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Smart attendance recording application using deep facial recognition in group photos

Likith K[1], Manvi Singh[2], Mishika Jain [3], Tejas Kumar L[4], Arun Kumar Gopu[5]

CSE, Dayananda Sagar University, Bangalore, India[1-4]

Professor, Dayananda Sagar University, Bangalore, India[5]

Abstract: This project proposes a model to build an efficient attendance recording application that uses advanced deep learning techniques for face recognition. This project aims to reduce the time-consuming traditional attendance recording method and avoid errors such as manual errors and proxying. Although this attendance registration system may already exist, they operate in a way that uses individual student images. The program aims to use a group photo of students to identify each student and create an Excel file that professors can use to record attendance. Using advanced deep learning techniques and a native-react developed application, the application is trained to achieve maximum accuracy through a well-designed, easy-to-use graphical user interface application that would be deployed in the Play Store, allowing users to interact with it. The research involved studying and analyzing different works by different researchers, how they designed and created an application, and how we can improve it, simplifying the registration process of attendees and setting a new standard of accuracy and convenience in the attendance management system.

Keywords: Face Detection, Deep learning technique, Deep Face, Face recognition, Android application, VGG.

I. INTRODUCTION

In this paper, we explain the overarching goal of developing an efficient attendance recording application that employs advanced deep learning techniques for face detection of each student in group picture and recording their attendance, with the goal of releasing the programme on the Play Store. Motivated by the inefficiencies inherent in traditional attendance systems, such as signatures, which are not only time-consuming but also error-prone, our project attempts to use deep learning to revolutionise the attendance recording process and remove these inadequacies.

Inspired by DeepFace, an integrated face verification, and identification, we implement deep learning methods for face detection and facial embeddings in a methodical manner. DeepFace uses a convolutional neural network (CNN) to identify people with high accuracy by analysing their face traits. DeepFace has the ability to recognise faces in pictures, recognise people in a variety of images, and even confirm whether two faces are of the same person. It is an effective tool for activities like face verification, surveillance, and social tagging in online platforms because of its sophisticated capabilities, which include handling differences in facial expressions, lighting conditions, and positions.

We utilised the Native-react framework to develop the mobile application in order to guarantee a smooth user experience. It is a cross-platform development tool for creating mobile applications with a single codebase. It blends each platform's inherent capabilities and performance with the adaptability of React inherent. Developers may design mobile apps that feel and look natural on both iOS and Android devices by leveraging JavaScript and React. This framework is perfect for productive and economical mobile app development since it minimises code duplication, speeds up development, and guarantees a consistent user experience across platforms. We seek to accomplish accurate face detection and facial embedding extraction by utilising deep learning techniques similar to those used in DeepFace.

The project's implementation focuses a lot of emphasis on using deep learning methods for complex tasks like facial embeddings and face detection. The Native-react framework, which is widely recognised for its adaptability and cross-platform compatibility, will serve as the foundation for creating the mobile application, guaranteeing a consistent user experience throughout the Android platform.

In the system's workflow, administrators upload group images through the user-friendly Android application developed with Native-react. VGG module is then employed to precisely detect faces within these group photos, ensuring that attendance records capture the presence of individuals accurately. The system's strength lies in its ability to handle varying lighting conditions, diverse facial expressions, and multiple faces in a single frame, providing a comprehensive solution for attendance tracking in dynamic environments.

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Once VGG identifies faces in the group images, Deep Face is employed to uniquely recognize and match each individual. This face recognition step enhances the system's accuracy, allowing for the creation of a comprehensive attendance record that includes the identification of each attendee. Deep Face's ability to handle variations in facial expressions and deliver high-quality recognition results further solidifies the system's effectiveness.

The combination of VGG for face detection and Deep Face for face recognition elevates the project's capabilities, providing a holistic solution for attendance tracking in group photos. As the system continuously evolves with regular updates and improvements, it solidifies its position as a cutting-edge and user-friendly tool for institutions and organizations seeking efficient and accurate attendance management.

The Automated Attendance Management System incorporates a robust backend database to securely store and manage attendance records. This database serves as the central repository for all attendance-related information, ensuring data integrity, accessibility, and scalability. The backend architecture is designed to seamlessly integrate with the front-end components, including the Android application.

The backend database plays a crucial role in supporting features such as real-time updates, user authentication, and audit trails. It enables administrators to efficiently manage attendance records, review historical data, and generate reports. Security measures, including encryption and access controls, are implemented to safeguard sensitive information stored within the database. Google Cloud Platform (GCP) serves as an integral solution for both file storage and application deployment.

