Implementation of Classroom Attendance through Facial Recognition

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1. Introduction

In recent years, in order to improve the quality of education and ensure that students are obtaining an optimal educational experience, some instructors have made attendance mandatory. Currently, this has been enforced through the use of some sort of sign-in sheet or clickers that record student responses. Unfortunately, in many instances, this has led to a rise in academic dis-integrity and the policies have not resulted in the intended effect. This project aims to implement an innovative approach to record classroom attendance through the use of computer vision techniques.

2. Approach

The proposed approach will determine the number of classroom attendance through the use of object detection and object classification. Object detection will be used to detect where the faces are located in the image, while object classification will recognize the students and record their attendance. These two aspects of the project will be discussed in greater detail next.

2.1 Object detection

First, the number in attendance will be determined by detecting the individual faces present in the captured image. This will be accomplished through the use of object detection, where a face is classified as an object. A neural network will be implemented to learn face and non-face patterns and will be able to identify the locations of the faces in the image. [1] The following dataset will be used to learn face patterns: University of Massachusetts-Amherst Face Detection Data Set and Benchmark [2].

2.2 Object classification

Next, using the faces detected within the image, face recognition will be performed to determine the identities of the students present. Then, the corresponding attendance will be recorded. To perform this face recognition, a convolutional neural network (CNN) will be implemented. In this case, the classes will be the different students enrolled in the class.

2.3 Challenges

The known challenges of face detection and classification include: (1) Pose variation, which is present when the subject's face is angled away from the direction of the camera; (2) Feature occlusion, where the subject's face is partially covered by another object; (3) Ambient conditions such as poor lighting or low image resolution.

Therefore, in order to limit the scope and workload of the project, the following assumptions will be made: [3]

- All subjects will be facing the camera
- No feature occlusion
- Ideal ambient conditions
- Small class size

3. Expected outcomes

For this project, we hope to deliver an algorithm, coded in MATLAB, which will take an image of a class as an input, and provide the identities of the students present as an output. A successful implementation will be evaluated by the recognition of a majority of the students in the class. If both face detection and classification are accomplished successfully, and time allows, robustness of the algorithm will be explored.

The component of the approach taken that may lead to issues is the training of the neural network to recognize the faces of the students present. Therefore, in the event of a roadblock with this part of the project, recording of the number of students in attendance with a fidelity rate will be prioritized. If this is successfully achieved, then assigned seating will be utilized to identify students present by looking at their expected location. In addition, if time permits, the algorithm will be improved to overcome some of the challenges of face detection.

References

[1] P. Juell and R. Marsh. A Hierarchiucal Neural Network for Human Face Detection, 1995. Pattern Recognition, 0031-3203(95)00129-8.

[2] V. Jain and E. Learned-Miller. FDDB: A Benchmark for Face Detection in Unconstrained Settings, 2010. University of Massachusetts, Amherst, UM-CS-2010-009.

[3] I. Marqués. Face Recognition Algorithms. Universidad del Pais Vasco.