



Smart Exam Malpractice Detection and Evidence Capture YOLO

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ABSTRACT: Due to the increasing popularity of the online classes and tests, the proctoring systems that are both dependable and automated are needed more to ensure that the academic honesty of the students is secured. Old-fashioned ways of invigilation cannot be applied on a large scale, and they are usually not able to notice some minor indicators of malpractice in case of remote exams. The smart monitoring system is developed on the principle of using computer vision and DL to detect cheating during exams and document evidence that could be verified. To maintain a watch on suspicious activities, the system employs the publicly available datasets and detection models that are already trained. Such models are facial landmark predictors and mobile object detection models. Video frames of a webcam stream or uploaded file are preprocessed and before processing, they are executed by extracting frames, resizing, normalizing and localizing landmarks of the faces in the video frame. Various DL object recognition models, such as YOLOv5, YOLOv8, YOLOv9 and YOLOv11, are run, and their performance in terms of detection of banned items such as cell phones is tested. Performance is determined by metrics such as Precision, Recall and mAP. According to the tests, YOLOv5 performs best in terms of the aggregate performance and has a Precision of 0.848 and mAP of 0.663. Instead, YOLOv8 and YOLOv11 are the ones with the highest Recall of 0.709. The structure is compatible with a web application based on Flask in order to enable real-time tracking, evidence recording, and automatic notifications. This increases the openness and trustworthiness of AI-based test proctoring systems.

KEYWORDS: Online Examination Monitoring, Academic Integrity, Computer Vision, Deep Learning, Object Detection, Automated Proctoring System.

I. INTRODUCTION

As electronic learning and distance learning develop rapidly, these days online tests are applied much more frequently. Such systems also can be scaled, flexible and are accessible making them easily accessible by the school and students giving tests anywhere since they are not bound to the location. Anyway, the fact that digital tests are taken at home rather than traditional raises new issues as to ensuring that the test process is not biased and that academic integrity is ensured. Since the population of online learners continues to increase, schools must possess good technology that could make learning both safe and secure and with minimal control [1].

Although the number of online proctoring sites is quite large, the majority of the monitoring techniques are still based on human monitoring or webcam monitoring. These techniques are incapable of locating modest instances of malpractice or determining complex trends of conduct on assessments. The higher the number of online tests conducted, the more difficult it becomes to pay attention to a great number of individuals simultaneously and determine the reason why they behave in a weird manner. Many of the existing practices do not also include structured forms of tracking evidence that can be used to demonstrate bad conduct. This complicates matters and institutions have more difficulties in monitoring potential breaches. Due to these issues, smarter and more automated monitoring of digital testing environment is necessary and this can render them more reliable and consistent [2, 3].

To address these issues, this paper is aimed at developing an intelligent examination monitoring system and thus more effective and reliable remote assessment supervision. The aim of the study is to enhance automated monitoring of the behavior of the candidates in addition to enabling them to be constantly monitored during the test sessions. To promote the open evaluation procedures, the proposed framework emphasizes the improved accuracy of detection, the systematic



recording of events, and the competent management of evidence. The framework will reduce the invigilation by human means and increase flexibility of monitoring to achieve a situation in which it becomes applicable to big online test environments through advanced visual analysis and automated tracking [4, 5].

Internet based testing systems are also being upgraded with smart tracking and the impact of the same will be tremendous on online learning in future. Individuals would be more convinced to take tests online when they are aware that the approach is just, accountable and is user friendly to all. Such systems may be used to assist schools to detect any form of dishonesty, ensure that standards of tests are never compromised, and safeguard academic standards. Automated monitoring solutions would also help eliminate large-scale testing and would simplify operations and reduce the number of tasks managers need to complete. Finally, the smarter proctoring systems can be enhanced to achieve the bigger objective of developing online learning tools that are safe, reliable, and scalable [6].

II. RELATED WORK

The recent advancements in intelligent proctoring systems have considered the application of computer vision and computer-monitored watching to enhance the reliability of test supervision. According to Haider et al. an invigilation system based on AI, which involves pose estimation to monitor the behavior and position of students during tests, was proposed [7]. This research revealed that an underweight lightweight monitoring solution that does not require extensive computing capabilities may come in handy. This would render them accessible to schools that have little hardware infrastructure. The approach was however largely anchored on the analysis of stance and may have failed to detect a broader spectrum of suspicious activities. Similarly, Wang et al. developed the system, which is capable of identifying cheating and saving trusted evidence in a blockchain [8]. Their contribution was on the opening up and making online tests safe through safe management of records. Although it became simpler to trust recorded events and discern what took place with the help of the system, the introduction of blockchain technologies may complicate real-world deployments and are expected to take more time to operate.

