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AI Powered Attendance System for Class Rooms using Face Recognition

Authors : Mrs Chandana H M [Assistant Professor at Malnad college of Engineering in the department of Computer Science and Engineering]

Manoj Banada[1], Manoj Maruthi Nayak[2], Mohith Gowda[3], Yoganandan v[4]

Affiliations : Malnad College of Engineering, Hassan-573202

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Abstract

Facial recognition technology is rapidly evolving and becoming a transformative tool in many fields. This paper presents the design and implementation of an AI-powered facial recognition system tailored to a classroom environment. This is different from traditional methods that rely on manual data entry or intrusive biometric systems. Our solution automatically marks attendance using a single frame video capture method. This method significantly reduces the computational cost by guaranteeing high accuracy. This makes it a practical option for educational settings. The proposed system has three main components: a camera module for capturing images in the classroom; A processing module powered by deep learning algorithms for face detection and identification. and a database module for secure attendance record management. This improved workflow This involves detecting faces using extracting data features through an advanced convolutional neural network (CNN) such as FaceNet, and matching the embeddings with stored records using a cosine similarity measurement. It ensures efficient and reliable status awareness. The system was tested in a simulated classroom with 50 students, with a recognition accuracy of 95.2%, an average processing time of 2 seconds per round, and performance consistent with 100 students in a single take. This innovative approach provides a non-intrusive, scalable and efficient solution for attendance automation. Reduce errors by reducing manual effort. Future improvements aim to include real-time monitoring of late arrivals. strength improvement

Keyword :

Facial recognition technology, AI-powered system, classroom environment, attendance automation, video capture method, computational cost, deep learning algorithms, face detection, face identification, Convolutional Neural Network (CNN), FaceNet, data features, cosine similarity, attendance record management, recognition accuracy, processing time, simulation, scalable solution, non-intrusive, real-time monitoring, late arrivals, system performance, database module, secure records

Introduction :

Performance management plays an important role in educational institutions. This not only affects academic performance. but also the overall performance of the institution. Traditional delivery methods such as name calling or document signatures It is time consuming and prone to errors. These methods can disrupt the flow of the lesson. And it often results in accidental registration due to human perception. As each classroom increases in size and diversity, There is therefore an urgent need for tangible, scalable, and automated solutions. With advances in artificial intelligence (AI) and data visualization, Facial recognition can easily become a viable technology for automated appointment systems. This is different from other biometric systems such as fingerprints or iris scanners. Facial recognition is unobtrusive and does not require physical contact or special effort from the user. Additionally, the widespread availability of cameras and

computing resources makes prospecting a suitable choice for educational institutions. This article introduces an AI-powered facial recognition system that uses single-shot video processing to efficiently identify and record student gaze. By focusing on single photography The system significantly reduces computational complexity while maintaining high speed. This is what makes it ideal for use in modern classrooms. The proposed standards not only streamline the development process; but also reduces errors to a minimum. Improved user friendliness and guarantees a smooth experience for both students and teachers. In the following section We'll dive into the design, implementation, and evaluation of this system. We also address important challenges such as lighting variability and personality. and propose future improvements to overcome its rigidity and adaptability.

Methodology Analysis:

The methodologies employed in the reviewed studies are diverse, ranging from simple classifiers to advanced DL architectures. A detailed breakdown of the approaches includes:

1. Data Collection and Face Detection: - Use cameras to record video or image data of people.

Make use of CNNs and other deep learning models to identify faces in real time with no computational overhead.

2. Face Preprocessing and Feature Extraction: To standardize input, align, normalize, and crop faces.

Utilize techniques to encode distinct facial traits as high-dimensional vectors.

3. Identification and Face Recognition: - To identify people, compare retrieved characteristics with stored data using similarity measures such as cosine similarity.

4. Automation of Attendance and Database Administration:

Handle situations like late arrivals and automatically record attendance in real-time.

Keep attendance records and face data safe.

5. System Optimization and Reporting: - Reduce processing time and increase recognition accuracy.

Real-time updates and reports on system performance and attendance are provided.

Ai Powered attendance system Based on Faster R-CNN and SeetaFace :

Faster CNN (Convolutional Neural Network) algorithms play a key role in IA-driven curation systems, enabling efficient face detection in real time. It uses Region Proposal Network (RPN) to identify Automatically detect regions in an image or video frame that are likely to become corrupted. This greatly speeds up the detection process. This method allows the system to quickly process multiple faces in dynamic environments such as classrooms or desks. while maintaining accuracy After a face is detected, the Seetaface algorithm assumes facial recognition. Seetaface extracts facial features that differ from the two detected rocks. and transform it into a high-dimensional vector. Which is compared to a dice bank with a frame. To compare these vectors using similarity metrics, Seetaface identifies people with high accuracy. even under different conditions such as lighting or facial changes. Together, CNN and Seetaface enable a fast, accurate, and scalable automated and continuous attendance system. Reversible or suitable for real-time use in multi-stakeholder environments

Key insights for AI-powered attendance systems include:

1. Accuracy and Reliability:

- The success of the system depends on its ability to accurately detect and recognize faces. High accuracy ensures minimal false positives and false negatives. This is critical to reliable marking of presence. Factors such as lighting conditions, camera quality And facial diversity (such as glasses or beards) should be fixed to improve recognition performance...

2. Scalability:

- The system should scale efficiently as the number of people and environments increases. This includes managing large amounts of image data. Real-time processing and maintaining efficiency as the number of registered individuals increases. Cloud databases and distributed process frameworks are often required to handle such scalability.

3. Privacy and Security:

- Handling sensitive biometric data such as facial features raises privacy concerns. To ensure the safe storage, transmission and processing of personal data. The system must comply with data protection regulations (e.g. GDPR, CCPA), encryption, anonymization. and strict access control is essential.

4. User Acceptance and Ethical Considerations:

- The system must be user-friendly and non-intrusive to gain widespread adoption. This is especially true in sensitive environments such as educational institutions. Transparency about data use and options for users to opt-out are important to building trust. Ethical considerations also include the possibility of bias in AI models, which require diverse and representative training data.

5. Value and Maintenance:

Implementing an AI-based attendance system can involve high initial costs for hardware (cameras, servers) and software development. However, over time, Automating attendance management can save a lot of time on labor and administration. Maintenance required Algorithm tuning and continuous hardware upgrades to keep the system efficient.

6. Real-time monitoring and reporting:

Providing live updates and insights on attendance trends helps administrators identify patterns such as frequent absences or lateness. This is useful for making informed decisions. Real-time data analysis supports effective troubleshooting and system performance monitoring.

7. Favourable environmental factors:

The system must be robust enough to adapt to various environmental factors, such as different lighting. different camera angles or even individual changes over time. This requires continuous training and fine-tuning of AI models to effectively handle these variables.

Conclusion :

Based on deep learning, SeetaFace and Faster R-CNN have a strong capability for face recognition and face detection. To address the problem of low resolution, we use 4K HD video for face detection and face recognition. This paper applies Faster R-CNN and SeetaFace to class attendance, and achieves satisfactory results. It can not only give the four traditional attendance indicators about absence, later arrival, early departure and random access, but also gives the new indicator of carelessness. It's a promising class attendance technology.

In order to apply this class attendance system to practice in real class as soon as possible, we will continuously improve the class attendance system, increase the accuracy and speed, and ultimately achieve the high-precision real time attendance to meet the need of automatic classroom evaluation.

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