AttendEase: An Intelligent Attendance System using Face Detection

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Abstract

The proposed attendance marking system leverages a custom Convolutional Neural Network (CNN) to identify and mark attendance from group photos based on a limited dataset of only five individual images per person. By employing image augmentation techniques like rotation, scaling, flipping, and brightness adjustment, the system synthetically expands the dataset to enhance model generalization. These augmented images are then combined into synthetic group photos where the system detects and classifies individuals. The CNN performs both **object detection** and **classification**, accurately localizing each person and assigning the correct identity in group photos. This approach provides an efficient solution for attendance marking with minimal data, offering a scalable and robust system for real-world applications requiring automated attendance verification from visual inputs.

Problem Statement

In many real-world scenarios, especially in classrooms, conferences, or events, attendance tracking is often performed manually, which is time-consuming and error-prone. The need for an automated system that can accurately recognize individuals in group photos and mark attendance based on pre-registered faces is critical. However, the challenge lies in generating a sufficiently large dataset for training models with only a limited number of images per individual. This project addresses the problem of creating an effective attendance marking system with minimal data by generating synthetic datasets and leveraging deep learning techniques for object detection and classification.

Background

Automated attendance systems using facial recognition or object detection have gained significant attention due to their ability to streamline and secure the process. Traditional methods often rely on complex setups involving hardware and large labelled datasets, making them difficult to deploy in resource-constrained environments. The advent of deep learning, especially CNNs, has provided a powerful tool for solving such problems. Recent approaches in the field of computer vision, like object detection (e.g.,

YOLO, SSD) and face recognition, have shown promise in real-time applications. However, generating high-quality datasets with limited data remains a bottleneck. Techniques like data augmentation, synthetic image generation, and transfer learning can help overcome this challenge and allow for the development of robust models with minimal data.

Datasets

We are developing a custom dataset by capturing our own images and applying a range of advanced augmentation techniques, such as rotation, scaling, flipping, and brightness adjustments and using generation techniques using GANs. This approach will enhance the model's ability to generalize across different poses, lighting conditions, and perspectives, ensuring more accurate and robust performance in real-world applications.

Deliverable Objectives

1. **Dataset Generation**:

- Generate a diverse and large dataset using only 5 individual photos per person through augmentation techniques.
- Synthesize group photos with multiple individuals from the augmented dataset.

2. **Model Development**:

- Develop a custom CNN model that can detect and classify individuals in group photos.
- Incorporate object detection for localization (bounding boxes) and classification (identity recognition).

3. **System Implementation**:

- Create an automated system that can take a group photo as input, detect and classify each individual, and mark attendance based on their identity.

4. **Evaluation**:

- Evaluate the performance of the model on unseen group photos to assess the accuracy of detection and classification.
- Ensure the system is robust, with good generalization across different poses and lighting conditions.

Models and Tools

1. **Custom CNN**:

- Object detection using CNN layers for bounding box prediction.

- Classification head for identifying individuals based on augmented images.

2. **Data Augmentation**:

- Use **Keras ImageDataGenerator** or **TensorFlow** for rotation, zoom, flip, and brightness adjustments.

3. **Synthetic Data Generation**:

- **Pillow (PIL)** or **OpenCV** to create synthetic group photos by placing augmented individuals in random positions.

4. **Training Framework**:

- **TensorFlow** or **Keras** for model training and optimization.