

Master internship

GENERAL INFORMATION

Key-terms: Machine Learning; Behavioral analysis; Education.

Title: Behavioral Analysis to Improve Students' Academic Performance Using Artificial Intelligence.

Duration and period: 3 à 5 months ideally from April 2025

Work environment: UCBL Lyon1, LIRIS laboratory, UMR 5205 CNRS, Lyon, France

Type : Bac+5, Master 2, Bac+4, Master 1

Supervisors: Dr M. Essaid KHANOUCHE, Pr. Frédérique BIENNIER

Application: Send CV and academic transcripts of 2023/24 and 2024-25 to mohamed-essaid.khanouche@univ-lyon1.fr

Context and Motivation

The Internet of Behavior (IoB) is an emerging interdisciplinary field that focuses on collecting, analyzing, and interpreting behavioral data to optimize decision-making in various sectors, including energy, healthcare, smart cities [1, 2], and education [3, 4, 5, 6, 7]. With the increasing integration of digital tools in learning environments, IoB presents an opportunity to develop intelligent systems that can monitor and enhance student engagement in classrooms.

In traditional learning settings, instructors rely on visual cues and student interactions to assess engagement levels. However, this approach is subjective and limited in scalability, particularly in large classrooms or online learning environments. Recent advancements in Artificial Intelligence (AI), Computer Vision, and Multimodal Learning Analytics provide new possibilities for automated, real-time assessment of student engagement based on behavioral indicators.

This internship aimed at developing an intelligent behavioral analysis system that leverages AI techniques, including Deep Learning, Computer Vision, and Audio-Signal Processing, to analyze student engagement and concentration in class. The system will process multimodal data (video, audio, and sensors) to detect behavioral patterns associated with attention, distraction, and cognitive load, enabling proactive interventions to enhance the learning experience.

Required profile

- Strong knowledge on machine learning and data analysis (preparation, cleaning, and exploration).
- Solid programming skills in Python (Pandas, Scikit-learn, TensorFlow/PyTorch) and proficiency in data visualization tools (Matplotlib, Seaborn).
- Familiarity with ethical issues related to educational data analysis would be a plus.

Planning

- Review existing approaches for behavioral analysis in classrooms based on computer vision, deep learning, etc.
- Analyze reference datasets and identify key behavioral patterns (e.g., concentration, distraction).
- Develop and validate AI-based models for engagement detection.
- Assess models robustness in real/simulated scenarios and compare results with existing approaches.
- Contribute to a research publication.

References

- [1] C. A. Abbas, M. E. Khanouche, L. Cheklat, C. Ghedira-Guégan and F. Biennier, "Online and Physical Internet of Behaviors: A literature review," 28th Int. Conf. on KES, vol. 246, pp. 3522-3531, Séville, Spain, 11-13 September 2024.
- [2] Q. Zhao, G. Li, J. Cai, M. Zhou, and L. Feng, "A Tutorial on Internet of Behaviors: Concept, Architecture, Technology, Applications, and Challenges," IEEE Comm. Surveys & Tutorials, vol. 25, no. 2, pp. 1227–1260, 2023.
- [3] O. Embarak, "An adaptive paradigm for smart education systems in smart cities using the internet of behaviour (IoB) and explainable artificial intelligence (XAI)," In 8th IEEE Int. Conf. on Information Technology Trends, pp. 74–79, 2022.
- [4] US. Umar, ME. Rana, and VB. Hameed, "Predicting Student Performance Through Classroom Concentration: A Review on Machine Learning and Computer Vision Approaches," In IEEE 21st Student Conference on Research and Development, pp. 408-414, 2023.
- [5] J. Mo, R. Zhu, H. Yuan, Z. Shou, and L. Chen, "Student behavior recognition based on multitask learning," Multimedia tools and applications, vol. 82, no 12, pp. 19091-19108, 2023.
- [6] B. Perumal, P. Nagaraj, TSN. Charan, YVS SaiDeepak, CVV. Reddy, and S. Nagendra, "Student Engagement Detection in Classroom using Deep CNN-based Learning Approach," In 8th IEE Int. Conf. on Communication and Electronics Systems. pp. 1233-1238, 2023.
- [7] R. Luckin, "Towards artificial intelligence-based assessment systems," Nature Human Behavior, vol. 1, n°3, pp. 1-3. 2017.