Automated Online Proctoring Using Artificial Intelligence

Ashwini N[1] , Aditya Rana[2] , Lakshmi B N[3] , Aditya Abrol[4] , Vinutha K[5] , Aaryan Kumar Gupta[6]

[1]Department of Computer Science and Engineering BMS Institute of Technology and Management Bangalore, India ashwinilaxman@bmsit.in
[2]Department of Computer Science and Engineering BMS Institute of Technology and Management Bangalore, India adityarana338@gmail.com
[3]Department of Computer Science and Engineering BMS Institute of Technology and Management Bangalore, India lakshmibn@bmsit.in
[4]Department of Computer Science and Engineering BMS Institute of Technology and Management Bangalore, India adityarol10@gmail.com
[5]Department of Information Science and Engineering BMS Institute of Technology and Management Bangalore, India vinuthak_ise2014@bmsit.in
[6]Department of Computer Science and Engineering BMS Institute of Technology and Management Bangalore, India aaryankumar@gmail.com
DOI: 10.47750/pnr.2023.14.S02.334

Abstract

Proctoring exams is the current need in social distancing and pandemic driven society. Education institutes and universities must explore alternate technologies to continue their essential educational exams. An Artificial Intelligence (AI) driven remote proctoring is the one method that will ensure end-to-end security for online Exams. The proposed method will help cheating and malpractices. Due to the COVID-19 pandemic, the world is under severe downfalls in terms of economy. Even daily activities get restricted due to enforcements like lockdown. With remote proctoring using AI-based supervision technologies, it will ensure that students do not get indulged in cheating or unfair means throughout the examination. Proctoring exams is the current need in social distancing and pandemic driven society. Education institutes and universities must explore alternate technologies to continue their essential educational exams. An Artificial Intelligence (AI) driven remote proctoring is the one method that will ensure end-to-end security for online Exams. The proposed method will help cheating and malpractices. Due to the COVID-19 pandemic, the world is under severe downfalls in terms of economy. Even daily activities get restricted due to enforcements like lockdown. With remote proctoring using AI-based supervision technologies, it will ensure that students do not get indulged in cheating or unfair means throughout the examination. We compared the working of The Multi-task Cascaded Convolutional Networks (MTCNN) and OpenCV's Caffe model of the Deep neural network (DNN). The MTCNN resulted in the best outcomes when there was contrasting the images. DNN gave a better performance with an impediment speed head movements and can detect side faces. In addition, it gave the speediest fps of all.

Keywords- Artificial Intelligence, Closing or opening mouth, People count, Detection of Mobile phone, Online Proctoring, Gaze tracking.

I.INTRODUCTION

Online examination proctoring are gaining importance because of the comfort of working from home, security and accessibility. This approach cannot just increase the importance of a course or stream-based examinations. Help in Massive Open Online Courses (MOOCs) and other credit-based certifications for the concern of establishing credibility.

Instead of taking examinations in a traditional classroom setup, now we could emphasize comfort-based learning and verification using digital proctoring on a remote basis. According to the United Nations Educational, Scientific and Cultural Organization (UNESCO) Educational Disruption and Response to COVID-19 pandemic, most of the governments across the globe are closing educational institutions and significantly shifting all their ventures to remote and online techniques influencing over 89% of the world's student population.

The essential emphasis remains on the accuracy of the models used for proctoring. The depth of analysis to avoid malpractices in the case of the remote environment includes a high-level analogy of suspicious movement detection and flagging. Elimination or hardening false positives until significant accuracy.

This system involves multiple detection mechanisms such as the face, eyeball movement, change of tabs, device and more. Often, one or more of these techniques together could facilitate the fairness of examination and add credibility and integrity, apart from identity verification to avoid non-repudiation.

II.LITERATURE SURVEY

Since the schooling business is encountering major reform with arising innovations, instructive organizations to lead semester-end and selection tests distantly.

While many schools are closed amid the COVID-19-episode, numerous colleges have started assessments that students can work using web technology [1].

G. Cluskey, et al. presented a paper on online exam cheating without proctor supervision. This work shows how remote proctoring can help to prevent cheating during online exams [2]. Bardesi, H., Al-Mashaikhi, A., Basahel, A. et al. worked on COVID-19 compliant and cost-effective teaching model. This work is more relevant to utilize low-cost measures that educational institutions can adapt to streamline online classes. This is more relevant with the less privileged area where mobile data is costly [3]. Bodiwala, S., Nanavati, N. suggested an efficient stochastic computing-based DNN accelerator with optimized activation functions. This work is noteworthy in face detection [4]. Jain, V., Jain et al. worked on Sign Language detection using AI. They have used multiple techniques to recognize sign gestures students make during online classes [5]. Nandhini V.L. works on an analytics model related to intelligence algorithms building helped to understand a few concepts [6]. An extensive survey on traditional and deep learning-based face sketch synthesis models was reported in one of the research projects [7]. Ansari, M., Singh, D.K. presented a human detection for preventing/reducing COVID spread [8]. S. Roy et al. work on plant disease detection using AI helped to understand the possible approach to use for image detection [9]. S. Mishra et al. worked on feature detection using Deep Learning [10].

