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Article in *International Journal of Innovative Technology and Exploring Engineering* · January 2020

DOI: 10.35940/ijitee.B7682.0119320

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Face Detection and Recognition for use in Campus Surveillance



B. Kranthikiran, Padmaja Pulicherla

Abstract: *The study of image processing in today's world and the booming possibility of building a smart classroom and a smarter campus with the help of aided vigilance and surveillance is slowly moving from a thought that can be considered for the future to an actual real-world implementation. In modern day schools and university campuses there is an increasing demand for a real-time monitoring and quick responding database that tracks the student activities. This is not always required but serves as a one-click system that handles average information searches and returns the list of fast action options that are available in tracking the campus activities that come in the purview of its span. In a diverse educational campus comprising of several branches and streams that share a single campus, there is a possible chance of intrusion and unauthorized entry which may lead to undesirable and unnecessary loss of intellectual property and manipulation of identity. In a particular academic unit, there would be a surveillance system that monitors and tracks these activities and offers to its privileged users a response in real-time. It can also be used to track the attendance of students in an automated fashion which leads to a digitized and paperless approach. It can be said that this will be implemented in its entirety to a campus unit. Face identification is an essential step in face recognition, in which one of the typical of a class and authoritative application in visual sensor network. Visual perception is one of the physical measurements based on secured features. Face identification is a demanding assignment, because it has to scan and match against a library of known faces. E.g. lighting condition, different posture, various kind of body languages.*

Keywords: Visual Recognition, Surveillance, Security, image processing and Biometric.

I. INTRODUCTION

Video surveillance are increasingly in demand in modern day academic systems. A more creative and strategic interface which helps in detecting and recognizing known and unknown persons inside the campus. Face recognition is a computer technology being used in a various kind of applications which finds human faces in digital images. Face identification also refers to the physical measurement-based process by the one who keeps and points their face in the visual perspective. Hence it is the least disruptive and rapid biometric technology.

Revised Manuscript Received on January 30, 2020.

* Correspondence Author

Dr. B.Kranthikiran*, Associate Professor, JNTUHCHE, Kukatpally, Hyderabad, India.

Dr. Padmaja Pulicherla, Professor, Department of CSE, Teegala Krishna Reddy Engineering College, Hyderabad, India.

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It works with the most apparent in finding with individual person – the human face. As a substitute of requiring people to place their hand on a reader (a process not acceptable in some cultures as well as being a source of illness transfer) or accurately position their eye in visual scene, face identification systems capture the image once the human's face entered into the described area. There is no interference or delay, and in many of the cases the course of study is completely unknown of the process. The persons do not feel "under surveillance" or that their solitude has been conquered.

A. About Facial Recognition System

We had seen the show "Las Vegas" in social media which has seen face identification software in task. In that one episode, the security department at the fictional Montecito Hotel and Casino used CCTV to capture an image of a card counter, thief or blacklisted as distinct. It should process the captured image through the data warehouse in order to identify the person. At last the all the brutes are accompanied from the casino and they are prisoned. Since the social media cannot brings the fact as it is to the world. In 2001, the Tampa Police Department placed police cameras furnished with visual perception technology in their Ybor City nightlife district in order to avoid the offence in that area. But it was not succeeded and it was abolished in 2003 because of its inefficiency. Hence people were opposed and forbid the cameras from getting such a clear shot to recognize anyone. Boston's Logan Airport also installed two individual tests of face identification devices at their security end. Within three months the results were thwarted. As the protocols of Electronic Privacy Information Centre, the device processes the accuracy rate of 61.4 which leads to get other security options for airport officials. People have the capability of identifying & differentiating faces naturally, but such type of computers had built in recent days. In the mid-1960s, software developers had started to innovate the device to identify and distinguish the human faces which takes longer time and different types of algorithms and technical programs have been developed by software developers that are explained below.

B. Face Recognition By Independent Component Analysis

Nowadays number of face identification algorithms use face depictions are observed by unverified data collection techniques. The protocols used in this type represents faces as a linear combination of such images. Principal component analysis (PCA) is the best example of those procedures.

The PCA based on the two identical relationships between pixels in the image data collection. In face identification, the significant data accommodated high order relationships surrounded by the picture element. It appears to be rational to expect that better basis picture element may be found by methods responsive to these high-order statistics. Independent component analysis (ICA), a rationalization of PCA, is one such method. We can use the version of ICA which can be obtained from the principle of optimal information transfer through building block deep neural networks.

