Biometric Attendance Prediction using Face Recognition Method

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Abstract

Objectives: Face recognition has arisen as a smart solution to discourse many present-day needs for empathy and the confirmation of identity claims. It fetches together the capacity of other biometric methods, which endeavor to tie uniqueness for the individual characteristic features of the body, and the further familiar functionality of visual reconnaissance systems. Face acknowledgment is a vital field for authentication purpose particularly in the case of student's attendance. This paper is intended at applying a digitized system for attendance recording. **Methods/Statistical Analysis:** In this process two methods are used to determine the face recognition attendance system- Principle Component Analysis (PCA), Linear Discriminant Analysis (LDA). PCA is a statistical procedure that uses an orthogonal modification to transform a set of observations of probably correlated variables into a set of values of linearly uncorrelated variables. LDA is a generalization of Fisher's linear discriminant, a method used in statistics, pattern recognition and machine learning to find a linear permutation of features that shows or separates two or more classes of objects or events. **Findings:** However the current system of tracking attendance via records is difficult to manage. Face recognition based attendance system deals with the maintenance of the student's daily attendance details. Biometric appreciation comprises alike, within an open-mindedness of calculation, of pragmatic biometric behaviors in contradiction of formerly poised data for a focus. Estimated identical is obligatory due to the dissimilarities in biological characteristics and deeds both within and among persons. It generates the attendance for the student on basis of presence in the class. **Application/Improvements:** Project can be modernized in nearby future as, when a responsibility for the same arises, as it is very flexible in positions of growth. And the enrichment approach of camera formation based on the result of the position valuation in order to progress the face detection effectiveness.

Keywords: Biometric Features, Computer Vision Communities, Machine Learning, Pattern Recognition

1. Introduction

Keeping track of attendance in schools, universities, and companies is very essential. The prevailing method monitors the way that observers the student by giving the attendance through retaining the registers of attendance sheets for numerous students and by several sessions or courses that the student has registered. This technique monitors up with the outfits like paper or attendance record and pen to mark the attendance to the students for a definite class for the definite date and time.[1] During the lecture, laboratories the faculty stops the lecture to record the student attendance. This is a prolonged process which encompasses marking of attendance for every single individual student in the class. Due to this the exertion most of the time is wasted by looking at the presence of student. The foremost aspect involved in the traditional attendance system is to maintain the attendance sheets for the imminent purpose.[2] The problem arises when the attendance records are lost, this predicts

when the student wants to see his attendance details and we can't access further to this because of absence of attendance data. When a class comprehends more than thirty students, the manual attendance classification, proceeds a lot of time to recognize each and every student by their name or by their registration number and see whether they are present in the class. And the time is wasted for more than twenty minutes in the overall fifty minutes of class. Another problem is that there is chance of giving a proxy attendance to the students by the other students. This implicates the lack of trust in stuck between student and the faculty.

1.1 Deviation within Persons

Biometric individualities and the info arrested by biometric classifications may be exaggerated by fluctuations in age, situation, disease, anxiety, professional factors, exercise and warning, deliberate alterations; socio-cultural features of the condition in which the exhibition happens, vicissitudes in hominoid boundary with the organization, and so on. As an outcome, each contact of the distinct through the association (at enrollment, documentation, and so on) will be associated with dissimilar biometric info. Folks bidding to prevent gratitude for one reason or alternative also underwrite to the characteristic vagueness in biometric classifications.

The roles and responsibilities of the face recognition system involve the admin and the student who is using the system and functioning on the system.[18] Where, the student is central person who is benefited by the system by giving presence just by taking a photograph. Here the student has to register by his name and registration number and by taking a sample copy of his face. Then the admin takes the details of each and every student and maintains a database.[10,17] The admin plays a governing role in the system because he is the one who is working on it. And whenever the student goes to the class and stand in front of the camera, it will capture the student face and the admin will check for the status of the image then verifies the unique student face and provide the attendance to the student. So the system relays on admin and the student.[19] The student is benefited by the system by providing attendance which is helpful in the examination and other aspects. The student while standing in front of the camera should maintain a limited distance for a high resolution image.