Expected results include the creation of a smartphone application that uses DeepFace's guiding principles to achieve superior efficiency and accuracy in face detection. It is anticipated that the use of deep learning algorithms, such to those used in DeepFace, will enable automated attendance record-keeping, removing the need for human input and lowering errors related to conventional approaches. Through the utilisation of these cutting-edge technologies, the project aims to optimise the process of recording attendance and set a new benchmark for precision and convenience in attendance control.

II. PROBLEM STATEMENT

The conventional methods employed for tracking student attendance exhibit inherent inefficiencies, time-consuming procedures, and a susceptibility to errors, particularly attributable to manual entries and signatures. These traditional approaches not only consume valuable teaching time but also pose challenges in maintaining accurate and up-to-date attendance records. The need for a more streamlined and error-resistant method becomes evident as educational institutions grapple with the limitations of these outdated systems. Traditional attendance management systems often rely on manual methods or card-based systems, resulting in inefficiencies, inaccuracies, and time-consuming processes. The demand for an automated attendance management system leveraging advanced deep learning techniques for face detection and recognition is growing. The objective is to create a robust system capable of accurately identifying and recording attendance from group photos, overcoming challenges such as varying lighting conditions, diverse facial expressions, and multiple faces in a single frame.

III. LITERATURE SURVEY

[1] The Student Attendance Management System, advanced via way of means of Jacksi, Ibrahim, and Ali in 2018, employs a Model-View-Controller (MVC) structure the use of MySQL, GUI, and JavaScript. It electronically information and manages scholar attendance, supplying a user-pleasant GUI for smooth statistics manipulation. The machine analyzes attendance statistics, producing facts and issuing warnings for targeted absences. Its modular layout guarantees scalability, permitting handy extensions to deal with a developing scholar population. This study provides a strong and adaptable answer for optimizing attendance control in instructional institutions.

[2] In the survey paper by Mr. Prasad V. Upadhye et al. (2019) published in the International Journal for Research in Applied Science & Engineering Technology, the authors explore various Smart Attendance Systems. One notable solution presented involves managing student attendance through an Android application utilizing a Python face recognition algorithm. This hardware-free and cost-efficient system not only reduces paperwork but also offers a compact, handy, and portable solution for attendance marking. The research highlights the effectiveness and efficiency of this innovative approach, providing a valuable contribution to the field of attendance management.

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[3] In the International Journal of Engineering and Advanced Technology (IJEAT) by Nandhini R, Duraimurugan N, and S.P. Chokkalingam (2019), their research focuses on a Face Recognition Based Attendance System. The system utilizes automatic face recognition, incorporating deep learning and Convolution Neural Network (CNN) technologies. This Automatic Attendance System (AAS) enhances accuracy and speed, facilitating high-precision real-time attendance for automated classroom evaluation. The system's scalability is emphasized, making it applicable to larger settings such as seminar halls, where it effectively senses the presence of numerous individuals, showcasing its versatility in attendance management.

[4] In the International Journal of Computer Science Trends and Technology (IJCST) by Aman Jobanputra, Shubham Jain, and Kruttika Choithani (2016), the Smart Attendance Management System utilizes Face Detection for efficient attendance tracking. The teacher captures a class picture, which is uploaded to a MATLAB-equipped computer for face recognition, subsequently generating attendance. The system provides real-time attendance marking through a dedicated app, utilizing Java and MS Access for database integration. The research emphasizes the potential for improvement by expanding the facial recognition database with more images and variable poses, enhancing the system's accuracy and reliability in attendance management.

[5] In the International Journal Recent Technology and Engineering (IJRTE) by Mayur Surve, Priya Joshi, Sujata Jamadar, Minakshi Vharkate, the Automatic Attendance System using Face Recognition Technique (2020). The student's attendance is captured using the student's webcam, the application systematically records student data from images in attendance sheets, accommodating multiple faces which yields accurate results in various conditions. The application utilizes HAAR features and AdaBoost for face recognition. Implementing a GUI as well for the student information and dataset creation.

[6] In the International Journal of Machine Learning and Computing by Tata Sutabri, Pamungkur, Ade Kurniawan, and Raymond Erz Saragih, "Automatic Attendance System for University Student Using Face Recognition Based on Deep Learning". The proposed design of the application employs a Convolutional Neural Network for face detection and Dlib's CNN for face detection to effectively record attendance of the attendees along with the student ID, Date, Time. The application uses a Raspberry Pi camera which captures a 240px photo for quicker face recognition due to its shorter processing time. Reducing the size of the image aids swift transfer to the admin's computer, therefore maintaining accuracy under ample lighting.

