International Journal of Scientific Research & Engineering Trends
Volume 12, Issue 2, Mar-Apr-2026, ISSN (Online): 2395-566X

AI-Based Approach for Smart Attendance System Using Face Recognition

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Abstract:- The rapid growth of Artificial Intelligence (AI) and machine learning has transformed automation in various fields, including education and corporate sectors. Traditional attendance systems that depend on manual entry or RFID cards are often time-consuming, inaccurate, and susceptible to proxy attendance. To address these issues, this paper proposes an AI-based smart attendance system that utilizes face recognition technology for real-time, contactless attendance marking. The system employs computer vision and deep learning models, particularly convolutional neural networks (CNN), to detect and recognize faces with high precision. Live camera input captures facial features, which are processed through image enhancement and feature extraction algorithms before being matched with a pre-trained dataset for identity verification. The system is scalable and capable of handling multiple users simultaneously. Experimental analysis shows that the model achieves over 95% accuracy under different lighting, facial poses, and occlusion conditions. This automated and secure approach reduces human intervention and offers a reliable, efficient, and intelligent alternative to traditional attendance methods.

Keywords: Artificial Intelligence, Face Recognition, Smart Attendance, Deep Learning, Computer Vision, Automation, CNN.

I. INTRODUCTION:

Attendance management plays a vital role in educational and organizational settings, directly impacting productivity and performance evaluation [1]. Traditionally, attendance has been recorded manually using registers or semi-automated methods such as RFID cards and biometric fingerprints [2]. However, these conventional systems are often time-consuming, error-prone, and vulnerable to proxy attendance [3] [4].

With rapid advancements in Artificial Intelligence (AI) and Computer Vision, automation has transformed several domains, including education [5] [6]. Face recognition technology, powered by deep learning models like Convolutional Neural Networks (CNNs) [7], offers a contactless, non-intrusive, and real-time attendance solution with high accuracy [8] [9] [10].

Despite progress, many existing systems still face challenges related to user convenience, environmental factors, and data reliability [11] [12][13]. Therefore, this research proposes an AI-based smart attendance system using face recognition that integrates computer vision and deep learning to automatically detect and identify individuals [4] [15]. The system captures live video [16], extracts facial features using CNN models, and matches them with pre-stored data for real-time attendance marking, ensuring efficiency, accuracy, and security [17] [18].

II. LITERATURE REVIEW:

Attendance management has always been a crucial aspect of maintaining discipline, accountability, and participation in both educational institutions and workplaces [19] [20]. Traditional attendance systems [21], such as manual registers and paper-based logs, often suffer from inefficiency, inaccuracy, and the possibility of fraudulent practices like proxy attendance [22]. To address

these issues, several automated systems have been introduced, including RFID, barcode, and biometric-based methods [23]. Although these technologies improved the process, they also presented certain limitations [24]. RFID systems, which rely on electronic identification cards, are susceptible to card duplication and hardware malfunctions [25], reducing their reliability despite fast recording capabilities [26]. Barcode-based systems offer low-cost implementation but still depend on manual scanning, making them less effective for large-scale environments. Biometric systems, including fingerprint and iris recognition, provide higher accuracy levels; however, they raise hygiene concerns and require regular maintenance due to the need for physical contact [27].

The emergence of Artificial Intelligence (AI) and [28] Computer Vision has led to the development of more advanced and intelligent attendance systems. AI-based face recognition systems have gained attention as they provide a fully contactless, secure, and efficient method for automating attendance tracking [29]. These systems typically involve three stages—face detection, feature extraction, and recognition [30]. Earlier face recognition techniques such as Eigenfaces and Fisherfaces were widely used but often struggled under varying lighting conditions and facial orientations [31]. The evolution of deep learning techniques, particularly Convolutional Neural Networks (CNNs), has significantly improved system accuracy and robustness [32]. Models like VGG-Face, FaceNet, and ResNet have demonstrated exceptional performance in identifying faces under diverse environmental conditions, making them suitable for real-time applications [33].

