**Attendance System Using CCTV and Machine Learning**

**Objective**

The main goal of this project is to create an automated attendance system applying machine learning methods and CCTV cameras. Several benefits of this system over conventional attendance systems are:

* Automated Attendance Marking saves time by removing the need for roll calls, writing attendance on paper so lowering human mistakes.
* Improved Security: Facial recognition helps to identify illegal users, so marking just registered users.
* The system lets managers access real-time data by means of live tracking of attendance.
* Easy Integration: The system can be implemented with current CCTV system, so saving expenses.
* Effective data management results from orderly storing attendance records, so minimizing paperwork and enabling simple data access.

**Methodology**  
The system is developed in a very systematic way to ensure accuracy and efficiency. The key components of the methodology include:

1. **Gathering and Preparing Data**

* A CCTV camera is used to take pictures of every employee or student.
* Each person has about 500 photos saved in a structured directory.
* To improve model training, pre-processing methods such as resizing, grayscale conversion, and image augmentation method from TensorFlow e.g., rotation, zoom, shear, etc.

1. **Training of Models**

* For facial recognition, a Convolutional Neural Network (CNN) with a deep learning foundation is employed.
* For classification, a pre-trained model such as VGGNet-16 and then we will refine according to our preference.
* To avoid overfitting in our train model we will use L2 regularization and dropout strategies are used.
* For effective learning, the Adam optimizer is utilized in conjunction with a categorical cross-entropy loss function.
* For later inference, the trained model is stored in.h5 format.

1. **Face Recognition and Detection**

we will use Three methods of detections:

* Haar Cascade (this is quick but imprecise)
* Deep Neural Network (DNN) (this is in between of high accuracy and high computation cost and have a stronger range)
* Multi-task Cascaded Convolutional Networks (MTCNN): a computationally costly but highly accurate method
* The trained CNN model is applied to the detected face to classify its identity.
* The identity is detected by the model by comparing the extracted features with the registered faces, if present in database the name will occur otherwise it will display unknown.

1. **Data storage and attendance marking**

* Attendance is automatically recorded if a match is discovered
* Openpyxl will be used to store the attendance records as this will store the attendance with name confidence and the time of marking.
* For scalability, a database integration option (such as SQLite or PostgreSQL) is taken into consideration.
* Data visualization and real-time monitoring are made possible by a web-based dashboard.

1. **System Optimization and Upcoming Improvements**

* Retraining with fresh images allows the model to get better over time.
* Faster and more efficient models like MobileNetV2 are explored for real-time performance.
* Additional security measures, such as liveness detection, are implemented to prevent spoofing.
* API-based integration allows third-party software to utilize the attendance data.

Reference:

Implementing CCTV-Based Attendance Taking Support System Using Deep Face Recognition: Case Study at FPT Polytechnic College *(Received: 24 January 2020; Accepted: 17 February 2020; Published: 21 February 2020)*

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