# Reviewed: The Face Authentication Processes for Accessing Cloud Computing Services using iPhone

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*Abstract* – **Presently, there are several IT services that provide services for convenient access. Users can access those services by local access or remote access from anytime or anywhere including services which are on cloud computing system. Furthermore, mobile devices are very more widely used in our society as we have seen the large number of delivered mobile devices each year. However, the security for accessing the cloud services must be concerned because there are many of illicit uses of the processes easier for fraudsters. Authentication is one of the ways to prevent fraudsters. This research proposes both physical features by using face recognition and voice recognition system and behavioural feature using password. This paper describes face recognition processes in more detail. Researchers also proposed adaptive biometric authentication for accessing cloud computing services using iPhone. The research integrates the adaptive biometric authentication with multi-modal approaches which have advantages in term of flexibility and security. The status of this research is in progress.**

*Keywords* – **Cloud computing, Adaptive, Face Recognition, Biometric Authentication.**

## 1. Introduction

The researchers have proposed the overall conceptual framework of the Adaptive Biometrics Authentication for Accessing Cloud Computing Services using iPhone [1]. Researchers describe more thoroughly details of the proposed framework. The proposed conceptual framework composes of three major layers including client layer, application layer and database layer. The overall process can also be divided into two major phases including enrollment phase and testing phase. In enrollment phase, clients can provide their information such as account name, password, email, scanned face, recorded voice and so on. System administration can also enter the prepared information manually into the database as batch processing mode. The information will be preprocessed and stored into database which is on cloud computing. The second phase is the testing phase where clients can try to use their biometric information such as face, voice or password to get the authentication for accessing the desired applications on cloud computing platform. This research uses multi-modal biometric authentication with an adaptive approach [3,4,12]. However, this paper describes in more detail just only the face recognition processes.
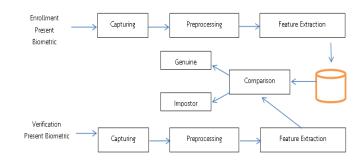


*Figure 1. Face Recognition Processes of the proposed framework*

## 2. Literature Review

Bharadwaj, S., Bhatt, H. S., Singh, R., Vatsa, M., and Noore, A. [9] had proposed QFuse as a new framework in their research. They mentioned that biometrics is increasingly being used in many applications. The current techniques are unable to provide significant levels of accuracy in uncontrolled environments. This paper presented an adaptive context switching algorithm with an online learning framework. This proposed framework uses the quality of input images to dynamically select the best biometric matcher of fusion algorithm. The results showed that the algorithm can improve the optimization of accuracy and computation time.

Veeramachaneni, K., Osadciw, L. A., and Varshney, P. K. [10] had proposed AMBM algorithm to sensor management of a biometric security system which can help to improve the robustness of the system. Multiple biometric data are fused at the decision level which meets more challenging and varying accuracy requirements. This approach can be adapted to meet the varying system needs by particle swarm optimization. The AMBM algorithm selects the fusion rule and sensor operating points to optimize system performance.

Kumar, A., Kanhangad, V., and Zhang, D. [11] had proposed their research with a new framework for adaptive multimodal biometrics management. The major objective was to ensure the optimal performance for the desired level of security. The research uses score-level fusion rules which are adapted to ensure system performance using hybrid particle swam optimization model. The experimental results showed that the adaptive selection of fusion rules using hybrid PSO-based approach can give better performance than the decision-level scheme using PSO.

Latha, L. and Thangasamy, S. [12] had also studied multimodal biometric authentication using five component traits. They indicated that a single biometric authentication is often much limited therefore a multimodal approach is proposed. This research used five component traits such as iris, ear, palm print, fingerprint and retina. The scores of each biometrics will be combined using weighted sum fusion rule. The research was tested on five different datasets. The results showed that this multimodal biometric authentication system is much more dependable and precise than a single biometric modal.

