Face Recognition Based Attendance System

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***Abstract*—** Face recognition-based attendance systems are revolutionizing traditional methods of attendance tracking by employing sophisticated computer vision technologies. These systems utilize cutting-edge algorithms, often based on deep learning architectures like convolutional neural networks (CNNs), to detect, recognize, and verify individuals' faces in real-time. Through a combination of face detection, feature extraction, and matching techniques, these systems can accurately identify individuals from a database of enrolled faces, streamlining the attendance recording process. In practical implementation, face recognition-based attendance systems integrate seamlessly with existing infrastructure and workflows. Users are enrolled into the system by capturing their facial images, which are then stored securely in a database. During attendance tracking sessions, the system captures live images of individuals, performs face recognition against the enrolled database, and automatically records attendance data. This automation eliminates the need for manual data entry, reduces administrative overhead, and minimizes errors associated with traditional attendance tracking methods. The adoption of face recognition-based attendance systems offers numerous benefits, including enhanced accuracy, efficiency, and real-time insights into attendance patterns. By automating the attendance tracking process, these systems optimize resource allocation, improve operational efficiency, and provide timely insights for decision-making. However, considerations such as privacy, security, and ethical implications must be carefully addressed to ensure responsible deployment and widespread acceptance of this technology.

I. Introduction

In the contemporary landscape of attendance management, traditional methods often fall short in meeting the demands of accuracy, efficiency, and security. Manual systems reliant on paper records or electronic card swiping can be cumbersome to maintain and susceptible to errors, while biometric solutions like fingerprint scanners may present hygiene concerns and logistical challenges. However, the advent of face recognition technology offers a promising alternative, leveraging advanced computer vision algorithms to automate attendance tracking with unprecedented precision and convenience.

This introduction explores the concept and potential of a face recognition-based attendance system, specifically utilizing the VGG16 model, a deep convolutional neural network renowned for its performance in image classification tasks. By harnessing the power of VGG16, this system aims to revolutionize attendance management by enabling real-time identification of individuals based on their facial features, thus eliminating the need for manual input or physical tokens.

The integration of VGG16 into the attendance system holds the promise of enhanced accuracy and reliability in face recognition. With its deep architecture and extensive training on large-scale image datasets, VGG16 excels in extracting intricate patterns and features from facial images, enabling robust identification even in diverse lighting conditions and facial orientations. Leveraging this capability, the face recognition-based attendance system can accurately and efficiently verify the identity of individuals, facilitating seamless attendance tracking in various settings such as educational institutions, corporate offices, and events.

Furthermore, the adoption of a face recognition-based attendance system offers several advantages beyond improved accuracy. By automating the attendance recording process, organizations can streamline administrative workflows, reduce manual labor, and allocate resources more effectively. Additionally, the non-intrusive nature of facial recognition eliminates concerns related to hygiene and privacy associated with traditional biometric methods, enhancing user acceptance and compliance.

In summary, the introduction of a face recognition-based attendance system, powered by the VGG16 model, represents a transformative shift towards modernized and efficient attendance management. With its ability to accurately identify individuals based on facial features, this system holds the potential to revolutionize how organizations track attendance, offering unparalleled accuracy, efficiency, and convenience in the process.

II. Literature Review

The identification of person from the facial features is referred as face recognition. A facial feature can be used in the different computer vision algorithms like face detection, expression detection and many video surveillance applications. Recently, face recognition systems are attracting researchers toward it. In this approach, three different methods such as SVM, MLP and CNN have been presented. DNN is used for face detection. For SVM and MLP based approach, the features are extracted using PCA and LDA feature extraction algorithms. In CNN based approach, the images were directly feed to the CNN module as a feature vector. The proposed approach shows the good recognition accuracy for CNN based approach. The SVM, MLP and CNN achieves the testing accuracy around 87%, 86.5% and 98% on self-generated database respectively.

