ISSN: 2249-7196
IJMRR/Sep. 2024/ Volume 14/Issue 7/108-116
Ms. Usha Maheshwari / International Journal of Management Research & Review

CNN-BASED MULTIMODAL BIOMETRIC SYSTEM

Ms. Usha Maheshwari [1], B. Shyamala [2], R Sanjana [3], D. Keerthana [4]

[1] Assistant Professor, Malla Reddy Engineering College for Women (Autonomous Institution) Hyderabad.

[2] [3] [4] Student, Malla Reddy Engineering College for Women (Autonomous Institution) Hyderabad.

ABSTRACT: *Unimodal biometrics is less accurate and safe because to a number of issues, including noisy data, intraclass variance, interclass similarities, non-universality, and spoofing. Multimodal biometrics is employed to get around these issues and boost security. For personal authentication, multimodal biometrics uses data from several sources. As multimodal biometrics are on the cutting edge of unimodal biometrics, they are becoming increasingly popular these days. An introduction to multimodal biometrics is provided in this publication. The general multimodal biometrics block diagram, the multimodal biometric system's modules, the various fusion levels in multimodal biometrics, and related studies are all described in this study.*

INTRODUCTION

Our electronically connected information society is depending more and more on accurate automatic individual authentication to function [1]. Before granting access to resources, a number of systems demand identity verification. For person authentication, fingerprints has long been recognized as a reliable method [2]. As a result of recent technological advancements, biometrics is an emerging method for person authentication. A biometric system uses behavioral traits like voice, writing style, or movement, or physiological traits like fingerprint, face, hand print, iris, etc., to identify or authenticate a person. As long as it meets criteria like universality, uniqueness, permanence, and, ultimately, collectability, any human physiological or behavioral trait can theoretically be used to create a personal identity. Biometric identifiers are unaffected by misplacing, forgetting, guesswork, or easy forging, in contrast to possession- and knowledge-based personal identifying schemes [3]. Examples of biometric systems include voice, face, fingerprint, and palm print recognition. The foundation of traditional individual identification systems is "Something that you have," like a key, or "Something that you know," like a personal identification number (PIN), but the foundation of biometrics is "Something that you are." Real-world biometric applications use unimodal systems [4]. These biometric systems that are

unimodal rely on proof from a single information source to verify a person's identity. While these unimodal fingerprinting systems offer numerous benefits, they also have a number of drawbacks, such as:

- Noisy data: - Because noisy data might result in incorrect rejection, biometric sensors' susceptibility to noise causes improper matching. An International Journal of Signal and Image Processing
- Intra class variation: - The biometric information collected for verification purposes will differ from the information used to create the registration template for a specific person. We call this variance inside a class. A biometric system's false rejection rate (FRR) rises with significant intra-class variability.
- Interclass similarities: - When feature spaces relating to several individuals overlap, it is referred to as inter-class similarity. Significant similarities between classes raise a biometric system's False Acceptance Rate (FAR).
- Non universality: - Some people are unable to give the necessary independent biometric because of illnesses or impairments.
- Spoofing: - Unimodal biometrics are susceptible to spoofing, which is the process of forging or mimicking data. Using a multimodal biometric system, which is based on various sources of information for your own authentication, is the best way to address these issues with unimodal biometric systems.

RELATED WORK

Human Identification in Information Systems: Management Challenges and Public Policy Issues

Human data is used in many information systems. An efficient and successful identification method must be created and maintained in order to consistently link data with specific individuals. The literature on information technology has surprisingly little to say about human identification. aims to address that shortcoming by conducting a survey on human identification and identity. explains methods such as biometrics, names, codes, token- and knowledge-based

identification, and more. finds that the main task facing management is to come up with a plan that is both economically feasible and has a high enough level of integrity to handle the risks the company faces while interacting with its customers. suggests that strategies created to safeguard the organization's interests while granting members anonymity or allowing them to use various identities or pseudonyms be used far more frequently. explains resident registration programs and multi-purpose programs, and it highlights the repeated requests to expand and execute them. Determines matters of public policy. The harm to personal privacy posed by the general-purpose usage of an inhabitant registration scheme is particularly concerning. It is hypothesized that if these techniques are aggressively pursued, the backlash could be severe enough to endanger society.

Multimodal Biometric System using Iris and Inner-Knuckle Print

In the future, multimodal biometric systems will become a universally accepted trend. Compared to unimodal biometrics, multimodal biometrics has various advantages. Among the disadvantages include spoof attacks, noisy data, and non-universality. Compared to a unimodal system, a multimodal biometric system is more precise and efficient. We describe a multimodal biometric identification method in this research that uses the inner-knuckle print of the finger and Iris. This system will perform above expectations with amazing results.

