**Smart Vision: Attendance marking System using CNN**

**Objective:**

The project aims to develop an **Automated Attendance System** using a **CCTV camera** to streamline the process of tracking attendance in workplaces, educational institutions, and other organizations. The key objectives are:

1. **Automate Attendance Marking** – Eliminate manual attendance processes by leveraging real-time face recognition from CCTV feeds.
2. **Enhance Accuracy & Security** – Reduce errors and unauthorized proxy attendance through AI-based facial recognition.
3. **Improve Efficiency** – Minimize human intervention, saving time and resources while maintaining attendance records.
4. **Seamless Integration** – Develop a system compatible with existing CCTV infrastructure and attendance management software.
5. **Data Analytics & Insights** – Provide reports on attendance trends, absenteeism, and working hours using analytics.

**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:**

1. 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)* Ngo Tung Son 1, Bui Ngoc Anh1, Tran Quy Ban1, Le Phuong Chi1, Bui Dinh Chien1
2. Integration of FaceNet and DeepFace Algorithms for Optimized Attendance Management in Educational Systems *(Received: 21 october2023; Accepted: 19 october 2023; Published: 22 november2023)*  Bhamidi Sri Bhargava 1, Kusam Uday Tej Reddy 2, Vithalapuram Srihari3 , K. Venkatesh Sharma4

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