Educational Testing Service (ETS) that conducts GRE and TOEFL, among others, is permitting understudies to give tests from home where a delegate screens them for the whole term of the test.

Author/ Year	Topic	Findings	Gap
V. Kazemi, J. Sullivan (2017)	One millisecond face alignment with an ensemble of regression trees	This paper addresses the problem of Face Alignment for a single image.	exploiting the structure of image data, it doesn't helps with efficient feature selection.
Shilpa Ananth (2019)	Faster R-CNN for object detection	It elaborates the technical details of the Faster R-CNN detection pipeline.	The only stand-alone portion of the network left in Fast R-CNN was the region proposal algorithm.
Paul Viola and Micheal Jones (2001)	Rapid Object Detection using a Boosted Cascade of Simple Features	They introduced a Cascade of Classifiers	Haar cascades require a lot of positive and negative training images to train.
Kaipeng Zhang (2016)	Joint Face Detection and Alignment Using Multi-task Cascaded Convolutional Networks	He proposed a deep cascaded multi-task framework which exploits the inherent correlation between them to boost up their performance	accuracy is less over the state-of-the-art techniques on the challenging FDDB and WIDER FACE benchmark for face detection,

Fig. 1. Summary of gap analysis from literature review

III.DETAILED DESIGNED

AI has triple abilities that are vision-based, consolidated with multithreading to involve cooperation:

- Gaze following
- Mouth open or close
- Person and Phone Counting

Aside from this, the discourse from the receiver will be recorded, changed over to message, and contrasted with the content of the question paper to report the number of usual words verbally expressed by the test-taker [11].

IV.ARCHITECTURAL DESIGN OF THE PROJECT

The currently proposed method aims to detect various cheating behaviours during an online exam session with a multimedia

analysis system. Our proposed "online exam process includes two phases: the preparation and the exam phases." The person taking the test needs to authenticate himself before starting the examination with a password and authentication of the face. The exam preparation phase includes a set of steps. They are securely calibrated to guarantee that all connected sensors are functioning efficiently [12]. Further, the person taking the test verbally acknowledges and learns the online exam proctoring (OEP) system with its rules, such as no secondary entry is allowed in the same room, during the exam phase the person taking the test should not depart from the room, etc. The person taking the test in the exam phase is monitored continuously by the OEP system for detecting real-time cheating behavior [13].

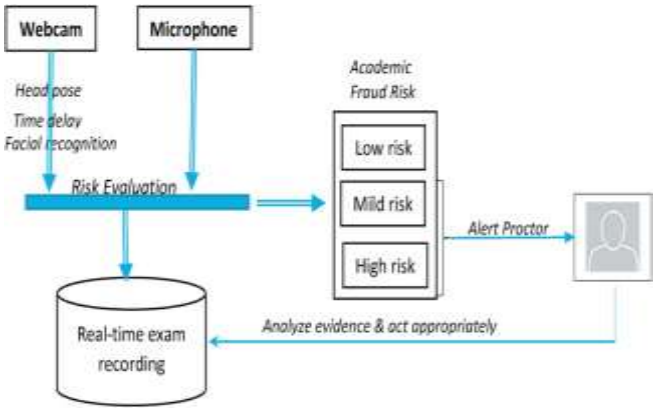

Fig. 2. Architectural Design

V.BEHAVIORAL DESIGN

The student appearing at an exam sometimes cheats by viewing or hearing prohibited information. Henceforth an OEP system needs to be developed to see and listen to what the test-taker hears and see. The system includes two hardware components consisting of a microphone and a webcam. The monitor has the webcam mounted on top it facing the person taking the exam, which serves multiple purposes like identifying the test-taker, his movements and what is he doing through his eyeballs (looks). Due to the growing popularity and reduced cost of wearable cameras, this design analyzes beyond what the test taker sees also decreases cost. Potential cheating is identified by an integrated device microphone which captures what the test taker hears with its rules when any human voices are detected and of the webcam [14].