AN OVERVIEW OF MULTIMODAL BIOMETRICS

Because biometrics are so accurate, they are currently displacing current authentication methods. This study presents a novel multimodal biometric system that reduces the data set using multiple computational approaches. Unimodal systems' shortcomings can be addressed by multimodal biometric systems. This method makes use of the facial and fingerprint modalities. Two algorithms are employed in the multi-algorithmic approach for faces: PCA (Principal Component Analysis) and LDA (Linear Discriminant Analysis). Additionally, the crossing number method is used to recognize fingerprints. In order to increase accuracy, both of these modalities are ultimately merged utilizing a sum rule at the appropriate score level. The suggested approach outperforms the unimodal face & fingerprint recognition systems, according to experimental

results. Additionally, the combined multi-algorithmic method and the PCA plus LDA approach are compared in this paper.

Intricacies of Secured Multi-Biometric System

In order to identify people using all of their available attributes, the multi-biometrics method is intended as a security precaution. Research in this exciting field is done to increase an organization's or nation's security. The restrictions associated with uni-modal applications are addressed by the incorporation of multi-modal biometrics into real-time applications. This study aims to examine the drawbacks and compromises associated with the design and evaluation of multi-biometric systems, as well as the advantages of fusion level, integrating techniques, and spoofing detection. To sum up, a comprehensive analysis of multi-modal protected biometrics methods and strategies was conducted to guarantee the integrity of data identification. Future research should take into account a few of the points that were mentioned.

Method and apparatus for calculating an index key

The current invention is related to a tool and a process for figuring out an index key of a template that will be utilized in a database system that uses continuous classification. The template and a group of templates are related by the index key. The template and its corresponding templates within the set on template each consist of several multi-value elements, with each multi-value element having one or more values. The process entails computing a element-based separation metric for every template element within a minimum of one subset of the blueprint elements. This metric is determined by subtracting the value of the corresponding template element from the average template element appreciate that has been calculated for the set of templates. An assessment of the template element's capacity for differentiation determines the element-based distance metric's precision. Creating an index key with several computed element-based distance metrics is another step in the process. Additionally, a system and method for searching for a candidate template within a database system using continuous categorization, as well as a method of supplying an index key of a template included in the system, are related to the invention.

METHODOLOGY

To implement this project, we have designed following modules

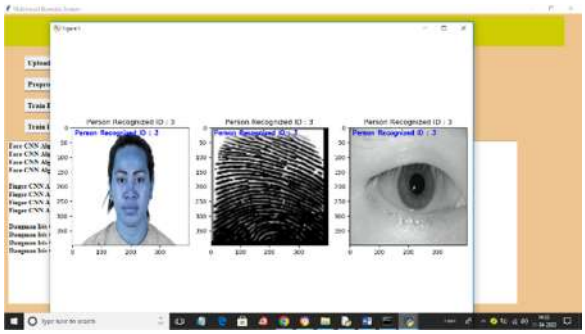
1) Upload Multimodal Biometric Dataset: Using this module, the full dataset with all three distinct iris, face, and finger photos will be uploaded to the application.
2) Preprocess Images: With the help of this module, we will acquire each image, normalize, then shuffle them all to the same size. All face regions will be extracted, and the IRIS region will be extracted from the image using the Daugman algorithm for faces. Following processing, the photos will be divided into instructional and evaluation sets, with 80% of the images used for learning and 20% for test.
3) Train Face Model: To create a model, the CNN algorithm will receive 80% of the processed face photos. The trained model will then be applied to 20% of the test data to determine the prediction accuracy.
4) Train Finger Model: To create a model, 80% of processed finger photos will be fed into the CNN algorithm. The trained model will then be applied to 20% of test data to determine prediction accuracy.
5) Train Iris Model: Eighty percent of processed Iris pictures will be fed into the CNN algorithm in order to create a model, which will then be applied to twenty percent of test data in order to determine prediction accuracy.
6) Comparison Graph: This module will allow us to compare the accuracy of each method on a plot.
7) Multimodal Recognition System: With the help of this module, we can upload a folder comprising three pictures—a face, a finger, and an iris. CNN will identify the person after analyzing all of those photos.

RESULT AND DISCUSSION

In above screen click on 'Upload Multimodal Biometric Dataset' button to upload dataset to application

In above screen CNN face training completed and we got its accuracy as 100% on test and we can see other metrics also. Now click on 'Train Finger Model' button to train finger CNN and get below output

In above graph x-axis represents biometric algorithm names and y-axis represent accuracy and other metric in different colour bars. From all algorithms Face CNN model got high accuracy. Now click on 'Multimodal Recognition System' to upload folder with face, iris and finger like below screen



In above screen from all images person ID is recognized as 3 and similarly you can upload and test other images

CONCLUSION

It has been noted that multimodal biometrics represents the future of unimodal biometrics since it solves issues with noisy data, intraclass variance, interclass similarities, nonuniversality, and spoofing that arise with unimodal biometrics. Multimodal biometric systems are widely used for identity verification; nonetheless, there are still some obstacles in their design, such as selecting suitable modals, determining the best fusion level, and ensuring redundancy in the extracted characteristics.