C. Eigen-Spaces

The Eigen-Spaces method is an efficient approach for facial recognition in computing digital images. Under this category of algorithm, there are many approaches available. All of the methods are using the projection concept in the algorithms. The point of this paper is to exhibit a free near examination among a portion of the fundamental Eigen space-based methodologies. We accept that doing free investigations is pertinent, since correlations are ordinarily performed utilizing the usage of the exploration bunches that have proposed every strategy, which doesn't consider totally equivalent working conditions for the calculations. Regularly, a challenge between the capacities of the examination bunches as opposed to a correlation between strategies is performed. This investigation considers hypothetical viewpoints just as recreations performed utilizing the Yale Face Database, a database with not many classes and a few pictures for each class, and FERET, a database with numerous classes and barely any pictures per class.

Nearby Binary Pattern (LBP) is a basic yet extremely effective surface administrator which names the pixels of a picture by thresholding the area of every pixel and thinks about the outcome as a double number. Because of its discriminative power and computational effortlessness. LBP highlights were proposed initially for surface investigation, and as of late have been acquainted with speak to faces in facial pictures examination. The most significant properties of LBP highlights are their resistance against light changes and their computational effortlessness. Diverse AI strategies, including format Matching, Support Vector Machine (SVM), Linear Discriminant Analysis (LDA) and the direct programming procedure are inspected to perform outward appearance acknowledgment utilizing LBP highlights. Contrasted with Gabor wavelets, LBP highlights can be inferred quick in a solitary sweep through the crude picture and lie in low-dimensional component space, while as yet holding discriminative facial data in a reduced portrayal.

Since it is both time and memory escalated to convolve face pictures with a bank of Gabor channels to extricate multi-scale and multi-direction partner coefficients. The speculation capacity of LBP includes crosswise over various databases are assessed. Clearly low-goals pictures in genuine situations make genuine articulation acknowledgment significantly more troublesome. Thus, in this work, LBP highlights for low-goals outward appearance acknowledgment are examined. Analyses on various picture goals show that LBP highlights perform steadily and vigorously over a helpful scope of low goals of face pictures. The sample face detection is shown in Fig.1.



Fig. 1: Face detection

A significant viewpoint is that such innovation ought to have the option to manage different changes in face pictures, similar to revolution, changes in appearance. Shockingly, the scientific varieties between the pictures of a similar face because of brightening and review course are quite often bigger than picture varieties because of changes in face character. This shows an extraordinary test to confront acknowledgment. At the center, two issues are key to effective face acknowledgment calculations: First, the selection of highlights used to speak to a face. Since pictures are liable to changes in perspective, light, and articulation, a successful portrayal ought to have the option to manage these potential changes.

In geometric or highlight based strategies, facial highlights, for example, eyes, nose, mouth, and jaw are distinguished. Properties and relations, for example, zones, separations, and points between the highlights are utilized as descriptors of countenances. Despite the fact that this class of strategies is conservative and effective in accomplishing information decrease and is obtuse toward varieties in light and perspective, it depends intensely on the extraction and estimation of facial highlights. Shockingly, include extraction and estimation strategies and calculations created to date have not been solid enough to take into account this need. Conversely, layout coordinating and neural techniques for the most part work legitimately on a picture-based portrayal of appearances, i.e., pixel force exhibit. Since the discovery and estimation of geometric. Highlights are not required; this kind of technique has been increasingly down to earth and simpler to execute when contrasted with geometric element-based strategies.

D. Issues And Objectives

Face Recognition human facial highlights like the mouth, nose and eyes in a full-frontal face picture. We will adjust a multi-step process so as to accomplish the objective. To recognize the face locale, we will utilize a skin-shading division technique. Morphological strategies will be adjusted to discover the gaps that would be made after the division procedure. From the skeletonizing procedure, a skeleton of the face will be gotten from which face shape focuses could be removed. Facial highlights can be situated in the inside of the face form. We will utilize a few diverse facial pictures to test our technique.

1. To recognize face in live video. Facial highlights are separated to identify the face which is to be checked.

2. Constant face acknowledgment: Here, face acknowledgment module recognizes an individual on the spot dependent on different preparing tests of an individual.
3. The point of this task is to identify and perceive the known and the obscure individual by utilizing face identification and acknowledgment in video observation.
4. Face recognition is the way toward recognizing the district of face in a picture. The face is acknowledgment by utilizing the Eigen-Face technique and face location is actualized by utilizing the Principal Component Analysis (PCA).