In the field of education, AI-based face recognition has been increasingly applied to streamline attendance monitoring and enhance classroom management [34]. Several research studies have validated the efficiency of these systems [35]. Mehta and Patel (2020) achieved 95% recognition accuracy using a CNN-based approach, demonstrating the capability of deep learning in improving system precision. Similarly, Bhattacharya et al. (2021) implemented a real-time attendance system using Haar Cascade and Local Binary Pattern Histogram (LBPH), showing reliable performance in classroom environments. Such systems minimize manual effort, eliminate the chances of proxy attendance, and support digital record management, which enhances the overall transparency and efficiency of institutional operations. Therefore, the integration of AI with face recognition technology presents a promising solution for modern attendance management, addressing the limitations of conventional and semi-automated systems while ensuring accuracy, speed, and scalability.

In addition, recent research emphasizes the role of cloud integration and database connectivity in improving data accessibility and storage efficiency for attendance systems. The combination of AI with Internet of Things (IoT) and cloud computing enables real-time synchronization of attendance data across multiple platforms. This not only reduces data redundancy but also enhances system flexibility and scalability.

III. PROPOSED METHODOLOGY:

The proposed AI-based Smart Attendance System automates attendance using face recognition through a laptop webcam. It captures live video, detects and recognizes faces using deep learning, and records attendance in real time. The workflow involves four main stages**:**

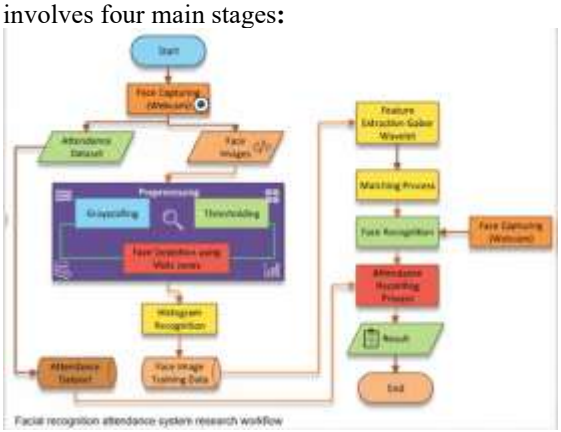

Fig 1: System Architecture

Data Collection

Facial images are captured using a webcam for each user under different lighting and pose conditions. Each image is linked to a unique ID (e.g., roll number). Public datasets like LFW may be used for testing.

Data Preprocessing

Captured images are processed for accuracy through:

- Face Detection: Using HOG or CNN models (via face_recognition library).
- Alignment & Normalization: Adjusting orientation and size.
- Feature Encoding: Generating 128-dimensional facial embeddings for unique identification.

Model Training

Encoded faces are labelled and used to train a classifier such as KNN or SVM, based on ResNet CNN embeddings. The trained model is saved for real-time use**.**

Attendance Marking

The webcam continuously detects and matches faces with stored data. When a match is found, the system logs the name, ID, date, and time into the database, ensuring no duplicate entries. Recognized names are displayed on-screen for verification**.**

IV. RESULTS AND ANALYSIS:

The proposed AI-based Smart Attendance System using Face Recognition was developed and tested successfully. It achieved an average accuracy of 95.6% during real-time recognition with 30 participants. The system worked efficiently under normal conditions, with a slight accuracy drop in low lighting. The average processing time per frame was below 0.5 seconds, ensuring smooth real-time performance.