Some studies have even investigated the use of AI in visual tracking to identify odd behavior when conducting online tests. Baloji et al. demonstrated an artificial intelligence-based test cheating search system that monitors the actions of students and reports them [9]. Their work demonstrated that ML techniques might be exploited to better the detections and reduce the necessity of human supervision. The system was largely an acknowledgment of basic operations, and it was not entirely developed to address the issue of scalability in-the-moment with large-scale online exams. Huy et al. in another research proposed to take a mixed DL approach, searching through video streams to detect cheating in real-time [10]. The model was more capable of identifying bad behaviour through the application of cumulative learning models, but the approach may require much computer power to monitor things at all times in numerous exam sessions.

Object detection based monitoring system has also received a lot of attention in recent study. Xu et al. developed an examination monitoring system whose object detection model is better to identify actions that do not appear right and objects that are supposed not to be present during examinations [11]. They demonstrated that they were better detected in an environment with high diversity of visuals. Nevertheless, the research focused on the degree of object location in dogs mostly and did not comment much on how to manage evidence and monitor behavior patterns in an organized manner. Olanrewaju proposed an improved web based test system using automatic proctoring and background activity monitoring in order to detect bizarre activities occurring out of the primary camera frame [12]. The framework enabled the system to work more effectively and to retain it safer, as well as demonstrated how difficult it is to maintain the track of reliable both in a large variety of test scenarios.

Other emerging research has examined the proctoring tools that are AI powered. This is because these tools have been integrated to facilitate a smoother and quicker tracking process. Priya et al. [13] in their work characterized an AI-based proctoring system, which observes what the student is doing when looking at the test, using webcams. Nonetheless, the system proved that it is not necessary to use special hardware to achieve automated tracking. It does not find, however, more complicated patterns of behavior with ease. According to Divyashree et al., the concept of maintaining a proctoring environment with the use of AI should be implemented to ensure the tests are safer through the utilization of smart monitoring technologies [14]. Although this system had improved the automated detection, the work demonstrated the existence of issues with the ability of automatic detection to be scaled up and the dependability of the system in retrieving evidence in large regions of examination. In addition, Dahan et al. [15] provided a list of AI-based solutions that are capable of identifying suspicious behavior during tests and which indicates how relevant automatic tracking systems are in ensuring academic integrity.



With these enhancements, it remains that a small set of issues still has to be resolved before reliable and scalable online test tracking can be achieved. Most of the existing procedures merely examine some of the patterns, require lots of computing ability, or lack effective means to organize information or maintain a trace on classes. Due to these reasons, the full smart monitoring system should be obtained that can perform all the functions. This will enhance reliability in detection, performance will be maintained and the basis will be on evidence. The research paper seals these gaps by developing a comprehensive research framework in regards to examination monitoring. This will enhance automatic monitoring, enhance behavioral analysis and easier tracking of potential examination violations.

III. MATERIALS AND METHODS

The proposed system is built with the help of computer vision and DL to provide the smart mechanism of finding cheating people in the test and obtaining evidence that can be verified. This approach involves the use of publicly available datasets and already trained models to identify faces, gaze and mobile devices. In case of online tests, webcams are used to provide the video stream. In offline testing, the video recordings are exchanged and viewed. It is a conventional procedure that involves the acquisition of information, its pre-treatment, and application in the creation of a model. Frames are then repeated to retrieve face markers, orientation of head pose and object detections. Strange behaviors include that of looking away, taking longer hours than usual to close your eyes, talking on cell phone and being with other people. They are located by complicated algorithms, e.g. dlib 68-point predictor of gaze estimation based on landmarks on the face, CNN based solver of head pose estimation and a variety of YOLO variants (YOLOv5, YOLOv8, YOLOv9 or YOLOv11) variants of object detection. A time persistence mechanism based on rules and checking of violation initiating the collection of evidence is in place. To make the system compatible with a Web Application based on Flask and a SQLite-based logging interface, it will be configured. It is thus possible to do real-time watching, automated alerts and trace evidences. It will open, rescue, and scale supervised online test settings based on AI.