II. LITERATURE SURVEY

In existing scenario for everybody the primary anxiety is home-based safety. To improve home-based safety an endeavor is made in this paper. Based on RECS the suggested scheme is developed. The suggested scheme experimental authentications displayed by the outcomes. It is totally incorporated and wireless software design.[1]

In this work based on Embedded Linux podium the notion of shrewd ATM safekeeping scheme is recommended in instruction to deliver dependable safety solution to the publics. By protracted ability of OpenCV s/w on credit card size RaspberryPi panel which is recycled for image processing maneuver the scheme is executed. By RaspberryPi board the scheme is easy to develop.[2]

A staid subject at present-day is cumulative number of robberies and self-deception. A expression recognition scheme must be established in instruction to evade this condition. Based on face recognition to grow a safety right of entry controller application is the latitude of this scheme. For face detection and recognition haar-like topographies, HOG and SVM algorithm are used correspondingly.[3]

By the facial physiognomies the capability to identify and recognize a person is expression recognition. By incorporating PCA and LDA, a crossbreed expression recognition algorithm is suggested by this broadsheet. On T and AT dataset of imageries the presentation of suggested algorithm is assessed.[4]

In processor-based communiqué of a system controller a verification is a important subject. Using PCA algorithm, a technique for Scholar's Attendance System which will integrate with the face recognition technology is described in this paper. Associated to the old-style black and white presence methods the outcome of initial test displays enhanced presentation in the valuation of the presence. From imageries this broadsheet concentrated on a face discovery algorithm.[5]

For unimpeded face credentials and authentication which attains up-to-the-minute presentation on numerous benchmark datasets an author defines the particulars of a deep learning pipeline in this paper. An author suggested which is fast and proficient of DPSSD for identifying faces with big scales variants.[6]

The record custody technique for illicit in the nation is still guidebook. By guidebook stodgy of forms and inscription of reports will go citizens. This technique is not sufficient and occasionally lead to break of procedures in certain criminality cases especially by an inside person, or somebody from the outside person. The design of an expression recognition

scheme for safety controller in Nigeria is the aim of this paper. By identifying the expressions of the criminals and intelligences of such corruptions for keeping of illicit registers and crime cases nearby make sure they are caught and dealt with according to the bylaws of the nation.[7]

Low-cost real-time structural design based on FPGA for expression recognition is offered in this paper. Based on a preliminarily well-defined set of expressions the suggested structural design proficient of discovery expressions in group. For real-time observation schemes of regularly congested places the above technique can be incorporated to categorize the hypothetical bases of hazard, and there by condense the threat of likely illicit activities. The outcomes shown that this structural design is 95% proficient to identifying faces.[8]

The request of reckoning, communiqué and stowage abilities have elevated by the intensification of applications based on expression identification and tenacity in recent IoT and big data condition. To develop dealing out volume and save the bandwidth the fog works out based expression credentials and resolve outline is suggested by an author. To estimate the effect of safety scheme on scheme presentation at last an author implement the archetype scheme.[9]

In the region of face credit substantial development has been made in modern ages. To fix safety subjects and proposal litness to nifty household controller an involuntary face credit scheme is flawlessly well-matched. By Raspberry pi the spare of expensive image dealing out board is the goal of this work. Through incorporating the OpenCV public library to the Raspberry Pi board this work is based on image dealing out.[10]

A majority biometric verification technique is expression credit. An author intends a multi-channel CNN based methodology for PAD in this framework. For both caricature and clouding assaults, a face PAD which encompasses a extensive diversity of 2Dimension and 3Dimension performance assaults the author also hosted WMCA databank. The featured based method and suggested technique are likened and discover the best recital of a presented technique.[11]

III. COMPLETE DESIGN OF THE PROPOSED SYSTEM

The reason for this segment is to give Software Requirement Specification to

Face Detection and Recognition: Dataset assortment, Detection procedure and database association.

The product prerequisite determination report enrolls every fundamental necessity for venture improvement. The product item created is an application by name "Continuous Face discovery and Recognition in video observation".