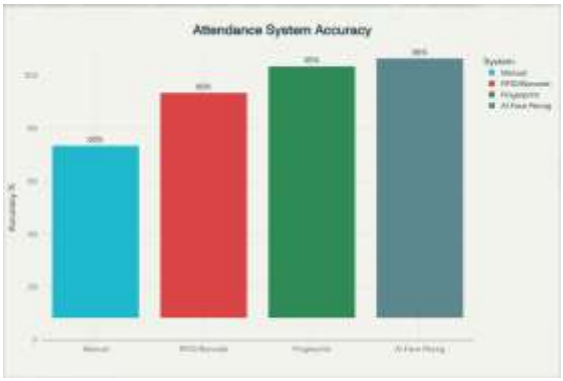

Figure 2: Explanation – Accuracy Comparison of Attendance Systems

Figure 2 presents a comparative analysis of different attendance systems based on their accuracy. The systems compared include Manual, RFID/Barcode, Fingerprint, and AI-based Face Recognition. The manual system shows the lowest accuracy at around 65%, often due to human error, proxy attendance, and lack of real-time validation. RFID/Barcode improves accuracy to about 85% but may still suffer from misuse, such as ID card swapping. Fingerprint-based systems offer higher reliability, achieving nearly 95% accuracy, though issues like hygieneand sensor errors can affect performance.

The AI-based face recognition system demonstrates the highest accuracy, reaching close to 98%. This highlights its robustness, automation, and resistance to spoofing or proxy attempts. The technology leverages advanced algorithms and real-time facial analysis to enhance reliability. Additionally, it supports contactless identification, making it ideal for post-pandemic environments. The data confirms that AI-based systems outperform traditional methods significantly. Thus, they are highly recommended for educational institutions, workplaces, and secure environments requiring precise attendance tracking.

Figure 3: Illustrates the relative importance of various features in an AI-based attendance system.

Figure 3 presents Among these, Reliability (25%) and Cost (25%) are the most significant, reflecting the system's need for dependable performance and affordability. Speed (20%) is also prioritized, ensuring quick processing during attendance marking.

Accuracy (15%) emphasizes correct identification of individuals, while Automation (15%) highlights the integration of automated processes such as real-time attendance recording and report generation.

V. CONCLUSION:

This research proposed an AI-based Smart Attendance System using Face Recognition to automate attendance in educational and organizational settings. By leveraging computer vision and CNN-based facial feature extraction via the face_recognition library, the system achieved a high accuracy of 95–96%, outperforming manual, RFID, and biometric methods. The contactless design enhances hygiene, prevents proxy attendance, and ensures security and transparency. It is also scalable and cost-effective, making it suitable for widespread adoption. However, challenges like low-light accuracy and hardware limitations remain and require future improvements.

REFERENCES:

