Real-time Attention Span Tracking in Online Education

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ABSTRACT:

Over the last decade, e-learning has revolutionized how students learn by providing them access to quality education whenever and wherever they want. However, students often get distracted because of various reasons, which affect the learning capacity to a great extent. Many researchers have been trying to improve the quality of online education, but we need a holistic approach to address this issue. This project intends to provide a mechanism that uses the camera feed and microphone input to monitor the real-time attention level of students during online classes. We explore various image processing techniques and machine learning algorithms throughout this study. We propose a system that uses five distinct non-verbal features to calculate the attention score of the student during computer based tasks and generate real-time feedback for both students and the organization.

Keywords—Artificial Intelligence, Attention, Blink rate, Drowsiness, Eye gaze tracking, Emotion classification, Face recognition, Body Posture estimation, Noise detection.

1. INTRODUCTION

The demand and need for online education are increasing rapidly. Almost all the schools and colleges throughout the world have shifted to the online mode of lectures and exams due to the recent corona virus outbreak, and this trend will most likely continue in the upcoming years. The increasing demand for online education opens the gate to automation in the field. One major issue in the online mode of lectures is that students tend to lose their concentration after a certain period and there is no automated mechanism to monitor their activities during the classes. Some students tend to just start a lecture online and move away from the place, or might even use a proxy to write online tests for them. This situation also takes place in online course platforms such as EdX and Coursera where the student tries to skip lectures just for the sake of completion and certification. The loss in concentration not only affects the student's knowledge level but also hurts the society by producing low-skilled laborers.

2. LITERATURE SURVEY

The demand and need for online education are increasing rapidly. Almost all the schools and colleges throughout the world have shifted to the online mode of lectures and exams due to the recent corona virus outbreak, and this trend will most likely continue in the upcoming years. The increasing demand for online education opens the gate to automation in the field. One major issue in the online mode of lectures is that students tend to lose their concentration after a certain period and there is no automated mechanism to monitor their activities during the classes. Some students tend to just start a lecture online and move away from the place, or might even use a proxy to write online tests for them. This situation also takes place in online course platforms such as EdX and Coursera where the student tries to skip lectures just for the sake of completion and certification. The loss in concentration not only affects the student's knowledge level but also hurts the society by producing low-skilled laborers.

Objectives of Literature Survey

• Learning the definitions of the concepts.

• Access to latest approaches, methods and theories.

• Discovering research topics based on the existing research

• Concentrate on your own field of expertise– Even if another field uses the same words, they usually mean completely.

• It improves the quality of the literature survey to exclude sidetracks– Remember to explicate what is excluded.

Before building our application, the following system is taken into consideration:

1. A Survey on State-of-the Art-Drowsiness Detection Techniques. SVM, Hidden Markov Model, CNN.

2. An Experimental Study on the Influence of Environmental Noise on Students Attention. Visual tracking test.

Some of these problems include:

Accuracy and reliability: One of the biggest challenges with real-time attention span tracking is ensuring that the system is accurate and reliable. Existing systems use various sensors and algorithms to track attention, but these can sometimes be prone to errors or inaccuracies.

Interpretation and analysis: Even if the attention tracking data is accurate, it can be difficult to interpret and analyze the data to determine the underlying causes of attention lapses. For example, a student may lose focus because they are bored with the material, or because they are struggling to understand it.

Privacy and ethical concerns: Attention tracking systems can potentially be intrusive and raise privacy concerns, especially if they involve the use of cameras or other invasive sensors. There are also ethical concerns related to the use of such systems, such as the potential for bias or discrimination based on the data collected.

Integration with existing systems: Real-time attention tracking systems need to be integrated with existing online education platforms, such as learning management systems (LMS), to be effective. However, this can be a challenging task, especially if the platform does not provide the necessary APIs or data access points.