2. Related Works

Face exposure is an essential first-step in face acknowledgement systems, with the persistence of extracting the face expanse from the database. It also has a number of applications in areas such as content-based image recovery, video coding, video conferencing, multitude observation, and intellectual human–computer boundaries.[3] It is not just that the face recognition problem received extensive among various stages. The human face is a vibrant thing and has a high degree of inconsistency in its arrival, which makes face detection a tough tricky in computer vision. A widespread variety of performances have been suggested, ranging from simple edge-based procedures to composite high-level methodologies employing progressive form recognition procedures.[4] It defines about a new skill for detection of human faces within color images. The methodology relies on image subdivision based on skin color, features extracted from the two dimensional distinct cosine make over. It is also one of a few efforts to syndicate a feature-invariant approach, such as color-based skin segmentation, laid-back with appearance-based face detection. The main advantage of the new technique is its low computational necessities, in terms of both handling speed and memory consumption.[5] It describes around Face detection is an enormously active subgroup of entity recognition because it has several solicitations, especially in the security and reconnaissance field. In our security obsessed world, administration bodies are exceptionally interested in what surveillance responsibilities can be computerized and in turn are devoting heavily in this field. The task of distinguishing a face in an image is not an easy problem because many troubles arises and must be engaged into account. For starters, faces will generally reside in very little area in most images and they are generally located subjectively.

The face recognition system displays the occurrence of large pose variations ruins one of the most stimulating features of spontaneous face recognition from low resolution images. It suggests a novel recognition methodology for their vigorous and well-organized matching. The background is based on harvests of modest image processing filters that compete with untreated grey scale input to yield a single equivalent score between two personalities. Moreover, the nature of most real-world applications are such that to apt, often real-time system reaction is needed, challenging appropriately efficient as well as robust identical processes.[14]

The literature study shows that the traditional attendance system has been used to mark attendance for the students in the schools, colleges and other sectors. This prediction has been defined as the oldest act to provide the attendance and follows up with the use of tools like paper and pen for providing attendance. This technique needs to preserve the attendance record throughout the completion of the student academic year for attending the exams. If the attendance records have been no-where to be found then the attendance information for the students in a certain class is lost. Every day the class lecturer has to genuinely mark the attendance for each and every student and the faculty has to see the student face whether he is physically present in the class or not and need to mark the attendance for the students. It consumes a lot of time and the effort is more. To overcome these issues the literature studies have proven a technique called face recognition for the attendance system. The earlier studies have shown that the face recognition technique is efficient to provide the attendance and this is even served as the security point of view. This technique proposes the benefits like, as it provides automatic attendance, there is no need of any tools like paper and pen, there is no way to provide the inconsistent data entry, time is saved. Moreover it is the efficient real-time system for providing the attendance to the students.

3. Materials and Methods

Feature abstraction and identical algorithms sustain that Biometric features cannot be unswervingly related but necessitate constant and individual topographies to primary be mined from sensor productivities. Alterations in feature withdrawal set of rules distress presentation, with properties occasionally intensified by necessities for accomplishing interoperability between exclusive organizations. For instance, each face-recognition of individually individual will engender a different face recognition doppelgänger every single period it is practical due to demonstration angle, compression, grime, moisture, unalike sensors, as well so on. Accordingly each individual can harvest a huge number of changed parodies from a solitary face.

3.1 Proposed System Overview

Face recognition is the procedure of classifying one or more people in images or videos by examining and relating patterns. Procedures for face recognition characteristically extract facial features and compare them to a database to find the best match. Face recognition is an imperative part of several biometric, security, and observation systems, as well as image and video indexing systems.