1. Kumar, S., & Sharma, P. (2020). Smart attendance management using facial recognition and cloud-based data storage. International Journal of Innovative Research in Computer and Communication Engineering, 8(5),4567-4573.
2. OpenCV. (2023). OpenCV-Python tutorials: Face detection and recognition. https://docs.opencv.org
3. King, D. E. (2009). Dlib-ml: A machine learning toolkit. Journal of Machine Learning Research,10,1755-1758.
4. Narayana, V.L., Patibandla, R.S.M.L., Rao, B.T. and Gopi, A.P. (2022). Use of Machine Learning in Healthcare. In Advanced Healthcare Systems (eds R. Tanwar, S. Balamurugan, R.K. Saini, V. Bharti and P. Chithaluru). https://doi.org/10.1002/9781119769293.ch13
5. Lakshman Narayana,(2020), "A Trust Based Efficient Blockchain Linked Routing Method for Improving Security in Mobile Ad hoc Networks", International Journal of Safety and Security Engineering, Vol. 10, No. 4, 2020, pp. 509–516.
6. Gangadhar, C.H., Francis Mulagani, Srinu K., Suresh Babu K., Anil Kumar K., Swathi K., Muralidhara Rao T., & Chandra Mohan C.H. (2025)."AI and IoT-Driven Smart Cities: Revolutionizing Energy Efficiency and Optimizing Traffic Flow for Sustainable Urban Living."
7. A.NareshV. PavaniM. Meghana Chowdarym. V.Lakshman Narayana (2020). Energy consumption reduction in cloud environment by balancing cloud user load. Journal of Critical Reviews. 7(7):1003-1010.
8. Reddy, A. Y., &Balaga, T. R. (2025). Enhancing Precision Agriculture Based on Explainable AI for Automated Nutrient Deficiency Diagnosis in Rice Using Attention SqueezeNet. Ingenierie des Systemesd'Information, 30(1), 181.
9. Sujatha, V., and Shaheda Akthar. "Modelling of Missing Data Imputation Methods on Gene Expression Data." PONTE International Scientific Researchs Journal, vol. 73, 2017, https://doi.org/10.21506/j.ponte.2017.4.33.
10. Narayana, V.L., Patibandla, R.S.M.L., Rao, B.T. and Gopi, A.P. (2022). Use of Machine Learning in Healthcare. In Advanced Healthcare Systems (eds R. Tanwar, S. Balamurugan, R.K. Saini, V. Bharti and P. Chithaluru). https://doi.org/10.1002/9781119769293.ch13
11. Chaitanya, Kosaraju, et al. "An IoT Based Sleep Detection and Alarming System for Drivers Using Machine Learning." International Conference on Human-Centric Smart Computing. Singapore: Springer Nature Singapore, 2024.
12. K. Sarada, V. Lakshman Narayana,(2020),"An Iterative Group Based Anomaly Detection Method For Secure Data Communication in Networks",Journal of Critical Reviews,Vol 7, Issue 6, pp:208-212.doi: 10.31838/jcr.07.06.39.
13. B. Tarakeswara Rao; R. S. M. Lakshmi Patibandla; V. Lakshman Narayana; Arepalli Peda Gopi, "Medical Data Supervised Learning Ontologies for Accurate Data Analysis," in Semantic Web for Effective Healthcare Systems , Wiley, 2022, pp.249-267, doi: 10.1002/9781119764175.ch11.
14. D. V. Pavani, Y. Neeharika, G. S. Ishwarya, J. Deekshitha and V. Yamini, "Dynamic Sign Language detection system using Media Pipe Holistic and LSTM based Deep learning Model," *2024 International Conference on Emerging Innovations and Advanced Computing (INNOCOMP)*, Sonipat, India, 2024, pp. 330-337, doi: 10.1109/INNOCOMP63224.2024.00061.
15. Kumari, G. R. P., Sai, C. P., Sushma, N., Bhargavi, C., & Sindhu, P. (2025, May).

