RES MILITARIS
REVUE EUROPEENNE D ETUDES EUROPEAN JOURNAL OF MILITARY STUDIES
Social Science Journal

Enhancing The Security Of Iraqi Banks Through The Use Of Electronic Authentication And Facial Recognition Technology

By

Mareim Mahmoud Jameil AL-Aadamy
Iraqi Commission for Computers & Informatics, Baghdad, Iraq
E-mail: mareimamaar2@gmail.com

Dr. Mohammed Khodayer Hassan AL-Dulaimi
Department of Computer Engineering, AL-Rafidain University College, Baghdad, Iraq
E-mail: mohammednofa@yahoo.com

Abstract

Security issues with Internet Banking (IB) still exist due to unauthorized access to user accounts. Single-use PINs are used as one form of authentication. Identity broker users are exposed to security risks such as shoulder surfing, hacking, and phishing. As an alternative to a PIN, fingerprint matching (FPM) has the same drawback as fingerprints on unique mobile devices. A survey we conducted Specifically, in the central branch of the Iraqi Rafidain Bank in Baghdad, on 150 consumers. Most of them (84.4%) prefer biometric authentication techniques. In this paper, we propose an integrated two-level (2L) authentication technique. The user logs into their IB portal at the first level using either a PIN or FPM. Facial recognition technology is used to authenticate users at the second level Among the benefits of the second level of electronic authentication in Iraqi banks are 2L equals 3: (1) FR guarantees the legitimacy of the user independently of the login method; (ii) transactions are secured more effectively through sensitivity rating of banking products; and (3) it is important to understand different user preferences for authentication. Thus, adopting this model can improve banking experiences in terms of enhancing security and providing fair service.

Keywords: Internet Banking; User Authentication; face recognition.

1 Introduction

The popularity of Internet Banking (IB) has increased significantly over time as banking institutions compete in a rapidly-evolving technology era where client convenience and security and cost reduction are two of the most important success factors. Authenticated users can examine their account balances, get a list of recent transactions, move money between accounts, pay utility bills, and do several other online transactions in a standard IB portal. But it's a rising problem that IB has to deal with as security threats change, including data compromise, phishing, hacking, and other issues[1]. Due to these ongoing difficulties, banking institutions must constantly improve user authentication processes in IB contexts. Passwords, PINs, and tokens, which have been used for authentication for decades, are no longer effective. keep abreast of the cutting-edge tools and methods that hackers and fraudsters employ to illegally access customers' IB portals. The most used authentication method today is biometric authentication, which verifies users based on their physiological characteristics like fingerprints, face, and voice recognition, as well as behavioral traits like gestures, keystrokes, and gait. Experts in IB and financial technology have even projected that biometrics will eventually supplant the current electronic payment authentication system. for face detection and recognition, there are two main categories. broad areas, such as a holistic strategy that the look of the face as a crucial characteristic while a feature-based method that identifies

geometric Eyes, lips, cheeks, and other facial characteristics are potential candidates for a face recognition system. Numerous factors must be considered to create a practical and effective facial recognition system[2]. The system's accuracy, the facial recognition system's computational complexity, and simply updating and expanding the recognition capabilities are a few of these qualities.

1.3 Related Work

This section includes a survey of the related works about

In 2022, Said, Iman, and Mohamed [3], In this article, the outsourcing approach to Eigen decomposition and singular value decomposition is examined as well as some results from previous studies. In light of this, presented a reliable and effective outsourcing face recognition strategy based on principal component analysis. The information in the original image information is transformed for the proposed protocols, protecting privacy while conserving computing resources. In addition, local verification is supported to counteract cloud laziness. From both theoretical and empirical points of view, show the feasibility and evolution of the approach.

In 2021, Cherinor, Afzaal, and Umar[4] proposed an authentication framework that provides a better IB experience by enhancing security and improving the trade-off between convenience, security, and user authentication, preferences for both IB users and banks providing IB services. Future modifications of the suggested framework might investigate the usage of various data mining methods with the banking database to automatically and dynamically choose the kind of second-level authentication that the IB portal should impose.

In 2020, Ms.Sarika, and Dr. Seema S., [5]**,** Used face detection and identification techniques, an automated attendance recording system has been presented this study to update the attendance records of the students by detecting their physical presence in the classroom. In the fields of computer vision and image processing, face recognition functions similarly to object recognition. To extract the low-dimensional and more discriminating characteristics from the face, PCA and LDA are the two most often employed methods for feature extraction. This paper's objective is to give an independent, comparative analysis of three cutting-edge appearance-based feature extraction techniques (PCA, LDA, and hybrid approach) under perfectly equal processing and algorithm execution settings. SDB (Student Data Base) face databases were used for the tests. where the photographs were taken using a True vision HP laptop camera under various lighting situations, at various angles, with various facial expressions and stances, etc. When comparing the hybrid strategy with PCA and LDA utilizing SVM as a classifier, the rate of face recognition is increased.

