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Face Recognition Based Attendance System with Effective Time Approach

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Abstract: Using facial recognition technology, the Face Recognition-Based Attendance System (FRBAS) described in this code simplifies attendance management. Data exploration, preprocessing, Siamese network pair generation, Siamese network model definition, training loop, model evaluation and visualisation, model saving and visualisation are some of its essential steps. The initial step involves the exploration of data, the distribution of face photographs among identities, and preprocessing, which includes resizing. The next step involves creating pairs of similar and different samples and dividing the data into training and testing sets. Using DenseNet201, a Siamese neural network model extracts features, computes distances, and makes predictions in the third stage. The network learns from picture pairings through a training loop where accuracy and loss parameters are monitored. The model's performance is assessed against the test after training.

Keywords: Facial Recognition Based Attendance system, Siamese Network, Preprocessing ,Feature Extraction, Densenet201.

I. INTRODUCTION

Automatic face recognition (AFR) systems are the talk of the town these days, particularly in the educational sector. An innovative new approach named "Smart Attendance using Face Recognition" is presented in this study. This innovative method is intended to simplify the process of monitoring student attendance at educational institutions. Attendance was once taken in a slow, potentially error-prone manner. However, the new method makes far more automated and seamless attendance management through facial recognition technology.

The Face Recognition-Based Attendance System (FRBAS) incorporates a cutting- edge algorithm known as Densenet201, renowned for its exceptional capability in facial recognition. Densenet201 enhances the system's efficiency, ensuring rapid and precise identification of students' faces in images or videos captured by a camera. Unlike traditional attendance systems that necessitate manual record-keeping, FRBAS operates in real-time, automatically updating attendance records as students enter or exit.

The utilization of Densenet201 not only accelerates the recognition process but also significantly improves accuracy, marking a substantial advancement in attendance management. This state-of-the-art algorithm contributes to a seamless and reliable system, reducing the likelihood of errors and streamlining administrative tasks associated with attendance tracking.

One of the noteworthy features of FRBAS lies in its ability to revolutionize the handling of attendance in educational institutions. The real-time updates provided by the system eliminate the need for time-consuming manual data entry, allowing educators to redirect their focus towards providing a high-quality education. Moreover, the integration of Densenet201 strengthens the attendance system's overall dependability and efficiency by adding an additional degree of protection.

II RELATED WORK

Shaikh Mohd Ashfaque et al [1] have innovatively introduced a Face Recognition Based Attendance System that seamlessly integrates Machine Learning and RFID technology. This advanced system is designed to optimize accuracy and speed, aiming to

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deliver precise and real-time attendance records. The integration of facial recognition ensures a high level of precision, while RFID technology enhances the efficiency of the overall classroom evaluation process. This approach represents a modern and effective solution for automating attendance tracking in educational settings.

Nandhini R, Duraimurugan, et al. [2] devised an attendance system employing Deep Learning, RFID, and CNN for heightened accuracy in face recognition. The combination of these technologies improves accuracy and opens the door to further advancements. One prospective enhancement involves extending the system's application to seminar halls, enabling the seamless detection of multiple individuals, thereby broadening its scope and utility.

Dhanush Gowda H L, et al [3] implemented an attendance system based on face recognition, employing Deep Metric Learning and Convolutional Neural Networks (CNN). The system utilizes OpenCV for frame extraction and dliv for face recognition. Using deep learning for facial feature analysis and recognition, this integrated approach guarantees precise and effective attendance tracking. The integration of these technologies improves the attendance system's overall performance and dependability, giving it a strong option for a range of uses.

The authors Arjun Raj A et al [4] developed a Face Recognition-based smart attendance system incorporating Raspberry Pi and advanced algorithms such as Deep Neural Network, Ada-Boost, and LBPH. Their incorporation of the LBPH face recognition algorithm addresses challenges associated with varying head orientations and significant occlusion, ensuring robust performance in diverse scenarios. This novel approach enhances the system's accuracy and reliability, making it well-suited for practical applications in attendance management.

Thai-Veit Dang et al in [5] have created a smart attendance system that uses depth-separated convolutional networks to recognise faces, hence reducing model size and volume. The system is based on enhanced facial recognition, which is built on the backbone MobilenetV2. Hence the authors next research directions are not only the promotions in systems precisions and speed, but also the security and attendance enhancement with 3D facial recognition.

B. Pruthvi Raj Goud et al. [6] developed a smart attendance notification system that employs SMTP for efficient communication. The system incorporates face recognition and utilizes Support Vector Machines (SVM) for image set training. To further enhance performance, address constraints, and facilitate comprehensive reporting, the authors are[B.] of the number of samples per individual, revealing the minimum and maximum number of samples available for each person.