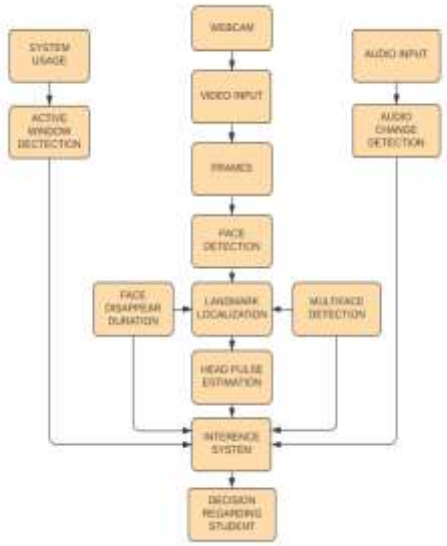

Fig. 3. Behavioral Design

VI.GAZE TRACKING

The proposed method aims to track the person's eyeballs writing the test. It will report when there is a movement of the test-taker towards the right, left, down, or up whenever the test-taker tries to access data through a glance at a signal from someone or a notebook. The above will be done using OpenCV for further image processing and Dlib's facial keypoint detector [15]. The primary thing to do is to find the eyes prior to image processing and to find the location or points of the eyes and then find the face. The rectangular object of the dlib module is taken as input by the facial keypoint detector which are just the coordinates

of a look. The inbuilt frontal face detector of dlib is used to see faces using any classifier. If you want high accuracy and speed it is suggested to use a convolutional neural network (CNN) for partially occluded faces and non-frontal facing faces [16].

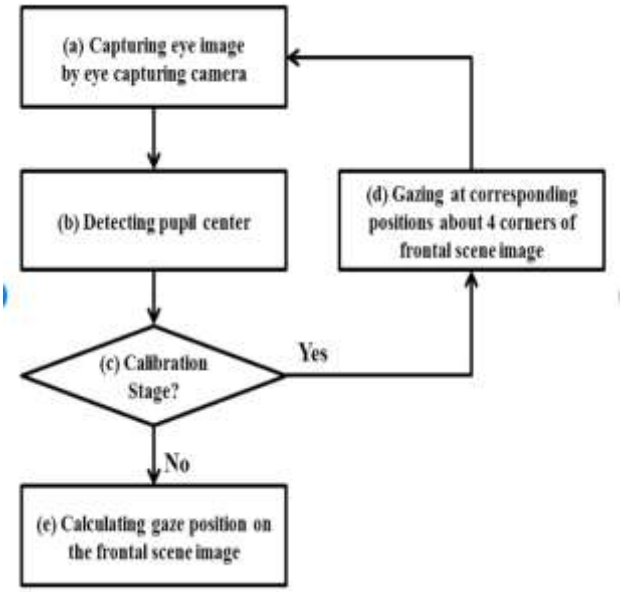

Fig 3: Workflow Diagram for Gaze tracking

The eyeballs of the test-taker are followed and reported in case the person taking the test is glancing from one side to the other side to have a look at a notepad or sign to somebody [17].

Fig. 4. Gaze tracking system testing

Fig. 5. Gaze tracking output

VII.MOUTH DETECTION

This is very similar to eye detection, where Dlib's facial vital points used for the task, and the person taking the test needs to sit straight, and the distance between the lips critical issues with five outer pairs and three inner pairs for 100 frames on an average [18].

The distances between the points increase if the person taking the test opens their mouth. If this increase is more than a particular value for a minimum of two inner pairs and three outer pairs, then an infringement is reported.

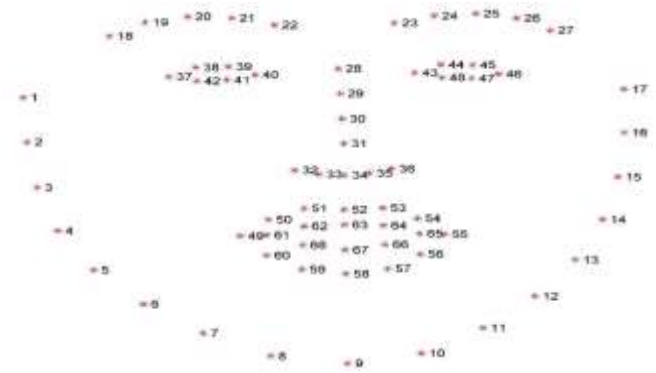

Fig. 6. Dlib's facial key points

VIII.PERSON AND PHONE COUNTING

The counting of person and phone are as follows:

- Here we utilized pre-prepared loads of YOLOv3 prepared on the Common Objects in Context (COCO) dataset to distinguish individuals and cell phones in the webcam feed.
- If the check isn't equivalent to a caution than it can be increased.
- In the COCO dataset, the set of cell phones is 67 and requires to be checked if any class list is equivalent to that.
- Then a cell phone can be reported.