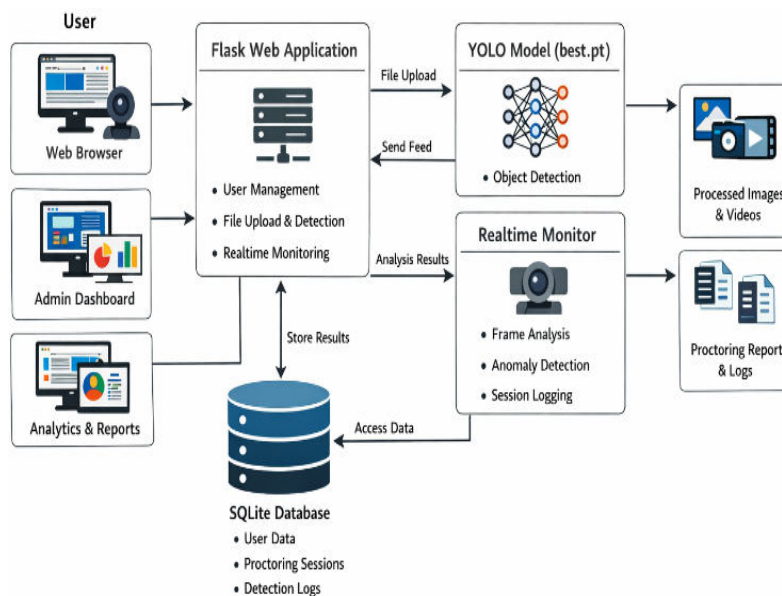


Fig.1 System Architecture

I developed a web-based AI proctoring system using Flask and YOLO as detection object and backend respectively. The system layout is in Figure 1. The user logs in or registers with the assistance of an online interface, uploads media or initiates real-time tracking. The YOLO model scans through shared photos and videos to identify objects and livestreams are watched to determine whether something suspicious is occurring. The server provides the authentication, processing and session control. The tracking results, logs and videos can be stored in the SQLite database and the manager dashboard allows you to view all of them.

A) Modules

1. User Authentication and Access Control: A user registration, a user login and a user session management authentication system ensure the security of the proctoring system to authorized users only. User credentials are secured because the password hashing enhances security and prevents unauthorized access. The system is different between



admins and regular users, and it ensures that a specific job possesses the appropriate permissions. Students can watch and analyze media, but through the administrative dashboard, administrators can look at the sessions, look at logs, and direct system actions.

2. Media Upload and Input Handling: One of the elements of the system that allows users to share pictures and videos to be analyzed is the fact that it deals with multimedia inputs. Before the files are uploaded, the system verifies the files to ensure that they are in an authorized format. A good example is that JPG, PNG, MP4 and AVI are supported. After the verification, the files are stored in the safe place on the computer and are prepared to be processed further. Ensuring the security of files and preventing the entry of unsupported or damaged media into the analysis pipeline, this component ensures that data passes well through the user interface and the detection algorithms.

3. Object Detection using Deep Learning: Advanced features of object recognition are developed with the help of a DL model that is based on the YOLO architecture. The model identifies items that are significant to track the examination, such as cell phones or other individuals in the frame using pictures and video frames. The findings of the analysis of each frame with the identification and location of objects are presented through the use of bounding boxes and annotations. With the automated detection, the uploaded or recorded media is now easier and more precise to detect suspicious behaviors.

4. Real-Time Monitoring and Behavioral Analysis: It can be used to monitor the subject at every moment with the real-time webcam recording and frame-by-frame analysis of the test results. The system captures live video and searches the video against features that could indicate potential violations, including looking off-screen, spending too much time with your eyes closed, talking into your cell phone, or having more than one person in the viewing section. The system will be able to visually analyze the data in real time, hence it will be easy to monitor and manage the test settings.

5. Proctoring Session Logging and Data Management: The acts are completely pursued with monitoring them in a systematic session registration and database management. Recording key data on the proctoring sessions, such as the duration of the proctoring session, the number of processing frames, behaviors observed and time. The police also can store the photos and videos of the evidence of suspicious activity and examine them at a later date. Through gathering information in a premeditated manner, examination sessions can be properly documented and a culture of transparency fostered when discussing potential infractions.