Shubham Yelve, et al [7] designed a comprehensive review on the progress of automated attendance systems, integrating RFID, FERET, CNN, and deep learning technologies. In an effort to increase the precision and effectiveness of attendance tracking systems, their work demonstrates the possibility for future development by investigating several face detection algorithms. The report emphasises how important it is to use cutting-edge technologies to improve attendance records across a range of industries.

III METHODOLOGY

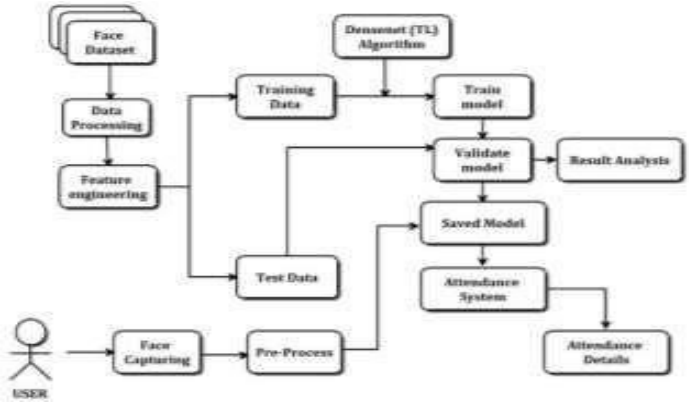

Fig1: System Architecture

A Dataset Description

The high-resolution camera which is used for capturing video is used to take frontal images of the students. The dataset used in this project is a collection of extracted

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face images, stored in the "Extracted Faces/Extracted Faces" directory. Each subdirectory within this directory represents reading and resizing the face images to a consistent size of a unique individual, and the images inside each subdirectory correspond to different instances of that person's face. The code provided analyzes the distribution model groups faces into appropriate groups. The ultimate outcome furnishes details about the identified individuals. [1.] Effective preprocessing, high-quality training data, and the resilience of the trained model are all necessary for this method to be accurate and help students identify faces in photos.

1 Siamese network: A Siamese neural network is an architecture of a neural network that consists of two or more related subnetworks. In this sense, "identical" means that they have the same setups, weights, and parameters. Both sub-networks replicate actively working on refining the system's capabilities and optimizing report generation.

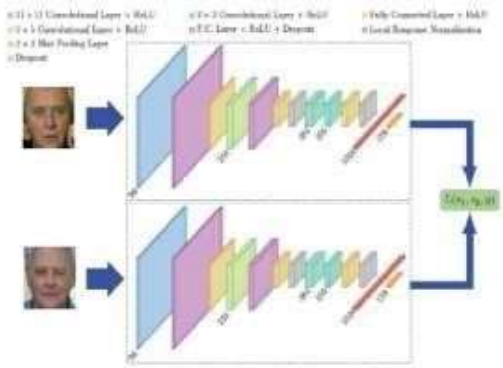

Fig 2 : Siamese Network

2 Densenet201 Algorithm

A sophisticated convolutional neural network architecture, Densenet201 stands out for its distinct characteristics. The idea of dense interconnectedness, in which inputs are received by each layer from all levels before it, is particularly noteworthy. In order to maintain high learning capacity while minimising computational complexity, the architecture additionally uses bottleneck layers, which are made up of 1x1 and 3x3 convolutions. By combining 1x1 convolutions and 2x2 average pooling, transition layers enable downsampling and spatial dimension reduction. Global average pooling, which reduces feature maps for every class, is typically the last step in Densenet201 projects.

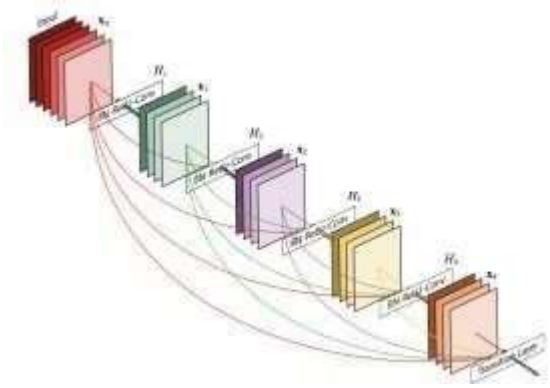

Fig 3: Densenet201 Algorithm

B. Preprocessing

The proposed system architecture describes the process of face recognition process .Initially an picture is first input into the facial recognition system for student attendance, and it is then converted into frames. Preprocessing is applied to these frames in order to improve facial traits, such as face detection and normalisation. After features are extracted, usually a Siamese Model is trained to recognise facial landmarks and texture patterns. The model picks up correlations and patterns that are essential for identification after being trained on a labelled dataset. When used, the 128x128 pixels. Converting the images to NumPy arrays for further processing. Creating pairs of similar and dissimilar face images by combining images from the same individual (similar) and different individuals (dissimilar).Splitting the paired data into training and testing sets.