In 2019, Musab and Musbah [6], placed a strong emphasis on the need to understand how security impacts consumers who use electronic banking services and how that impact connects to how those consumers behave when utilizing those services. It also demonstrates that user behavior toward accepting any electronic banking services provided by the system is most significantly influenced by user trust and privacy concerns. Security concerns may erode client confidence, which in turn lowers the number of people using electronic financial services. So, for banks To persuade people to accept the electronic banking system and win the user's trust, it is advised to find a technique to boost user confidence through the exhibition of the newest and finest security technology.

In 2019, Wahyu Mulyono, Ibnu Utomo, Ignatius Moses Setiadi, De Rosal Susanto, Ajib Rachmawanto, Eko Hari, Fahmi, Amiq Muljono [7]**,** Eigenface was used to reduce the

dimensions and find the best vector for distributing the face image in the face space. This method has been widely used and implemented in many previous types of research for human face image recognition. Not only for detecting human faces under normal conditions but the ability of PCA to correctly recognize images with different expressions has also been demonstrated. It can even recognize facial images with different challenges such as detecting faces after plastic surgery and combining them with facial image reconstruction techniques. This research aims to examine the performance of the PCA-Eigenface method for human facial image recognition from several databases that have their challenges, such as lack of illumination of facial images, significant differences in expression, and use of accessories such as glasses. Recognizable accuracy varies quite well, from 100% to 67% in each database with an average estimate of over 85%.

In 2018, Zafaruddin, G. Md Fadewar, H. S [8]**,** provide a method for detecting and identifying human faces as well as an effective near-real-time facial recognition system that monitors and identifies a person's head by comparing their facial features with those of other people. The method takes advantage of the fact that faces are often erect and can thus be represented by a limited number of distinct 2D views by treating face recognition as a 2D discrimination issue LEM. Face images are projected onto a feature space called "face space" which effectively stores the contrast between images of existing faces. The "eigenvectors" or eigenvectors of the set of faces are what define the area of the face, not always associated with individual characteristics such as eyes, ears, and noses. The system enables unsupervised learning of new face recognition skills.

In 2018, Anissa, Purnawarman, and Eri Prasetyo [9]**,** This article use the eigenface technique to implement the human face recognition system. One of the Principal Component Analysis (PCA)-based facial recognition techniques is Eigenface. A mathematical process called PCA was used to generate a set of features for face recognition. The first stage of face recognition is face detection using the cascade classifier approach, followed by face preprocessing, collecting, and training of the faces found, and then face recognition.

In 2017, Kumar, Kalitin, and Tiwari [10], By utilizing PCA and putting into practice the idea of dividing the dataset into training, cross-validation, and test sets to compute misclassification errors, this publication focuses on the issue statement that was previously discussed. It allows for a better match between the algorithm and the fresh training set. The extensively used but poorly understood principal component analysis (PCA), also known as the dimensionality reduction technique, is sometimes referred to as a "black box." The goal of this paper is to offer a detailed explanation of the PCA and the mathematics underlying its methodical development of the required recognition system.

In 2017, Abbas, Eyad I., Safi, Mohammed E.and Rijab, Khalida S.[11], this paper describes the different classifier methods with minimum means of clusters to achieve the face recognition rate of humans from the feature extracted of training face image data for many sets of images as a database. Principal Component Analysis (PCA) is a robust method used as a feature extraction technique for face recognition but the recognition decreases with the variation of a person’s actions. The features extracted for face images are light insensitive, individual, hidden, and activity are effective in biometric recognition. Face recognition is treated as a two-dimension recognition problem, the fact is to take the advantage of these human faces' straight poses, in general, may be represented as a small set of two-dimension characteristics view. The training and testing face images are selected from Research Laboratory for Olivetti and Oracle (ORL) face database, which have minimum pose variation. Three classifier methods are used to obtain the distance of recognition. These classifiers are the

Euclidian distance method, the Squared Euclidian Distance method, and the City-Block Distance method. By Clustering the difference of training images with images set for each person and determining the mean to it, the minimum mean is representing the recognition of the person. The cluster method with the Squared Euclidian Distance method produces higher a recognition rate of 100% near the Euclidian Distance method which gives a human face recognition rate 98% higher than the City-Block Distance method which gives a recognition rate of 95%.