6. Administrative Dashboard and Analytics: The administrative control is simplified by a user interactive dashboard which displays information on monitoring actions in great detail. Through the interface, monitors are able to view proctoring sessions, behavior logs, and video or evidence picture records. Making a review is simpler when you can filter the choices based on the user, date, or type of event. Also, statistical summaries and aggregated indicators enable administrators to monitor the overall work of the system and identify trends of weird behavior, which manifest themselves in several examination periods.

B) Methods/Techniques

YOLOv5: YOLOv5 performs real-time item detection through the detection and classification of items in one forward pass. It can help visualize the scene correctly and efficiently as it is based on its convolutional backbone to extract visual features and multi-scale feature aggregation to reliably locate items of varying sizes.

$$"x = \sigma(t_x) + C_x, \quad y = \sigma(t_y) + C_y \quad (1)"$$

$$"w = p_w \cdot e^{t_w}, \quad h = p_h \cdot e^{t_h} \quad (2)"$$

YOLOv8: The YOLOv8 enhances performance of object detection by means of anchor-free design and better feature extraction mechanisms. Multi-scale feature representation enables more accurate localization of objects of variable size and orientation and efficient inference, which makes it ideal in time-sensitive and moving visual monitoring, where objects are moving.

$$"L = \lambda_{\text{box}}L_{\text{box}} + \lambda_{\text{obj}}L_{\text{obj}} + \lambda_{\text{cls}}L_{\text{cls}} \quad (3)"$$

YOLOv9: YOLOv9 is more stable in learning and detection because it includes better feature aggregation and gradient propagation techniques. Both enhanced object localization and classification tasks with quicker inference in visually complicated scenes in variable lighting and occlusions.



$$L_{YOLOv9} = \lambda_{box}L_{box} + \lambda_{obj}L_{obj} + \lambda_{cls}L_{cls} + \lambda_{dfl} + L_{dfl} \quad (4)$$

YOLOv11: Better spatial awareness of visual scenes is achieved by means of more refined feature extraction and feature fusion mechanisms introduced in YOLOv11.

dlib 68-Point Facial Landmark Predictor: It generates significant sites on the eyes, nose, mouth, eyebrows and jawline with the dlib 68 point facial landmark predictor. Precision localization of landmarks makes it possible to analyze facial geometry in depth and such analyses are useful in estimating gaze, facial alignment, and behavior in visual tracking systems.

Head Pose Estimation (CNN-Based Solver): Head pose guesses the position of the head relative to the camera based on the rotational angles yaw, pitch and roll. Based on the facial characteristics, CNN can give efficient orientation estimates in case of a change in lighting and head movement.

Eye Aspect Ratio (EAR) for Blink Detection: Based on the EAR, it is possible to detect blinking through the use of geometric relationships between eye landmark points. To improve the number of blink patterns and length of long eye closures across sequential video frames, the ratio remains unchanged during normal movements of the eyes and decreases significantly when the eyes are closed.

Kalman Filter / IOU Tracking for Multi-Face Tracking: Kalman filtering is used in combination with IOU tracking to track the identity of different faces in video frames. Tracking is consistent even when temporary obstructions are present with the use of motion prediction and association of bounding boxes. This renders the visual analysis of many people more consistent and precise.

EXPERIMENTAL RESULTS

Precision: Precision is a measure of the proportion of correctly classified instances or samples to the ones that were indicated as positives. As such, the way to determine the precision is:

$$\text{Precision} = \frac{\text{True Positive}}{\text{True Positive} + \text{False Positive}} \quad (5)$$

Recall: ML adopts recall as a metric that is intended to assess the level of how well a model can locate all the significant instances of a particular category. The percentage of true positives correctly identified by a model divided by the number of actual positives indicates the ability of a model to capture examples of a specific group.

$$\text{Recall} = \frac{\text{TP}}{\text{TP} + \text{FN}} \quad (6)$$

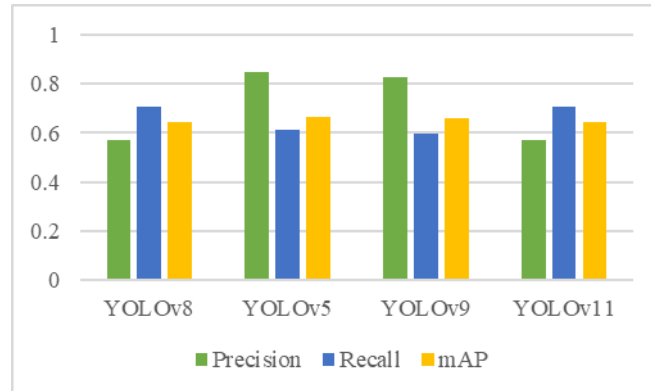
mAP: Measures of quality ranking are MAP. Considers the amount of relevant proposals and their position in the list. The geometric mean of all searches or users is called AP at K which is multiplied by K.