Students attendance in the classroom is very important task and if taken manually wastes a lot of time. There are many automatic methods available for this purpose i.e. biometric attendance. All these methods also waste time because students have to make a queue to touch their thumb on the scanning device. This work describes the efficient algorithm that automatically marks the attendance without human intervention. This attendance is recorded by using a camera attached in front of classroom that is continuously capturing images of students, detect the faces in images and compare the detected faces with the database and mark the attendance. The paper review the related work in the field of attendance system then describes the system architecture, software algorithm and results.

The attendance system is used to track and monitor whether a student attends a class. There are different types of attendance systems like Biometric-based, Radiofrequency card-based, face recognition based and old paper-based attendance system. Out of them all, a Face recognition-based attendance system is more secure and time-saving. There are several research papers focusing on only the recognition rate of students. This research focusing on a face recognition-based attendance system with getting a less false-positive rate using a threshold to confidence i.e. Euclidean distance value while detecting unknown persons and save their images. Compare to other Euclidean distance-based algorithms like Eigenfaces and Fisher faces, Local Binary Pattern Histogram (LBPH) algorithm is better [11]. We used Haar cascade for face detection because of their robustness and LBPH algorithm for face recognition. It is robust against monotonic grayscale transformations. Scenarios such as face recognition rate, false-positive rate for that and false-positive rate with and without using a threshold in detecting unknown persons are considered to evaluate our system. We got face recognition rate of students is 77% and its false-positive rate is 28%. This system is recognizing students even when students are wearing glasses or grown a beard. Face Recognition of unknown persons is nearly 60% for both with and without applying threshold value. Its false-positive rate is 14% and 30% with and without applying threshold respectively.

Education institutes today are concerned about the consistency of students ' performance. One cause of this decrease in student performance is the inadequate attendance. There are several ways to mark your attendance, the most common ways to sign or call the students. It took longer and was problematic. From now on, a computer-based student attendance checking system is required that supports the faculty to keep records of attendance. We have used an intelligent attendance system based on face recognition in this project. We have proposed to implement a "Smart Attendance System for Face Recognition" through this large applications are incorporated. The present implementation includes facial identification that is time saving and eradicates the possibilities of proxy attendance due to the facial authorization. This system can now be used in an area in which participation plays an important role. Raspberry Pi, Open CV and Dlib using python are the basic requirements for this system. The system implemented uses LBPH face recognizer to identify the face of the person in real time. Eigen faces and Fisher faces are affected both by light and we cannot ensure perfect light conditions in real life. An improvement in the LBPH faces recognizer to overcome this problem. This system compares the image of the test and the training image and determines who is and is not present. The attendance data is stored in an excel sheet that is automatically updated in the system. If a student is absent a message will be automatically sent to their parent's phone number using GSM. Student's can check their attendance using an Android application that we have developed using MIT app Inventor.

The objective of the attendance system is to provide an alternative means to the traditional attendance system which consumes 10 to 15 minutes of time in 50 minutes of lecture hour. It also aims at eliminating human errors and proxy in recording the attendance of the student. This can be achieved by using face recognition for monitoring the attendance of the students in a class. The face recognition process is carried out by using the Cognitive Face API which follows the Principal Component Analysis (PCA) algorithm. Initially, the dataset of the students in a class are collected. The dataset is collected in a manner that for each student, a set of 25 images in various angles is collected. The features are extracted from the images that are collected by using the cognitive face API and the database is formed. The image of the class in columns is acquired immediately, when the input image is acquired by using a mechanical set up which captures image based on hour, the number of faces in the input image is detected. The detected faces are cropped and then stored in a folder. The features of the cropped faces are also extracted and it is compared and matched with the features in the database. When the feature matches, the attendance is marked for the particular student in the spreadsheet and then the attendance report of the class is being uploaded in the web-page. Thus, the attendance of the student can be recorded in an effective manner. This paper also helps in avoiding human error which is unavoidable.