Cost and scalability: Implementing a real-time attention tracking system can be costly, especially if it involves developing custom hardware or software solutions. Additionally, scaling such a system to accommodate a large number of users can be a significant challenge, especially if it requires significant infrastructure and computing resources.

3. PROBLEM STATEMENT

The demand and need for online education are increasing rapidly. Almost all the schools and colleges throughout the world have shifted to the online mode of lectures and exams due to the recent corona virus outbreak, and this trend will most likely continue in the upcoming years. The increasing demand for online education opens the gate to automation in the field. One major issue in the online mode of lectures is that students tend to lose their concentration after a certain period and there is no automated mechanism to monitor their activities during the classes. Some students tend to just start a lecture online and move away from the place, or might even use a proxy to write online tests for them.

4. PROPOSED SYSTEM:

This study makes use of five parameters to calculate the attention-span level of the student attending the online class. Facial recognition is used to validate the student's attendance. The attention span score is calculated using blink rate, facial expression, eye gaze, background noise, and body posture and is updated continuously for a window length of 5 seconds. Instead of sequential

execution, all the models required to calculate the attention span are executed in parallel once the online lecture starts. This is achieved using multithreading all the functions, which plays a major role in reducing the time consumption of each model as well as the whole system. For every 5 seconds, the model will generate the attention span score and provide real-time feedback to the students in the form of live graphs which are plotted for each parameter as well as the calculated attention span score.

5. OBJECTIVES

The purpose of attention span detection during online classes is to gather data and analyze the state of the student, to evaluate his performance based on concentration level, instead of just academic scores. To present a method that uses a camera feed and a mouthpiece contribution to monitor student's continuing attention levels during online classes. To improve the quality of online education. To tackle the issues involved in online education using five parameters. We used the face recognition model to verify the student attending the online class. we have implemented and used lightweight models to reduce the processing time. We visualize the scores in the form of a live graph and generate automated reports.

6. METHODOLOGY

We are planning to implement this project using the following steps.

- To detect Facial Landmark we are using Haar cascade algorithm.
- To Face Recognition we are using LBPH algorithm
- To detect body pose we are using CNN or R-CNN

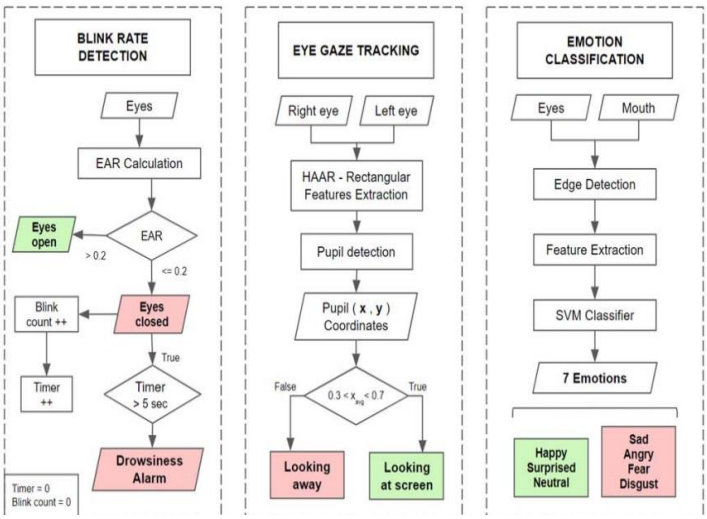

Fig-1: Work flow

Haar Cascade:

Here we will work with face detection. Initially, the algorithm needs a lot of positive images (images of faces) and negative images (images without faces) to train the classifier. Then we need to extract features from it. For this, haar features shown in below image are used. They are just like our convolutional kernel. Each feature is a single value obtained by subtracting sum of pixels under white rectangle from sum of pixels under black rectangle.