To solve the problems identified in the existing system, we provide the face recognition based attendance system for the students who attend a certain lecture, laboratory or exam at the specific time. Thus saving the time and effort thereby reducing the distractions and disturbances.[6] Additional advantage is when concerning exams, when the lecturer accidentally losses the attendance report of students or when the student lies about specifying the average attendance for attending the exam, the system will have a record of the students attendance of every class thereby allowing the students for attending the exam at a particular instance of time, thus protecting both lecturer's and students' rights. In addition, an automated performance evaluation would provide more accurate and reliable results avoiding human error.

This work, proposes a system that takes the attendance for the students in a classroom. The system takes the attendance automatically using face recognition. However, it is difficult to estimate the attendance accurately using each result of face recognition independently because the face detection rate is not sufficiently high. The system proposes a method for estimating the attendance exactly using all the results of face recognition obtained by constant reflection. Endless surveillance improves the performance for the estimation of the attendance.[7] We constructed the attendance system based on face recognition, and applied the system to classroom. This system relates the works in the field of attendance management and face recognition.

Here we use techniques to recognize the student face by the color based detection, PCA for face detection and for feature extraction LDA.

3.2 Principle Component Analysis (PCA)

Principal Component Analysisis a statistical procedure that uses an orthogonal alteration to convert a set of observations of possibly correlated variables into a set of values of linearly uncorrelated variables called principal components. The number of principal components is less than or equal to the number of original variables.[22] This transformation is defined in such a way that the

first principal component has the largest possible variance (that is, accounts for as much of the variability in the data as possible), and each succeeding component in turn has the highest variance possible under the constraint that it is orthogonal to the preceding components.[15] The resulting vectors are an uncorrelated orthogonal basis set. PCA is sensitive to the relative scaling of the original variables.

3.3 Linear Discriminant Analysis (LDA)

Linear Discriminant Analysis is a simplification of Fisher's linear discriminant, a method used in statistics, pattern recognition and machine learning to find a linear permutation of features that exemplifies or separates two or more classes of objects or events. The ensuing combination may be used as a linear classifier or, more commonly, for dimensionality reduction before later classification. LDA is also closely related to PCA and factor analysis in that way they both look for linear combinations of variables which are best to explain the data.[21] LDA explicitly cracks to model the difference between the classes of data. PCA on the other hand does not take into account any difference in class, and factor analysis builds the feature combinations based on differences rather than likenesses. Discriminant analysis is also different from factor analysis where it is not an interdependence technique: a distinction between independent variables and dependent variables.

3.4 System Implementation

Implementation of face recognition is done by MATLAB environment. MATLAB is widely used in all areas of practical arithmetic, in education and research at universities, and in the industry. MATLAB stands for MATrixLABoratory and the software is made up about vectors and matrices. This makes the software predominantly useful for linear algebra but MATLAB is also a great tool for solving arithmetical and differential calculations and for numerical integration.[9] MATLAB has powerful graphic tools and can produce nice pictures in both 2D and 3D.[8] MATLAB also has some tool boxes useful for signal processing, image processing, optimization, etc.[20]

The project highly deals with the heavy advantages in any type of organizations, universities, colleges, schools and other sectors. And deals with providing attendance using the bio-metric method of face-recognition. So far the bio-metrics method like finger print recognition is in use for the security point and for authentication in the organizations. This method have some limitations during the authentication like when the finger is damaged due to accident then the finger prints may not be in a good position at that time the authentication (Pan, 2012) is difficult to manage.[12] The authentication can be hacked by having a print of the person. To overcome this we can demonstrate the face recognition technique to provide authentication and can serve at the security purpose and can provide attendance to the students and to the faculties. This project can be used in any organization for the authentication and this project works on easy environment which is platform independent.[13] It consumes less time for detecting the face and for providing the attendance. It is also consumes less cost for the installing in the organization. Having this product in any sector can relate customer satisfaction.