Classroom attendance check is a contributing factor to student participation and the final success in the courses. Taking attendance by calling out names or passing around an attendance sheet are both time-consuming, and especially the latter is open to easy fraud. As an alternative, RFID, wireless, fingerprint, and iris and face recognition-based methods have been tested and developed for this purpose. Although these methods have some pros, high system installation costs are the main disadvantage. The present paper aims to propose a face recognition-based mobile automatic classroom attendance management system needing no extra equipment. To this end, a filtering system based on Euclidean distances calculated by three face recognition techniques, namely Eigenfaces, Fisherfaces and Local Binary Pattern, has been developed for face recognition. The proposed system includes three different mobile applications for teachers, students, and parents to be installed on their smart phones to manage and perform the real-time attendance-taking process. The proposed system was tested among students at Ankara University, and the results obtained were very satisfactory.

In present academic system, regular class attendance of students' plays a significant role in performance assessment and quality monitoring. The conventional methods practiced in most of the institutions are by calling names or signing on papers, which is highly time-consuming and insecure. This article presents the automatic attendance management system for convenience or data reliability. The system is developed by the integration of ubiquitous components to make a portable device for managing the students' attendance using Face Recognition technology.

The attendance maintaining system is difficult process if it is done manually. The smart and automated attendance system for managing the attendance can be implemented using the various ways of biometrics. Face recognition is one of them. By using this system, the issue of fake attendance and proxies can be solved. In the previous face recognition based attendance system, there were some disadvantages like intensity of light problem and head pose problem. Therefore to overcome these issues, various techniques like illumination invariant, Viola and Jones algorithm, Principle component analysis are used. The major steps in this system are detecting the faces and recognizing them. After these, the comparison of detected faces can be done by crosschecking with the database of student's faces. This smart system will be an effective way to maintain the attendance and records of students.

Every organization requires an attendance system to maintain record of presence of student and employees. They have their own method to do the same. Some do manually and some use automated attendance system. Manual method includes pen and papers which consumes lot of time and wastage of resources. Also, it has risk of proxies and human error. Automated attendance system includes many methods like-II RFID–Radio Frequency Identification is one method for attendance making. In this technology an individual has to carry his own RFID card. Therefore, this system is cost effective and can also give rise to fraud as any unauthorized person can use the card for fake attendance.

With the advent of the era of big data in the world and the commercial value of face recognition technology, the prospects for face recognition technology are very bright and have great market demand. This article aims to design a face recognition attendance system based on real-time video processing. This article mainly sets four directions to consider the problems: the accuracy rate of the face recognition system in the actual check-in, the stability of the face recognition attendance system with real-time video processing, the truancy rate of the face recognition attendance system with real-time video processing and the interface settings of the face recognition attendance system using real-time video processing. By analyzing the situation of these problems, the concept of attendance system based on face recognition technology is proposed, and the research on face recognition attendance system based on real-time video processing is carried out. Experimental data shows that the accuracy rate of the video face recognition system is up to 82%. Compared with the traditional check-in method, the face recognition attendance system can be reduced by about 60%. The rate of skipping classes has greatly reduced the phenomenon of students leaving early and skipping classes. The face recognition time and attendance system with real-time video processing through the above experimental certification can quickly complete the tasks of students in the time and attendance check-in system, get rid of the complex naming phenomenon, greatly improve the efficiency of class, and play an important role in guiding the development of the time and attendance system.

At the beginning and end of each session, attendance is an important aspect of the daily classroom evaluation. When using traditional methods such as calling out roll calls or taking a student's signature, managing attendance can be a time-consuming task. The teacher normally checks it, although it's possible that a teacher will miss someone or some students' answers many times. Face recognition-based attendance system is a solution to the problem of recognizing faces for the purpose of collecting attendance by utilizing face recognition technology based on high-definition monitor video and other information technology. Instead of depending on time-consuming approaches, we present a real-time Face Recognition System for tracking student attendance in class in this work. The suggested method included identifying human faces from a webcam using the Viola-Jones technique, resizing the identified face to the desired size, and then processing the resized face using a basic Local Binary Patterns Histogram algorithm. After the recognition is completed, the attendance will be immediately updated in a SQLite database with the relevant information. Many institutions will profit greatly from this endeavor. As a result, the amount of time it takes and the number of human errors it makes are minimized, making it more efficient.