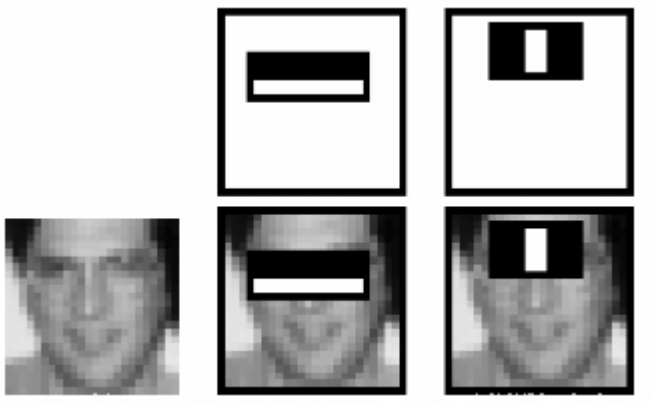

Fig-2: Feature Mapping

LBPH:

Local Binary Patterns Histogram algorithm. It is based on local binary operator. It is widely used in facial recognition due to its computational simplicity and discriminative power.

The steps involved to achieve this are:

- creating dataset
- face acquisition

- feature extraction
- Classification

The LBPH algorithm is a part of open cv.

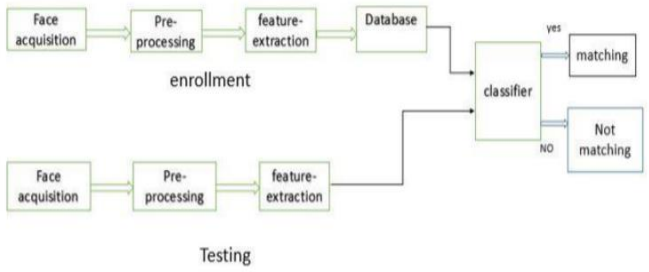

Fig-3: LBPH architecture

CNN:

Open Pose also uses CNN as its main architecture. It consists of a VGG-19 convolutional network that is used to extract patterns and representations from the given input. The output from the VGG-19 goes into two branches of convolutional networks.

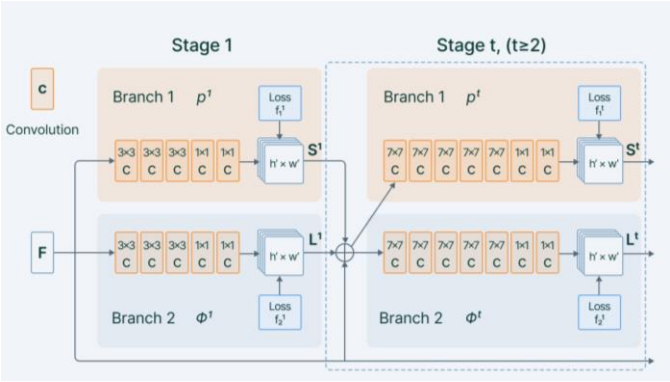

Fig-4: Open Pose Architecture

7. SYSTEM ARCHITECTURE

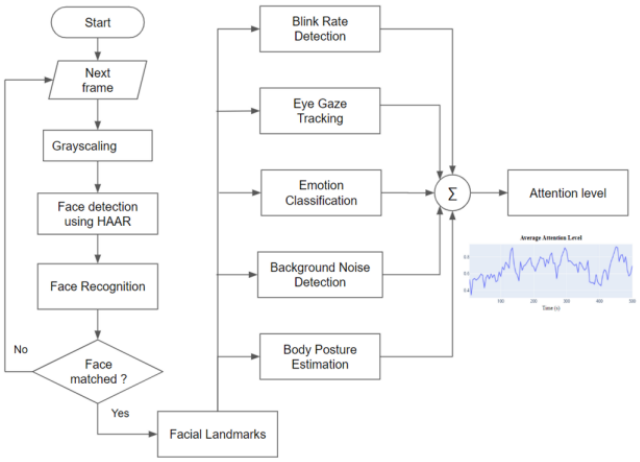

Fig-1: System Architecture

This system makes use of five parameters to calculate the attention-span level of the student attending the online class. Facial recognition is used to validate the student's attendance. The attention span score is calculated using blink rate, facial expression, eye gaze, background noise, and body posture and is updated continuously for a window length of 5 seconds. Instead of sequential execution, all the models required to calculate the attention span are executed in parallel once the online lecture starts.

