COMBINING BIOMETRIC MODALITIES FOR PERFECT IDENTITY RECOGNITION AND EFFICACIOUS AUTHENTICATION

P. Bhargavi Devi¹, Dr. K. Sharmila²
¹Research Scholar, Department of Computer Science, VISTAS, bhargavimowly@gmail.com
²Research Advisor and Associate Professor, VISTAS, Chennai, sharmila.sc@velsuniv.ac.in

ABSTRACT

Setting up security for resources and physical properties these days are simply not adequate, it is likewise similarly cardinal to upgrade the realness of a person. In neoteric times, this personality security and legitimacy are impelled through the qualities and deportment of the person. Biometric modalities assume a huge function in effectuating and increasing the real security for an individual. The example acknowledgment framework which this area proffers records to different usage associative to the handling and upgrade of a picture. In spite of the fact that it is tremendous and well known among immense applications and functionalities, the work heretofore to this examination centers around consolidating the modalities, however the productive pre-handling instruments have been less stressed. This examination has turned the concentrate principally towards animating a novel personality with an enhancement in viably extemporizing the nature of the picture methodology by the combination of two biometric modalities, for example, the unique mark and iris of a person. The way toward blending the modalities additionally involves that the powerful pre-handling to eliminate commotion is effectuated utilizing a solitary level two-dimensional wavelet (DWT) decay consolidated utilizing a Haar wavelet. The Peak-Signal to Noise proportion (PSNR) is distinguished by applying a respective sifting strategy to every pixel in the picture. This PSNR assesses the amount of commotion to flag by processing the mean squared mistake (MSE) and afterward plays out the division of the biggest information incentive to the determined MSE. The last advance uses the converse two-dimensional Haar wavelet (IDWT) patching up the nature of every pixel to get an expanded picture for better component distinguishing proof, acknowledgment and validation. The recreations for this indagation of improved combination is actualized in MATLAB GUI, and the outcomes have been effectively gotten.

Keywords - Biometric modalities, Fingerprint, Iris, Fusion, PSNR, MSE, DWT, IDWT

I. INTRODUCTION

Biometrics is an intriguing pattern recognition domain which expounds the idiosyncrasy using the characteristics that each of the modalities proffer. These modalities have become an integral part of an individual’s quotidian lives, and most importantly an impeccable part of every security system [1], [2]. The modality of an individual can aid in analyzing three cardinal aspects such as: individuality, identification and authentication. The security of a system [5] has three primary components - authentication, authorization, and accountability. The primary component being Authentication, which is rudimentary for any process. In the information technology domain, authentication means either the process of verifying the identities of communicating equipment, or verifying the identities of the equipment’s users which are primarily humans [6]. Biometric modalities play a crucial role in establishing unique identification. Unlike the possessions like the cards and keys, biometric modalities are tangible and those which are physiological and deportment-based. The various biometric modalities through which multifarious indagation are performed are fingerprint, iris, signature, gait, hand geometry, face recognition, voice and keystroke dynamics [1]. These modalities unlike the possession-based security accesses cannot be replicated, forged or stolen. This is the reason that these systems are incorporated in all domains and fields.

www.turkjphysiotherrehabil.org
Although biometric systems have been an enhanced form of augmenting security, they have had their share of disadvantages which are caused due to impairments. If an individual is injured or faces an untoward situation, then these modalities may hold marks which may deter the identification and recognition process. In other ways, these single modality security systems have been breached using various cyber-hacking techniques. Therefore, in recent times the multimodal systems have been developed to encourage the use of modalities for secure transactions and working, to enhance the security and authentication process. The multimodal systems have been constructed based on integrating more than one modality, thereby stimulating the origination of a new identity for the individual. This integration helps in deriving unique patterns which are then feature extracted for authentication. Although various modalities have been expounded on the previous research such as commingling of facial features with voice recognition or even the keystroke dynamics, this paper focuses on the fusion of the fingerprint to the iris. This is done with a series of pre-processing mechanisms before obtaining the quality augmented fused identity.

This paper is regimented into five sections, where the second section explicates the architecture of the proposed methodology along with the various phases which is implemented. The third section focuses primarily on the integration of the biometric modalities used for this study. The last two sections illustrate the results and the conclusion for the performed simulations respectively.

II. FRAMEWORK OF THE PROPOSED METHODOLOGY

The proposed methodology entails a series of phases before the final outcome of noise-corrected enhanced image with good quality is procures. The below figure illustrates a brief overview of the outlining phases of the implemented process.