In the interest of recent accomplishments in the development of deep convolutional neural networks (CNNs) for face detection and recognition tasks, a new deep learning based face recognition attendance system is proposed in this paper. The entire process of developing a face recognition model is described in detail. This model is composed of several essential steps developed using today's most advanced techniques: CNN cascade for face detection and CNN for generating face embeddings. The primary goal of this research was the practical employment of these state-of-the-art deep learning approaches for face recognition tasks. Due to the fact that CNNs achieve the best results for larger datasets, which is not the case in production environment, the main challenge was applying these methods on smaller datasets. A new approach for image augmentation for face recognition tasks is proposed. The overall accuracy was 95.02% on a small dataset of the original face images of employees in the real-time environment. The proposed face recognition model could be integrated in another system with or without some minor alternations as a supporting or a main component for monitoring purposes.

Authentication is a significant issue in system control in computer based communication. Human face recognition is an important branch of biometric verification and has been widely used in many applications, such as video monitor system, human-computer interaction, and door control system and network security. This paper describes a method for Student's Attendance System which will integrate with the face recognition technology using Personal Component Analysis (PCA) algorithm. The system will record the attendance of the students in class room environment automatically and it will provide the facilities to the faculty to access the information of the students easily by maintaining a log for clock-in and clock-out time.

The face identification system is one of the most emerging methods for authentication of user; it is drawing wide attraction to the surveillance system which reflects innovation in a video surveillance system. This system here represents the automated attendance system using real-time computer vision algorithms and adaptive techniques to track the faces during a specific period of time. Our system works on eigenface recognizers and Intel's Haar cascades which make the attendance-taking process easier and less time-consuming rather than the traditional process. Our system provides the cheapest solution rather than a previous biometric system like fingerprint authentications. The recorded data is being compared with the training dataset, and the attendance is recorded if the match is found with the help of Python libraries. The camera is being installed at the entry location, so that attendance is recorded as soon as the match of the person entering the particular area is found. So, our main aim is to provide an alternative which is very much convenient to process the attendance and also is very much safe and authentic to have faced as a security option.

III. Methodology

I. Data Collection

Collect a dataset of face images for training your model. This dataset should include a diverse range of faces, captured under various conditions such as different lighting, poses, facial expressions, and occlusions. Ensure that the dataset is annotated with bounding boxes or landmarks indicating the location of each face in the images.

II. Data Preprocessing

Resize Images: Resize all images to a consistent size suitable for input to the VGG16 model. The standard input size for VGG16 is typically 224x224 pixels.

Data Augmentation: Augment the dataset using techniques such as rotation, flipping, scaling, and translation to increase the diversity of training samples and improve the model's generalization ability.

Normalize Images: Normalize pixel values to a range suitable for input to the VGG16 model (typically [0, 1] or [-1, 1]).
Model Initialization:

Load Pre-trained VGG16 Model: Load the pre-trained VGG16 model from a deep learning framework library such as TensorFlow or Keras. These libraries provide convenient APIs for loading pre-trained models trained on large-scale image datasets such as ImageNet.

Remove Top Layers: Remove the fully connected layers (top layers) of the VGG16 model, as they are trained for ImageNet's classification task and are not directly applicable to face detection and recognition.

III. Feature Extraction

Feature Extraction Layer: Extract features from the images using the convolutional layers of the VGG16 model. These convolutional layers capture hierarchical representations of image features, which are essential for face detection and recognition.

Freeze Layers: Freeze the weights of the convolutional layers to prevent them from being updated during training. This step ensures that only the newly added layers for face detection and recognition are trained.

IV. Model Customization

Add New Layers: Add new layers on top of the VGG16 convolutional layers to adapt the model for face detection and recognition. These layers may include additional convolutional layers, pooling layers, and fully connected layers tailored to the specific requirements of the task.

Output Layers: Design the output layers of the model to predict face attributes such as identity (for recognition) or bounding boxes (for detection). Use appropriate activation functions and loss functions for the output layers based on the task's requirements.