In 2017, D.Saraswathi, E.Srinivasan, [12]**,** In this paper, a CAD system for mammography diagnosis is suggested. An adaptive median filter is used to preprocess the mammography image, and the ROI is segmented using Otsu's thresholding method. The classifier was then given the ROI's retrieved GLCM characteristics. This CAD system employed classifiers like SVM and KNN, and the performance metrics were examined. SVM outperforms KNN in terms of classification accuracy (95.7%) and sensitivity (0.91); both figures are greater. This shows that our CAD system's automated breast cancer diagnosis, which has higher accuracy and sensitivity, is dependable as a tool for radiologists**.**

In 2016, Liu Chengyuan, Zhang Ting, and Ding Dongsheng, [13], In this paper, based on the traditional PCA, combined with the advantages of KPCA(kernel-PCA), a new composite kernel-PCA algorithm is designed. By combining the two single kernel functions, the new algorithm can make full use of their complementary characteristics. Experiments were performed on ORL and FERET face databases respectively. Through the analysis and comparison of the experimental results, it is proved that this algorithm can achieve the efficient recognition of face images, and has better robust performance when dealing with a large sample database.

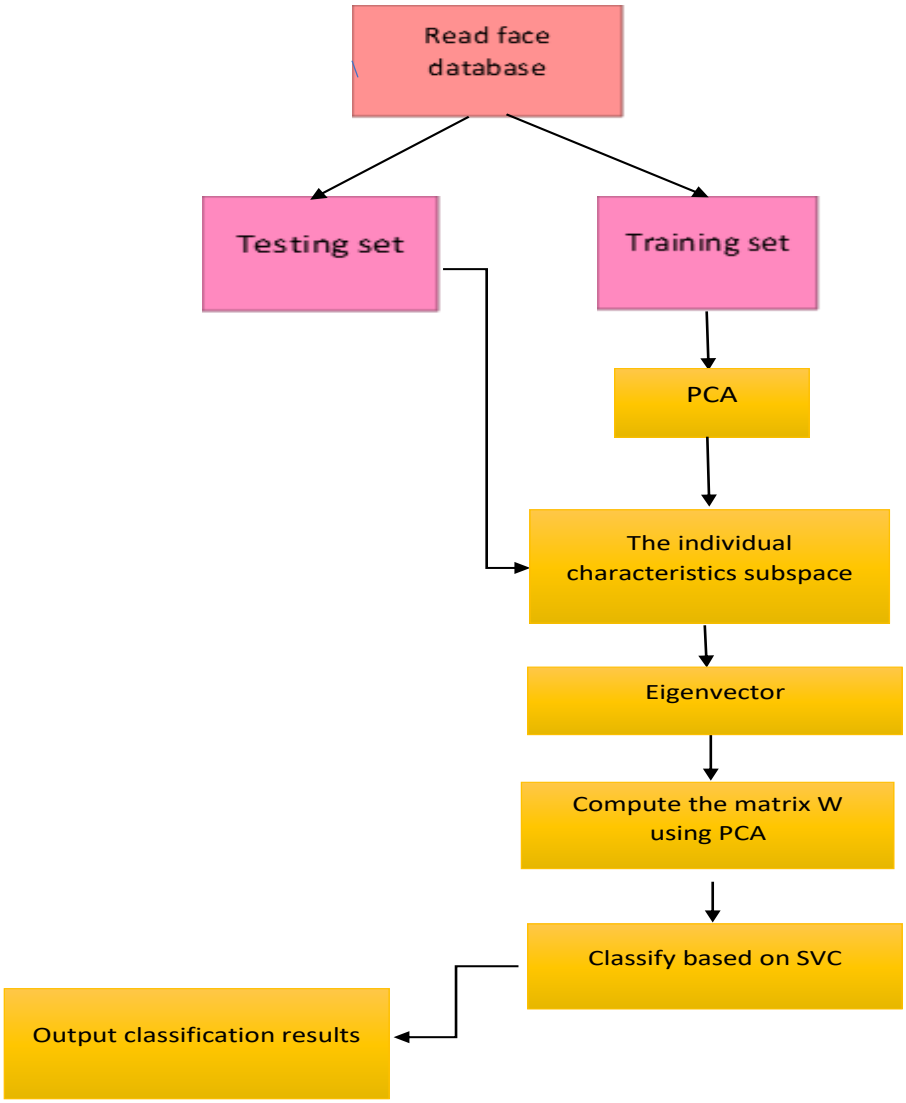
In 2015, YUJUN YANG, JIANPING LI, YIMEI YANG, [14], This paper presents a boundary detection technique for retaining the potential support vector. Through seeking structural risk minimization of the SVM, it improves the learning generalization ability and achieves the minimization of empirical risk and confidence range in the case of a small statistical sample size and it can also obtain the desired good statistical law.

