

DRAFT PAPER

by SCSE CC

Submission date: 09-Nov-2023 03:45PM (UTC+0530)

Submission ID: 2222686747

File name: DRAFT_PAPER_4.docx (246.52K)

Word count: 8226

Character count: 49436

Smart Attendance Monitoring System Based On Facial Recognition

1 Thorat Amey Arun
School of Computer Science and Engineering
Vellore Institute of Technology, Chennai
Tamil Nadu, India
thoratamey.arun2023@vitstudent.ac.in

1 Dr. S. Bharathiraja
School of Computer Science and Engineering
Vellore Institute of Technology, Chennai
Tamil Nadu, India
bharathiraja.s@vit.ac.in

Abstract

Facial recognition technology is used in smart attendance monitoring systems to automatically identify and confirm people so that their attendance can be marked. Due to its many benefits over more traditional attendance recording techniques like handwritten sign sheets or RFID cards, this kind of technology is getting more popular. Students or employees can just stroll in front of a camera to have their attendance recorded without having to carry any specific identification cards or any electronic gadgets. Smart attendance monitoring systems can also be implemented with the help of CCTV cameras. In order to capture clear and consistent photos of people for face recognition, it is necessary to accurately identify CCTV cameras and maximize their settings. In large businesses, in particular, this can save a lot of time and tension. It can boost security, reduce costs, and increase productivity, but it's important to address privacy concerns and make sure the tools are utilized morally and responsibly. With the help of facial recognition technology, people may be recognized even in poor lighting or crowded environments. Facial recognition based smart attendance monitoring systems have a number of advantages over traditional approaches, but it's essential to use them nicely and perfectly. This paper is a systematic literature review of various papers based on facial recognition. This systemic review's major goal is to provide insight into a model based on three factors: deep learning, machine learning, and image processing. Some research gaps have been identified as a result of the systemic review and need to be filled.

Keywords

Local Binary Pattern (LBP), Convolutional Neural Networks (CNN), Generative adversarial network (GAN), Support Vector Machine (SVM), Face recognition (FR), Machine Learning (ML), Deep Learning (DL), Local Binary Pattern Histogram (LBPH), Principal Component Analysis (PCA) and Linear Discriminant Analysis (LDA)

18 INTRODUCTION

Facial recognition is one of the most advanced fields in artificial intelligence and computer vision, which has revolutionized the way we authenticate and identify individuals. This technology involves the accurate identification of individuals based on unique facial features, offering a promising method for attendance monitoring systems. The deployment of facial recognition in attendance monitoring systems has gained special attention due to its potential to address various important challenges present in traditional attendance systems.

Face recognition is a technology that uses computer algorithms and machine learning to identify and verify individuals by analyzing their facial features in images and videos. It mainly detects faces in the system, extracts unique characteristics, and compares them to known faces for tasks like authentication, security, access control, etc. It is also utilized in diverse domains, including law enforcement,

customer service, and personalized marketing. It is also showcasing great potential to transform and develop various aspects of modern life and business operations.



Figure. 1: Person is trying to open mobile lock with help of face recognition and detection technique which is already preinstalled.

A smart attendance monitoring system is a real time solution with a modern face recognition system for handling people with their daily activities and can be used to detect human faces automatically with the help of capturing the current date, time, and location.



Figure. 2: Person is trying to detecting face of themselves for marking attendance in class

A smart attendance monitoring system based on facial recognition is a better solution for atomizing and optimizing the process of tracking and recording attendance. This can utilize facial algorithms to identify individuals in a given area. This system eliminates the need for traditional manual methods and increases accurate, efficient, and secure attendance management. It can be used in educational institutions, businesses, and other organizations to improve attendance monitoring and overall system operation efficiency. This system improves security and reduces the risk of attendance fraud by ensuring that individuals are physically present during the checking process, making it a reliable and better solution for attendance management.

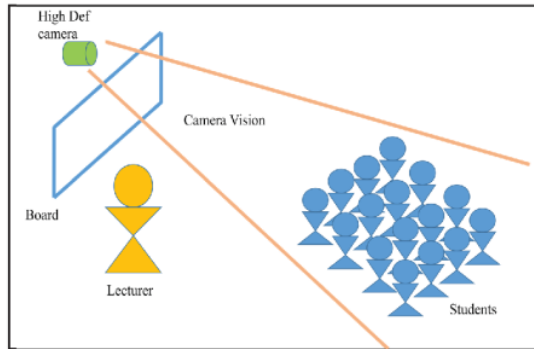


Figure. 3: Single Camera is detecting face of all students present in class for marking their attendance

This review aims to consolidate existing literature on this subject and recognize research gaps to establish clear objectives. In recent years, several studies and implementations have explored the advantages of using facial recognition in attendance monitoring. These applications are motivated by methods of remarkable accuracy, efficiency, and contactless operation. Beyond these practical benefits, its potential to contribute to improved security, reduced manual effort, and enhanced data analytics makes it an appealing area of research and development.

The given sections above will explore the evolution of facial recognition technology, its implementation in attendance monitoring, etc. over a period of years. By investigating and defining these methods, the paper aims to provide a comprehensive overview of the subject and present an insightful perspective on the current state of facial recognition based attendance monitoring systems and the promising avenues for future research and development.

METHODOLOGY

This literature review will assess various papers and projects within this domain, dividing it into the methodologies, findings, and limitations of existing systems. By identifying gaps and shortcomings in the existing body of knowledge, this review aims to lay the groundwork for formulating accurate research objectives. The selection of papers was mainly based on three main aspects, which are machine learning, deep learning, and image processing. In finding out from the literature survey done, the methods used in the image processing model are Eigenface, Fisherface, Linear Binary Pattern, and Histogram of Oriented Gradients. And in the machine learning model are Support Vector Machine, Adaboost, XGBoost, Decision Tree, Viola Jonas, Regression, Clustering, PCA, and LDA. And in the deep learning model, mainly CNN and its types and GAN and its types. The primary algorithms used to implement facial recognition models are listed below.

SURVEY DESIGN

The survey is done over the period of time by identifying the problem statement and doing literature reviews on selected 30 papers based on machine learning, deep learning and image processing algorithms which are mainly find from IEEE and then finding the research gap in model for identifying the objective for implementing it in future.

LITERATURE SURVEY

By considering the research papers selected from 2017 till present, they are classified into three major domains, which are "Image Processing (IP), Machine Learning (ML), and Deep Learning (DL)" as stated in the methodology.

One paper may have used various algorithms in different domains. So, the maximum number of algorithms used in particular domains in that paper will be classified as that domain paper.

E.g. Paper "Comparative Study of Feature-based Algorithms and Classifiers in Face Recognition for Automated Attendance System[3]" will be classified as Machine Learning domain paper as it consists of 2 Machine Learning and 1 Image Processing algorithms.

"Paper "Face Recognition for Identification and Verification in Attendance System: A Systematic Review[2]" is a literature review paper of other research papers, so that paper is considered in the Image Processing Domain."