![Fig 1. A Brief overview](image1)

The following figure details a more scrutinized process with each of the sub-implementations that the above phases hold.

![Fig 2. A Detailed Architecture of Proposed Model](image2)

The various stages in the implementation for this study entails the initial phase of loading the modalities in the MATLAB GUI. The pre-processing step incorporates the transformation of the original RGB images to be converted to the grayscale image. This image is then effectively processed through the various stages which are elaborated in the following section.

www.turkiphysiotherrehabil.org
III. METHODOLOGY

The study emphasizes primarily on the pre-processing steps that the image is passed through. The various steps pertaining the successful implementation of the modalities is segregated to be commingled with the fusion of the modalities. The various processes thus executed are detailed as follows:

a) Image Loading

The data pertaining modalities for processing were obtained from various web sources. The Pre-processing is effectuated with the converted grayscale image. The input image is then resized to fit the axes of the outcome.

b) DWT

A single-level one-dimensional wavelet decomposition using the Haar wavelet aids in overall segmenting and bifurcating into two components which are the high level and low-level frequency [4]. The image which is passed into the transform is further sub-segmented it into quadratic bands comprising a Low-Low, Low-High, High-Low and High-High frequencies. The major use of DWT is that it extracts the features even from low-band frequencies, and the loss of features is mitigated [4]. The below figure illustrates the division of these bands using the procured image.

![DWT For Fingerprint](image)

![DWT For Iris](image)

The illustrated image is quadrated into LL, LH, HL and HH bands [5] for the biometric modalities chosen for this study. In which each segment is further decomposed into quadratic bands of similar frequencies.

c) Bilateral Filtering and PSNR

The image filtering mechanism to smooth out the noise from off the images is effectuated using bilateral filtering. This method although smooths the pixels of the image, it preserves the edges using a combination of local neighborhood pixel values. The clustering of pixels in this methodology is implemented by analyzing the geometric approximate closeness and photometric equivalence pertaining spatial and domain relevance [9].

The PSNR value is an image quality metric that is used to analyze the noise value in an image [10]. The value of PSNR escalates proportionally to the decrease in the Mean Squared Error (MSE) value, which indicates that the quality of the image evinces best results, when the PSNR value is relatively higher. The PSNR value is computed by the below formula [11]

\[
PSNR = 10 \log_{10} \left( \frac{\text{peak}^2}{\text{MSE}} \right)
\]  

(1)

Where peak refers to the value specified manually, or is the highest range of value extracted from the input image used. The below figure illustrates the effectuated implementation procured after applying the bilateral filter on the input image.
d) IDWT
The single level inverse discrete 2-D wavelet reconstruction mechanism is used to transform the image back [4]. In this study, the transform used on the image is the Haar wavelet. The figure illustrated below depicts the IDWT process.

![IDWT Image](image1)

Fig 6. DWT For Fingerprint

![IDWT Image](image2)

Fig 7. DWT For Iris

e) Acquiring the Fused Image
The fusion of the images is done by simple concatenation of the reconstructed images. There are however layers of fusion which can be implemented. They are Sensor-level, Feature-Level, decision-level and Matching Score level [12]. The pre-mapping and post-mapping fusion are bifurcated amongst these levels of fusion, where the sensor-level and feature-level fall under the pre-mapping category, while the latter two fall under the post-mapping classification. In pre-mapping fusion, the integration of data is done before stratification, while in post-mapping fusion, the data is incorporated after mapping into matching score/decision space [12]. This process of combining the modalities helps in acquiring a new identity for the individual, thereby augmenting the security of access.

IV. RESULTS
This section demonstrates the various steps implemented in the MATLAB GUI process.
Fig 8. Step-wise implementation of the Fingerprint Modality

Fig 9. Step-wise implementation of the Iris Modality

Fig 10. Fusion of the Modalities

Figures 9 and 10 concomitantly explicate the procedure for iris, and the fusion of the modalities respectively. The PSNR values thus identified for the input images are 83.3756 and 38.5317 for fingerprint and iris respectively.
V. CONCLUSION

The significance of this study is pivoted towards enhancing the image quality by computing the various associated filters and wavelet transforms. The indagation illustrates that although the modality is a unique identification technique which can be used for various applications and effectuations, it is mandatory that these images thoroughly go through a meticulous analysis of various enhancement processes before they are finally utilized to create a unique identity. The future work can entail improving the PSNR value, which could augment the processing of the quality further through various other simulations.

REFERENCES