Varuvanathorn, S. and Nitsuwat S. [13] had purposed their research which used the global face features along with triangle geometry of 4 segments including left eye, right eye, nose and mouth. The research objective was to improve the efficiency of identifying person using face recognition. The research used approximately 120 images of faces for training and testing. The results showed that this technique can improve the efficiency of identifying person using face recognition by 4.16% compared to the technique which used only whole features of the face.

Duangsang, B. [14] had proposed their research of human face recognition using Principle Component Analysis technique to detect human face. The research consisted of two phases including detection and recognition phases. The detecting and verify the human face used Template matching from eye region. The recognition phase used eigenfaces and neural network with color model.

Huang, Z., Liu, Y., Li, X., and Li, J. [15] had proposed the adaptive face and ear biometric recognition framework using sparse coding (ABSRC) which can effectively reduce the adverse effect of degraded modality. ABSRC consisted of two-phase sparse coding strategy. First, face and ear features are separated encoding. Then the weighted features are integrated to form a unique feature vector. The results of the experiment showed that the framework can improve robustness to various kinds of image regression and outperforms the current methodologies such as MSRC, MWGSR and also other conventional multimodal methods.

## 3. Face Recognition in the Research

Face Recognition Processes as shown in Figure 1 are the processes to identify the real person using automatic system. In this research, the images of a person will be gained from digital camera of an iPhone. The face recognition will compare the tested facial features of the image and the facial features in the collected database. Face Recognition Processes consist of four major processes. The result of the previous process will be the input of the next process. Therefore, the quality of the result of the previous process may affect to the result of the next processes.

### 3.1. Face Detection

This process is used to locate a face region on the image typically indicated by a large rectangle on the screen. The current face detection techniques are entirely dependable in the currently uses, however, the current face recognition techniques are much less reliable in the currently uses. There are many face detection techniques implemented in camera devices including iPhone or other smartphones. The current face recognition techniques are very responsive to common uses, such as the level and the direction of contrast, the noise of the image sensors, the orientation of the faces, the expression of the face, and so on. Therefore these may give unexpected results.

From the literature review, this research will use the LBP-based technique [5,8] of face detection. LBP-based technique uses histograms method of pixel intensity collating, such as edges, corners, and flat regions; on the other hand, Haar-based technique checks the facial region by comparing the regions of the specific features with other regions in the images which it often does thousands of checking per image. LBP-based technique can be used not only to improve face detection with more dependable but also to reduce computing time. This technique [5,6,8] has several advantages than the other techniques. In conclusion, the LBP-based detectors are significantly faster than the Haar-based detectors for several times.

This research will set up LBP-based parameters for 4-channel BGRA because the images will be gathered from iPhone as image sensor. The example of LBP calculation is shown in Figure 2. The original LBP operator labels the pixels of an image by determined the threshold of each pixel using 3-by-3 values surrounding of the center pixel and considering the result as a binary number.

| 145 | 146 | 153 |
|-----|-----|-----|
| 147 | 150 | 156 |
| 158 | 159 | 156 |

Example

| 0 | 0 | 1 |
|---|---|---|
| 0 |   | 1 |
| 1 | 1 | 1 |

Threshold

$(01111100)_2 = 124_{10}$

Pattern

*Figure 2. Example of LBP calculation.*

Face detection algorithm will typically works on grayscale [2,5] images therefore all the gathered images needed to be converted from color camera images to grayscale images which has values between 0-255 intensity levels of color. For images in color spaces such as RGB color which is used in standard color TV and also the camera sensors of mobile devices. Y' can be computed from gamma compressed intensities as a summation of weighted values as shown in formula (1). The example of conversion from color image into grayscale is shown in Figure 3.