1. Image Processing:

"In the paper "Student attendance with face recognition (LBPH or CNN): Systematic literature review", a systematic literature review using the PRISMA technique, conducted by authors Andre Budimana, Fabian, Ricky Aryatama Yaputara, Said Achmad, and Aditya Kurniawan[1]", a total of 1130 articles were initially identified. From this pool, a survey was conducted on 30 articles focusing on CNN and LBPH algorithms, involving identification, screening, eligibility, and inclusion steps. The survey shed light on key aspects, such as the process of applying face recognition to class attendance, the comparative effectiveness of various face recognition algorithms, and the external factors influencing accuracy, including the use of surveillance camera videos and varied facial positions.

"Paper "Face Recognition for Identification and Verification in Attendance System: A Systematic Review" by Ahmad Anshari, Sulistyo Aris Hirtranusi, Dana Indra Sensuse, Kautsarina, and Ryan Randy Suryono[2]" conducted a systematic review based on the Kitchenham method, a method frequently employed in prior studies, such as those addressing issues in Peer to Peer (P2P) Lending. They performed a comprehensive background study on Attendance System, Face Recognition, Identification, and Verification, while their research encompassed planning, conducting, and documenting the review process. As a result, they gleaned insights into the utilization of Face Recognition technology in attendance systems across different organizational fields, identified the security methods commonly used, and outlined the success factors driving effective Face Recognition implementation.

"Paper "Face Recognition based Attendance Management System" authored by Smitha, Pavithra S Hegde, and Afshin[5]", an automated attendance system model is presented. Students must register with the system by providing their information, and their photos are taken and saved in a dataset. The process encompasses four key stages: Dataset Creation, involving image capture, preprocessing, and region of interest extraction; Face Detection employing Haar-Cascade Classifier; Face Recognition with Local Binary Pattern Histogram-based recognition; and Attendance Updating streamlines attendance management by listing absentees and emailing them to the appropriate faculty

members. Identified faces are tagged as present in an Excel sheet.

"In the paper "Facial Recognition Attendance Monitoring System using Deep Learning Techniques" authored by Dr. A Manjula, D. Kalpana, and Sanjay Guguloth[9]", a Facial Recognition Model is introduced, employing Eigenfaces, Fisherfaces, and Local Binary Pattern Histogram (LBPH) algorithms. The methodology utilizes classifiers for face detection, distinguishing between faces (1) and non-faces (0) in images. The original image is improved via LBPH calculation, which highlights face features, resulting in a histogram containing 16,384 positions (8x8x256). Euclidean Distance is employed to identify the image with the closest histogram to the input image, facilitating effective facial recognition.

"In the paper "Face Recognition Based Attendance Management System Using Machine Learning" by authors Anju V Das, Anjana Shyju, Thomas Varghese, and Nisha Mohan P M[10]", an effective and secure personal authentication technique based on facial recognition is developed and evaluated using Python, OpenCV, and TensorFlow. The model comprises five key components which are Feature Extraction, Person Identification, Face Verification, Data Augmentation, and Face Recognition. These methods work hand in hand to enhance the accuracy and security of the authentication system, with performance compared to existing systems, ensuring a robust and reliable framework for personal identification.

"In the paper "Face Recognition Based Automated Attendance Management System", authors Aparna Trivedi, Chandan Mani Tripathi, Dr. Yusuf Perwej, Ashish Kumar Srivastava, and Neha Kulshrestha[11]" introduce system built using Python, specifically Django and Flask, along with CSV integration. The application, a Windows based system, utilizes Python's Django and Flask Application capabilities for easy web service development by invoking COM or COBRA components. MySQL serves as the backend database, facilitating two user categories which are Admin users who are responsible for uploading files with annotation details to the main storage, and end users who benefit from the system by searching for files through query keywords, streamlining attendance management and access.

"In the paper "Face Recognition Based Attendance System" authored by Anuj Singh, Nikhil Rawat, and Rajan Kesri[15]", the proposed system focuses on live-streaming video from a classroom, with the primary objective of detecting faces. There are four major stages to the process: Dataset creation involves taking pictures of students from different angles and in different positions with a webcam; Face Detection, which is executed using a Haar-Cascade Classifier with OpenCV; Face Recognition, involving the preparation of training data, training the face recognizer, and prediction, utilizing the Local Binary Pattern Histogram approach; and finally, Attendance Updating, where recognized faces are marked as present in an Excel sheet, simplifying the attendance management process.

"Paper "Face Recognition Using Eigenface Algorithm on Laptop Camera" by Rika Rosnelly, Mutiara S. Simanjuntak, Ade Clinton Sitepu, Mulkhan Azhari, Sandy Kosasi, and Husen[20]", a method for face recognition using the eigenface algorithm on a laptop camera is proposed. The method involves capturing face images from the laptop

camera, preprocessing them for noise removal, and training a face recognition model using the eigenface algorithm. The model calculates distances between new images and eigenfaces to identify matches. The proposed method achieves an 85% accuracy on a dataset, demonstrating its simplicity, effectiveness, and suitability for face recognition on laptop cameras with low-quality images.

2. Machine Learning:

"In the research paper "Comparative Study of Feature-based Algorithms and Classifiers in Face Recognition for Automated Attendance System" by Ms. Sarika Ashok Sovitkar and Dr. Seema S. Kawathekar[3]", they propose a comprehensive face recognition model that integrates various concepts such as PCA, LDA, Eigenfaces, and geometric principles. The model is structured into five main components: Face Detection employing the Viola Jones algorithm, Preprocessing for noise removal and image enhancement, Feature Extraction including PCA and LDA for local feature identification, Face Recognition for matching features with a database, and Attendance Marking, marking attendance in an Excel sheet after successful face recognition, providing a well-structured approach to attendance monitoring and recognition.

"In the research paper "Efficient Real Time Attendance System Based on Face Detection Case Study "MEDIU Staff"" by authors HUDA.H.Mady and Shadi M.S. Hilles[4]", an automated attendance system was developed specifically for Al-Madinah International University (MEDIU), aiming to enhance the educational institution's attendance tracking. The model is structured into three main components: the creation of the MEDUE Staff Database (MEDUE-S-V-DB) comprising 20 videos, the acquisition of training and testing videos with various facial attributes, and the application of the face detection Viola-Jones method. This cascade detector utilized Viola-Jones for face detection and incorporated trained classification models, including frontal CART and Profile face classifiers, enhancing the accuracy and efficiency of attendance monitoring.

"In the paper "Student Attendance System Based on Face Recognition and Machine Learning", authors Praveen K. Sah, Mamata Garanayak, Sujata Chakravarty, Bijay K. Paikaray, Rakesh Sharma, and Suneeta Tripathy[12]" proposed a comprehensive model employing Decision tree, Support Vector Machine, Convolutional Neural Network (CNN), VGG-19, and ResNet-50. Each model was separately fitted using a training dataset that is consist of 75% of the data, with the remaining 25% used for testing. The methodology included data preprocessing, involving face cropping, image reshaping, noise removal, feature extraction, and data splitting. The results demonstrated varying steps of accuracy and F1-scores, with CNN achieving the highest accuracy at 96.82% and an F1-score of 89.00%, showcasing its strong performance in the given context.

"The paper "2D-3D Facial Image Analysis for Identification of Facial Features Using Machine Learning Algorithms With Hyper-Parameter Optimization for Forensics Applications" by Gangothri Sanil, Krishna Prakash, Srikanth Prabhu, Vinod C. Nayak, and Saptarshi Sengupta[19]" introduces a method for identifying facial features in 2D and 3D facial images. It employs traditional techniques like SIFT and SURF for 2D feature extraction and MediaPipe for 3D feature extraction.