Fig. 7. System testing and Output

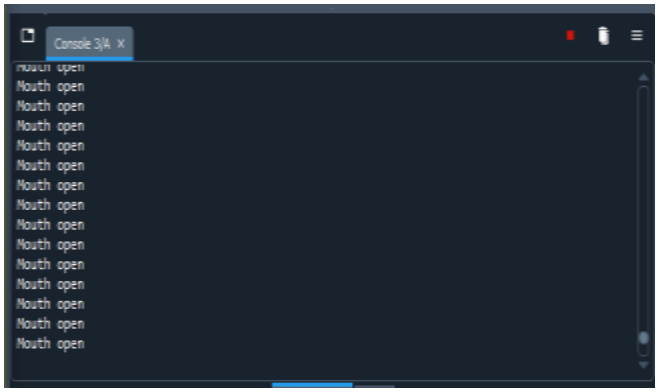

Fig. 8. System testing and Output

- (You Only Look Once) YOLO v3 pre-prepared model can be utilized to arrange 80 items and is really quick and close to as precise as Solid-state drives (SSD).

- It has 53 convolutional layers with every one of them followed by a clump standardization layer and a cracked Rectified Linear Unit (RELU) initiation.
- To down sample, rather than utilizing pooling they have utilized a step of 2 in convolutional layers.

Fig. 9. Workflow Diagram

To include people or anything present in the module we need to know its list in it. The record of individual is 0 so we need to check on the off chance that the class anticipated is zero, we increase a counter [19].

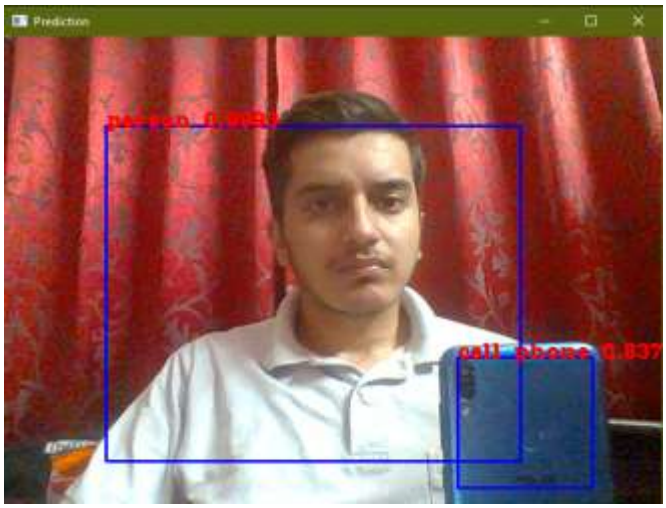

Fig. 10. System testing and Output

Fig. 11. System testing and Output

IX. RESULTS AND DISCUSSION

Results are discussed under the following three categories:

- As eye-following and mouth location depend on dlib we can make a solitary string for them, and another string can be utilized for the YOLOv3 assignments: individuals tallying and portable discovery.
- YOLOv3 is applied to the webcam feed in the operation count_people_and_phone(). Later, the classes of items identified are verified and those fitting are moved if two or more individuals are recognized, or a cell phone is distinguished.
- Capacities are sent to independent strings which have limitless circles in them, which can be broken by delegates by squeezing 'q' twice.

X.TEST CASE FOR ALL THE THREE MODULE AND COMBINED USING MULTI THREADING

This framework can be joined with a protected program to forestall cheating. This task doesn't dispose of the requirement for a delegate as he is needed to play out specific activities. This framework can be joined with a safe program to forestall cheating.

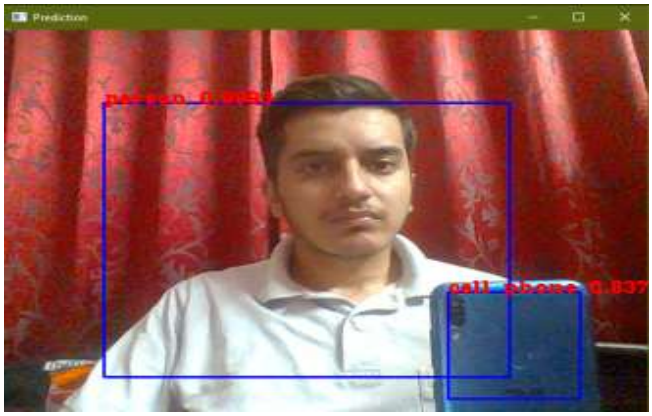

Fig. 12. Combined output Using Multi-Threading

Fig. 13. Combined output Using Multi-Threading

XI.CONCLUSION

Semi computerizes administering dependent on vision and sound-based abilities to forestall cheating in online tests and screen various understudies at a time. The work consists of two sections, vision and sound-based functionality. This mechanized delegating framework can screen clients naturally through the webcam and mouthpiece.

