

1. Introduction

Analysis of students' behaviour is important for instructors because it is one of feedbacks from students that let the instructors to understand their students. This can enable the instructors to be able to improve their teaching methods or materials. Examples of Tracking students' behaviour in the class are emotion, attendance, and action. Currently, it is very difficult and laborious to observe these behaviours when there is a large number of students in a class, e.g. in a lecture hall. Therefore, we propose a system called "Classnalytic" to assist instructors to track students' behaviour in their class. The proposed system utilises computer vision and machine learning techniques to tackle the problem.

2. Features

The proposed system can identify students and perform attendance tracking using a camera, installed at the front of the classroom, as shown in Figure 1. Moreover, it can track their emotions and actions in real-time as well as generating a report after the class. User interface of the system is shown in Figure 2.

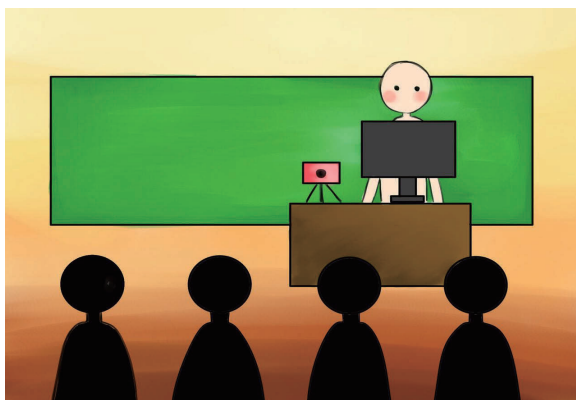


Figure 1: Setting of Classnalytic

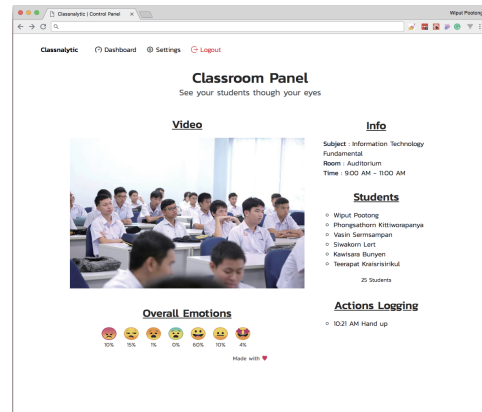


Figure 2: User Interface

3. Algorithm

Our proposed system consists of the following deep learning—Convolutional Neural Network (CNN)—models.

1. Face detection: Multi-task Cascaded CNN is used. This model searches for human face and feature points, i.e., eyes, mouth, nose. A face will be detected when the algorithm can detect any of these features. This is an advantage of the model as it can detect human face in various light conditions.
2. Person classification and identification: Inception-ResNet is employed.
3. Emotions detection: ResNet50 can classify human emotion into seven emotions, i.e., anger, contempt, disgust, fear, happiness, neutral, sadness and surprise.
4. Action Detection: OpenPose package is used. It is proposed by Hidalgo and his colleagues in order to detect human body, hand, and facial key points in real-time. The algorithm can track multi-person activities in real-time on a single image.

4. System Requirements and Tools

- A server with an NVIDIA graphic card with more than 4GB memory
- A video camera, e.g. webcam
- Latest version of Google Chrome and Mozilla Firefox