3.5 System Architecture

The system architecture shows how the flow of face recognition system works from initializing the camera, detecting face, face alignment, feature extraction, featuring matching, storing in database and finally recognizing the face.[11] This process works using the MATLAB environment. The design of face recognition system architecture shows the workflow that is shown in Figure 1.
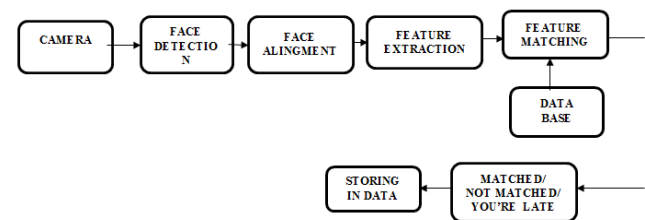

Figure 1. System Architecture.

3.6 Challenges of Face Recognition System

Spontaneously provide attendance for the students.
- Reduce paper work.
- Duplication of data entry can

- reduced.
- No need to maintain paper records.
- Fast and readily available attendance
- with high resolution.
- It saves their time and efforts.
- The system is convenient and secure
- for the users.
- Provide the GUI.

4. Experimental Results

The output results are shown as a step by step process by initializing the camera, capturing faces, detecting faces and providing attendance for the students.

4.1 Initializing the Camera and Capturing the Student Face

The webcam at the first starts initializing the camera and starts capturing the first student face when he is ready to capture. It is figured out in Figure 2.
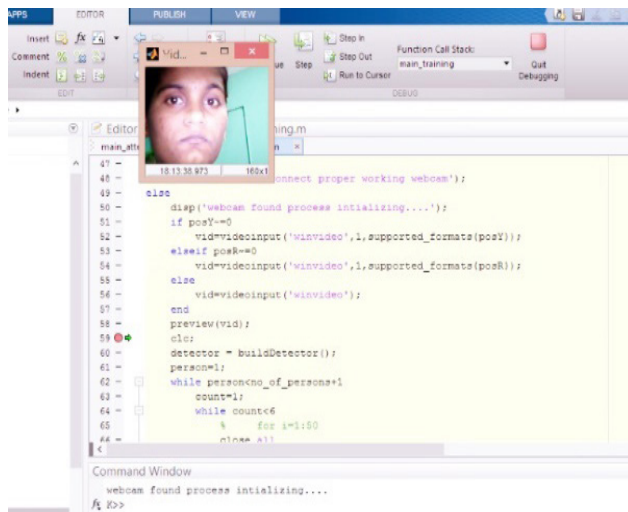
Figure 2. Initializing the camera and student facing to capture the images.

4.2 Dialogue Box that prompts whether Next Person is Ready to Capture After Few Seconds

After capturing the first student the product asks for the next student whether he is ready to take the image. If he

is ready it asks to replace within 5 to 8 seconds and starts capturing the second person. The process is layered out in Figure 2 and Figure 3.
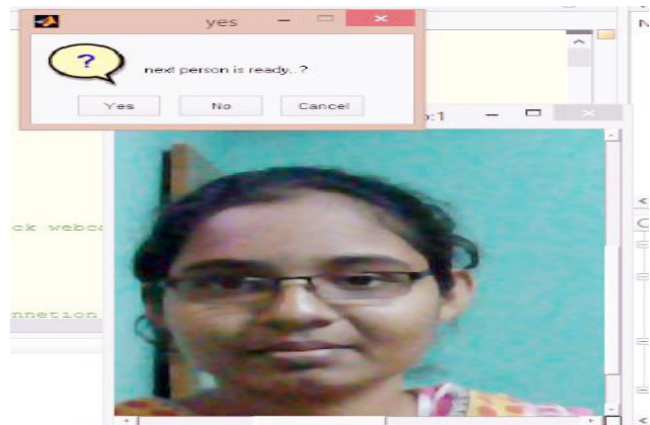
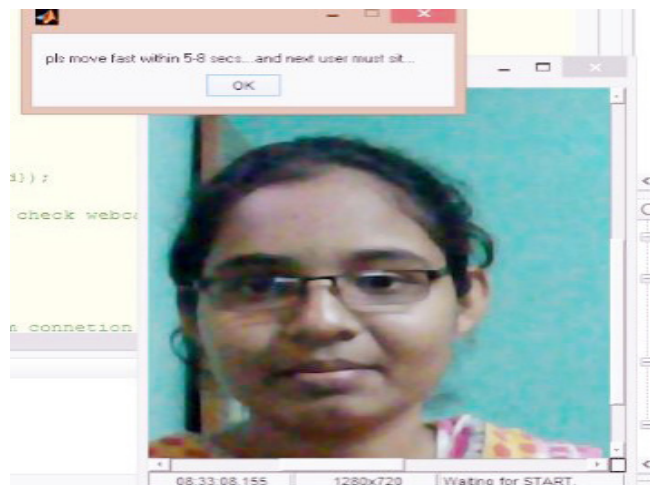**Figure 3.** Alert box that prompts whether the person is ready.