$$\text{mAP} = \frac{1}{n} \sum_{k=1}^{k=n} \text{AP}_k \quad (7)$$

“Table.1 Performance Evaluation”

ML Model	Precision	Recall	mAP
YOLOv8	0.570	0.709	0.644
YOLOv5	0.848	0.612	0.663
YOLOv9	0.828	0.598	0.659
YOLOv11	0.570	0.709	0.644

Table 1 demonstrates that the total detection performance of the models tested is the best in YOLOv5. It achieves this by scoring higher on the precision, recall and mAP measures when combined together.



“Fig.2 Comparison Graph”

Figure 2 illustrates the performance graph of the tested detection models compared to each other. The visualization indicates that YOLOv5 has superior overall performance indicating that it is effective and consistent in all measures of evaluation.

IV. CONCLUSION

As the number of individuals studying in electronic learning environments continues to rise, ensuring that the online exams are fair and/or honest is increasingly becoming a concern. The solution, which was developed, addresses this issue, and considers the computer vision and DL as the means to generate an intelligent tracking system capable of detecting cheating during tests and documenting the evidence that can be verified. The framework accepts video streams of webcams or videos that are uploaded and performs some basic processing such as frame extraction, resizing, normalization and localization of face landmarks. The dlib 68-point shape predictor is used to check the behavioral monitoring of the face landmarks and CNN-based solver is used to determine the face pose. This allows the system to detect the gaze direction and unusual head movements. Additionally, a variety of various DL object detection systems are used to detect mobile phones, including YOLOv5, YOLOv8, YOLOv9 and YOLOv11. This allows a complete comparison of the performance of detection of all models to be undertaken. The measurement of system performance is done using precision, Recall, and mAP. YOLOv5 has the highest total detection capability with a Precision of 0.848 and mAP of 0.663. The use of a Flask-based web application to record evidence and send automated alerts allows the data to be tracked and controlled in real-time. The designed framework is scalable and dependable, and it may be automated AI-based proctoring of exams. It also facilitates a better level of monitoring, better evidence, and improved trust on the environment where remote-based exams are conducted.

The intelligent test monitoring framework can be stabilized and scaled in the future by adding sophisticated DL models and multimodal behavioral analysis to it. Coupled with audio based anomaly detection, transformer vision models and enhanced gaze tracking techniques, it may become more accurate. Cloud-based deployment and distributed processing may make possible large-scale exams involving many people at the same time. More clear and reliable can be provided with the help of using AI methods that can be described and adaptive threshold processes. Meanwhile, privacy-protective measures can be implemented to ensure that privacy-related student surveillance information is managed safely.

REFERENCES

1. Noma-Osaghae, E., David, U. J., Mommoh, J. S., Adetunji, O. J., & Isaac, O. A. (2025). Development of an examination hall malpractice detection system using pose estimation and machine learning. *Mansoura Engineering Journal*, 50(4), 13.
2. Evangeline, S., & MP, S. A. (2025, October). Smart exam hall invigilation with biometric authentication and AI-based malpractice detection. In *2025 7th International Conference on Innovative Data Communication Technologies and Application (ICIDCA)* (pp. 348–353). IEEE.
3. Potla, B. (2025). *Monitoring Students Actions During Examination using Neural Networks* (Doctoral dissertation, National College of Ireland, Dublin).