Methodologies

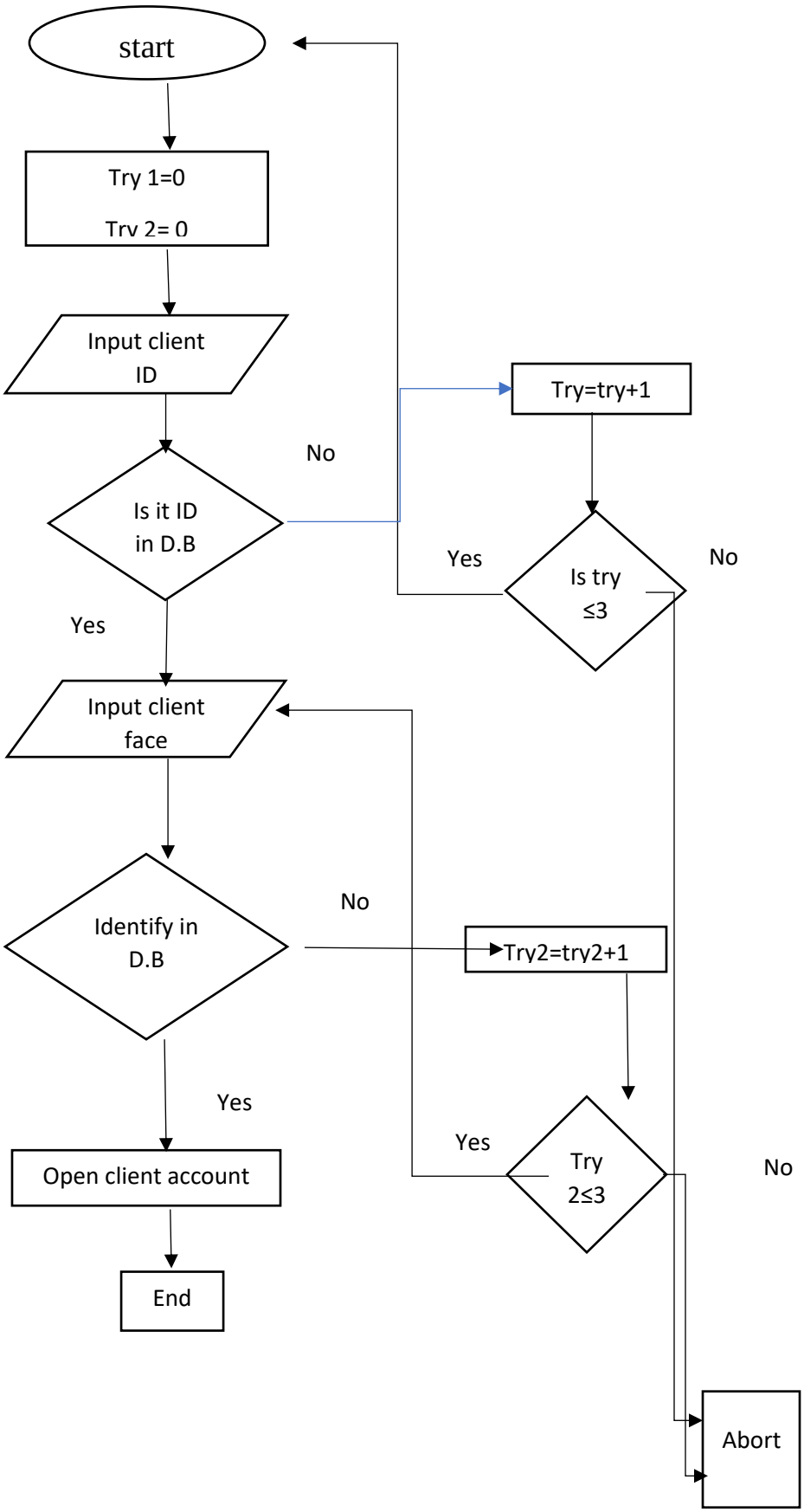
The five components of the proposed system are separated. Specifically, the phases of face detection, preprocessing, and training, the test phase of face recognition, and attendance Add a note to the database. The proposal's initial step The system is used for PCA face detection. the process algorithm. generally using this approach a face detection approach based on modified Eigen Faces. This type of face detection technology is more dependable, potent, and beneficial in real-time applications. worked on the grayscale image, noise removal, histogram equation, and segmentation, which enhances the quality of the cropped image rapidly to lower the error rate and aids in the extraction of facial features. feature extraction is the most difficult and crucial one. This entails identifying regional features like the nose and eyes. Mouth, etc., are common to all faces. Facial normalization is another name for facial extraction. The most popular feature extraction techniques, such as PCA; extracting the fewest dimensions and calculating faces as Eigen using eigenvalues, have been successfully implemented in the proposed system.