Data Flow Diagrams

- The DFD is also called as bubble chart. It is a simple graphical formalism that can be used to represent a system in terms of input data to the system, various processing carried out on this data, and the output data is generated by this system.
- The data flow diagram (DFD) is one of the most important modeling tools. It is used to model the system components. These components are the system process, the data used by the process, an external entity that interacts with the system and the information flows in the system.
- DFD shows how the information moves through the system and how it is modified by a series of transformations. It is a graphical technique that depicts information flow and the transformations that are applied as data moves from input to output.
- DFD is also known as bubble chart. A DFD may be used to represent a system at any level of abstraction. DFD may be partitioned into levels that represent increasing information flow and functional detail.

Level 0:

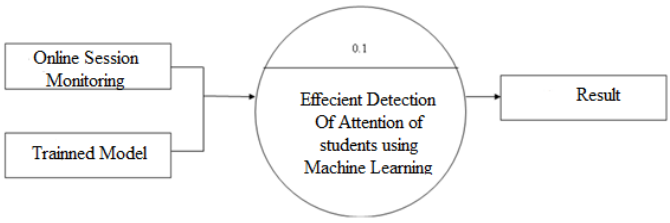

Fig-2: Level 0 Data Flow Diagram

Level 0: describes the overall process of the project. We are passing academic online sessions and its Trained Model as input system will efficiently detect attention spam in the classes using machine learning algorithm.

Level 1:

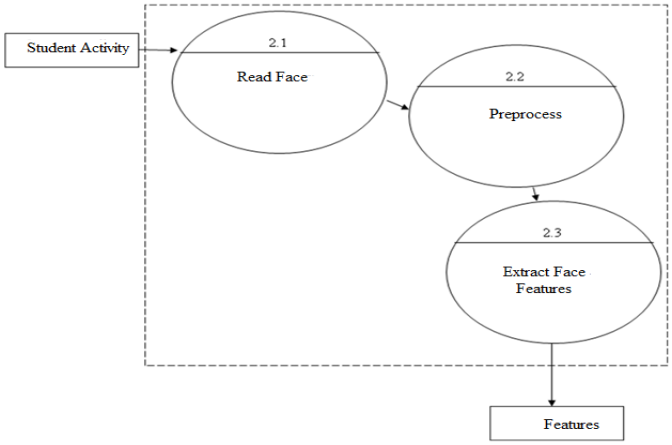

Fig-3: Level 1 Data Flow Diagram

Level 1: describes the first step process of the project. We are passing student activities of online meeting System will read activities and detect the face and preprocess and extract the features like, eyes, nose, mouth etc..

8. CONCLUSIONS:

we have implemented a system to tackle the issues involved in online education using five parameters. We used the face recognition model to verify the student attending the online class. We used the other five parameters - blink rate, eye gaze, emotion, posture, and noise level to calculate the attention level of the student throughout the lecture. Since this involves real-time processing, we have implemented and used lightweight models to reduce the processing time. We visualize the scores in the form of a live graph and generate automated reports. The feedback generated can be used for: 1) Evaluating student performance 2) Improving teaching standards 3) Preventing malpractice during online examinations As a part of future works, we can improve our system's performance further by training our models using more data. Also, the same attention tracking mechanism can be further optimized to simultaneously work with multiple subjects in a classroom using video footage from the CCTV cameras. Moreover, we have used human observed attention scores as ground truth-values as we currently do not have any dataset for measuring the attention span during online lectures. A standard dataset can help to evaluate the system's performance more reliably.

9. REFERENCES:

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