REFERENCES

[1] R. Clark, "Human Identification in Information Systems: Management Challenges and Public Policy Issues," Journal of Information Technology and People, vol. 7, no. 4, pp. 6-37, 1994.

[2] M. Deriche, "Trends and Challenges in Mono and Multi Biometrics," in Proc. of Image Processing Theory, Tools and Application (IPTA), Sousse, pp.1-9, 23-26 Nov 2008.

[3] A. Mishra, "Multimodal Biometrics it is: Need for Future System," International Journal of Computer Application, vol. 3, no. 4, pp. 28-33, June 2010.

[4] M. S. Ahuja and S. Chabbra, "A Survey of Multimodal Biometrics", International Journal of Computer Science and its Applications, pp. 157-160.

[5] M. Golfarelli, D. Maio and D. Maltoni, "On the Error-reject Tradeoff in Biometric Verification Systems," IEEE Trans. on Pattern Analysis and Machine Intelligence, vol. 19, no. 7, pp.786-796, July 1997.

[6] A. Ross and A. Jain, "Information Fusion in Biometrics," Journal of Pattern Recognition Letters, vol. 24, pp. 2115-2125, 2003.

[7] V. Mane and D. Jadhav, "Review of Multimodal Biometrics: Applications, Challenges and Research Areas," International Journal of Biometrics and Bioinformatics (IJBB), vol. 3, no. 5, pp. 90-95, 2009. Signal & Image Processing : An International Journal (SIPIJ) Vol.4, No.1, February 2013 63

[8] K. Delac and M. Grgic, "A Survey of Biometric Recognition Methods," in Proc. of 46th International Symposium on Electronics in Marine (ELMAR), Zadar, pp. 184-193, 16-18June 2004.

[9] D. Kisku, A. Rattani, P. Gupta and J. Sing, "Biometric Sensor Image Fusion for Identity Verification: A Case Study with Wavelet-Based Fusion Rules Graph Matching," in Proc. of IEEE Conference on Technologies for Homeland Security, HST '09, Boston, pp. 433-439, 11-12 May 2009.

[10] S. Hariprasath and T. Prabakar, "Multimodal Biometric Recognition using Iris Feature Extraction and Palmprint Features," in Proc. of International Conference on Advances in Engineering, Science and Management (ICAESM), Nagapattinam, pp. 174-179, 30-31 March 2012.

[11] A. Kumar, M. Hanmandlu and S. Vasikarla, "Rank Level Integration of Face Based Biometrics," in Proc. of Ninth International Conference on Information Technology: New Generations (ITNG), Las Vegas, pp. 36-41, 16-18 April 2012.

[12] S. Jahanbin, Hyohoon Choi and A. Bovik, "Passive Multimodal 2D+3D Face Recognition using Gabor Features and Landmark Distances," IEEE Trans. on Information Forensics and Security, vol. 6, no. 4, pp. 1287-1304, Dec. 2011.

[13] T. Murakami and K. Takahashi, "Fast and Accurate Biometric Identification Using Score Level Indexing and Fusion," in Proc. Of International Joint Conference on Biometrics (IJCB), USA, ,pp. 978-985, 2011.

[14] Y. Zheng and A. Elmaghraby, "A Brief Survey on Multispectral Face Recognition and Multimodal Score Fusion," in Proc. of IEEE International Symposium on Signal Processing and Information Technology (ISSPIT), Bilbao, pp. 543-550, 14-17 Dec 2011.

[15] N. Gargouri Ben Ayed, A. D. Masmoudi and D. S. Masmoudi, "A New Human Identification based on Fusion Fingerprints and Faces Biometrics using LBP and GWN Descriptors," in Proc. of 8th International Multi-Conference on Systems, Signals and Devices (SSD), Sousse, pp. 1-7, 22-25 March 2011.

[16] P. K. Mahesh and M. N. S. Swamy, "A Biometric Identification System based on the Fusion of Palmprint and Speech Signal," in Proc. of International Conference on Signal and Image Processing (ICSIP), Chennai, pp. 186-190, 15-17 Dec. 2010.

[17] M. Hanmandlu, A. Kumar and V. K. Madasu, " Fusion of Hand Based Biometrics using Particle Swarm optimization, " in Proc. Fifth International Conference on Information Technology: New Generations (ITNG), pp. 783-788, 2010.

[18] A. Yazdanpanah, K. Faez and R. Amirfattahi, "Multimodal Biometric System using Face, Ear and Gait Biometrics," in Proc. of 10th International Conference on Information Sciences Signal Processing and their Applications (ISSPA), Kuala Lumpur, pp. 251-254, 10-13 May 2010.

[19] F. A. Fernandez, J. Fierrez and D. Ramos, "Quality-Based Conditional Processing in MultiBiometrics: Application to Sensor Interoperability," IEEE Trans. On Systems, Man, And Cybernetics—Part A: Systems and Humans, vol. 40, no. 6, pp.1168-1179, Nov. 2010.