Face identification and following is the way toward deciding if a face is available in a picture. Not at all like face acknowledgment—which recognizes diverse human faces, face location just demonstrates whether a face is available in a picture. Moreover, face following decides the accurate area of the face.

Face identification and following has been a functioning exploration territory for quite a while on the grounds that it is the underlying significant advance in a wide range of uses, for example, video observation, face acknowledgment, picture improvement, video coding, and vitality protection. The relevance of face identification in vitality preservation isn't as clear as in different applications. Be that as it may, it is intriguing to figure out how a face recognition and following framework enables power and vitality to be spared. Assume one is viewing a TV and taking a shot at different undertakings at the same time. The face location framework is for checking whether the individual is taking a gander at the TV. In the event that the individual isn't legitimately taking a gander at the TV inside some timeframe, the TV's brilliance is diminished to spare vitality. At the point when the individual goes back to take a gander at the TV, the TV's brilliance can be expanded back to unique. What's more, if the individual turns away for a really long time, at that point the TV will be naturally killed.

A. System Architecture Diagram

The proposed system and its architecture and its components are given below for discussion. The architecture diagram is shown in Fig.2.

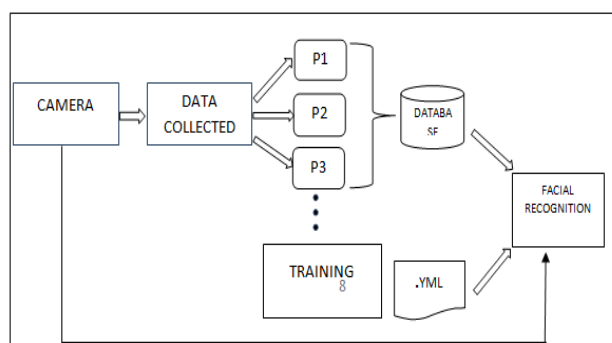


Fig 2. Proposed System Architecture

The key components of the architecture system are:

Dataset collection: This component is implemented as a python application where it is used to get the dataset for each person in different orientations. It is linked with Face directory and the database to store the Names and Id's.

Training: This component is implemented as a python application where it is used to train the images in the directories and to create an yml file. It contains the dataset values for each person which is used to recognize the person

Recognition: This component is implemented as a python application where it is used to detect the faces in the live stream and compare them with the database names and the dataset value to recognize the faces. It displays the recognized names in the live stream and displays as 'unknown' if it does not match with any faces in the directory and in the database.

IV. IMPLEMENTATION AND RESULTS

The proposed system has been implemented and the capture output screens were given below for analysis. The images capture during the training phase is shown in Fig.3. The same images with respect to Grey scale is given in Fig. 4.

Table 1. Test cases for Face Detection

Test ID	Input Image	Expected Outcome	Output Obtained	Status
1	Face 1	Face Detected	Face Detected	Correct
2	Face 2	Face Detected	Face Detected	Correct
3	Face 3	No Face Detected	No Face Detected	Correct
4	Face 4	Face Detected	Face Detected	Correct
5	Face 5	No Face Detected	No Face Detected	Correct
6	Face 6	Face Detected	Face Detected	Correct

The testcases conducted for Face detection with different images is tabulated in Table 1. The results obtained are satisfactory and correct as expected. When there is no input image, the result obtained is "No face Detected" and when there is input image, the output obtained is "Face Detected".

Table 2. Test cases for Face Recognition

Test ID	Input Video	Expected Outcome	Output Obtained	Status
1	Live Video 1	Face 1 Recognized	Face 1 Recognized	Correct
2	Live Video 2	Face 2 not Recognized	Face 2 not Recognized	Correct
3	Live Video 3	Face 3 Recognized	Face 3 Recognized	Correct
4	Live Video 4	Face 4 Recognized	Face 4 Recognized	Correct
5	Live Video 5	Face 5 not Recognized	Face 5 not Recognized	Correct
6	Live Video 6	Face 6 Recognized	Face 6 Recognized	Correct

The testcases conducted for Face recognition with different video streams as input is tabulated in Table 2. The results obtained are satisfactory and correct as expected. When there is no input video stream, the result obtained is "Face not Recognized" and when there is input video stream, the output obtained is "Face Detected".



