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Enhancing Classroom Engagement using Real-Time Student Attention Monitoring with YOLOv9
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Abstract
This research investigates the utilization of YOLOv9 in classrooms to monitor student attention in real time, thereby addressing the challenge of sustaining student engagement. The inability of conventional teaching methods to maintain students' attention frequently necessitates the implementation of dynamic modifications to instructional strategies. The goal is to create a system that accurately identifies students' attention levels. The system was trained and tested on annotated datasets using the YOLOv9c and YOLOv9e models, resulting in precision, recall, and mAP scores that demonstrated high effectiveness. A dashboard from Streamlit offered real-Time and cumulative insights, which allowed for immediate pedagogical adjustments. The results showed that YOLOv9c had a higher precision (0.876) and YOLOv9e had a superior recall, underscoring their respective strengths. However, despite a few misclassifications, the system's robust performance suggests its potential as a transformative educational tool. Future enhancements will focus on integrating additional data sources, reducing misclassifications, and improving algorithm scalability and accuracy to foster a more adaptive learning environment and showcase the system's potential for diverse educational applications. © 2024 IEEE.

Author Keywords
classroom engagement; deep learning in education; Real-Time student attention monitoring; YOLOv9 object detection

Index Keywords
Adversarial machine learning, Contrastive Learning, Deep reinforcement learning, Federated learning, Object detection, Object recognition, Teaching; Classroom engagement, Deep learning in education, Dynamics modifications, Misclassifications, Objects detection, Real- time, Real-time student attention monitoring, Student engagement, Teaching methods, YOLOv9 object detection; Students

References

- Freeman, S.
  Active learning increases student performance in science, engineering, and mathematics
  (2014) *Proceedings of the National Academy of Sciences*, 111 (23), pp. 8410-8415.

- Mosly, I.
  Artificial Intelligence?s Opportunities and Challenges in Engineering Curricular Design: A Combined Review and Focus Group Study
  (2024) *Societies*, 14 (6), p. 89.

- Reddy, S.N., Pathlavath, M., Narsareddygari, S., Naik, S.M.
  Investigating the Transformative Effects of Active Learning Methodologies in the Field of Engineering Education to Improve Learning Outcomes in Students by Unleashing Their Potential
  (2024) *Journal of Engineering Education Transformations*, 37 (2).

- Jeyamala, C., Abirami, A.
  Enhancing Student Learning and Engagement in Freshman Course on Problem Solving Using Computers
  (2020) *Journal of Engineering Education Transformations*, 33.
  no. Special Issue

- Wu, T.-T., Lee, H.-Y., Wang, W.-S., Lin, C.-J., Huang, Y.-M.
  Leveraging computer vision for adaptive learning in STEM education: Effect of engagement and self-efficacy
  (2023) *International Journal of Educational Technology in Higher Education*, 20 (1), p. 53.

- Naqvi, W.M., Sundus, H., Mishra, G., Muthukrishnan, R., Kandakurti, P.K.
  AI in Medical Education Curriculum: The Future of Healthcare Learning
  (2024) *European Journal of Therapeutics*,

- Kim, H., Chae, Y., Kim, S., Im, C.-H.
  Development of a Computer-Aided Education System Inspired by Face-To-Face Learning by Incorporating EEG-Based Neurofeedback into Online Video Lectures
  (2022) *IEEE Transactions on Learning Technologies*, 16 (1), pp. 78-91.

- Attar, E.T.
  Integrated biosignal analysis to provide biomarkers for recognizing time perception difficulties
  (2023) *Journal of Medical Signals & Sensors*, 13 (3), pp. 217-223.

- Sadasivam, S.G., Muthukrishnan, S., Lr, H.
  Multimodal Approach to Identify Attention Level of Students using Jetson Nano
  (2022) *2022 8th International Conference on Signal Processing and Communication ICSC*, pp. 624-629.

- Su, M.-C., Cheng, C.-T., Chang, M.-C., Hsieh, Y.-Z.
  A video analytic in-class student concentration monitoring system
  (2021) *IEEE Transactions on Consumer Electronics*, 67 (4), pp. 294-304.

- Arciniegas, D.F.T., Amaya, M., Carvajal, A.P., Rodriguez-Marin, P.A., Duque-Muñoz, L., Martinez-Vargas, J.D.
  Students' attention monitoring system in learning environments based on artificial intelligence
  (2021) *IEEE Latin America Transactions*, 20 (1), pp. 126-132.

- Wang, C.-Y., Yeh, I.-H., Liao, H.-Y.M.
  (2024) *YOLOv9: Learning What You Want to Learn Using Programmable Gradient Information*,

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