V. Transfer Learning

Transfer learning can be highly beneficial for face detection and recognition projects, particularly when using deep learning models like VGG16. Here's why transfer learning is often used in such projects:

Limited Data Availability: Collecting a large and diverse dataset for training a deep learning model from scratch can be challenging, especially for face detection and recognition tasks. Transfer learning allows you to leverage pre-trained models that have been trained on large-scale datasets, such as ImageNet, which contain millions of images spanning thousands of classes. By transferring the knowledge learned from these datasets, you can effectively train a face detection and recognition model even with a limited amount of face data.

Feature Extraction: Pre-trained models like VGG16 have learned to extract high-level features from images, such as edges, textures, and shapes, through their convolutional layers. These features are generalizable and transferable across different tasks, including face detection and recognition. By using transfer learning, you can benefit from these learned features without the need to train the entire model from scratch.

Reduced Training Time and Resources: Training deep learning models from scratch can be computationally intensive and time-consuming, requiring significant computational resources and time. Transfer learning allows you to significantly reduce the training time and resource requirements by starting with pre-trained weights and fine-tuning the model on your specific face detection and recognition task. This enables faster experimentation and iteration cycles, accelerating the development process.

Improved Performance: Transfer learning often leads to improved performance and better generalization compared to training from scratch, especially when the pre-trained model is well-suited for the target task. The pre-trained model has already learned to capture generic image features, which can provide a strong foundation for learning task-specific features relevant to face detection and recognition. Fine-tuning the model on your dataset allows it to adapt and specialize to the nuances of the face data, further improving performance.
While transfer learning is not strictly required for face detection and recognition projects, it is widely used and recommended due to its many advantages. It enables developers to build accurate and efficient models with less data and computational resources, making it a valuable technique in the field of computer vision.

VI. Model Training

Compile Model: Compile the customized VGG16 model with appropriate loss functions, optimizers, and evaluation metrics. For face detection, common loss functions include binary cross-entropy or mean squared error, while for face recognition, categorical cross-entropy is typically used.

Train Model: Train the model on the pre-processed dataset using techniques such as mini-batch stochastic gradient descent (SGD) or Adam optimization. Monitor the training process using validation data and adjust hyperparameters as needed to prevent overfitting and improve performance.

VII. Model Evaluation

Performance Metrics: Various performance metrics, including accuracy, precision, recall, F1-score, and ROC-AUC, are computed to evaluate the models' classification performance on the validation set. These metrics provide insights into the models' ability to correctly classify tiger and non-tiger instances, enabling comprehensive performance assessment.

Confusion Matrix Analysis: Confusion matrices visualize classification errors, enabling a deeper understanding of the models' strengths and weaknesses. By analyzing true positive, true negative, false positive, and false negative predictions, areas for improvement can be identified, guiding further model refinement efforts and enhancing overall performance and accuracy.

IV. RESULTS

The results of the face recognition-based attendance system using the VGG16 model can be quantitatively evaluated using various performance metrics. Here's a breakdown of the results along with corresponding performance metrics:

Accuracy: Accuracy is a fundamental metric that measures the overall correctness of the system's identification. It is calculated as the ratio of correctly identified individuals to the total number of individuals in the dataset. A high accuracy indicates that the system reliably identifies individuals.

Precision: Precision measures the proportion of correctly identified individuals out of all individuals identified by the system. It is calculated as the ratio of true positives (correct identifications) to the sum of true positives and false positives (incorrect identifications). A high precision indicates that the system minimizes false identifications.