A machine learning algorithm then receives these features as input, fine-tuned through hyperparameter optimization, and trained on labeled facial images. With a 95% accuracy on forensic facial images, this method stands out by its ability to leverage both 2D and 3D features, enhancing robustness to pose and lighting variations, offering potential applications in forensics like facial identification, matching, and reconstruction.

"In the paper "Face Recognition Using Fisherface and Support Vector Machine Method" by Syachrul Qolbi Nur Septiab, Intan Nurma Y⁹taac, and Herlina Napitupuluab[21]", a method for face recognition using the Fisherface algorithm and support vector machines (SVMs) is proposed. The method involves extracting features from face images using Fisher's linear discriminant analysis (FLD) and training an SVM classifier with these features. The SVM classifier is then utilized for recognizing faces in new images. The proposed method achieves a high accuracy of 99.76% on a face image dataset, showcasing its simplicity, accuracy, and resilience to changes in posture and lighting.

"The paper "Design of an E-Attendance Checker through Facial Recognition using Histogram of Oriented Gradients with Support Vector Machine" by Allan Jason C. Arceo, Renee Ylka N. Borejon, Mia Chantal R. Hortinela, Alejandro H. Ballado Jr., and Arnold C. Paglinawan[24]" presents a design for a facial recognition based electronic attendance checker system. For face identification and recognition, the system makes use of a support vector machine (SVM) classifier and the histogram of oriented gradients (HOG) feature descriptor. The grayscale image is first processed, extracting the HOG feature descriptor representing gradient orientations. The SVM classifier then categorizes the faces into different identities. On a dataset consisting of 37 students, the system's accuracy of 95.65% was quite good. Furthermore, the technology demonstrated resilience in the face of changes in ambient light levels and the distance between the pupil and the camera.

"The paper "The Role of the Eyes: Investigating Face Cognition Mechanisms Using Machine Learning and Partial Face Stimuli" by Ingon Chanpornpakdi and Toshihisa Tanaka[26]" uses machine learning and partial face stimuli to investigate the role of the eyes in face cognition. Making use of an RSVP, or fast serial visual presentation task, participants were presented with partial face stimuli that varied in the presence of facial features. Machine learning techniques were employed to analyze the ERP data, revealing that the N170 component exhibited a stronger response to partial face stimuli with eyes compared to those without eyes. Additionally, the P200 component displayed a stronger response to full face stimuli, indicating its association with holistic facial feature processing, while the N170 component was linked to local feature processing, particularly the eyes. The findings emphasize the critical role of the eyes in face recognition, offering insights into the neural mechanisms involved and potentially enabling the development of more robust face recognition methods against occlusions and variations in pose and lighting.

3. Deep Learning:

"In the paper "Face Recognition based Attendance System" authored by Dhanush Gowda H.L, K Vishal, Keertiraj B. R, Neha Kumari Dubey, and Pooja M. R.[6]", a modern face

verification system is proposed, where training and enrollment are distinct processes. The model is structured around a Face Recognition Model that employs deep metric learning techniques to create an effective metric space with reduced dimensions where pictures of the same class cluster together. To enable efficient training, metric loss and hard negative mining strategies are applied. The enrolment phase employs a smaller ResNet neural network, and the system can effectively detect and recognize faces, marking attendance by matching the new face to the enrolled faces in a 128-dimensional space.

"In the paper "Face Recognition Smart Attendance System using Deep Transfer Learning", authors Khawla Alhanaee, Mitha Alhammadia, Nahla Almenhalia, and Maad Shatnawia[7]" present a Face Recognition Smart Attendance System that makes use of networks that have already been trained, like SqueezeNet, GoogleNet, and AlexNet. The proposed system encompasses key stages: data collection involving 200 images captured with an iPhone 12 front facing camera, data formatting in JPG files, data augmentation to increase dataset size, and the training phase which involves parameter adjustments within the base architecture, comprising frequency of validation, number of epochs, training length, and learning rate, ultimately advancing facial recognition capabilities for smart attendance tracking.

"In the paper "Single Sample Face Recognition Using Convolutional Neural Networks for Automated Attendance Systems", research conducted by authors Foteini P. Filippidou and George A. Papakostas[8]", they developed an automated attendance system using the SSPP face recognition method, applicable in both in-person and remote learning settings. They categorized SSPP face recognition methods into five groups: Generic databases, Virtual sample generation, Feature-based, Hybrid, and Others. The model's evaluation was based on CNN-based object classifiers, including MobileNetV2, ResNet50V2, DenseNet121, InceptionV3, and VGG16. The accuracy of these models ranged from 93.4% to 100%, demonstrating the system's effectiveness in diverse scenarios.

"Authors Soumitra Chowdhury, Sudipta Nath, Ashim Dey, and Annesha Das present an Automatic Class Attendance System using CNN-based Face Recognition in their article "Development of an Automatic Class Attendance System using CNN-based Face Recognition"[13]". First, the system takes pictures of student faces and groups them into a tagged dataset. Although the Histogram of Oriented Gradient (HOG) method can also be utilized for face identification, a Convolutional Neural Network (CNN) model is used for face recognition. The system's parts are organized into four main phases: Data Entry, Face Recognition, Dataset Training, and Attendance Entry. To enable effective attendance tracking, the system's default option is to take 20 images from a live video stream at 2-second intervals.

"In the paper "Face Recognition Based Attendance System" by Nandhini R, Duraimurugan N, and S.P. Chokkalingam[14]", the system's objective is to capture and store students' facial data for attendance purposes, with a focus on detecting various facial features and even recognizing the students' seating positions and postures. To achieve this, a Convolution Neural Network (CNN) is employed, resembling a multilayer perceptron but designed for accelerated processing. In order to facilitate effective

feature extraction and analysis, the CNN is composed of an input layer, an output layer, and a hidden layer with many components, such as convolution layers, pooling layers, fully connected layers, and normalizing layers.

"The paper "Unsupervised Face Domain Transfer for Low-Resolution Face Recognition" by Sungeun Hong and Jongbin Ryu[16]" offers a brand-new unsupervised domain transfer method to improve face recognition at low resolution. The technique maps high-resolution (HR) face photos to low-resolution (LR) equivalents using a generative adversarial network (GAN). Through GAN training, the generator creates LR face images that are nearly identical to authentic LR pictures, subsequently facilitating the training of a face recognition model on these generated LR face images. The approach surpasses existing methods, boasting advantages such as its unsupervised nature and task-specific mapping, making it practical and effective for various low-resolution face recognition applications, including security surveillance and video conferencing.

"The paper "Chinese Face Dataset for Face Recognition in an Uncontrolled Classroom Environment" by Nianfeng Li, Xiangfeng Shen, Liyan Sun, Zhiguo Xiao, Tianjiao Ding, Tiansheng Li, And Xinhang Li[17]" created UCEC-Face dataset consists of 7395 images of 130 subjects, photographed in a demanding educational setting. There are 86 females and 44 guys in it. To utilize UCEC-Face for face verification, gender, expression, and age recognition, four models, namely OpenFace, ArcFace, VGG-Face, and Mediapipe, were utilized. However, the accuracy achieved was only 69.7%. Despite this limitation, these Face recognition algorithms support social stability and play crucial roles in various domains, demonstrating their significance in multiple areas.