C Feature extraction: Feature extraction takes on even more significance in Siamese networks since it supports the network's capacity to identify relevant representations of input images for later similarity comparisons. Because of its distinct dense connectivity pattern, DenseNet201 stands out as a strong option for feature extraction inside these networks. DenseNet201 uses dense connections, in contrast to conventional convolutional neural networks (CNNs), in which every layer receives direct input from every layer that comes before it. Better feature representation learning results from this architecture's ability to efficiently reuse features and maintain a smooth gradient flow

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throughout the network during training. Siamese networks may extract highly discriminative features that capture complex patterns by utilising DenseNet201's dense connectedness

D Algorithm used parameter updates. These networks find various uses since they can be used to compare feature vectors to determine how similar the inputs are. A neural network typically gains the ability to predict several classes. When we need to add or remove new classes from the data, this presents a challenge. In this case, the complete dataset must be used to update and retrain the neural network. Furthermore, deep neural networks need a large amount of data in order to learn. However, SNNs(Siamese Neural Networks) acquire knowledge of a similarity function. As a result, we can teach it to determine whether the two photographs are same, which is what we will do now.

E. Image Classification upon the completion of feature extraction. To determine how similar or unlike the feature vectors are based on the extracted characteristics, they are then compared using a distance calculation. Based on this calculated distance, it is determined whether or not two photos are of the same person. A little distance indicates resemblance, while a high distance indicates dissimilarity. With backpropagation, the system may learn from its errors and is trained on many pairs of images to increase accuracy. It is also possible to fine-tune on a smaller, task-specific dataset for adaptation following training on a larger dataset.

IV. RESULT

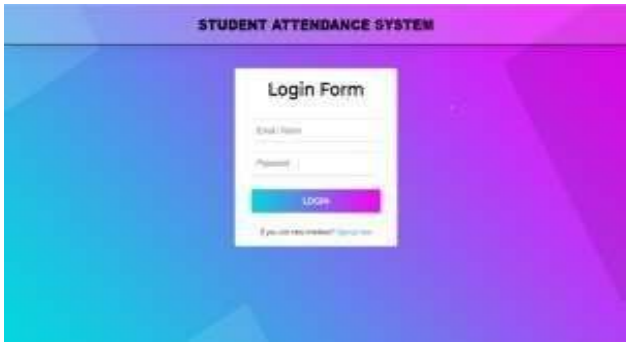

Fig 4: Attendance Login Page

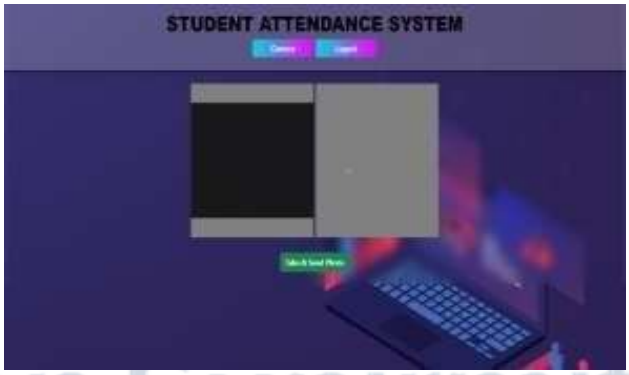

Fig 5: Attendance Input Page

Fig 6: Capturing Student Face Through WebCamera

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Fig 7 :Prediction of Student face in Backend

Fig 8: Identified the students face with name

V. CONCLUSION

The Face Recognition-Based Attendance System (FRBAS) has advanced significantly, offering a strong foundation for future enhancements.. The distribution of facial photos across identities was discovered through data exploration, which is important for analysis and training models. Important preparation techniques, like scaling images, were used to efficiently prepare the data. For thorough training, the Siamese network's pair generating process guaranteed a solid dataset containing both comparable and dissimilar samples.The application of the Siamese neural network model, which uses DenseNet201 for feature extraction, was a crucial turning point. This sophisticated algorithm uses facial recognition technology to reliably identify people and forecast attendance. Utilising the foundation established in this phase, the following stages will concentrate on model training, evaluation, and deployment in order to attain effective attendance system.

VI. FUTURE ENHANCEMENT

Use real-time attendance monitoring to give timely updates on the status of attendance. This can be done by combining the system with camera feeds that are in real time, making it possible to track and record attendance continuously. By adding multi-factor authentication to the system, you may increase security. For more reliable verification and to lower the possibility of identity fraud or unwanted access, combine additional biometric modalities like fingerprint or iris recognition with facial recognition. To make platform deployment and management simple, take advantage of containerisation or cloud-based infrastructure solutions.

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