Project Proposal

An AI-based Teaching Practices and Classroom Activities Tool to Improve Education

Introduction and problem statement:

Research has shown the effectiveness of particular teaching practices in classrooms. Current practice in creating an inventory and an assessment of teaching practices involves time-consuming and potentially unreliable classroom observations by humans. The goal of this project is to build a fully automated tool that extracts all relevant teaching practices and classroom activities data from a video recording that is done on a low-cost mobile device, such as a phone or tablet. An automated tool would allow educators to do their own classroom assessments in an easy and low-cost way. The tool would provide relevant data to help improve educational practices in classrooms across the world, serve as an invaluable tool for educators, administrators, and institutions, and help to transform education. Previous work by Owens et al. (PNAS, 2017) focused on an audio-based classroom activity tracker (DART). This project goes well beyond their work by relying on both video and audio recordings. The project will rely on state-of-the-art signal processing as well as machine learning techniques for audio and video recordings. The outcome will be a fully functional prototype of a server-based tool where educators can upload their recordings.

Example of a classroom recording with students that were automatically recognized and tagged by a face-recognition algorithm.

Project goals

1. Build an automated system that uses state-of-the-art image, video, and audio processing to provide new set of valuable classroom indicators that cannot easily be obtained by human observers**.**
2. The classroom recordings should be done my low-cost/low-tech devices, such as cell phones or tablets.

3. The recordings will be processed on a server, not on the actual devices.
4. Proposed classroom activity measures and indicators:
    - Classroom activities over time, i.e., lecturing, quiz, individual work, discussions, exercises, etc.
    - What % of the students and what % of the time do they pay attention to the instructor?
    - What % of the students and what % of the time do they spend on their devices (phones, tablets, laptops)?
    - What % of the students and what % of the spent time do students take notes?
    - How many questions were asked in class? Who asked questions? Do students who focus on the instructor ask more questions?
    - How many slides are shown? How much text is on each slide? At what pace are slides advanced? How much explanations are provided by the instructor per slide? How many questions are asked for each slide?
    - When does the attention span start to decrease for a given educational practice and instructor?

Stretch-goals

- A basic AI-based recommendation and feedback engine that provides direct feedback to the instructor based on the key measures observed.
- Perform the same analysis by using recorded Zoom sessions.

Desired student skills

The ideal student should have:

- excellent Python (or C) programming skills;
- taken some machine learning/neural networks/image processing courses;
- basic knowledge of image/video processing and object detection algorithms.

Deliverables

- A functional prototype that uses one or several cell phones (and/or tablets) to record and analyze full-length class sessions.
- The code (on Github), nicely documented
- Demo images and videos
- A final report
- A final presentation

Contact

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