Detection via Background Subtraction and Improved Three-Frame Differencing, *Arabian Journal for Science and Engineering*, vol. 42, pp. 3621.
- [11] SitalakshmiVenkataraman,"A Grid-Based Neural Network Framework for Multimodal Biometrics", *World Academy of Science , Engineering and Technology*,2010.
- [12] Murugan, B.S., Elhoseny, M., Shankar, K. and Uthayakumar, J., 2019. Region-based scalable smart system for anomaly detection in pedestrian walkways. *Computers & Electrical Engineering*, 75, pp.146-160.
- [13] Sengar, S. (2017). Detection of moving objects based on enhancement of optical flow. *Science Direct*, Vol. 145, pp.131-141.
- [14] Uthayakumar, J., Metawa, N., Shankar, K. and Lakshmanaprabu, S.K., 2018. Financial crisis prediction model using ant colony optimization. *International Journal of Information Management*.
- [15] Sengar, S. S., and Mukhopadhyay, S. (2017). Motion detection using block based bi-directional optical flow method. *Journal of Visual Communication and Image Representation*, 49, 89-103.