An Overview Of Methods

Since childhood, humans have had little trouble recognizing faces. Due to their enormous scale, it continues to be the most difficult and demanding task in terms of machinery. The training dataset for face recognition includes face identification. The given input image is compared in this process to a face database; this process is known as training; during training, different samples of faces belonging to different people are stored in the training dataset; during testing, an unknown face or image must be recognized from the training dataset. By comparing the retrieved features from the training dataset with the testing dataset, recognition is accomplished. According to the extensive research conducted over the past three decades, there are two main categories of face recognition techniques: template-based methods, which focus primarily on a feature like a nose, eyes, mouth, or chin, and geometric feature-based methods, which focus primarily on shape, facial expressions, etc. Because feature-based methods produce better results and are unaffected by lighting conditions, the proposed system is where we put our attention.



(Fig. 1) *The proposed system work plan.*



(Fig. 2) *flowchart of the proposed system.*

Facial Feature-Based Techniques

Eigen Faces

PCA sometimes referred to as the K-L transform method, is an effective dimensionality reduction technique[15]. To identify faces, Sirovich and Kirby created a method in 1987 that makes use of Eigenfaces. Principal component analysis (PCA), a technique devised by Matthew Turk and Alex Pentland, is used for face detection and recognition. A matrix of M*N dimensions is an image. This technique converts the M*N matrix into a single dimension (M'=M*N), which is known as the image vector, and calculates Eigen-vectors from the linear combination of Eigenface weights. Find the image vector for each image in the training set, then divide the total number of images in the training set by the sum of all face image vectors to get the average face vector (). Subtract the average-face vector from all the image vectors. All (image-vectors - average-face-vector) should be stacked into the one-dimensional matrix A, where A is ([M*N]*I), where the total number of pictures. Calculate A's covariance matrix using the formula: cov(A)=A*A.[16]

Identify the covariance matrix's eigenvalues and eigenvectors. Since the covariance matrix is very large, the lower dimensionality reduction is accomplished by transposing (A)*A to calculate the eigenvectors. The linear combination of weights is what the eigenfaces are therefore thought to be. Ghostly pictures are another name for Eigenfaces.[17]

(Fig. 3) *Eigenfaces*

Classification

The Euclidean distance is the measurement of the separation between two points, P and Q, and it is the length of the line segment that connects them. Most authors utilize the Euclidean distance between landmarks as a morphometric metric. After obtaining facial feature points from a two-dimensional or facial image, they choose a few important distances between them and compute the relevant Euclidean distances. The facial recognition system then compares faces based on these separations. SVM, or Support Vector Machine, was created first for binary classification. Still, a multi-class classification problem is face recognition. SVMs can recognize faces using one-against-one and one-against-all, respectively. The categorization between each class and all the other classes is called "against all." The categorization between each pair of classes is done using the one-against-one approach. We use a one-against-all approach to classify faces. Based on the features mentioned above, technologies used with classifiers, similar to PCA Compare to many real-time circumstances, such as various lighting conditions and unexpected faces Facial emotions differ, and features change (faces covered). Additionally, system performance is assessed in the words distance, false positive rate, training time, and recognition rate.

(Fig. 4) *The Olivetti database for training and testing*

Result

To minimize attitudes, the training set and facial images from the Olivetti database were carefully selected. This database contains 40 categories, each with 10 faces and representing a different person. All face images are used for training and testing, as shown in Figure (4). For ease of processing, the image format has been changed to Format Experts Group (JPEG). We used 30% for testing and 70% for training. With the help of EIGEN FACE technology and (SVM) algorithm, which is one of the most famous classifiers known for its efficiency in work and classification, we built an integrated model (AI) based on the face recognition method

(PCA) method. As seen in the accompanying figure, we have a comprehensive model with an accuracy success rate of 92%.

classification report:

	precision	recall	f1-score	support
0	0.50	0.33	0.40	3
1	1.00	1.00	1.00	3
2	0.50	0.67	0.57	3
3	1.00	1.00	1.00	3
4	1.00	0.67	0.80	3
5	1.00	1.00	1.00	3
accuracy			0.92	120
macro avg	0.94	0.92	0.92	120
weighted avg	0.94	0.92	0.92	120

(Fig. 5) *a sample of real practical results.*

More Results

We can get accurate results from state-of-the-art machine learning models. used additional classifiers to display more results, test the model more, and conclude the best class that was applied to the model.

