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Multimodal Authentication System with Gender Classification

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ABSTRACT

Multimodal biometric authentication is one of the method to identify the person. In the biometric authentication we use the biometric traits of the user in order to identify the person. In this process we have considered the various biometric traits of the user like facial features, iris and finger prints of the user in order to authenticate the person. In the unimodal biometric authentication we take only one biometric trait of the user in order identify the person whereas in the multimodal biometric authentication we take two or more biometric traits of the person in order to identify the person. By using the multimodal biometric authentication it enhances the accuracy and the security than that of unimodal biometric system. The images of the fingerprint, iris and the face are taken as the input. Then using the Canny edge detection the features of the input images are detected. Then the fusion process is performed on these images and then they are compared to the database in order to see whether the images given are of authenticated person or not. Using the multimodal approach the false positive rate of the authentication is reduced.

If the user is successfully authenticated then the gender of the person is classified by the face image provided.

Keywords: Multimodal, Unimodal, Authentication, Gender Classification, Canny Edge Detection.

1. INTRODUCTION

Biometric authentication is one of the way to identify the person. Biometric authentication can be done to identify the person uniquely using their biological and behavioural traits. For the biometric authentication we can consider the various biometric traits of the person like facial features, fingerprints, iris, voice pattern and more.

The biometric authentication can be mainly categorised into two main categories they are unimodal biometric authentication and multimodal biometric authentication. In the unimodal biometric authentication we take only one biometric trait of the person in order to identify the person uniquely. Whereas in the multimodal biometric authentication we take two or more biometric traits of the person in order to identify the person uniquely. Using multimodal biometric authentication is more advantageous than that of the unimodal authentication system. Since in the multimodal biometric we take two or more biometric traits of the person the output is more accurate when compared to that of unimodal biometric authentication.

The main interesting advantage in using the multimodal authentication system is that it is highly secure because we use more than one biometric trait for the authentication.

Gender classification using biometric traits is one of the way in which we classify the gender of the individual person using their biological features. By seeing the face of the individual its says weather the person is male or female. Instead of classifying the gender of the person using the images, we classify the gender of the person through the live camera. The camera detects the faces of the person on the live camera and then the gender classification is done.

2. LITERATURE SURVEY

In [1], the gender classification is done in two ways in which one is Appearance-based Gender Classification and the other is Biological Information-based Gender Classification. In the Appearance-based Gender Classification the gender is classified based on the characteristics of the body, clothing and the movements of the body. In this appearance based gender classification the main drawback is that the image with the low quality will decrease the accuracy of the gender classification. They introduced a new approach called the Multiscale Facial Fusion Feature (MS3F) for accurately classifying gender from facial images, even in unpredictable conditions.

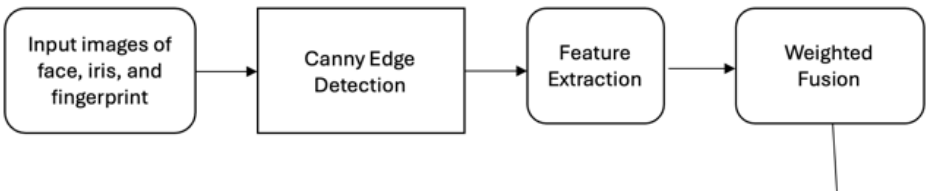
In [2], it is shown that the identification of gender can also be done using the fingerprints. The hybrid CNN-SVM model was in order to identify the gender using the fingerprints. This CNN-SVM model combines the best features which were extracted by the CVM classifiers and the SVM classifiers for the identification of gender.

In [3], the authors used the behavioural biometric of the person in order to classify the gender of the person. They have considered the behavioural biometrics like the handwritten signatures for the gender classification. The various steps that have been used in classification of gender using the behavioural biometrics using handwritten signatures include dataset collection, data pre-processing, feature extraction and classification. A dataset of 4,790 of high quality signature images both male and female images are collected. They have used three algorithms KNN, Decision Tree and Support Vector Machine in which the Decision tree has the highest accuracy.

3. METHODOLOGY

3.1 Proposed Architecture

The proposed architecture of the Multimodal Authentication System and Gender Classification is depicted in the below diagram. In the proposed architecture all the three input images of the user face, fingerprint and iris are given to the system. Then these images are converted to the grey scale images. The canny edge detection algorithm is applied on these grey scale images to extract the important features from the images. Then the fusion is performed on these images to extract the fused image. If the fused image is present in the dataset then the user is considered as the authenticated user otherwise the user is identified as the unauthenticated user. After the authentication is done then the gender classification is done. The gender classification is done only on the authenticated user.