"In the paper "Out-of-Distribution Detection for Reliable Face Recognition" by Chang Yu, Xiangyu Zhu, Zhen Lei, and Stan Z. Li[18]", a method for detecting out-of-distribution (OOD) samples in face recognition systems is proposed. The method utilizes the observation that face recognition systems are more confident in their predictions on in-distribution samples and that the feature representations of OOD samples differ from those of in-distribution samples. By calculating confidence scores and measuring the distance between feature representations, the proposed method effectively detects OOD samples without significantly impacting the system's performance on in-distribution samples. The method shows promise in enhancing the reliability of face recognition systems in various real-world applications.

"The paper "Low-Power Scalable 3-D Face Frontalization Processor for CNN-Based Face Recognition in Mobile Devices" by Sanghoon Kang, Jinmook Lee, Kyeongryeol Bong, Changhyeon Ki[19] Youchang Kim, and Hoi-Jun Yoo[22]" introduces a scalable, low-power 3D face frontalization processor intended for CNN-based mobile face recognition. The processor utilizes a pipelined architecture to achieve high throughput while minimizing power consumption. Techniques like weight quantization and zero-skipping are employed to reduce memory accesses. Implemented in 65nm CMOS technology, the processor achieves impressive performance with a throughput of 4.73 frames per second (fps) and a power consumption of 0.53 milliwatts (mW). Its scalability, low-power design, and real-

time capabilities make it suitable for various mobile applications including facial recognition, video conferencing, and augmented reality.

"The paper "Occluded Thermal Face Recognition Using Bag of CNN (BoCNN)" by Sumit Kumar and Satish Kumar[23]" presents a method for a bag of convolutional neural networks for occluded thermal facial recognition (BoCNN). This method addresses the challenge of recognizing partially or fully occluded faces in thermal images, which are typically noisy and low-resolution. The proposed approach involves extracting features from the thermal image using multiple CNNs and concatenating them to form a bag of features. These features are then utilized to train a classifier for face recognition. The method achieves a commendable accuracy of 90% when evaluated on a dataset of occluded thermal images. Its robustness to noise and occlusions, along with its ability to handle pose and lighting variations, make it a promising solution for occluded thermal face recognition in applications.

"In the paper "Face Recognition Using Faster R-CNN with Inception-V2 Architecture for CCTV Camera" by Lavin J. Halawa, Adi Wibowo, and Ferda Ernawan[25]", a face recognition method is proposed, leveraging Faster R-CNN for face detection and Inception-V2 architecture for feature extraction from CCTV camera images. The process involves real-time face detection, robustness to lighting and pose variations, and high efficiency, with face recognition performed on the extracted features. Evaluated on a dataset of 6 individuals with 50 face images each, the method achieved an impressive accuracy of 90%, offering a promising solution for CCTV-based face recognition applications.

"The paper "Adversarial Cross-Spectral Face Completion for NIR-VIS Face Recognition" by Ran He, Jie Cao Lingxiao Song, Zhenan Sun, and Tieniu Tan[27]" presents a method for cross-spectral face completion, aiming to generate visible (VIS) face images from near-infrared (NIR) face images. This task is challenging due to the differing spectral information captured by NIR and VIS images. A generative adversarial network (GAN) with a texture inpainting and a pose correction component is used in the procedure. The texture inpainting component, a convolutional neural network (CNN), learns to synthesize realistic VIS image textures by inpainting missing pixels in the NIR image texture. By warping the NIR picture, the pose correction component—an additional CNN—is trained to map NIR face images to VIS facial poses in the VIS domain. When tested on a dataset of NIR and VIS face images, the GAN components work together to produce high-quality VIS image completions and enhanced accuracy for NIR-VIS face identification.

"The paper "A Face Emotion Recognition Method Using Convolutional Neural Network and Image Edge Computing" by Hongli Zhang, Alireza Jolfaei, and Mamoun Alazab[28]" introduces a approach that combines image edge computing with a convolutional neural network (CNN) for facial emotion recognition. The method begins by extracting edge features from the face image, utilizing image edge computing to capture robust representations of object edges. These edge features are then inputted into a CNN, which is trained on a labeled dataset of face images to establish associations between the edge features and corresponding emotions.

When the suggested approach was tested on a dataset of annotated face photos, it demonstrated an impressive accuracy of 85%. The approach's benefits include its utilization of image edge computing for robustness against pose and lighting variations, as well as the CNN's ability to enhance accuracy and efficiency in learning the relationship between edge features and emotions during face emotion recognition.

"The paper "A Robust GAN-Generated Face Detection Method Based on Dual-Color Spaces and an Improved Xception" by Beijing Chen, Xin Liu, Yuhui Zheng, Guoying Zhao, and Yun-Qing Shi[29]" presents a novel approach for detecting GAN-generated face images. The method utilizes a dual-color space combining RGB and YCbCr, along with an enhanced Xception network, to extract features from the face image. After that, a classifier trained on a dataset of actual and GAN-generated face images is fed these features. The proposed method achieves an impressive 98% accuracy on a

GAN generated face image dataset, offering robustness and improved performance compared to existing methods.

"The paper "Identity Aware Face Super-Resolution for Low-Resolution Face Recognition" by Jin Chen, Jun Chen, Zheng Wang, Chao Liang, and Chia-Wen Lin[30]" introduces a technique for low resolution face recognition called identity aware face super resolution (FSR). The suggested method uses identification traits that are extracted from low resolution facial photos to direct the super resolution procedure. The technique produces the latest advances in terms of image quality and face recognition accuracy by training the super resolution algorithm on a dataset of high resolution and low resolution face photographs. The utilization of identity features and the inclusion of real world low resolution face images enhance the method's ability to preserve identity information and generalize to practical scenarios.

INFERENCES OUT OF LITERATURE REVIEW

Sr No.	Name Of Paper	Basic Ideas Of Execution	Algorithms Used	Advantage	Disadvantage
[1]	"Student attendance with face recognition (LBPH or CNN): Systematic literature review"	This Paper was Review Paper On Various Algorithms To Find Out Which One Algorithms is best suited	EigenFace, FisherFace, SVM, CNN, LBPH, MLP	High Accuracy and Stability	Many datasets are required, Affect by external factors
[2]	"Face Recognition for Identification and Verification in Attendance System: A Systematic Review"	This Paper was Review Paper on Various Algorithms to Find out best suited answers of some important questions	This is review is literature surveys based on research questions. So, it was reviewed to get answer of questions	Information Security, Training and Insurance factors	Security Issues
[3]	"Comparative Study of Feature-based Algorithms and Classifiers in Face Recognition for Automated Attendance System"	This Paper was Research and Execution Paper in which the model is based on hybrid structure (template and geometric model both)	PCA, LDA, Eigenface, Some geometrical model	The recognition rates of PCA, LDA, and Hybrid approach for a face angle with a left- or right-side face image in good light conditions are 68%, 75%, and 86%, respectively.	The identification rate drops by up to 10% in poor lighting conditions, such as when it is foggy or dark and faces are not visible.
[4]	"Efficient Real Time Attendance System Based on Face Detection Case Study "MEDIU Staff""	This paper is implementation paper made for attendance in Al-Madinah International University (MEDIU). Model is based on video acquisitions.	Viola Jonas algorithms	It can be used in commercial life, law enforcement and security be used in commercial life, law enforcement and security	Pose, illumination conditions, facial expressions, orientation, etc