classifiers that are used

- NB, GaussianNB
- KNN, KNeighbours Classifier
- DT, DecisionTreeClassifie

========== NB RESULT ==========
Accuracy score:0.86

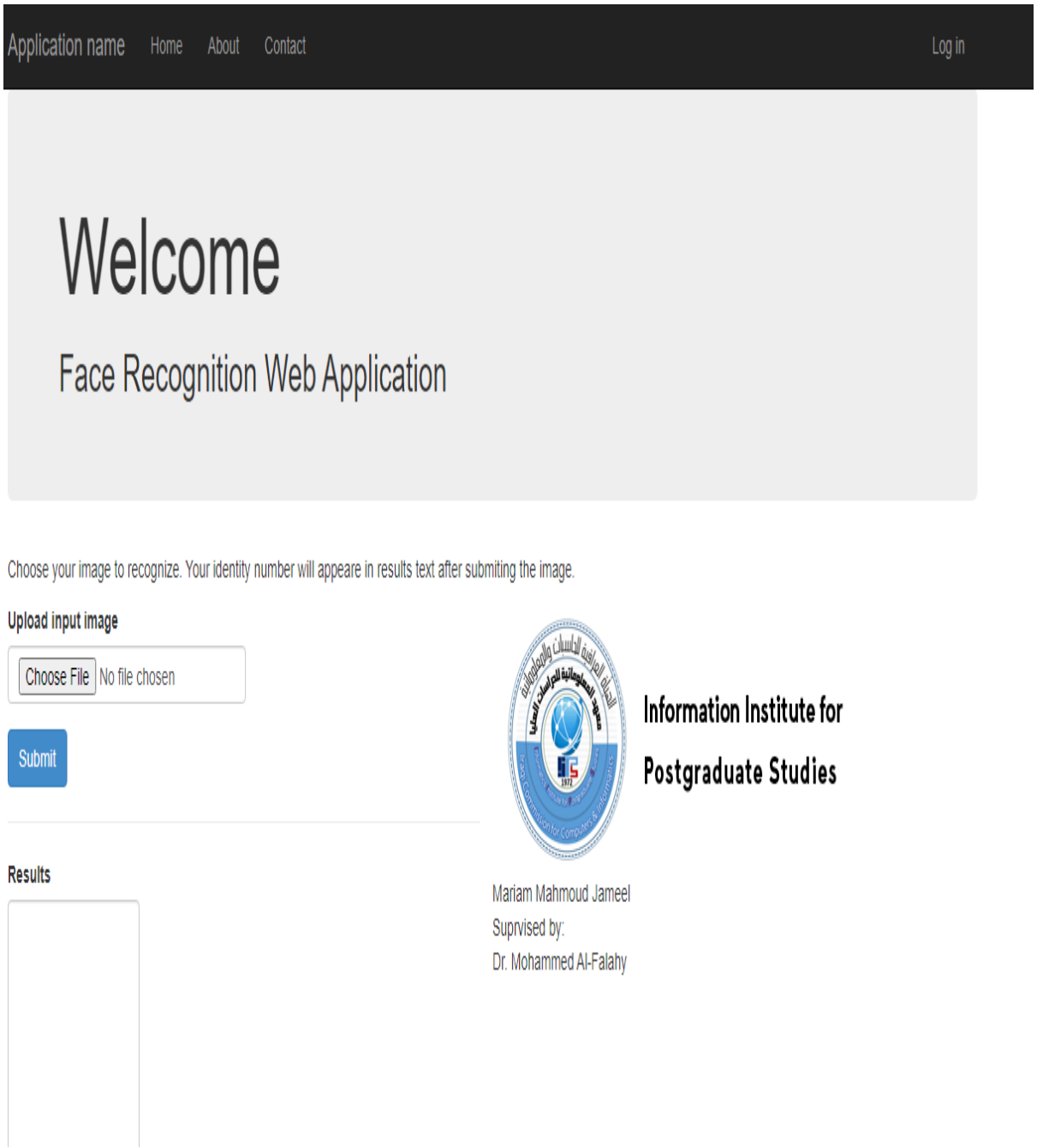
========== KNN RESULT ==========
Accuracy score:0.72