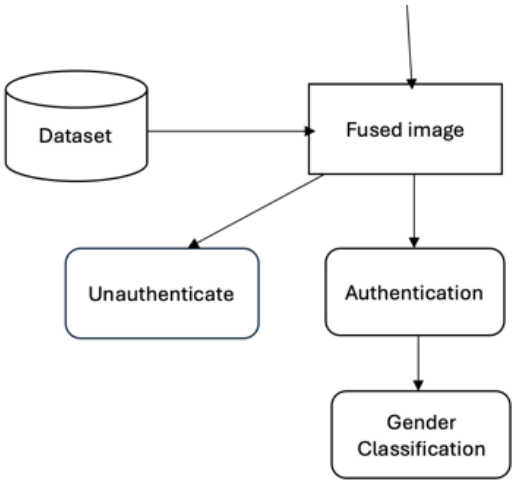


Fig 3.1.1 System Architecture

In the Fig 3.1.1 shows the architecture of the Multimodal biometric authentication and gender classification. According to the above architecture first the authentication is done after which the gender classification is done.

3.2 Dataset

The dataset used for the multimodal authentication and gender classification consists of the various biometric traits of the person like face dataset, iris dataset and finger print dataset. The dataset consist of the various persons face, iris and fingerprint images dataset. The fusion of the images of face, iris and fingerprint of same person is fused into single image and stored as the dataset which is later used at the time of authenticating the person.

For creating the fusion image dataset first the feature extraction of face, iris and fingerprint images is done. After the feature extraction is done then the canny edge detection is applied for the images. These images are resized and then the fusion of these resized edge-detected images is done. Then this fused image is stored in the specific folder where the dataset of the fuse images are present. These fused images are used for the further authentication process.

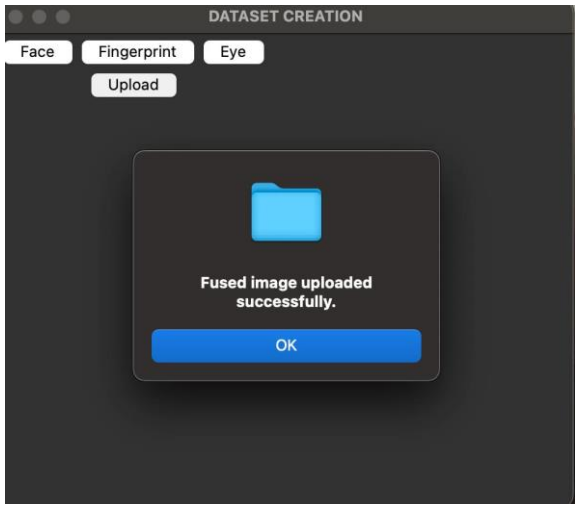


Fig 3.1 Successful upload of fusion image to dataset

Figure 3.1 shows the dialogue box saying fusion is image is successfully uploaded to the dataset.

3.3 Image Processing

Feature Extraction: First the images are taken as input. Then these images are converted into grayscale images. This conversion of images to the grayscale reduces the complexity of image while extracting the features from the image. After conversion of the images to the grayscale the images are resized using imutils's resize() function[5]. After the resizing the images the Canny edge detection algorithm is applied. This canny edge detection algorithm detects the edges of the images which are the most important features. After the canny edge detection the resulted edge-detected image is returned as output for this detection. Canny edge detection performed for all the images face, iris and fingerprint images.

Image Fusion: All the three edge-detected images are resized, so that all the images can be resized into the same dimensions. After the images have been resized they have combined using a weighted fusion technique. This fusion technique involves in the blending of the three images each image having a certain weight in order to get the final fused image. After the fusion is performed the fused image is displayed.

3.4 Algorithms Used

Canny Edge Detection

The Canny Edge Detection algorithm is used to extract the features from the input images. This canny edge detection is used to covert the grey scale images to the edge-detected representation. Using this canny edge detection the important and significant features from the image can be detected through which the fusion of the images is performed.

Weighted Fusion

This weighted fusion algorithm is used to combine the three images after the edge detection. This is a fusion technique which fuses the three images namely face, iris and fingerprint images using the weighted fusion technique. In this technique each image is given a specific weight and the fused image is formed by combining these weights.

MD5 Hashing

The MD5 Hashing algorithm is used save the fused image. This algorithm is used to create a unique file name to the fussed image. By using the MD5 Hashing the fused image can have the unique file name through which the fused image can be identified uniquely at time of authentication.

3.5 Authentication and Gender Classification

Authentication: The fused image is compared to the dataset. If the fused image is present in the dataset then it a message box is displayed showing Authenticated. If the fused image is not present in the dataset then the message box is popped showing Unauthenticated.

Gender Classification: The gender classification is performed only on the authenticated user images. If the user images are recognised as unauthenticated then the gender classification is performed on those images. When the person is authenticated along with the authenticated dialogue box it also shows the gender for the given input image.

4. RESULTS

After giving the input of three images face, iris and fingerprint it does the fusion of these images and authenticates the person and if the person is authenticated then only the gender of the person is classified.

