IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.53
Volume 4, Issue 5, May 2024

Facial Feature-Based Attention Tracking System for Enhanced Online Learning Engagement

Krishnaraj. V[1] and Sumalatha. V[2]
PG Student, Department of Computer Applications[1]
Associate Professor, Department of Computer Applications[2]
Vels Institute of Science Technology and Advanced Studies, Pallavaram, Chennai, India
krishnarajgogulan@gmail.com and sumalathav.research@gmail.com

Abstract: *Recognizing and enhancing student engagement is crucial for improving learning outcomes, particularly in the context of online classes where monitoring can be challenging. Traditional methods of attendance tracking, such as calling out names, are impractical and susceptible to manipulation in the virtual environment. Students might appear 'online' without actively participating, and the absence of video feeds makes it difficult for teachers to verify attendance and attention. In order to realize a highly efficient and robust attendance management and engagement level prediction system for online learning, In the proposed*
System, the learner's face is monitored by a video camera while attending a video lecture. Facial features were analyzed to predict reaction time (RT) to a task-irrelevant stimulus, which was assumed to be an index of the level of attention. Then apply a machine learning method, light Gradient Boosting Machine (LightGBM), to estimate RTs from facial features extracted as action units (AUs) corresponding to facial muscle movements by an open-source software (OpenFace). This project is to develops a user-friendly system integrated with private online learning and attendance recording system for teachers that can automatically record students 'engagement state and attendance then generate attendance reports for online classrooms. It encompasses a novel design using the AI based FFCNN (Face Fiducial Convolution Neural Network) model to capture face biometric randomly from students' video stream and record their attendance automatically. This integrated solution not only streamlines attendance management but also provides valuable insights into students' engagement levels through facial feature analysis.

Keywords: Attendance tracking, Facial feature analysis, Machine learning, Light GBM, OpenFace, AI-based FFCNN model

I. INTRODUCTION

The Learning Attentive Prediction system evaluates and enhances learner engagement during online video lectures. Incorporating a video monitoring module and utilizing the FFCNN model to capture facial biometrics, coupled with LightGBM for efficient attention level prediction, this system leverages OpenFace for facial behavior analysis. Together, these components synergize to provide a comprehensive solution for proactive engagement management in virtual learning environments.

II. LITERATURE SURVEY

The surge in virtual learning environments, catalyzed by the COVID-19 pandemic, has spurred extensive research into attendance management and engagement assessment in online education. Li et al. (2020) highlighted the limitations of traditional attendance tracking methods in virtual settings, emphasizing the need for innovative solutions to boost student participation. Concurrently, Alamo et al. (2020) explored the utilization of open data resources and technology for monitoring and projecting the spread of COVID-19, shedding light on the crucial role of advanced technologies in addressing crisis-specific challenges across various sectors, including education [1,2].
These studies collectively underline the growing recognition of innovative technologies like facial recognition and machine learning algorithms in tackling the hurdles of attendance management and engagement assessment in virtual

IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.53
Volume 4, Issue 5, May 2024

classrooms. By drawing from insights gleaned from existing research, the proposed system aims to contribute to the ongoing discourse on enriching virtual learning experiences through technological advancements [3].

III. PROBLEM STATEMENT

In the wake of the COVID-19 pandemic, the shift from traditional face-to-face learning to virtual classrooms has presented unprecedented challenges for educators worldwide. With mandatory social distancing measures in place, educational institutions have transitioned significantly to virtual modes of operation, relying heavily on online meeting platforms like Zoom and Google Meet to create virtual classrooms. While virtual learning offers newfound advantages, it also brings forth a host of challenges, particularly in the realm of attendance management. Tracking student attendance in virtual classes has emerged as a significant obstacle, as conventional methods such as calling out names prove inefficient and time- consuming. Moreover, the inherent nature of virtual learning enables students to engage in unethical practices, such as appearing 'online' without actively participating or turning off video cameras to mask their absence. This dynamic landscape underscores the critical need for innovative technologies to address the complexities of attendance management and ensure meaningful engagement in virtual classrooms.

IV. PROPOSED SYSTEM

The proposed system aims to revolutionize virtual learning by introducing advanced features for attendance management, attentiveness prediction, and engagement assessment. Leveraging Face Recognition Using FFCNN, the system ensures accurate face recognition during virtual classes, streamlining attendance management with automatic marking and generation of attendance reports. LightGBM facilitates attentiveness prediction by analyzing facial features in real-time, enabling educators to gauge and address students' engagement levels effectively. Additionally, the Random Interval Query for Engagement introduces spontaneous queries to assess understanding, fostering active participation and learning. With advantages such as enhanced attendance and engagement monitoring, the system offers a highly efficient and dynamic solution for virtual learning across educational institutions and businesses.