Figure 4. Alert box that prompts to move the next person.

4.3 Checking whether all Captured Images are Clear

After capturing all the student images the system asks, whether all the captured images are clear. If it is clear then the value is 1. If it is not clear the value is 2, where the system will recapture the student images. This is shown in Figure 4 and Figure 5.
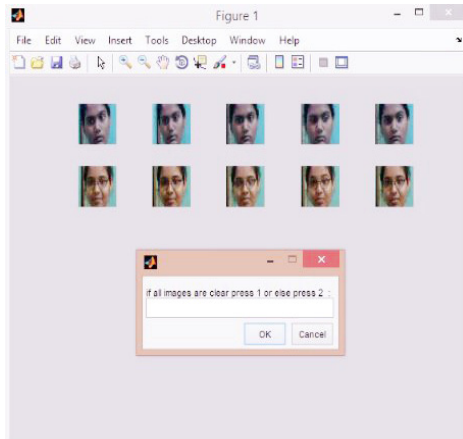
Figure 5. Checking the captured images are clear.

4.4 Assigning the Student Names

After setting the clear images, the system asks for the student names to enter where these details of the students will be stored in a database. And the process is figured in Figure 6 and Figure 7.
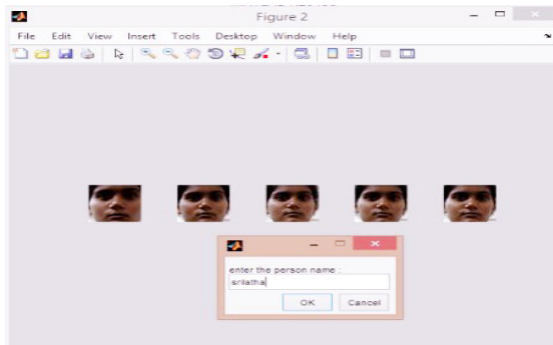
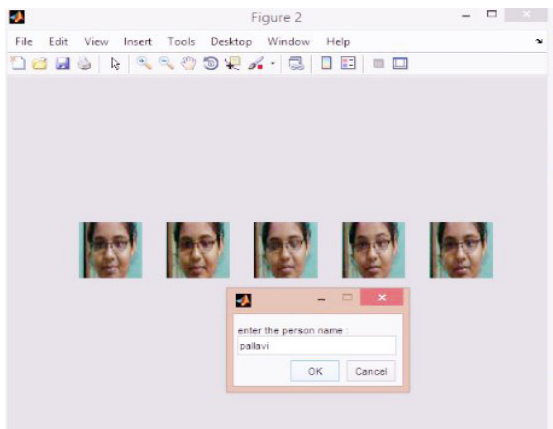

Figure 6. Assigning name to the first person.

Figure 7. Assigning name to the second person.