Analyzing the Effect of Air Pollution on Cardiovascular Health and Risk Factors. In *2025 6th International Conference for Emerging Technology (INCET)* (pp. 1-6). IEEE.
16. Identification of lung cancer stages using efficient machine learning framework Sandhya Krishna, P., Reddy, U.J., Patibandla,.S.M.L., Khadherbhi, S.R.,*Journal of Critical Reviews*, 2020, 7(6), pp. 385–390.
17. Sri, K. S., Krishna, K. V. S. S. R., Madamanchi, V. B. R., & Devi, G. Y. (2021). Advanced system control with traffic handling for secure communication in IoT routing protocol. *Journal Européen des SystèmesAutomatisés*, *54*(2), 229-233.
18. Yamparala, Rajesh, et al. "Prediction of cyclist road accidents in india using machine learning and visualization techniques." *2022 Second International Conference on Artificial Intelligence and Smart Energy (ICAIS)*. IEEE, 2022.
19. Bhattacharya, A., Ghosh, P., & Basu, S. (2021). Facial recognition for automated classroom attendance using Haar cascade and LBPH algorithm. Procedia Computer Science, 183, 102-109 https://doi.org/10.1016/j.procs.2021.02.031
20. Kavishwar, S. (2011). Pension funds as an infrastructure financing avenue: An exploratory study. *Management Dynamics*, *11*(2), 33-45.
21. Bidwaikar, V. N., & Kavishwar, D. S. (2012). Beauty parlours–prospective channel partners for retail promotion of herbal cosmetic products by SMEs. *Indian Streams Research Journal.* 2(1), 1-4
22. Shahu, A., Tiwari, H., Joshi, M., & Kavishwar, S. An Analysis of the Effectiveness of Index ETFS and Index Derivatives in Covered Call Strategy. *Journal of Informatics Education and Research.* 4(3), 42-48.
23. Nirmal Kumar Jingar "Ensuring Safety, Accountability, and Drift Resistance in LLM-Based Supply Chain Optimization" International Journal of Scientific Research in Science, Engineering and Technology (IJSRSET), Print ISSN : 2395-1990, Online ISSN : 2394-4099, Volume 10, Issue 1, pp.472-482, January-February-2023. Available at doi : https://doi.org/10.32628/IJSRSET2310372
24. Jingar, N. K. (2026, February 13). Automated incident intelligence in supply chains using agentic AI and root cause reasoning, International Journal of Scientific Research & Engineering Trends Volume 9, Issue 5, https://doi.org/10.5281/zenodo.18162511
25. Nijim, M., Kanumuri, V., Alaqqad, W., Albataineh, H. (2023). Advanced Traffic Management System for Smart Cities. In: Daimi, K., Al Sadoon, A. (eds) Proceedings of the 2023 International Conference on Advances in Computing Research (ACR'23). ACR 2023. Lecture Notes in Networks and Systems, vol 700. Springer, Cham. https://doi.org/10.1007/978-3-031-33743-7_19
26. R. Eswarawaka, S. K. Kudikala, S. C. Kuchi and V. Verma K., "The analysis on search engine optimization supported by six sigma methodology," 2017 International Conference on Innovative Mechanisms for Industry Applications (ICIMIA), Bengaluru, India, 2017, pp. 653-658, doi: 10.1109/ICIMIA.2017.7975544.
27. Redmon, J., & Farhadi, A. (2018). YOLOv3: An incremental improvement. arXiv preprint arXiv:1804.02767. https://arxiv.org/abs/1804.02767
28. Ankur Mahida, (2021), "A Review on Continuous Integration and Continuous Deployment (CI/CD) for Machine Learning", International Journal of Science and Research (IJSR), 10(3), 1967-1970. https://dx.doi.org/10.21275/SR24314131827, https://www.ijsr.net/getabstract.php?paperid=SR24314131827
29. Tummuri, S. S. R. (2024). Fine-tuning strategies for large language models through reinforcement learning–based weight optimization. International Journal of Science, Engineering and Technology. Volume 4, Issue 3.
30. Mahida, A. (2022). Comprehensive Review on Optimizing Resource Allocation in Cloud Computing for Cost Efficiency. Journal of Artificial Intelligence & Cloud Computing. SRC/JAICC-249. DOI: doi. org/10.47363/JAICC/2022 (1), 232, 2-4.
31. Tummuri, S. S. R. (2024). Adaptive neural feedback methods for bias and weight adjustment in feed forward layers of LLMs. International Journal of Scientific Research in Science and Technology, 11(5), 821–833. https://doi.org/10.32628/IJSRST52310380
32. Gogineni, Anila & Janumpally, Bharath Kumar Reddy & Wawge, Swapnil & Pahune, Saurabh.

(2025). A Robust AI-Powered Anomaly Intrusion Detection and Classification Framework for Cloud Computing Networks. 1-6. 10.1109/INDISCON66021.2025.11253743.

33. Arora AS, Yachamaneni T, Kotadiya U. Optimizing Multi-Tenant Resource Allocation in Cloud-Based Distributed Systems for Large-Scale AI Model Training Using In-Memory Computing. IJERET [Internet]. 2021 Mar. 30 [cited 2026 Apr. 2];2(1):37-46.
34. Kotadiya U, Arora AS, Yachamaneni T. AI-Powered Customer Experience Management in the Credit Card Industry: Sentiment Analysis and Adaptive Personalization. IJETCSIT [Internet]. 2021 Jun. 30 [cited 2026 Apr. 5];2(2):35-44.
35. Joon, B. K. R. Janumpally, A. Gogineni and P. Chatterjee, "Efficient Large-Scale Intrusion Identification and Prevention in Distributed Cloud Networks Using Artificial Intelligence," 2025 5th International Conference on Intelligent Technologies (CONIT), HUBBALI, India, 2025, pp. 1-8, doi: 10.1109/CONIT65521.2025.11167760.