[5]	"Face Recognition based Attendance Management System"	This is an implementation paper intended for instructional purposes related to student attendance. The basis of the detection model is the Haar-Cascade Classifier.	Local Binary Pattern Histogram, Haar-Cascade Classifier	Mark attendance with ID no.	Need of Good UI
[6]	"Face Recognition based Attendance System"	This is an implementation paper for contemporary face verification systems, where enrollment and training are two distinct processes.	Deep Learning, Metric Loss, CNN, Hard Negative Mining, ResNet neural network	This approach will respond faster and recognize more faces from a single frame with greater accuracy.	Training of Dataset need more time
[7]	"Face Recognition Smart Attendance System using Deep Transfer Learning"	Using pre-trained networks, a Face Recognition Smart Attendance System is proposed in this paper. The stages of the suggested approach are as follows: gathering, pre-processing, augmentation, training and validation, and testing.	AlexNet, GoogleNet, SqueezeNet, CNN	SqueezeNet, GoogleNet, and AlexNet are the three networks that attained validation accuracy of 98.33%, 93.33%, and 100%, in that order.	Using pretrained data
[8]	"Single Sample Face Recognition Using Convolutional Neural Networks for Automated Attendance Systems"	This study suggested developing an automatic attendance system using the SSPP facial recognition technique. SSPP: Single Sample for Face Recognition	CNN based object classifiers, i.e. MobileNetV2, ResNet50V2, DenseNet121, InceptionV3, and VGG16 CNNs	By enhancing the frontal views to increase the training data, high performance was attained.	Implementing the model using maximum accuracy CNN
[9]	"Facial Recognition Attendance Monitoring System using Deep Learning Techniques"	Classifiers are used in the face detection methodology; the goal is to create an intermediate image that highlights the facial features in the original image, so improving it.	Open CV, LBPH (Local Binary Pattern Histogram), Haar Cascade, Eigen faces algorithm, Fisher faces algorithm, Euclidean Distance	Highly efficient algorithm	Lighting conditions, no camera with an optimal resolution
[10]	"Face Recognition Based Attendance Management System Using Machine Learning"	Model has designed an effective and secure technique for personal authentication using facial recognition. They have used Python, OpenCV, TensorFlow.	Haar Cascade, Viola Jones Face Detection Algorithm, Ada-Boost	Obtained steady results around the 90% of accuracy, reaching a maximum of 95% and also use two different model	Dataset size
[11]	"Face Recognition Based Automated Attendance Management System"	Model has proposed Face Recognition Based Automated Attendance Management System which is based on Python (Django and Flask) and CSV. MySQL is a backend database.	CNN, Haar Cascade, Open CV, LBPH (Local Binary Pattern Histogram), Eigen faces algorithm, Fisher faces algorithm	Paperless Attendance	High usability and security

[12]	"Student Attendance System Based on Face Recognition and Machine Learning"	Model is proposed for Face Recognition which is done by Data Preprocessing in which Face Cropping, Image Reshaping and Remove Noise, Feature Extraction and Splitting Data.	Decision tree, Support Vector Machine, Convolutional Neural Network, VGG-19, ResNet-50	CNN, VGG19, ResNet50 accuracy is above 90%	SVM, Decision Tree accuracy is near 70%
[13]	"Development of an Automatic Class Attendance System using CNN-based Face Recognition"	The system's components can be divided into four primary phases. These include face recognition, dataset training, data entry, and attendance entry. By default, a live video feed is used to capture 20 images at a 2-second period.	CNN, Histogram of Oriented Gradient (HOG) method, the function face_encodings in the face_recognition library of Tkinter	Maximum accuracy of about 92%	Need Many Images of each one person
[14]	"Face Recognition Based Attendance System"	The suggested method would take a picture of the face and save it for their attendance. The student's face must be photographed in a way that allows for the detection of every feature on the face.	CNN (Convolution Neural Network)	Accuracy, high-precision speed	Poor lighting condition
[15]	"Face Recognition Based Attendance System"	A model that detects faces from live classroom video streaming has been proposed. The four steps of this procedure are typically dataset creation, face detection, face recognition, and attendance updating.	Haar-Cascade Classifier, OpenCV, Local Binary Pattern Histogram	Mark attendance with ID no.	Need of Good UI
[16]	"Unsupervised Face Domain Transfer for Low Resolution Face Recognition"	The suggested technique learns a mapping function from high-resolution (HR) face photos to low-resolution (LR) face photographs using a generative adversarial network (GAN).	Generative adversarial network (GAN)	Is capable of picking up a mapping function between HR and LR facial pictures.	Often difficult and expensive to obtain
[17]	"Chinese Face Dataset for Face Recognition in an Uncontrolled Classroom Environment"	35 movies were used to gather the Chinese face dataset (UCEC-Face), which includes 7395 photos of 130 subjects, 44 men and 86 women in an uncontrolled classroom setting.	OpenFace, ArcFace, OpenCV, SSD, Dlib, RitinaFace, VGG-Face, and Mediapipe	Comparison between four different face recognition model.	Only 69.7% as accuracy Only
[18]	"Out of Distribution Detection for Reliable Face Recognition"	Confidence score --> the output of the face recognition system --> determines how far the feature representation is from the mean feature representation --> The distance is calculated L2-norm	CNN, GAN, L2 norm, Evaluation Metrics, ResNet64, Gaussian mixture model	It is effective at detecting a variety of OOD samples, including noise, occlusions, and adversarial attacks	Minimal impact on the performance of the face recognition system

[19]	"2D-3D Facial Image Analysis for Identification of Facial Features Using Machine Learning Algorithms With Hyper-Parameter Optimization for Forensics Applications"	Facial features --> extracted --> machine learning algorithm for classification --> labeled facial images --> hyper-parameter optimization to tune the hyperparameters of the ML --> technique for finding the best values for the hyperparameters	XGBoost, AdaBoost, Random Forest, Logistic Regression, Extra Tree Classifier, Light Gradient Boosting, SVM, Naive Bayes, Scale Invariant Feature Transform, Speeded up Robust Feature, MediaPipe	Achieved an accuracy of 90% using XGBOOST	Light Gradient Boosting has Achieved an accuracy of 62%
[20]	"Face Recognition Using Eigenface Algorithm on Laptop Camera"	face image --> by resizing it to 100x100 pixels and to grayscale --> eigenfaces --> to produce a coefficient vector --> Compare --> Most similar is considered to be match	Eigen value, Eigen vector, PCA	Accuracy of 85% on the test dataset, which is comparable to. It is relatively easy to implement and can be used on a variety of devices, including laptop cameras.	The system may be vulnerable to spoofing attacks. The system may not be suitable for real-time applications.
[21]	"Face Recognition Using Fisherface and Support Vector Machine Method"	The model is split into two sections: the first part describes the features of the face, while the second part describes the fisherface and support vector machine methods	FisherFace, SVM, PCA, LDA	Average Prediction Accuracy 99.76%, Precision 99.79%, and Recall 99.72%	It needs large time to executed due to Complex Calculation
[22]	"Low-Power Scalable 3-D Face Frontalization Processor for CNN-Based Face Recognition in Mobile Devices"	Face frontalization is the procedure for matching a frontal view to a face image. This is an important preprocessing step for CNN-based face recognition. Processor uses a pipelined architecture.	Local binary features, CNN, K-means Clustering, Regression, Euclidean distance	4.73 frames per second (fps) of high throughput and 0.53 milliwatts (mW) of low power consumption	Need to implement on each device individually
[23]	"Occluded Thermal Face Recognition Using Bag of CNN (BoCNN)"	BoCNN --> first extracting features --> thermal image --> set of CNNs --> concatenated to form a bag of features --> used to train a classifier to recognize the face	Convolutional neural networks and different types of its, LBP, LDP, LVP, LGHP and HOG	Accuracy of 90%	Need to implement with own dataset features extraction without transfer learning
[24]	"Design of an E-Attendance Checker through Facial Recognition using Histogram of Oriented Gradients with Support Vector Machine"	HOG feature descriptor is extracted from the grayscale image --> the SVM classifier is used to classify faces into different identities --> then the system records the student's attendance	Histogram of Oriented Gradients with Support Vector Machine, Raspberry Pi	It is accurate and efficient, with an accuracy of 95.65%. It is not affected by environmental factors such as luminance and distance	Only 37 students are used for evaluation