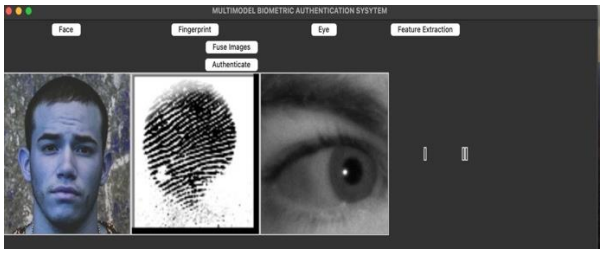


Fig 4.1 Input images

Figure 4.1 shows the input images of face, iris and fingerprint is given by the user.

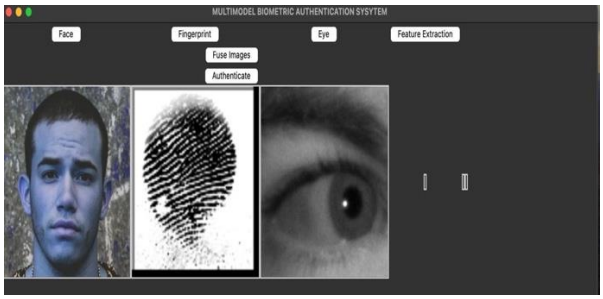


Fig 4.2 Feature extraction

Figure 4.2 depicts the features extraction from the three input images face, fingerprint and iris using the Canny Edge Detection technique.

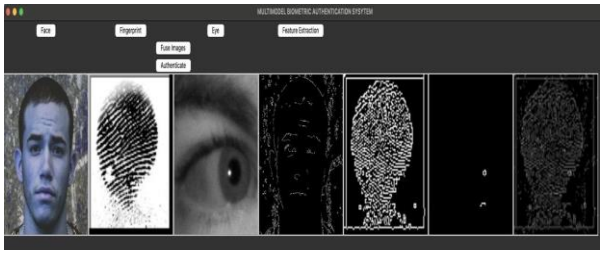


Fig 4.3 Feature Fusion

Figure 4.3 shows the fusion image. After the feature extraction done using the Canny Edge Detection the features of all the three images are extracted and the fused it into the single image.

Fig.4.4 Authenticated with Gender

Figure 4.4 shows that the images given by the user is the authenticated user. It shows the message box saying authenticated. Since the images given are of the authenticated person it also classifies the gender of the person.

Fig 4.5 Unauthenticated

Figure 4.5 shows that the images given by the user is the not authenticated user. The user can be defined as unauthenticated if the same user face, iris and fingerprint images are not given.

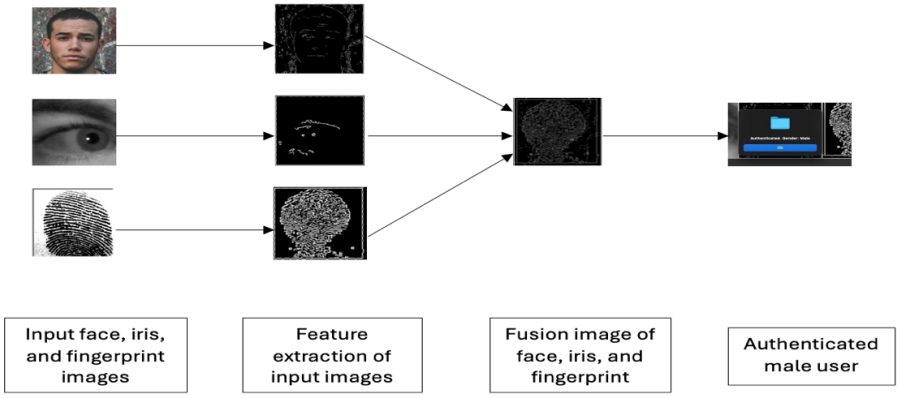


Fig 4.6 Authentication and Gender classification

Figure 4.6 contains the step by step process for the authentication and gender classification. First the face, fingerprint and iris input images are given. Then the feature extraction of these input images done. These images are fused together to form the single fused image. This fused image is compared with the dataset to authenticate the user. If the user is authenticated user then along with the authentication the gender of the user is also displayed.

5. CONCLUSION

In conclusion multimodal authentication is very useful and robust model in order to authenticate the user in the very accurate manner. The multimodal authentication and gender classification can be used for the security purpose in may applications. For the multimodal biometric authentication we have considered the three biometric traits like face images, iris images and fingerprint images. By using the Canny edge detection algorithm the relevant features from the input images have been extracted. These edge detected images are then further fused into the single image with which we say the user is authenticated or not authenticated user. Further the gender of the user is only classified if the user is authenticated user only using the face image of the user.

The integration of the multimodal biometric authentication and the gender classification is very useful to identify the gender accurately and also to enhance the security and usability in various applications.

Future Scope

In future we can we more fusion techniques to enhance the security of the system. We can also enhance the feature extraction process using the more advanced algorithms and techniques to improve the accuracy

of the authentication and gender classification.

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