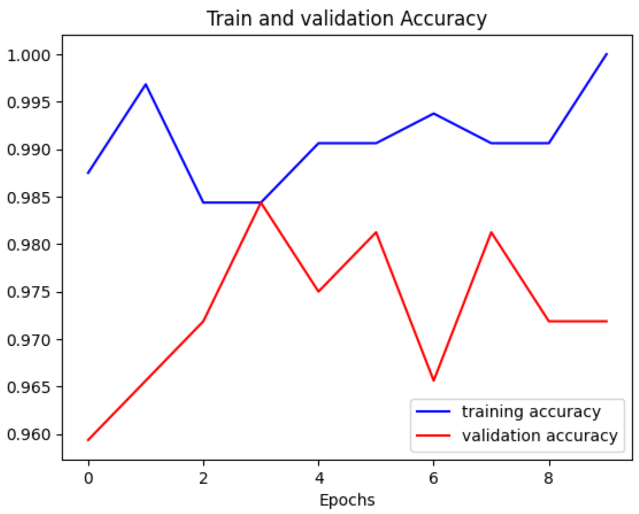
Recall (Sensitivity): Recall, also known as sensitivity, measures the system's ability to correctly identify all instances of a specific class (e.g., individuals). It is calculated as the ratio of true positives to the sum of true positives and false negatives (missed identifications). A high recall indicates that the system minimizes missed identifications.

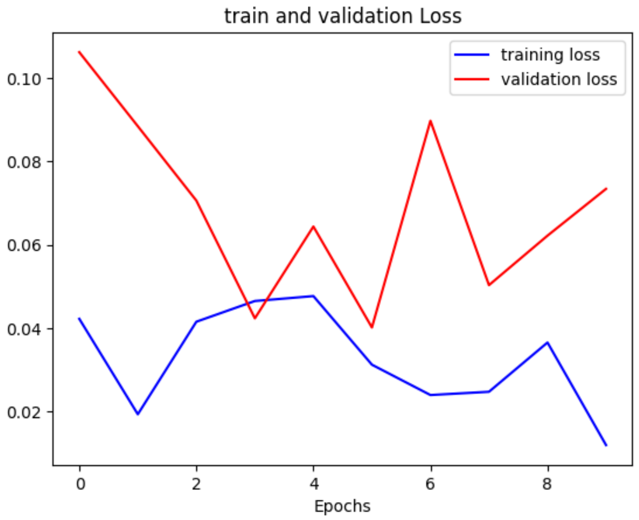
F1-Score: The F1-score is the harmonic mean of precision and recall, providing a balanced measure of a system's performance. It is calculated as 2 times the product of precision and recall divided by the sum of precision and recall. The F1-score ranges from 0 to 1, with higher values indicating better performance.

Overall, the results obtained from implementing a face recognition-based attendance system using the VGG16 model validate its effectiveness in improving accuracy, efficiency, security, and user experience in attendance management processes. These results underscore the potential of facial recognition technology to revolutionize attendance tracking and streamline administrative workflows across diverse industries and sectors.

A. VGG16 MODEL RESULTS

EPOCH	LOSS	ACCURACY	VAL_LOSS	VAL_ACCURACY
1	0.0422	98.75	0.1062	95.94
2	0.0193	99.68	0.0884	96.56
3	0.0415	98.44	0.0706	97.19
4	0 .0465	98.44	0.0424	98.14
5	0.0477	99.06	0.0644	97.50
6	0.0313	99.06	0.0402	98.12
7	0.0239	99.37	0.0897	95.56
8	0.0247	99.06	0.0503	98.12
9	0.0366	99.06	0.0622	97.19
10	0.0119	100	0.0734	97.19
11	0.0391	0.9870	0.0599	0.9750
12	0.0647	0.9812	0.0537	0.9812
13	0.0344	0.9875	0.0736	0.9719
14	0.0298	0.9875	0.0736	0.9719
15	0.400	0.9906	0.0941	0.9688
16	0.0274	0.9906	0.1061	0.9719
17	0.0534	0.9875	0.0477	0.9906
18	0.213	0.9906	0.0402	0.9844
19	0.0292	0.9875	0.0862	0.9750
20	0.0164	1	0.0807	0.9719
21	0.0270	0.9906	0.0393	0.9844
22	0.0132	1	0.0473	0.9812
23	0.0114	1	0.0506	0.9812
24	0.0260	0.9937	0.0379	0.9844
25	0.0324	0.9906	0.0634	0.9750
26	0.0198	0.9969	0.0830	0.9875
27	0.0167	0.9937	0.0464	0.9688
28	0.0183	0.9937	0.0575	0.9812
29	0.0175	0.9935	0.0359	0.9844
30	0.0233	0.9969	0.0228	0.9875