[25]	"Face Recognition Using Faster R-CNN with Inception-V2 Architecture for CCTV Camera"	Faster R-CNN to detect faces in the input image from the CCTV camera -> features of the detected faces are extracted using Inception-V2 --> features are fed into a face recognition classifier to identify the faces	Faster Regional Convolutional Neural Network, Region Proposal Network, Inception V2	Achieved an accuracy of 90%	Evaluated the proposed method on a dataset of 6 people, with each person having 50 face images
[26]	"The Role of the Eyes: Investigating Face Cognition Mechanisms Using Machine Learning and Partial Face Stimuli"	RSVP task to present participants with partial face stimuli which varied in terms of which facial features were present. ML to analyze the ERP data and identify the ERP components that were associated with FR.	ANOVA with Greenhouse-Geisser correction, xDAWN filter and linear SVM, Rapid serial visual presentation	improved comprehension of the neurological processes underlying face recognition, as well as more resilient to occlusions, changes in posture, and illumination	Reduce the ERP level to get less accuracy
[27]	"Adversarial Cross-Spectral Face Completion for NIR-VIS Face Recognition"	A method for creating a VIS from an NIR facial image, known as cross-spectral face completeness. The two parts of the GAN are the pose correction and texture inpainting components.	Visible face image, Near-infrared face image, Generative adversarial network, Convolutional neural network	Improved the accuracy of NIR-VIS face recognition	The identities that are used for training and testing differ completely from just 357 identities.
[28]	"A Face Emotion Recognition Method Using Convolutional Neural Network and Image Edge Computing"	Extracting edge features from the face image using image edge computing. Edge features are features that represent the edges of objects in an image. A CNN is then given the edge features in order to recognize the emotions on a face.	Haar classifier, Adaboost, Histogram Equalization, Image edge computing, Convolutional neural network	More robust to variations in pose and lighting	Only achieved an accuracy of 85% on the dataset
[29]	"A Robust GAN-Generated Face Detection Method Based on Dual-Color Spaces and an Improved Xception"	Extracting features from the face image using a dual color space. The dual color space combines the RGB and YCbCr color spaces. The improved Xception network is a convolutional neural network. To determine the image, the retrieved features are subsequently passed into a classifier.	GENERATIVE adversarial networks, and its types, Convolutional neural network, convolutional block attention module and multilayer feature aggregation	Achieved an accuracy of 98% on the dataset	More Time is required for execution of model using GAN

[30]	“Identity-Aware Face Super-Resolution for Low-Resolution Face Recognition”	Extracting identity features from the low-resolution face image. The identity features are then used to guide the super resolution process. To produce high resolution face photos that maintain the distinctive qualities of an identity, the super resolution algorithm is taught.	LFW, LightCNN_v9, VGGFace2, Euclidean distance, CelebA, Low-Resolution Face Identification	High Accuracy	Separate the identity features for explicit supervision into features related to angles and magnitude.
------	--	--	--	---------------	--

Table. 1

DATA ANALYSIS

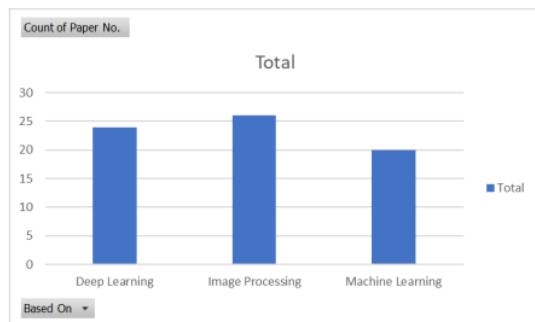


Figure.4

Domain	Count of Paper No.
Deep Learning	24
Image Processing	26
Machine Learning	20

Table. 2

The given Figure. 4 and Table. 2 above are representation the relation of how many papers is based on which domains. Here one paper can be based on more than one domain, E.g. “Development of an Automatic Class Attendance System using CNN-based Face Recognition” Paper is based on Image Processing and Deep learning[13] Also, single paper has more than one algorithm used of same domain.

E.g. “Face Recognition based Attendance Management System[5]”

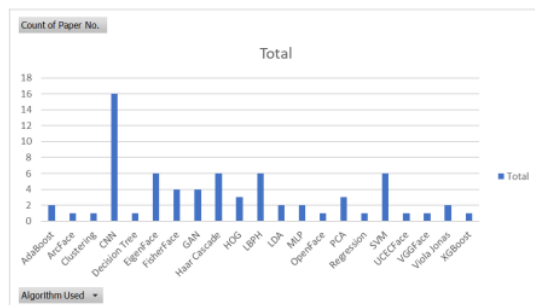


Figure. 5

Algorithm	Count of Paper No.
AdaBoost	2
ArcFace	1
Clustering	1
CNN	16
Decision Tree	1
EigenFace	6
FisherFace	4
GAN	4
Haar Cascade	6
HOG	3
LBPH	6
LDA	2
MLP	2
OpenFace	1
PCA	3
Regression	1
SVM	6
UCECFace	1
VGGFace	1
Viola Jonas	2
XGBoost	1

Table. 3

The given Figure. 5 and Table. 3 above are representation the relation of how many papers is based on which algorithms.

Deep Learning	Machine Learning
ArcFace	AdaBoost
CNN	Clustering
GAN	Decision Tree
OpenFace	LDA
UCECFace	MLP
VGGFace	PCA
Image Processing	Regression
EigenFace	SVM
FisherFace	Viola Jonas
Haar Cascade	XGBoost

HOG
LBPH

Table. 4

The given Table. 4 above is representation of various algorithms based on different domains.

By the doing review of selected 30 papers, maximum accuracy of any algorithms given was 98% using GAN and CNN in paper of "A Robust GAN-Generated Face Detection Method Based on Dual-Color Spaces and an Improved Xception"[29].