========== DT RESULT ==========
Accuracy score:0.66

========== SVM RESULT ==========
Accuracy score:0.92

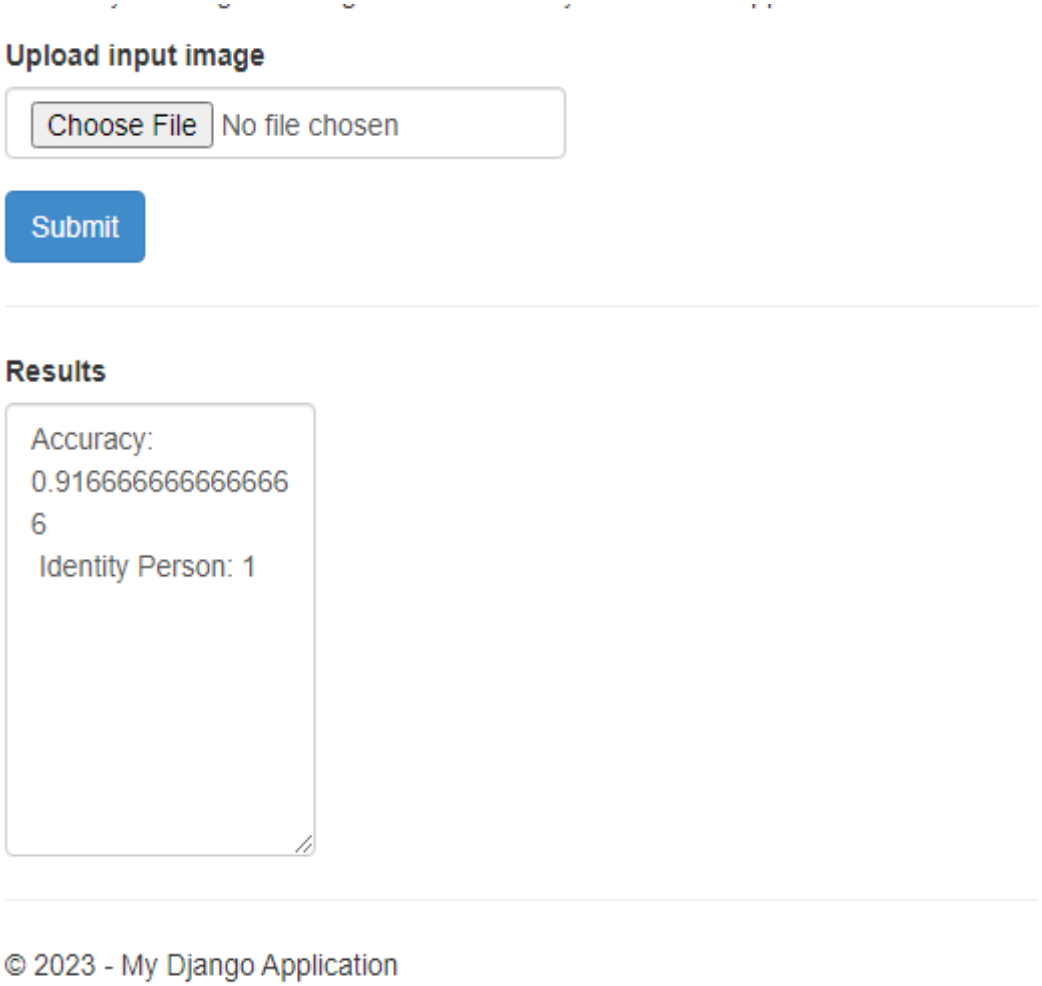
(Fig. 6) *more result*

This results of classifiers shows and proves that the best classifier applied to the model is the SVM with the highest percentage



(Fig. 7) *web app.*

The model was connected to the (Django) framework, and the application (web app) was developed for use in the real world and to create a unique work interface, as illustrated in the following figure: As a result, we have decided to create a comprehensive program to identify faces and implement the suggested system in Iraqi banks on the ground, subject to further improvement.



(Fig. 8)

Conclusion

The model biometric system put out in this work makes use of PCA and several distance-based classification techniques. Using a measure of the mean difference, the integral difference collection of images. Face recognition PCA algorithm The procedure is quick, easy, and effective in a constrained setting. It is a strong facial recognition extraction feature, but grouping to recognize people should make it better. With the Olivetti database, face identification based on Euclidean distance PCA and eigenface approach was used. According to test results, PCA using the eigenface approach and an SVM classifier produced the best outcomes, with a 92% recognition rate.

References

M. Sajić, D. Bundalo, Z. Bundalo, L. Sajić, and G. Kuzmić, 'Programmable electronic payment card transaction limit implemented using mobile electronic technologies', *2018 7th Mediterr. Conf. Embed. Comput. MECO 2018 - Incl. ECYPS 2018, Proc.*, no. June, pp. 1–5, 2018, doi: 10.1109/MECO.2018.8406035.

Y. M. Jiang and S. L. Liu, 'The analysis of security weakness in BitLocker technology', *NSWCTC 2010 - 2nd Int. Conf. Networks Secur. Wirel. Commun. Trust. Comput.*, vol. 1, pp. 494–497, 2010, doi: 10.1109/NSWCTC.2010.123.