Fig. 3: Training Images



Fig. 4: Equivalent Grey-Scale Images

V. IMPLEMENTATION AREAS

A. Law Requirement And Equity Arrangements

The present law requirement searching for creative advances to assist them in front of the world's consistently propelling hoodlums. Accordingly, creating advancements that can make the occupations of the law requirement official simpler. This incorporates acclaimed CABS-automated capture and booking framework and the youngster base assurance, a product answer for worldwide law requirement organizations to help ensure and recoup missing and explicitly abused kids, especially as it identifies with kid erotic entertainment.

B. Taxis

This type of systems can be applied in cabs to Store all offense-related confine one simple to-utilize framework - information is entered once and just once. It can also be used to help in criminal examinations, capture and store computerized pictures of the guilty party, encode all mug shots, imprints, tattoos and scars. It can be used to Identify past guilty parties, pre-incorporated with cutting edge biometric face acknowledgment programming. Child Base is an application that secures and recoup missing and explicitly misused youngsters, especially those kids misled through kid misuse pictures.

C. Identification Supports

With respect to essential distinguishing proof records, (Passports, Driver's licenses, and ID Cards), the utilization of face acknowledgment for ID programs has a few favorable circumstances over other biometric advances. Leveraging the current recognizable proof framework. This incorporates, utilizing existing photograph databases and the current enrolment innovation. Increase the open's collaboration by utilizing a procedure that is as of now acknowledged and anticipated. Integrate with fear monger watch records, including local, national, and universal "generally needed" databases.

D. Immigration

Most nations would prefer not to be seen just like a "feeble connection" with regards to tolerating foreigners and outcasts, especially if that individual uses the new nation as an organizing ground for worldwide lawbreaker and psychological militant exercises. Therefore, governments around the globe are inspecting their movement arrangements and techniques. Biometric innovation, especially face acknowledgment programming, can improve the adequacy of migration and customs staff. All things considered, to the

human eye it is regularly hard to decide an individual's character by taking a gander at a photograph, particularly if the individual has matured, is of an alternate ethnic foundation, has changed their haircut, shaved their facial hair, and so forth. FRS doesn't have this trouble.

E. Access Control

The utilization of biometric innovation, especially face acknowledgment programming (either freely or as one piece of a multi-layered biometric arrangement), can improve your security endeavors extensively. Biometric distinguishing proof guarantees that an individual is who they guarantee to be, dispensing with any stress of somebody utilizing unlawfully acquired keys or access cards.

F. Financial Administrations

The money related administrations industry rotates around the idea of security. However generally, security inside the business is constrained to a basic individual ID number (PIN) or secret key. Biometrics, especially face acknowledgment programming, can improve the security of the monetary administrations industry, sparing the establishment time and cash both through a decrease of extortion cases and the organization costs of managing overlooked passwords. Furthermore, biometric-based access control units can shield vaults, teller regions, and wellbeing store boxes to ensure against robbery. The utilization of biometrics can likewise guarantee that classified data stays private while stopping wholesale fraud, especially as it identifies with ATM terminals and card-not present online business exchanges. This system can also be applied for implementing safety and security in the following areas. They are Homeland defense, Airport security. They make use of the use of biometric identification, can enhance security efforts already underway at most airports and other major transportation hubs etc., This includes the identification of known terrorists before they get onto an airplane or into a secure location.

VI. SECURE ANALYSIS AND SURVEILLANCES SOLUTIONS

This incorporates the capacity to separate, order, and search non-facial symbolism. For instance, inside the law requirement application it enables to catch, chronicle, and recover such distinguishing attributes as tattoos, stamps, or scars. It can likewise break down scenes from either spilling or chronicled video, "looking" for strange events, the nearness of specific vehicles, explicit faces, and so on. This is valuable and can set aside huge time and cash to those people who go through hours, days, or weeks observing video streams (for example looking at a bank's security in a criminal examination).

VII. CONCLUSION

This paper describes the technique of finding and recognizing the faces of the peoples entering the campus through the cameras and the same can be used for implementing the security in the campus for surveillance.

This concept can also be enhanced further to enable automatic attendance for the employees of any organization. It may need certain hardware and configuration changes. The same approach can also be extended to identify the geographical location of the people within the campus. Simply the unnecessary movements of the employees to the other departments can also be tracked. When compared with the other available approaches, the proposed method is more efficient in streaming the live video. The recognition rate can be rapidly increased by using the cameras with high resolution. This concept was introduced here to enhance the facial recognition system performance with the support of Local Binary Patterns (LBP). The approach of modeling the system for facial detection and recognition in successive manner has been done. The feature extraction module in this system has been applied to extract the unique features of every facial image of the human beings for identification and recognition. In the classification process, the facial image obtained through the camera has been compared with the already stored facial images in the database. This approach identifies the major feature of the captured face with the most identical and matching face in the database. The accuracy has been increased much when compared with the other systems.