[7] In the report "A Novel Approach for Face Recognition: YOLO- based Face Detection and Facenet by Bagas Pandita Prayogo, Hendrawan, Eueung Mulyana. A face recognition system was developed that utilized existing pre-trained model, the YOLO deep learning model with various weights and various versions. Facenet was used to perform feature extraction and face classification which yielded 99.5% accuracy with the LFW dataset.

[8] In the report "You Only Look Once: Unified, Real-Time Object Detection" by oseph Redmon, Santosh Divvala, Ross Girshic , Ali Farhadi. The algorithm developed by the researchers yields great results by utilizing the YOLO v7 algorithm. Although slight changes were made in terms of how the images are being processed. The system resized the input image to 448X448 which ran on a single Convolutional Neural Network. The Network consists of 24 convolutional layers the system pretrained the convolutional layers on the ImageNet Classification task at half the resolution and then doubled the resolution for detection yielding 99.6% accuracy in object detection.

IV. PROPOSED WORKFLOW

Stage 1: Group Image Capture: The system incorporates a feature for capturing group images directly through the Native-react application. This functionality allows administrators to use the device's camera to capture real-time group photos during events, classes, or meetings.

Stage 2: Face Detection with VGG: Upon receipt of the group image, the system seamlessly progresses into Stage 2, where VGG takes charge of the face detection process. VGG, a cutting-edge real-time image classification algorithm, undertakes a meticulous scan of the entire frame to identify faces within the image. As the group image is fed into the VGG model, the algorithm's sophisticated capabilities come into play. VGG conducts an extensive analysis, accurately recognizing faces and precisely determining their positions within the group photo. Employing its advanced object detection mechanism, VGG not only identifies faces but also delineates their contours through dynamically drawn bounding boxes.This stage is foundational for subsequent phases in the attendance management process.

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The precise localization of faces by VGG establishes a robust groundwork for the ensuing application of Deep Face in Stage 3, ensuring accurate face recognition. The seamless integration of VGG significantly augments the overall effectiveness of the system in handling group images, contributing to the creation of a meticulous and reliable attendance record.

Stage 3: Facial Recognition with Deep Face: The initial step in Stage 3 involves the extraction of faces within the bounding boxes. These extracted faces undergo a normalization process to address variations in size, pose, and illumination. The normalization ensures that the input to the Deep Face model is consistent, enhancing the accuracy of the subsequent recognition process. Subsequently, the normalized faces are fed into the Deep Face model, where a comprehensive analysis of their unique features is conducted. Deep Face utilizes sophisticated algorithms to discern and understand the distinct characteristics of each face, enabling precise identification. The result is the association of recognized identities with the corresponding faces within the group image.

This stage is pivotal in completing the attendance management process, as the integration of Deep Face enhances the system's ability to accurately recognize and attribute identities to detected faces. The utilization of probability scores adds a layer of sophistication, providing valuable insights in cases of facial recognition complexities. Overall, Stage 3 ensures a comprehensive and reliable identification of individuals within the group photo, contributing to the creation of an accurate attendance record.

Stage 4: System Output and Functionality: Upon the completion of facial recognition in Stage 3, the system seamlessly proceeds to Stage 4, where it generates the final output and facilitates critical functionality by providing the names of students marked as present or absent. The output, presented in a clear and organized format, includes a list of students along with their attendance status.

This information is accessible to administrators through the user interface of the application. the system ensures user-friendly functionality by allowing administrators to easily navigate and manage attendance records. Administrators can review and verify the generated attendance list, make corrections if needed, and export comprehensive reports for further analysis or record-keeping purposes.