4. Nithya, G., Venkadesh, P., Divya, S. V., Daniel, D. P., Praveenkumar, V., & Suryakumar, V. (2025, August). Multi modal deep learning framework for malpractice detection in virtual exams using YOLOV5. In 2025 8th International Conference on Circuit, Power & Computing Technologies (ICCPCT) (pp. 624–629). IEEE.
5. Haider, S. M. S., Zubair, M., Waleed, A., Shahid, M., Asghar, F., & Khan, M. O. (2025). AI for academic integrity: GPU-free pose estimation framework for automated invigilation. *Automation*, 6(4), 82.
6. Venkatesh, M., Teja, A. R. L. N., Mahesh, S. U., Sharyu, P., & Jayavardhan, K. ProctoAI: Intelligent Assessment & Monitoring.
7. Haider, S. S., Zubair, M., Waleed, A., Shahid, M., Asghar, F., & Khan, M. O. Revolutionizing invigilation: An AI-based pose estimation solution for real-time, efficient, and GPU-free solution for exam halls.
8. Wang, H., Shukur, Z., Zainol Ariffin, K. A., Xiao, R., & Wang, L. (2025). Online exam cheating detection and blockchain trusted deposit based on YOLOv12. *Scientific Reports*, 15(1), 33236.
9. Balaji, K. R., Dhulai, L. M., Hattigoudar, P. A., Maritammanavar, P. B., & Mali, P. R. (2025). AI-driven exam cheating detection system. *Journal of Advance and Future Research*, 3(12), 854–861.
10. Huy, D. P. M., Nguyen, G. N., & Le, D. N. (2026). A hybrid deep learning approach for real-time cheating behaviour detection in online exams using video captured analysis. *Computers, Materials & Continua*, 86(3).
11. Xu, E., Lu, J., Xu, S., & Wang, J. (2025). Cheating recognition in examination halls based on improved YOLOv8. *Discover Computing*, 28(1), 256.
12. Olanrewaju, T. (2025). An enhanced web-based examination system using automated proctoring and background activity detection. *Journal of Institutional Research, Big Data Analytics and Innovation*, 1(3), 279–304.
13. Priya, V., Naidu, A. G., Manikanta, I. M., Kumar, C. S., Preetham, B. I., & Muthumeena, S. (2025, December). Proctonix AI-smart exam proctoring using AI and webcam. In 2025 4th International Conference on Automation, Computing and Renewable Systems (ICACRS) (pp. 1762–1768). IEEE.
14. Divyashree, D., Khan, S., Dey, B., & Ansari, I. (2025, July). AI-powered proctoring system using UPONet algorithm for secure online examination environment. In 2025 2nd International Conference on New Frontiers in Communication, Automation, Management and Security (ICAMS) (pp. 1–7). IEEE.
15. Dahan, M., Mohamad, Z. B., Safei, S. B., Alhammadi, A., & Yousafzai, J. K. (2025, October). AI-driven detection of suspicious activities for online exam integrity: Overview. In 2025 International Conference on Meta-Networking (MEET) (pp. 1–7). IEEE.
16. Malhotra, M., & Chhabra, I. (2026). Ensuring academic integrity through automated online exam proctoring: A decade-long systematic review.
17. C.Nagarajan and M.Madheswaran - 'Stability Analysis of Series Parallel Resonant Converter with Fuzzy Logic Controller Using State Space Techniques'- Taylor & Francis, *Electric Power Components and Systems*, Vol.39 (8), pp.780-793, May 2011. DOI: 10.1080/15325008.2010.541746
18. C.Nagarajan and M.Madheswaran - 'Experimental verification and stability state space analysis of CLL-T Series Parallel Resonant Converter' - *Journal of Electrical Engineering*, Vol.63 (6), pp.365-372, Dec.2012. DOI: 10.2478/v10187-012-0054-2
19. C.Nagarajan and M.Madheswaran - 'Performance Analysis of LCL-T Resonant Converter with Fuzzy/PID Using State Space Analysis'- Springer, *Electrical Engineering*, Vol.93 (3), pp.167-178, September 2011. DOI 10.1007/s00202-011-0203-9
20. S.Tamilselvi, R.Prakash, C.Nagarajan, "Solar System Integrated Smart Grid Utilizing Hybrid Coot-Genetic Algorithm Optimized ANN Controller" *Iranian Journal Of Science And Technology-Transactions Of Electrical Engineering*, DOI10.1007/s40998-025-00917-z,2025
21. S.Tamilselvi, R.Prakash, C.Nagarajan, " Adaptive sliding mode control of multilevel grid-connected inverters using reinforcement learning for enhanced LVRT performance" *Electric Power Systems Research* 253 (2026) 112428, doi.org/10.1016/j.epsr.2025.112428
22. S.Thirunavukkarasu, C. Nagarajan, 2024, "Performance Investigation on OCF and SCF study in BLDC machine using FTANN Controller," *Journal of Electrical Engineering And Technology*, Volume 20, pages 2675–2688, (2025), doi.org/10.1007/s42835-024-02126-w
23. C. Nagarajan, M.Madheswaran and D.Ramasubramanian- 'Development of DSP based Robust Control Method for General Resonant Converter Topologies using Transfer Function Model'- *Acta Electrotechnica et Informatica Journal* , Vol.13 (2), pp.18-31, April-June.2013, DOI: 10.2478/aei-2013-0025.
24. C.Nagarajan and M.Madheswaran - 'DSP Based Fuzzy Controller for Series Parallel Resonant converter'- Springer, *Frontiers of Electrical and Electronic Engineering*, Vol. 7(4), pp. 438-446, Dec.12. DOI 10.1007/s11460-012-0212-0.
25. C.Nagarajan and M.Madheswaran - 'Experimental Study and steady state stability analysis of CLL-T Series Parallel Resonant Converter with Fuzzy controller using State Space Analysis'- *Iranian Journal of Electrical & Electronic Engineering*, Vol.8 (3), pp.259-267, September 2012.