VIII. FUTURE SCOPE OF THE PROJECT

This methodology can be additionally improved for an Automated-Attendance-Tracking-System with a couple of code deviations and some equipment changes. Clearly the aftereffect of this face recognition framework is great however there is extension for future improvement. The principle improvement will seek after the exhibitions, perceives the continuous face recognition. We might want to improve our code for face acknowledgment just as tidy up the code so as to improve execution. Numerous troubles have been confronted when perceived appearances from database, for example, posture and lighting varieties, demeanor varieties, age varieties, and facial impediments. In future to improve the posture amendment, quality-based casing choice, maturing remedy, and imprint-based coordinating methods can be joined to fabricate a brought together framework for video-based face acknowledgment.

REFERENCES

1. Sahani, M., Subudhi, S., & Mohanty, M. N. (2016). Design of Face Recognition based Embedded Home Security System. *KSII Transactions on Internet & Information Systems*, 10(4). pp. 1751-1767.
2. Patoliya, J. J., & Desai, M. M. (2017, April). Face detection-based ATM security system using embedded Linux platform. In *2017 2nd International Conference for Convergence in Technology (I2CT)* (pp. 74-78). IEEE.
3. Deshmukh, S. V., & Kshirsagar, U. A. (2017). Implementation of Human Face Detection System for Door Security using Raspberry Pi, *International Journal of Innovative Research in Electrical, Electronics, Instrumentation and Control Engineering*, 5(4), pp. 186-191.
4. Borkar, N. R., & Kuwelkar, S. (2017, July). Real-time implementation of face recognition system. In *2017 International Conference on Computing Methodologies and Communication (ICCMC)* (pp. 249-255). IEEE.
5. Kar, N., Debbarma, M. K., Saha, A., & Pal, D. R. (2012). Study of implementing automated attendance system using face recognition technique. *International Journal of computer and communication engineering*, 1(2), pp.100-103.
6. Ranjan, R., Bansal, A., Zheng, J., Xu, H., Gleason, J., Lu, B. & Chellappa, R. (2019). A fast and accurate system for face detection,

identification, and verification. *IEEE Transactions on Biometrics, Behavior, and Identity Science*, 1(2), pp. 82-96.

7. Azeta, A. A., Omoregbe, N. A., Adewumi, A. O., & Oguntade, D. (2015). Design of a Face Recognition System for Security Control. *International Conference on African Development Issues (CU-ICADI) 2015: Information and Communication Technology Track*, pp.55-57.
8. Schaffer, L., Kincses, Z., & Pletl, S. (2017, September). FPGA-based low-cost real-time face recognition. In *2017 IEEE 15th International Symposium on Intelligent Systems and Informatics (SISY)* (pp. 000035-000038). IEEE.
9. Hu, P., Ning, H., Qiu, T., Song, H., Wang, Y., & Yao, X. (2017). Security and privacy preservation scheme of face identification and resolution framework using fog computing in internet of things. *IEEE Internet of Things Journal*, 4(5), pp. 1143-1155.
10. Thabet, A. B., & Amor, N. B. (2015, December). Enhanced smart doorbell system based on face recognition. In *2015 16th International Conference on Sciences and Techniques of Automatic Control and Computer Engineering (STA)* (pp. 373-377). IEEE.
11. George, A., Mostaani, Z., Geissenbuhler, D., Nikisins, O., Anjos, A., & Marcel, S. (2019). Biometric Face Presentation Attack Detection with Multi-Channel Convolutional Neural Network. *IEEE Transactions on Information Forensics and Security*, 15, pp.42-55.

AUTHORS PROFILE



workshops and conferences.

Dr. B. Kranthi Kiran is working as the Associate Professor in the department of Computer Science & Engineering, JNTUH College of Engineering, Hyderabad. He has published many Scopus indexed Journals, participated in various



Dr. Padmaja Pulicherla, working as the Professor in the department of Computer Science and Engineering at Teegala Krishna Reddy Engineering College, Hyderabad. He has published many Scopus indexed Journals, participated in various workshops and conferences.