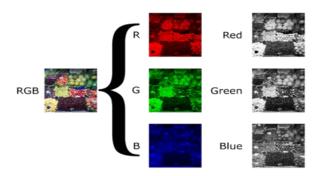$$Y' = (0.299xR) + (0.587xG) + (0.114xB) \qquad (1)$$



*Figure 3. Conversion from RGB color into grayscale color.* [2]

The celerity of face detection will also count on the size of the input images. Therefore it may be slow for larger images but it may be fast for smaller images. Hence the images from camera censors are needed to reduce the suitable sizes. Typically face detection usually works well for image size greater than 240x240 pixels [6] therefore this research reduces the image size to 240 pixels of width. Furthermore the images are needed to keep the aspect ratio between width and height as the same as the input images as shown in Figure 4.

scaledHeight = Round (img.rows / scale);
resize(img, smallImg, Width, scaledHeight));

*Figure 4. To keep the aspect ratio of width and height of image.*

Face detection is also not dependable in low light conditions. Therefore the images are needed to perform histogram equalization [6,7] which helps to improve the contrast and brightness of the images. Histogram equalization is also very important process for the facial recognition process. Histogram equalization is very useful process which will distribute the intensity of the images as shown in Figure 4. This process makes the areas of lower contrast to get a higher contrast and brightness.
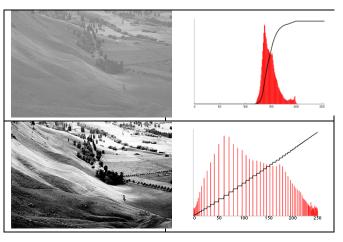


*Figure 5. Example of histogram equalization* [7].

### 3.2. Face Preprocessing

The quality of input images is very important process to the rest of the face recognition processes. Therefore face processing process is needed to improve the noises of the images such as low lighting conditions, face orientation, face expression, and so on. Hence it is very important to reduce these noises as much as possible. This process focuses on eye search regions, histogram equalization, and elliptical mask of the images.

Face preprocessing consists of three tasks including 1) eye search regions which consist of

geometrical transformation and cropping: This process focuses on the alignment of eyes which would include scaling, rotating, and translating the images, and then followed by the removal of the forehead, chin, ears, and background from the images 2) histogram equalization for left and right sides. This process will diffuse the brightness and contrast on both the left- and right-hand sides of the face equally. Furthermore, this process will reduce the image noise either. 3) The elliptical mask will remove some remaining hair and some background from the face image which will result only in the facial image.

### 3.3. Face Training

After collecting the desired face images of each person, the face recognition system must be trained by learning the facial data using a machine-learning algorithm which suites face recognition. There are many different face recognition algorithms in the literature; the simplest algorithms are eigenfaces and Artificial Neural Networks, however eigenfaces tends to work better than the ANNs [6]. Although eigenfaces is simple method, it can do the work as well as other complex face recognition algorithms. Therefore, it has become very popular as the basic face recognition algorithm for everyday use.

It is also very important that the training set has not only having enough varieties to cover the testing set, but also having a large number of faces. Therefore the collected faces in the training set should be differences of each person. There should not be the same images of each person. The collected faces should collect direct face, left-side faces, right-side faces, and some other face directions.

### 3.4. Face Recognition

Face Recognition process is the process that is capable to identify or verify a person by using his face image from iPhone camera with the facial features stored in the database. In this research is used the principle component analysis which uses eigenfaces. There are also some other recognition algorithms which use fisherfaces algorithm such as linear discriminate Analysis, elastic bunch graph matching. The results of this process are the scores of matching process of each test which will be used to determine that the person is the member of a system or not. If the person is determined as a member of the system, he will be allowed to access the services

provided on the cloud. If the person is determined as not to be the member of the system, he will be denied access to the services provided on the cloud.

### 4. Adaptive Methodology

This research uses not only biometric characteristics such as face recognition and speech recognition but also behavioral characteristic such as password as traditional methodology. Multi-biometric systems can be integrated from multiple biometric sources. This method can be used to overcome the limitations of non-universality or noisy sensor data to prevent spoof attacks or fraudsters encountered in mono biometric systems. The research also applies adaptive methodology which makes more dynamically entering the input sensor data instead of sequentially entering the data as shown in Figure 5. and 6. The system administrator can select types and also can select the numbers of input data which make the authentication more complex, more flexible and more secure.
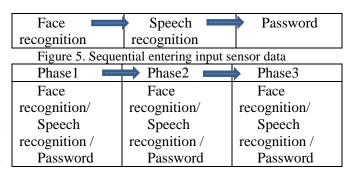
| Face recognition | → | Speech recognition | → | Password |
|---|---|---|---|---|