4.5 Student facing to the Camera to get the Attendance

Now all the details of the student and the images are stored in the database. Then the student comes for the next time to get the attendance. And the system recognizes the student face and asks for the acceptance whether the recognized person is correct or not. The result is layered in the Figure 8.
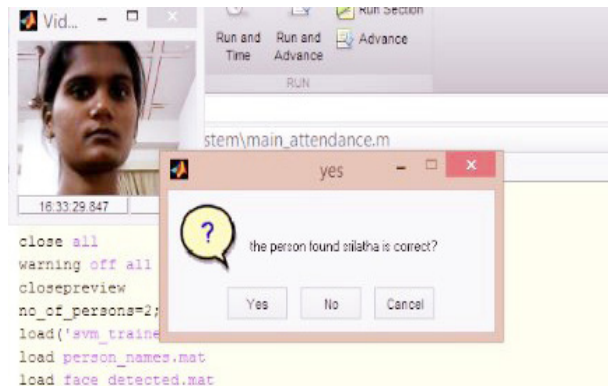

Figure 8. Recognizing the face.

4.6 Showing the Attendance Report of the Students

After the recognition the attendance report is generated by showing the check-in and the check-out time. The final outcome is shown in Table 1.

Table 1. Attendance report generated after recognizing

	A	B	C	D
1	STUDENT NAME	STUDENT NO	CHECK IN	CHECK OUT
2	Srilatha	1	8:04:38	8:50:05
3	Pallavi	2	9:01:01	9:51:10
4				
5				
6				

5. Discussion

The result assigned with project is providing attendance to the student whenever His/her face is focused to the camera. After focusing to the camera the face is detected and the face alignment is done to align the feature of the

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face then the feature is matched with the database results. If the result of the captured image is matched with the database then the attendance is provided to the particular student. Then the attendance sheet is generated for a list of students. The results that are associated with the face recognition system vary the results like some of the results may work perfectly and some results may not work exactly with the specifications when:

- Sometimes the face will not be
- detected due to the heavy focus of
- light.
- The image may be blur due to low
- light.
- The image will be captured exactly
- as the person frames to the camera in
- a correct position.
- If the student changes the direction
- of his face while capturing, then the
- duplication of the person is replaced
- with the other.
- The exact face is not determined if
- the student moves his face.
- The images may not be
- stored into the database due to specification error.

6. Conclusion

Biometrics is the automatic respect of people based on their social and biological features. It is a utensil for creating self-reliance that one is allocating with people who are previously known or not known and accordingly that they fit in to a group with certain rights or to a collection to be deprived of certain honors. It trusts on the presumption that personalities are physically and psychologically unique in a number of ways. The face recognition is dealing with the natural remedies where the biological features of the face combine to take the biometric attendance of the person. The proposed attendance management system is based on face recognition in the classroom lecture using the PCA analysis which emphasizes the feature capturing and detection of face. The system estimates the attendance and the position of each student by continuous observation and recording. The result of our preliminary experiment shows continuous observation improved the performance for estimation of the attendance. To conclude, Project works like a component which can access all the databases and picks up different functions and

functionalities. It overcomes the many limitations incorporated in the attendance. The time is saved efficiently, Easy implementation environment, generate report flexibly, there is no duplication entry of data. The run time for the detection of face is also very less which is very efficient to the students to use. Moreover this face recognition can be used for the security point of use.

7. Scope of Future Work

The project has a very vast scope in future. The project can be applied on intranet in prospect. Project can be modernized in nearby future as, when an obligation for the same arises, as it is very flexible in terms of development. And the enhancement approach of camera planning based on the outcome of the position valuation in order to progress the face detection effectiveness. In further work will intend to improve the face detection efficiency by means of the interaction among the system, students and the lecturer. The enhancement process will work on the process of capturing the image at a far distance by having a heavily high resolution camera. On the other hand, the system can be enriched by integrating video-streaming service and lecture archiving system, to provide more profound applications in the field of distance education, course management system and support for faculty development. The following are future scope of the project:

- Bar encryption reader centered attendance classification.
- Distinct Attendance method with the snapshot by means of Student login.