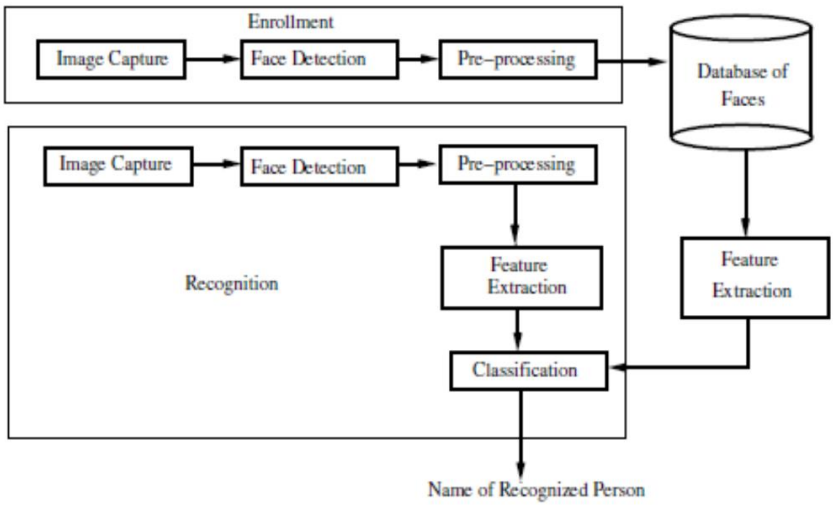

Fig: Flowchart of Proposed Design

REFERENCES

[1]. "DeepFace: Closing the Gap to Human-Level Performance in Face Verification" by Yaniv Taigman, Ming Yang, Marc'Aurelio Ranzato, and Lior Wolf. (Published in IEEE Conference on Computer Vision and Pattern Recognition, 2014).

[2]. "FaceNet: A Unified Embedding for Face Recognition and Clustering" by Florian Schroff, Dmitry Kalenichenko, and James Philbin. (Published in IEEE Conference on Computer Vision and Pattern Recognition, 2015).

[3]. "DeepID3: Face Recognition with Very Deep Neural Networks" by Yi Sun, Yuheng Chen, Xiaogang Wang, and Xiaoou Tang. (Published in IEEE Transactions on Pattern Analysis and Machine Intelligence, 2015).

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[4]. "VGGFace2: A dataset for recognising faces across pose and age" by Qiong Cao, Li Shen, Weidi Xie, Omkar M. Parkhi, and Andrew Zisserman. (Published in International Conference on Automatic Face & Gesture Recognition, 2018).

[5]. "ArcFace: Additive Angular Margin Loss for Deep Face Recognition" by Jiankang Deng, Jia Guo, Niannan Xue, and Stefanos Zafeiriou. (Published in IEEE Conference on Computer Vision and Pattern Recognition, 2019).

[6]. "Joint Face Detection and Alignment using Multi-task Cascaded Convolutional Networks" by Kaipeng Zhang, Zhanpeng Zhang, Zhifeng Li, and Yu Qiao. (Published in IEEE Signal Processing Letters, 2016).

[7]. "Face detection with end-to-end integration of a convnet and a 3d model" by Shaoqing Ren, Kaiming He, Ross Girshick, and Jian Sun. (Published in International Conference on Computer Vision, 2015).

[8]. "Facial Expression Recognition with Convolutional Neural Networks: Coping with Few Data and the Training Sample Order" by Wen-Sheng Chu, Sheng-Hua Zhong, and M. Stella Atkins. (Published in Pattern Recognition, 2017).

[9]. "Learning Deep Features for Discriminative Localization" by Bolei Zhou, Aditya Khosla, Agata Lapedriza, Aude Oliva, and Antonio Torralba. (Published in IEEE Conference on Computer Vision and Pattern Recognition, 2016).

[10]. "SphereFace: Deep Hypersphere Embedding for Face Recognition" by Weiyang Liu, Yandong Wen, Zhiding Yu, Ming Li, Bhiksha Raj, and Le Song. (Published in IEEE International Conference on Computer Vision, 2017).

[11]. "MobileFaceNets: Efficient CNNs for Accurate Real-Time Face Verification on Mobile Devices" by Shiyao Wang, Yan Wang, Zhe Li, and Jiashi Feng. (Published in IEEE Conference on Computer Vision and Pattern Recognition, 2018).

[12]. "Dual Attention Network for Scene Segmentation" by Jun Fu, Jing Liu, Haijie Tian, Zhiwei Fang, and Hanqing Lu. (Published in IEEE/CVF Conference on Computer Vision and Pattern Recognition, 2019).

[13]. “Automatic Attendance Face Recognition for Real Classroom Environments” by Chen Ping, Huangfu Da-Peng & Luo Zu-Ying. (Proceedings of the 2018 2nd International Conference on Big Data and Internet of Things - BDIOT 2018).

[14]. “Multi-Label Networks for Face Attributes Classification” by Sara Atito Aly, Berrin Yanikoglu (Published in 2018 IEEE International Conference on Multimedia & Expo Workshops (ICMEW)).

[15]. “Facial expression and attributes recognition based on multi-task learning of lightweight neural networks” by Andrey V. Savchenko (Published in 2021 IEEE 19th International Symposium on Intelligent Systems and Informatics (SISY)).