26. C.Nagarajan and M.Madheswaran, "Analysis and Simulation of LCL Series Resonant Full Bridge Converter Using PWM Technique with Load Independent Operation" has been presented in ICTES'08, a IEEE / IET International Conference organized by M.G.R.University, Chennai.Vol.no.1, pp.190-195, Dec.2007
27. Suganthi Mullainathan, Ramesh Natarajan, "An SPSS and CNN modelling based quality assessment using ceramic materials and membrane filtration techniques", *Revista Materia (Rio J.)* Vol. 30, 2025, DOI: <https://doi.org/10.1590/1517-7076-RMAT-2024-0721>
28. M Suganthi, N Ramesh, "Treatment of water using natural zeolite as membrane filter", *Journal of Environmental Protection and Ecology*, Volume 23, Issue 2, pp: 520-530,2022
29. Eenaja, A., Sirivarshini, C., Navya, J., Varshitha, G., & Sahithi, N. (2025). The requirement analysis of an offline automated invigilation system with Gmail alert integration. *Journal of Data Science*, 2025(1).
30. Harshitha, G. M., Kotian, R. V., & Shetty, R. (2025, February). ProctorGuard: AI-powered examination monitoring with face and device detection. In *2025 3rd International Conference on Intelligent Data Communication Technologies and Internet of Things (IDCIoT)* (pp. 1562–1567). IEEE.
31. Kumar, S. G. K., Regula, T., Al Hoqani, N. Y., Battina, M. R., & Al Salmi, A. N. (2025, June). Hybrid artificial intelligence and Internet of Things-driven proctoring framework for secure, scalable, and ethical examination monitoring in online and offline environments. In *2025 IEEE International Conference on Computation, Big-Data and Engineering (ICCBDE)* (pp. 590–594). IEEE.
32. Gopinathan, V. R. (2024). Cyber-Resilient Digital Banking Analytics Using AI-Driven Federated Machine Learning on AWS. *International Journal of Engineering & Extended Technologies Research (IJEETR)*, 6(4), 8419-8426.
33. Sulthana, A. R., & Murugeswari, B. (2011, March). ARIPSO: Association rule interactive postmining using schemas and ontologies. In *2011 International Conference on Emerging Trends in Electrical and Computer Technology* (pp. 941-946). IEEE.
34. Anbazhagan, K. (2025). Next-Generation Enterprise Cloud AI for Healthcare: Secure CNN Pipelines and Privacy Controls. *International Journal of Future Innovative Science and Technology (IJFIST)*, 8(6), 15980.
35. Mathew, A. (2023). Learning Metaverse Powered by Artificial Intelligence. *Recent Progress in Science and Technology* Vol. 4, 4, 134-141.
36. Dhinakaran, D. (2022). Joe Prathap P. M, Selvaraj D, Arul Kumar D and Murugeswari B," Mining Privacy-Preserving Association Rules based on Parallel Processing in Cloud Computing,". *International Journal of Engineering Trends and Technology*, 70(3), 284-294.
37. Garg, V. K., Soundappan, S. J., & Kaur, E. M. (2020). Enhancement in intrusion detection system for WLAN using genetic algorithms. *South Asian Research Journal of Engineering and Technology*, 2(6), 62–64.
38. Mathew, A., & Fofang, T. S. I. AI-Driven Fraud Detection: Leveraging Machine Learning for Scam Identification.