RESEARCH GAP

Through a comprehensive review of existing literature on facial recognition based attendance monitoring systems, several critical research gaps have come to the forefront. Challenges include the arduous implementation of facial recognition in low-resolution images and videos, where pixelation and reduced image quality hinder reliable identification. The complex calculations involved make the process time-consuming, necessitating the development of more efficient algorithms or hardware acceleration solutions. Additionally, the difficulty of implementation in crowded environments, where multiple faces intersect, poses a formidable challenge. The predominant reliance on 2D recognition techniques limits the technology's effectiveness in 3D settings. Recognizing individuals from various angles remains problematic, and the impact of varying lighting conditions on recognition accuracy requires further exploration. Addressing these research gaps is paramount to advancing the field, driving innovation, and ultimately enhancing the accuracy and applicability of facial recognition in attendance monitoring systems.

CONCLUSION

The literature research covered a thorough analysis of several facial recognition model implementation strategies. Various methods based on deep learning, machine learning, and image processing were found and investigated through a comprehensive examination of multiple models. Examining these models revealed important implementation-related research gaps, highlighting the need for further research and innovation in this area. The Objective for Design model was developed in response to these research gaps, marking a significant advancement in addressing and correcting the noted flaws and promoting the creation of more sophisticated and functional facial recognition systems that are expected to be indispensable in a wide range of applications.

FUTURE SCOPE

The objectives for the Smart Attendance Monitoring System based on Facial Recognition to be implemented in the future are to enhance accuracy by achieving a minimum of 95% in identifying individuals across challenging scenarios, including low-resolution images, various angles, and diverse lighting conditions. The system aims to implement real-time recognition of moving faces, a vital feature for dynamic surveillance applications. Additionally, there's a strong commitment to sustainability by reducing the power consumption of facial recognition systems by 50%. These objectives collectively drive the development of a more

versatile, efficient, and environmentally friendly attendance monitoring system capable of providing reliable and real time attendance data in diverse and demanding settings.

REFERENCES

- [1] Andre Budiman, Fabian, Ricky Aryatama Yaputera, Said Achmad, Aditya Kurniawan, "Student attendance with face recognition (LBPH or CNN): Systematic literature review", International Conference on Computer Science and Computational Intelligence, 2022
- [2] Ahmad Anshari, Sulistyio Aris Hirtranusi, Dana Indra Sensuse, Kautsarina, Ryan Randy Suryono, "Face Recognition for Identification and Verification in Attendance System: A Systematic Review", IEEE International Conference on Communication, Networks and Satellite (Commnetsat), 2021
- [3] Ms. Sarika Ashok Sovitkar, Dr. Seema S. Kawathekar, "Comparative Study of Feature-based Algorithms and Classifiers in Face Recognition for Automated Attendance System", International Conference on Innovative Mechanisms for Industry Applications, 2020
- [4] HUDA.H.Mady, Shadi M.S. Hilles, "Efficient Real Time Attendance System Based on Face Detection Case Study "MEDIU Staff", International Journal of Contemporary Computer Research, 2017
- [5] Smitha, Pavithra S Hegde, Afshin, "Face Recognition based Attendance Management System", International Journal of Engineering Research & Technology, 2020
- [6] Dhanush Gowda H.L., K Vishal, Keertiraj B. R, Neha Kumari Dubey, Pooja M. R., "Face Recognition based Attendance System", International Journal of Engineering Research & Technology, 2020
- [7] Khawla Alhanaaea, Mitha Alhammadia, Nahla Almenhalia, Maad Shatnawia, "Face Recognition Smart Attendance System using Deep Transfer Learning", International Conference on Knowledge-Based and Intelligent Information & Engineering Systems, 2021
- [8] Foteini P. Filippidou and George A. Papakostas, "Single Sample Face Recognition Using Convolutional Neural Networks for Automated Attendance Systems", IEEE Xplore, 2020
- [9] Dr A Manjula, D. Kalpana, Sanjay Guguloth, "Facial Recognition Attendance Monitoring System using Deep Learning Techniques", International Journal For Innovative Engineering and Management Research, 2023
- [10] Anju V Das, Anjana Shyju, and Thomas Varghese and Nisha Mohan P M, "Face Recognition Based Attendance Management System Using Machine Learning", International Journal Of Innovative Research In Technology, 2019
- [11] Aparna Trivedi, Chandan Mani Tripathi, Dr. Yusuf Perwej, Ashish Kumar Srivastava, Neha Kulshrestha, "Face Recognition Based Automated Attendance Management System", International Journal of Scientific Research in Science and Technology, 2022
- [12] Praveen K. Sah, Mamata Garanayak, Sujata Chakravarty, Bijay K. Paikaray, Rakesh Sharma and Suneeta Satpathy, "Student Attendance System Based on Face Recognition and Machine Learning", Advances in Computation Intelligence, 2022
- [13] Soumitra Chowdhury, Sudipta Nath, Ashim Dey and Annesha Das, "Development of an Automatic Class Attendance System using CNN-based Face Recognition", Emerging Technology in Computing, Communication and Electronics, 2020
- [14] Nandhini R, Duraimurugan N, S. P. Chokkalingam, "Face Recognition Based Attendance System", International Journal of Engineering and Advanced Technology, 2019
- [15] Anuj Singh, Nikhil Rawat, Rajan Kesri, "Face Recognition Based Attendance System", International Journal for Multidisciplinary Research,
- [16] Sungeun Hong, Jongbin Ryu, "Unsupervised Face Domain Transfer for Low-Resolution Face Recognition", IEEE SIGNAL PROCESSING LETTERS, 2019
- [17] Nianfeng Li, Xiangfeng Shen, Liyan Sun, Zhiguo Xiao, Tianjiao Ding, Tiansheng Li, And Xinhang Li, "Chinese Face Dataset for Face Recognition in an Uncontrolled Classroom Environment", IEEE, Science and Technology Development Center of the Ministry of Education under Grant, Digital Object Identifier, 2023
- [18] Chang Yu, Xiangyu Zhu, Zhen Lei, and Stan Z. Li, "Out-of-Distribution Detection for Reliable Face Recognition", IEEE SIGNAL PROCESSING LETTERS, VOL. 27, 2020
- [19] Gangothri Sanil, Krishna Prakash, Srikanth Prabhu, Vinod C. Nayak, And Saptarshi Sengupta, "2D-3D Facial Image Analysis for Identification of Facial Features Using Machine