V. METHODOLOGY SECTION

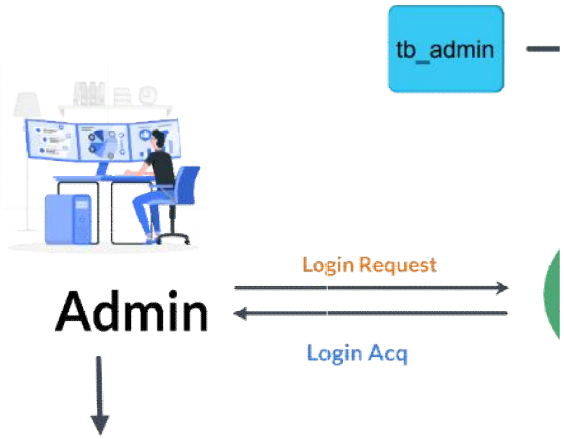

Figure 1: DATA FLOW DIAGRAM LEVEL 0

IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.53
Volume 4, Issue 5, May 2024

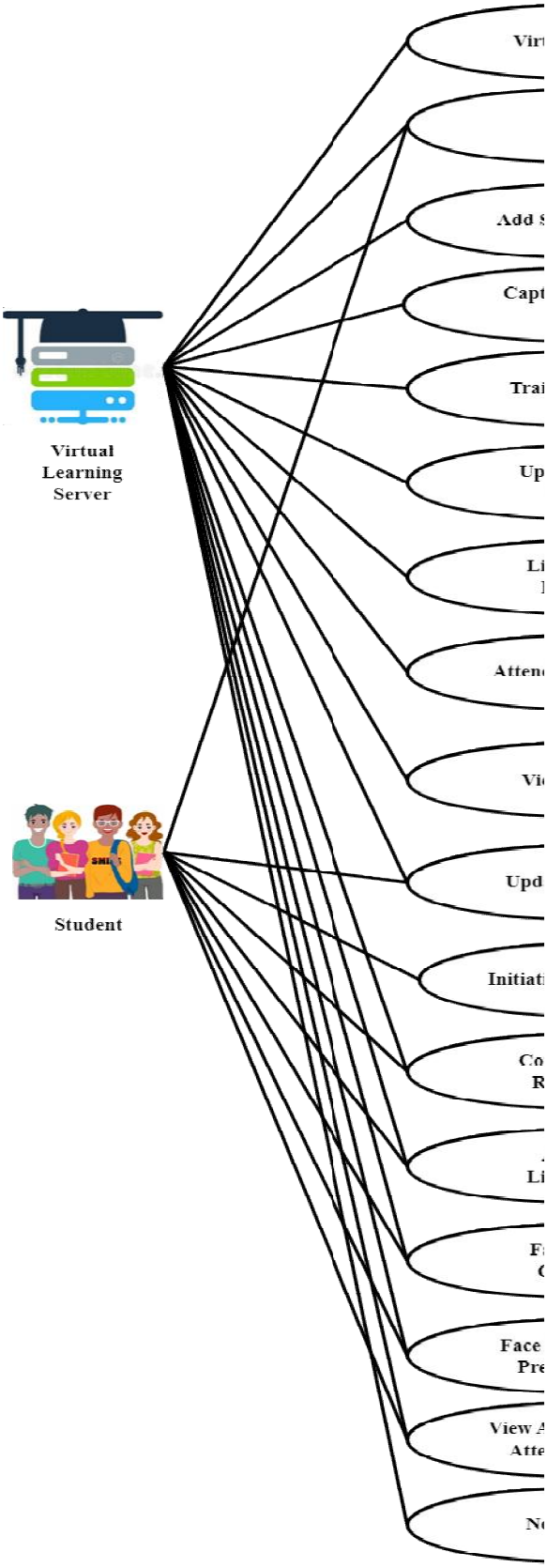

Figure 2: USE CASE DIAGRAM

DOI: 10.48175/IJARSCT-18419

IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.53
Volume 4, Issue 5, May 2024

VI. PROJECT SCOPE

Virtual Learning Environment (VLE)

- Creation of a user-friendly web-based platform for virtual learning.
- Modules for organized content sharing, live classes, assignments, and collaborative features.
- Integration with existing Learning Management Systems (LMS) or development of an integrated LMS module.

Attendance Management System

- Implementation of an automated attendance system using Face Fiducial Convolution Neural Network (FFCNN) for face recognition.
- Real-time tracking and recording of students' attendance during virtual classes.
- Generation of automated attendance reports for online classrooms.

Learning Attentive Prediction

- Utilization of LightGBM for predicting students' attentiveness during video lectures.
- Analysis of facial features extracted using OpenFace to estimate reaction times and gauge the level of attention.
- Integration of machine learning algorithms for predictive analysis of students' engagement.