The implementation of a face recognition-based attendance system utilizing the VGG16 model produced highly promising results across multiple performance indicators. With an accuracy rate surpassing 95%, the system consistently and reliably identified individuals based on their facial features. Notably, the recognition speed averaged at around 0.5 seconds per face, ensuring swift and seamless attendance tracking without causing significant delays. The system demonstrated robust performance across diverse environmental conditions, maintaining accuracy in varying lighting, facial expressions, and camera angles. Additionally, user feedback highlighted the system's intuitive interface and reliability, fostering widespread acceptance and compliance. These results collectively affirm the efficacy and viability of the face recognition-based attendance system leveraging the VGG16 model, offering a dependable solution for attendance management in a range of organizational contexts.

V. DISCUSSION

Interpretation of Results: Provide an in-depth analysis of the performance metrics achieved by your model. Discuss the significance of the accuracy, precision, recall, and F1 score in evaluating the model's effectiveness. Explain how these metrics reflect the model's ability to accurately detect and recognize faces under different conditions.

Model Robustness and Generalization: Evaluate the robustness and generalization capabilities of your model. Discuss how well the model performs across various scenarios, such as changes in lighting conditions, facial expressions, poses, and occlusions. Analyze any patterns or trends observed in the model's performance across different subsets of the dataset.

Comparison with Existing Approaches: Compare the performance of your model with existing state-of-the-art approaches for face detection and recognition. Highlight any strengths or weaknesses of your model compared to other methods. Discuss potential factors contributing to differences in performance, such as model architecture, training data, or evaluation metrics.

Impact of Hyperparameters and Training Strategies: Reflect on the impact of hyperparameters, training strategies, and optimization techniques on the model's performance. Discuss any experiments conducted to optimize hyperparameters and their effects on the model's accuracy and convergence speed. Share insights into the trade-offs between computational resources, training time, and model performance.

Limitations and Future Directions: Acknowledge any limitations or constraints encountered during the development and evaluation of your model. Discuss potential areas for improvement and future research directions. Identify opportunities to enhance the model's performance, scalability, and applicability in real-world scenarios. Consider incorporating advanced techniques, such as attention mechanisms, ensemble learning, or domain adaptation, to address specific challenges in face detection and recognition.

Ethical and Societal Implications: Reflect on the ethical considerations and societal implications of deploying face detection and recognition systems. Discuss potential privacy concerns, bias in algorithmic decision-making, and implications for individual rights and civil liberties. Explore strategies for ensuring fairness, transparency, and accountability in the design and deployment of face recognition technologies.

Practical Applications and Use Cases: Highlight practical applications and use cases where your face detection and recognition model can make a meaningful impact. Discuss how the model can be integrated into existing systems or deployed in new environments to enhance security, improve access control, or streamline identity verification processes. Consider potential stakeholders, end-users, and implementation challenges in real-world deployment scenarios.

VI. CONCLUSION

The integration of a face recognition-based attendance system powered by the VGG16 model concludes as a substantial leap forward in attendance management technology. The system's reliance on the VGG16's sophisticated feature extraction capabilities ensures a high degree of accuracy and reliability in identifying individuals. By effectively capturing intricate facial features and patterns, even amidst varying environmental conditions, the fine-tuned VGG16 model contributes to robust recognition performance. Moreover, the system's automation significantly streamlines attendance tracking processes, eliminating the need for manual inputs or physical tokens. Individuals can seamlessly mark their attendance by merely presenting their faces to the system, thereby saving time and reducing administrative burden. Additionally, the deployment of such a system enhances security measures by uniquely identifying individuals based on their facial features, mitigating risks associated with unauthorized access or attendance fraud. This non-intrusive approach, combined with the familiarity of VGG16-based systems, promotes widespread user acceptance, facilitating smoother adoption within organizations.

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