Figure 5. Sequential entering input sensor data

| Phase1 | → | Phase2 | → | Phase3 |
|---|---|---|---|---|
| Face recognition/ Speech recognition / Password | | Face recognition/ Speech recognition / Password | | Face recognition/ Speech recognition / Password |

*Figure 6. Adaptive entering input sensor data*

### 5. Conclusion

This paper described the face recognition processes which are used as a part of authentication for accessing cloud computing services using iPhone. First, starting with face detection process is the process that locates the face of the human in the images using the LBP-based technique. Second, face preprocessing process is the process that reduces the noise of facial images and also improves the quality of the images such as contrast and brightness, and face orientation. Third, the system is needed to train the preprocessed facial data using a machine-learning algorithm relying on eigenfaces. Finally, the face recognition processes perform the verification of the testing faces with facial features which are stored in the cloud computing data storage. In the research, we also deploy the adaptive approach with the proposed authentication method.

## References

[1]. Pukdesree, S., & Netinant, P. (2016). Conceptual framework: The adaptive biometrics authentication for accessing cloud computing services using iPhone. In *Recent Advances in Information and Communication Technology 2016* (pp. 209-216). Springer, Cham.

[2]. Grayscale. Retrived from: https://en.wikipedia.org/wiki/Grayscale.

[3]. Soltane, M. (2015). Face, Voice and Signature Multi-Modal Biometric Verification Fusion Systems. *Annals of the Faculty of Engineering Hunedoara*, *13*(4), 139.

[4]. Cutshaw, J. (2015). *Online authentication challenges for financial institutions in a complex digital era* (Doctoral dissertation, Utica College).

[5]. Ojala, T., Pietikainen, M., & Maenpaa, T. (2002). Multiresolution gray-scale and rotation invariant texture classification with local binary patterns. *IEEE Transactions on pattern analysis and machine intelligence*, *24*(7), 971-987.

[6]. Emami, S. (2012). Face Recognition using Eigenfaces or Fisherfaces. *Mastering OpenCV with Practical Computer Vision Projects. Pact Publishing*.

[7]. Histogram equalization. Retrived from: https://en.wikipedia.org/wiki/Histogram_equalization

[8]. Local binary patterns. Retrived from: https://en.wikipedia.org/wiki/Local_binary_patterns.

[9]. Bharadwaj, S., Bhatt, H. S., Singh, R., Vatsa, M., & Noore, A. (2015). QFuse: Online learning framework for adaptive biometric system. *Pattern Recognition*, *48*(11), 3428-3439.

[10]. Veeramachaneni, K., Osadciw, L. A., & Varshney, P. K. (2005). An adaptive multimodal biometric management algorithm. *IEEE Transactions on Systems, Man, and Cybernetics, Part C (Applications and Reviews)*, *35*(3), 344-356.

[11]. Kumar, A., Kanhangad, V., & Zhang, D. (2010). A new framework for adaptive multimodal biometrics management. *IEEE transactions on Information Forensics and Security*, *5*(1), 92-102.

[12]. Latha, L., & Thangasamy, S. (2013). Providing multimodal biometric authentication using five competent traits. *The Imaging Science Journal*, *61*(2), 212-218.

[13]. Varuvanathorn, S., & Nitsuwat, S. (2010). Facial recognition and using whole and segment facial features with the triangular geometry of the eyes and mouth together with the geometric face model. *The 6th National Conference on Computing and Information Technology*.

[14]. Duangsang, B. (2013). Facial recognition using Principle Component Analysis technique. Thesis. Faculty of Engineering, Kasetsart University.

[15]. Huang, Z., Liu, Y., Li, X., & Li, J. (2015). An adaptive bimodal recognition framework using sparse coding for face and ear. *Pattern Recognition Letters*, *53*, 69-76.