8. References

1. Sajid M, Hussain R, Usman M. A conceptual model for automated attendance marking system using facial recognition. 2014 IEEE Ninth International Conference on Digital Information Management (ICDIM); 2014. p. 7–10. Crossref
2. Kawaguchi Y, Shoji T, Weijane LIN, Kakusho K, Minoh M. Face recognition-based lecture attendance system. The 3rd AEARU Workshop on Network Education; 2005. p. 70–5.
3. Hjelmas E, Low BK. Face detection: A survey. Computer vision and image understanding. 2001; 83(3):236–74. Crossref
4. Abdallah, Abdallah S, Lynn Abbott A, El-Nasr MA. A new face detection technique using 2D DCT and self organizing feature map. Proc of World Academy of Science Engineering and Technology. 2007; 21:15–9.

5. Ephraim T, Himmelman T. Optimizing Viola-Jones Face Detection for use in Webcams; 2014.

6. Kumar S, Bhuyan MK, Chakraborty BK. Extraction of informative regions of a face for facial expression recognition. IET Computer Vision. 2016; 10(6):567–76. Crossref

7. Tokiwa Y, Nonobe K, Iwatsuki M. Web-based tools to sustain the motivation of students in distance education. FIE'09. 39th IEEE in Frontiers in Education Conference; 2009. p. 1–5. Crossref

8. Chang CL, Li E, Wen Z. Rendering Novel Views of faces Using Disparity Estimation; 2000.

9. Turk MA, Pentland AP. Face recognition using eigen faces. CVPR'91. Proceedings of IEEE Computer Society Conference on Computer Vision and Pattern Recognition; 1991. p. 586–91.

10. Li X, Areibi S. A hardware/software co-design approach for face recognition. ICM'04. Proceedings of The 16th International Conference on Microelectronics; 2004. p. 55–8.

11. Shehu V, Dika A. Using real time computer vision algorithms in automatic attendance management systems. 2010 IEEE 32nd International Conference on Information Technology Interfaces (ITI); 2010. p. 397–402.

12. Pan X. Research and implementation of Access Control System based on RFID and FNN-Face Recognition. 2012 IEEE 2nd International Conference on Intelligent System Design and Engineering Application (ISDEA); 2012. p. 716–9. Crossref PMid:22244688

13. Er MJ, Wu S, Lu J, Toh HL. Face recognition with radial basis function (RBF) neural networks. IEEE Transactions on Neural Networks. 2002; 13(3):697–710. Crossref PMid:18244466

14. Girosi F, Poggio T. Networks and the best approximation property. Biological Cybernetics. 1990; 63(3):169–76. Crossref

15. Graham DB, Allinson NM. Characterising virtual eigen signatures for general purpose face recognition. In Face Recognition. Springer Berlin Heidelberg; 1998. p. 446–56. Crossref

16. Haykin S. Neural networks: a comprehensive foundation Prentice-Hall Upper Saddle River. NJ MATH Google Scholar; 1999.

17. Liu Q, Tang X, Lu H, Ma S. Kernel scatter-difference based discriminant analysis for face recognition. ICPR'04. IEEE Proceedings of the 17th International Conference on Pattern Recognition. 2004; 2:419–22.

18. Moody J, Darken CJ. Fast learning in networks of locally-tuned processing units. Neural Computation. 1989; 1(2):281–94. Crossref

19. Samal A, Iyengar PA. Automatic recognition and analysis of human faces and facial expressions: A survey. Pattern recognition. 1992; 25(1):65–77. Crossref

20. Kar N, Debbarma MK, Saha A, Pal DR. Study of implementing automated attendance system using face recognition technique. International Journal of Computer and Communication Engineering. 2012; 1(2):100. Crossref

21. Nagendrarajah J, Perera MUS. Recognition of expression variant faces-a principle component analysis based approach for access control. 2010 IEEE International Conference on Information Theory and Information Security (ICITIS); 2010. p. 125–9. Crossref

22. Fernandes S, Bala J. Performance Analysis of PCA-based and LDA-based Algorithms for Face Recognition. International Journal of Signal Processing Systems. 2013; 1(1):1–6. Crossref