# Faculty of Computer Science
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# CS484

# Human Computer Interaction Project

**Project title:** **Student Behaviour Analysis during Lectures**

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# Introduction

- The purpose of this project is to develop a system that can analyze and detect student behavior during lectures using facial expressions and body language. The system will use Python programming language and various computer vision techniques to accurately identify and interpret the emotions and expressions exhibited by each student. The main objective is to provide the teacher with valuable insights into student engagement and emotional states, enabling them to evaluate and improve their teaching methods effectively.

# Project Scenario

1) A camera or webcam will be installed in the classroom to capture real-time video footage of the students during lectures. The video stream will be processed using computer vision techniques to detect and track individual students' facial expressions and body language.

2) The system will utilize pre-trained deep learning models or custom-trained models to recognize facial expressions such as happiness, sadness, anger, fear, and indifference. The models will analyze facial landmarks, expressions, and movements to determine the emotional state of each student.

3) In addition to facial expressions, the system will also analyze students' body language to further enhance the accuracy of behavior detection. It will consider factors like posture, gestures, and overall engagement levels to provide a comprehensive understanding of student behavior.

4) The detected facial expressions and body language will be processed to calculate the percentage of each emotion or behavior exhibited by each student. This data will be aggregated and analyzed to generate meaningful insights and metrics.

5) The system will generate a text file for each student, containing their name, ID, and the percentage of each detected emotion or behavior. This file will be made available to the teacher, who can review and evaluate student behavior during the lecture. The teacher can use this information to identify areas where students may need additional support or engagement.

# Conceptual Scenario

Mostafa, an assistant university professor, wants to improve student engagement and behavior during his lectures. He decides to implement a student behavior detection system to gain insights into students' attentiveness, emotional states, and participation levels. The system utilizes computer vision and machine learning algorithms to analyze facial expressions and body language in real-time.

Mostafa envisions the following key activities for the technology to support:

System Setup: Mostafa installs the behavior detection system on a computer in his classroom. He ensures that the camera is properly positioned to capture the students' facial expressions and body movements.

Lecture Monitoring: At the start of each lecture, Mostafa initiates the system and begins recording video footage of the students. The system analyzes the video stream in real-time, tracking each student's facial expressions and body language throughout the lecture.

Behavior Analysis: The system processes the collected data, recognizing and categorizing various behaviors such as attentiveness, engagement, boredom, confusion, and participation. It quantifies these behaviors as percentages for each student.

Generation of Reports: After the lecture, the system generates individualized behavior reports for each student. The reports include the student's name, ID, and the respective percentages of each behavior detected during the lecture. These reports provide a comprehensive overview of each student's engagement and participation.

Evaluation and Feedback: Mostafa reviews the behavior reports to gain insights into student behavior patterns and identify areas for improvement. He uses this information to tailor his teaching strategies to better engage and support students.

# General Scenario

- Imagine a bustling classroom filled with students engaged in a lecture. In this scenario, our advanced human interaction system is deployed, equipped with a camera capturing real-time video of the students. As the lecture progresses, the system diligently analyzes each student's facial expressions and body language using sophisticated computer vision techniques. It accurately recognizes and interprets emotions such as happiness, sadness, anger, fear, and indifference, along with assessing their overall engagement levels through posture and gestures. The system processes the data and generates personalized text files for each student, containing their name, ID, and the respective percentages of detected emotions and behaviors. Armed with this valuable information, the teacher can easily evaluate and understand the students' behavior during the lecture, identifying areas that require additional attention or support. With this system, the teacher gains the ability to fine-tune their teaching methods, fostering an environment that optimizes student engagement and learning outcomes.

# System features

1) Data Collection
2) Facial Expression Recognition
3) Body Language Analysis
4) Data Processing and Analysis
5) Reporting and Feedback

# Conclusion

- By implementing this system, teachers will have a powerful tool to evaluate and detect student behavior during lectures. The ability to analyze facial expressions and body language will provide valuable insights into student engagement, emotional states, and overall classroom dynamics. This information can be used to make data-driven decisions and improve teaching methods, ultimately enhancing the learning experience for students.

# PACT Analysis

| People | Activity | Context | Technology |
|--------|----------|---------|------------|
| **Age: 18 – 60+**<br><br>Students:<br><br>The system will analyze and detect the behavior of individual students during lectures, providing insights into their emotional states and engagement levels.<br><br>Teachers:<br><br>The system aims to support teachers in evaluating and understanding student behavior, enabling them to adapt their teaching methods accordingly. | Data collection:<br><br>Capturing real-time video footage of students during lectures using cameras or webcams. | Language:<br><br>The system is limited to English language. | Computer vision:<br><br>Leveraging computer vision algorithms and techniques to process video footage, detect facial expressions, and analyze body language. |
| Teachers:<br><br>Required to have minimal cognition to understand basic system usage. | Facial expression recognition:<br><br>Utilizing computer vision techniques to identify and interpret facial expressions exhibited by each student. | | Deep learning:<br><br>Utilizing pre-trained deep learning models or developing custom models for accurate facial expression recognition. |

| Persona: Improve educational strategy for better learning and understanding. | Body language analysis: Analyzing students' body language, including posture, gestures, and engagement levels, to enhance behavior detection. | | Data processing: Employing data processing techniques to aggregate and analyze the collected data, calculating the percentage of each emotion or behavior. |
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| | Data processing and analysis: Calculating the percentage of each detected emotion or behavior for each student and generating text files for evaluation. | | |
| | Reporting and feedback: Providing teachers with the generated text files to facilitate evaluation and improvement of teaching methods. | | |