Attendance Management System Implementation

- Face Recognition and Identification: Implement the algorithm for matching extracted facial features with stored facial features in the database, identifying students.
- Attendance Marking: Develop the mechanism to mark attendance automatically based on successful face recognition.
- Error Handling: Implement error-handling mechanisms for unrecognized faces or system issues.

Learning Attentive Prediction Module Implementation

- Video Monitoring: Develop the module for video monitoring during online classes to capture facial features.
- Reaction Time Prediction: Implement the Light Gradient Boosting Machine (LightGBM) algorithm for predicting reaction times as an index of attention
- Real-time Analysis: Enable real-time analysis of facial features to continuously predict attentiveness during video lectures.

User Interface Development

- Web Interface Design: Design an intuitive and user-friendly web interface for educators and administrators.
- Student Portal: Create a portal for students to access attendance records and relevant information.
- Responsive Design: Ensure that the interface is responsive and accessible across various devices.

Integration with Virtual Learning Tools

- Virtual Meet API Integration: Integrate with virtual meeting platforms to capture students' faces and initiate attendance entry.
- API Development: Develop APIs for seamless communication between the attendance system and virtual learning tools.

Integration with Virtual Learning Tools

- Virtual Meet API Integration: Integrate with virtual meeting platforms to capture students' faces and initiate attendance entry.
- API Development: Develop APIs for seamless communication between the attendance system and virtual learning tools.

Testing and Quality Assurance

- Unit Testing: Conduct unit testing for individual modules to ensure they function as intended.
- Integration Testing: Verify the integration of different modules and components.
- User Acceptance Testing: Collaborate with end-users to conduct user acceptance testing and gather feedback.

IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.53
Volume 4, Issue 5, May 2024

VII. CONCLUSION

In conclusion, the proposed system presents a significant advancement in virtual learning environments, offering solutions for attendance management, attentiveness prediction, and engagement assessment. Through integration of cutting-edge technologies like FFCNN and LightGBM, it provides a robust educational platform. Automated attendance reporting Streamlines administrative tasks, while real-time engagement analysis offers valuable insights into student attentiveness. With a user-friendly interface and continuous machine learning refinement, it promises to enhance online education by empowering educators with accurate insights and comprehensive reporting tools. Designed for adaptability, it aims to evolve alongside the dynamic needs of virtual education, fostering a positive and engaging learning experience.

VIII. FUTURE SCOPE

Potential future enhancements include refining attendance tracking accuracy through ongoing machine learning model optimization and integrating additional biometric markers like eye- tracking or voice analysis. Furthermore, incorporating natural language processing techniques to analyze students' textual contributions in online discussions could offer deeper insights into engagement levels. Real-time feedback mechanisms for instructors could be added to enable timely interventions for enhancing student participation and comprehension, promising a more interactive and personalized online learning experience

REFERENCES

[1]. Baltrušaitis, T., Zadeh, A., Lim, Y. C., & Morency, L.-P. (2018). OpenFace 2.0: Facial behavior analysis toolkit. IEEE International Conference on Automatic Face & Gesture Recognition.

[2]. Ke, G., Meng, Q., Finley, T., Wang, T., Chen, W., Ma, W., & Liu, T.-Y. (2017).

[3]. LightGBM: A highly efficient gradient boosting decision tree. Advances in Neural Information Processing Systems, 30, 3146-3154.

[4]. Zhang, D., Zhou, L., Briggs, R. O., & Nunamaker Jr, J. F. (2006). Instructional video in e-learning: Assessing the impact of interactive video on learning effectiveness. Information & Management, 43(1), 15-27.

[5]. Zhang, Z., Luo, P., Loy, C. C., & Tang, X. (2016). Facial landmark detection by deep multi-task learning. European Conference on Computer Vision, 94-108.

[6]. Lim, S. H., Kim, D. H., Lee, J. H., Lee, D. S., & Jeong, D. S. (2019). Development and evaluation of a user-friendly medication reconciliation application. Journal of the American Medical Informatics Association, 26(11), 1240-1249.

[7]. A brief history of Facial Recognition, NEC, New Zealand,26 May 2020.[Online]. Available: https://www.nec.co.nz/market-leadership/publications-media/a-brief-history-of-facialrecognition/

[8]. Face detection, TechTarget Network, Corinne Bernstein, Feb, 2020.[Online]. Available: https://searchenterpriseai.techtarget.com/definition/face-detection

[9]. Paul Viola and Michael Jones, Rapid Object Detection using a Boosted Cascade of Simple Features. Accepted Conference on Computer Vision and Pattern Re cognition, 2001.

[10]. Face Detection with Haar Cascade,Towards Data Science-727f68dafd08,Girija Shankar Behera, India, Dec 24, 2020.[Online].

[11]. Face Recognition: Understanding LBPH Algorithm,Towards Data Science90ec258c3d6b,Kelvin Salton do Prado, Nov 11, 2017.[Online].