- Learning Algorithms with Hyper-Parameter Optimization for Forensics Applications", IEEE, 2023
- [20] Rika Rosnelly, Mutiara S. Simanjuntak, Ade Clinton Sitepu, Mulkan Azhari, Sandy Kosasi, Husen, "Face Recognition Using Eigenface Algorithm on Laptop Camera", 8th International Conference on Cyber and IT Service Management (CITSM), 2020
- [21] Syachrul Qolbi Nur Septiab, Intan Nurma Yulitaac, Herlina Napitupuluab, "Face Recognition Using Fisherface and Support Vector Machine Method", International Conference on Artificial Intelligence and Big Data Analytics (ICAIBDA), 2021
- [22] Sanghoon Kang, Jinmook Lee, Kyeongryeol Bong, Changhyeon Kim, Youchang Kim, and Hoi-Jun Yoo, "Low-Power Scalable 3-D Face Frontalization Processor for CNN-Based Face Recognition in Mobile Devices", IEEE JOURNAL ON EMERGING AND SELECTED TOPICS IN CIRCUITS AND SYSTEMS, 2018
- [23] Sumit Kumar, and Satish Kumar, "Occluded Thermal Face Recognition Using Bag of CNN (BoCNN)", IEEE SIGNAL PROCESSING LETTERS, VOL. 27, 2020
- [24] Allan Jason C. Arceo, Renee Ylka N. Borejon, Mia Chantal R. Hortinela, Alejandro H. Ballado Jr., Arnold C. Paglinawan, "Design of an E-Attendance Checker through Facial Recognition using Histogram of Oriented Gradients with Support Vector Machine", International Conference on Smart City and Informatization (iSCI), 2020
- [25] Lavin J. Halawa, Adi Wibowo, Ferda Ernawan, "Face Recognition Using Faster R-CNN with Inception-V2 Architecture for CCTV Camera", International Conference on Informatics and Computational Sciences (ICICoS), 2019
- [26] Ingon Chanpornpakdi And Toshihisa Tanaka, "The Role of the Eyes: Investigating Face Cognition Mechanisms Using Machine Learning and Partial Face Stimuli", IEEE, 2023
- [27] Ran He, Jie Cao Lingxiao Song, Zhenan Sun, and Tieniu Tan, "Adversarial Cross-Spectral Face Completion for NIR-VIS Face Recognition", IEEE TRANSACTIONS ON PATTERN ANALYSIS AND MACHINE INTELLIGENCE, 2020
- [28] Hongli Zhang, Alireza Jolfaei, And Mamoun Alazab, "A Face Emotion Recognition Method Using Convolutional Neural Network and Image Edge Computing", IEEE, 2019
- [29] Beijing Chen, Xin Liu, Yuhui Zheng, Guoying Zhao, and Yun-Qing Shi, "A Robust GAN-Generated Face Detection Method Based on Dual-Color Spaces and an Improved Xception", IEEE TRANSACTIONS ON CIRCUITS AND SYSTEMS FOR VIDEO TECHNOLOGY, 2022
- [30] Jin Chen, Jun Chen, Zheng Wang, Chao Liang, and Chia-Wen Lin, "Identity-Aware Face Super-Resolution for Low-Resolution Face Recognition", IEEE SIGNAL PROCESSING LETTERS, VOL. 27, 2020

DRAFT PAPER

ORIGINALITY REPORT

5%

SIMILARITY INDEX

3%

INTERNET SOURCES

4%

PUBLICATIONS

%

STUDENT PAPERS

PRIMARY SOURCES

- | | | |
|--|--|--|
| <div style="background-color: red; color: white; width: 40px; height: 40px; display: flex; align-items: center; justify-content: center; margin: 10px 0;">1</div> | <div style="color: red; font-size: 1.1em; margin-bottom: 5px;">G. Balamurugan, V. Arulalan, V. Premanand.
"Object Detection Using a YOLOv4 Model in
Video Surveillance", 2023 4th International
Conference on Smart Electronics and
Communication (ICOSEC), 2023</div> <div style="color: gray; font-size: 0.9em;">Publication</div> | <div style="font-size: 1.5em; margin-bottom: 5px;"><1</div> <div style="color: gray;">%</div> |
| <hr/> | | |
| <div style="background-color: purple; color: white; width: 40px; height: 40px; display: flex; align-items: center; justify-content: center; margin: 10px 0;">2</div> | <div style="color: purple; font-size: 1.1em; margin-bottom: 5px;">www.ijraset.com</div> <div style="color: gray; font-size: 0.9em;">Internet Source</div> | <div style="font-size: 1.5em; margin-bottom: 5px;"><1</div> <div style="color: gray;">%</div> |
| <hr/> | | |
| <div style="background-color: purple; color: white; width: 40px; height: 40px; display: flex; align-items: center; justify-content: center; margin: 10px 0;">3</div> | <div style="color: purple; font-size: 1.1em; margin-bottom: 5px;">Kumar P, Salman Latheef T A, Santhosh R.
"Face Recognition Attendance System Using
Local Binary Pattern Algorithm", 2023 2nd
International Conference on Vision Towards
Emerging Trends in Communication and
Networking Technologies (ViTECoN), 2023</div> <div style="color: gray; font-size: 0.9em;">Publication</div> | <div style="font-size: 1.5em; margin-bottom: 5px;"><1</div> <div style="color: gray;">%</div> |
| <hr/> | | |
| <div style="background-color: teal; color: white; width: 40px; height: 40px; display: flex; align-items: center; justify-content: center; margin: 10px 0;">4</div> | <div style="color: teal; font-size: 1.1em; margin-bottom: 5px;">Beijing Chen, Xin Liu, Yuhui Zheng, Guoying
Zhao, Yun-Qing Shi. "A robust GAN-generated
face detection method based on dual-color
spaces and an improved Xception", IEEE
Transactions on Circuits and Systems for
Video Technology, 2021</div> <div style="color: gray; font-size: 0.9em;">Publication</div> | <div style="font-size: 1.5em; margin-bottom: 5px;"><1</div> <div style="color: gray;">%</div> |

5	D. Shamia, D. Abraham Chandy. "Intelligent system for cross-spectral and cross-distance face matching", Computers & Electrical Engineering, 2017 Publication	<1 %
6	link.springer.com Internet Source	<1 %
7	www.researchwithnj.com Internet Source	<1 %
8	Sarika Ashok Sovitkar, Seema S. Kawathekar. "Comparative Study of Feature-based Algorithms and Classifiers in Face Recognition for Automated Attendance System", 2020 2nd International Conference on Innovative Mechanisms for Industry Applications (ICIMIA), 2020 Publication	<1 %
9	eprints.uad.ac.id Internet Source	<1 %
10	arxiv.org Internet Source	<1 %
11	Matthew Turk, Alex Pentland. "Eigenfaces for Recognition", Journal of Cognitive Neuroscience, 1991 Publication	<1 %
12	digilib.itb.ac.id Internet Source	

<1 %

13

"Intelligent Techniques in Signal Processing for Multimedia Security", Springer Science and Business Media LLC, 2017

Publication

<1 %

14

Khawla Alhanaee, Mitha Alhammadi, Nahla Almenhali, Maad Shatnawi. "Face Recognition Smart Attendance System using Deep Transfer Learning", Procedia Computer Science, 2021

Publication

<1 %

15

Yoshida, Tomonari, Tomokazu Takahashi, Daisuke Deguchi, Ichiro Ide, and Hiroshi Murase. "Robust Face Super-Resolution Using Free-Form Deformations for Low-Quality Surveillance Video", 2012 IEEE International Conference on Multimedia and Expo, 2012.

Publication

<1 %

16

pubmed.ncbi.nlm.nih.gov

Internet Source

<1 %

17

www.imanagerpublications.com

Internet Source

<1 %

18

"Applications of Computational Methods in Manufacturing and Product Design", Springer Science and Business Media LLC, 2022

Publication

<1 %

19

dblp.dagstuhl.de

Internet Source

<1 %

20

downloads.hindawi.com

Internet Source

<1 %

21

www.researchgate.net

Internet Source

<1 %

22

www.techopedia.com

Internet Source

<1 %

Exclude quotes On

Exclude matches < 10 words

Exclude bibliography On