S. El Kafhali, I. El Mir, and M. Hanini, 'Security Threats, Defense Mechanisms, Challenges,

and Future Directions in Cloud Computing', *Arch. Comput. Methods Eng.*, vol. 29, no. 1, pp. 223–246, 2022, doi: 10.1007/s11831-021-09573-y.

C. U. Bah, A. H. Seyal, and U. Yahya, 'Combining PIN and Biometric Identifications as Enhancement to User Authentication in Internet Banking.', *arXiv Cryptogr. Secur.*, pp. 1–4, 2021, [Online]. Available: https://jp.arxiv.org/abs/2105.09496

'Algorithms and Classifiers in Face Recognition for Automated Attendance', no. Icimia, pp. 195–200, 2020.

M. A. M. Ataya and M. A. M. Ali, 'Acceptance of Website Security on E-banking. A-Review', *ICSGRC 2019 - 2019 IEEE 10th Control Syst. Grad. Res. Colloquium, Proceeding*, no. August, pp. 201–206, 2019, doi: 10.1109/ICSGRC.2019.8837070.

I. U. Wahyu Mulyono, D. R. Ignatius Moses Setiadi, A. Susanto, E. H. Rachmawanto, A. Fahmi, and Muljono, 'Performance Analysis of Face Recognition using Eigenface Approach', *Proc. - 2019 Int. Semin. Appl. Technol. Inf. Commun. Ind. 4.0 Retrosp. Prospect. Challenges, iSemantic 2019*, pp. 12–16, 2019, doi: 10.1109/ISEMANTIC.2019.8884225.

G. M. Zafaruddin and H. S. Fadewar, 'Face recognition using eigenfaces', *Adv. Intell. Syst. Comput.*, vol. 810, pp. 855–864, 2018, doi: 10.1007/978-981-13-1513-8_87.

A. L. Ramadhani, P. Musa, and E. P. Wibowo, 'Human face recognition application using PCA and eigenface approach', *Proc. 2nd Int. Conf. Informatics Comput. ICIC 2017*, vol. 2018-Janua, pp. 1–5, 2018, doi: 10.1109/IAC.2017.8280652.

V. Kumar, D. Kalitin, and P. Tiwari, 'Unsupervised learning dimensionality reduction algorithm PCA for face recognition', *Proceeding - IEEE Int. Conf. Comput. Commun. Autom. ICCCA 2017*, vol. 2017-Janua, no. December, pp. 32–37, 2017, doi: 10.1109/CCAA.2017.8229826.

E. I. Abbas, M. E. Safi, and K. S. Rijab, 'Face recognition rate using different classifier methods based on PCA', *Int. Conf. Curr. Res. Comput. Sci. Inf. Technol. ICCIT 2017*, no. December, pp. 37–40, 2017, doi: 10.1109/CRCSIT.2017.7965559.

D. Saraswathi and E. Srinivasan, 'Performance analysis of mammogram CAD system using SVM and KNN classifier', *Proc. Int. Conf. Inven. Syst. Control. ICISC 2017*, pp. 1–5, 2017, doi: 10.1109/ICISC.2017.8068653.

C. Liu, T. Zhang, D. Ding, and C. Lv, 'Design and application of Compound Kernel-PCA algorithm in face recognition', *Chinese Control Conf. CCC*, vol. 2016-Augus, no. 2, pp. 4122–4126, 2016, doi: 10.1109/ChiCC.2016.7553997.

Y. Yang, J. Li, and Y. Yang, 'The research of the fast SVM classifier method', *2015 12th Int. Comput. Conf. Wavelet Act. Media Technol. Inf. Process. ICCWAMTIP 2015*, no. 1, pp. 121–124, 2015, doi: 10.1109/ICCWAMTIP.2015.7493959.

Zhujie and Y. L. Yu, 'Face recognition with eigenfaces', no. 3, pp. 434–438, 2002, doi: 10.1109/icit.1994.467155.

Y. li Tian, T. Kanade, and J. F. Cohn, 'Recognizing upper face action units for facial expression analysis', *Proc. IEEE Comput. Soc. Conf. Comput. Vis. Pattern Recognit.*, vol. 1, no. 2, pp. 294–301, 2000, doi: 10.1109/cvpr.2000.855832.

C. B. Tatepamulwar, V. P. Pawar, S. D. Khamitkar, and H. S. Fadewar, *Technique of face recognition based on PCA with eigen-face approach*, vol. 810. Springer Singapore, 2018. doi: 10.1007/978-981-13-1513-8_92.