The proposed framework can join with a safe program to forestall cheating. The Cascade classifier gave the most exceedingly terrible outcomes for a large part of the test alongside a ton of bogus positives. Dlib had predictable outcomes with a slight edge to MTCNN. However, Dlib can't distinguish tiny appearances. Additionally, if the size of pictures is exceptionally outrageous and there is a guarantee that lighting will be acceptable alongside the least impediment. For the most part, forward-looking the face MTCNN may give the best outcomes as seen when we were contrasting the images. For general PC vision issues, OpenCV's Caffe model of the DNN module is awesome and can be used further. It functions admirably with an impediment, speedy head developments, and can distinguish side faces too. In addition, it additionally gave the speediest fps among all.

XII.FUTURE

Present online exams became possible through innovative proctoring solutions. The future of remote proctoring is quite bright because it ensures cheat-proof online assessments. Large e-learning institutions and global corporations have embraced it

wholeheartedly. The AI-driven procedure is becoming more common. The AI-driven solutions become more accurate when it uses a large number of training data available from participating students.

XIII. REFERENCES

[1] Jun Jiang, Zhong-bing Hu ‘‘Feature enhanced faster R-CNN for object detection’’ in Conference: Automatic Target Recognition and Navigation, February 2020. DOI:10.1117/12.2539211

[2] G. Cluskey, C. R. Ehlen and M. H. Raiborn, "Thwarting online exam cheating without proctor supervision", J. Acad. Bus. Ethics, vol. 4, pp. 1-7, 2011.

[3] Bardesi, H., Al-Mashaikhi, A., Basahel, A. et al. COVID-19 compliant and cost effective teaching model for King Abdulaziz University. Int. j. inf. tecnol. 13, 1343–1356 (2021). https://doi.org/10.1007/s41870-021-00684-0

[4] Bodiwala, S., Nanavati, N. “An efficient stochastic computing based deep neural network accelerator with optimized activation functions”. Int. j. inf. tecnol. 13, 1179–1192 (2021). https://doi.org/10.1007/s41870-021-00682-2

[5] Jain, V., Jain, A., Chauhan, A. et al. “American Sign Language recognition using Support Vector Machine and Convolutional Neural Network”. Int. j. inf. tecnol. 13, 1193–1200 (2021). https://doi.org/10.1007/s41870-021-00617-x

[6] Nandhini V.L., Suresh Babu K., Roy S.K., Sharan P. (2021) “Multichannel Biosensor for Skin Type Analysis”. In: Patnaik S., Yang XS., Sethi I. (eds) Advances in Machine Learning and Computational Intelligence. Algorithms for Intelligent Systems. Springer, Singapore. https://doi.org/10.1007/978-981-15-5243-4_57

[7] Balayesu, N., Kalluri, H.K. “An extensive survey on traditional and deep learning-based face sketch synthesis models”. Int. j. inf. tecnol. 12, 995–1004 (2020). https://doi.org/10.1007/s41870-019-00386-8

[8] Ansari, M., Singh, D.K. “Monitoring social distancing through human detection for preventing/reducing COVID spread”. Int. j. inf. tecnol. 13, 1255–1264 (2021). https://doi.org/10.1007/s41870-021-00658-2

[9] Roy, Sandip Kumar and Sharan, Preeta. "13 Image-based hibiscus plant disease detection using deep learning". Internet of Things and Machine Learning in Agriculture: Technological Impacts and Challenges, edited by Jyotir Moy Chatterjee, Abhishek Kumar, Pramod Singh Rathore and Vishal Jain, Berlin, Boston: De Gruyter, 2021, pp. 251-274. https://doi.org/10.1515/9783110691276-013

[10] S. Mishra, A. Prakash, S. K. Roy, P. Sharan and N. Mathur, "Breast Cancer Detection using Thermal Images and Deep Learning," 2020 7th International Conference on Computing for Sustainable Global Development (INDIACom), 2020, pp. 211-216, doi: 10.23919/INDIACom49435.2020.9083722.

[11] Viola, Paul , Jones, Michael ‘‘Rapid Object Detection using a Boosted Cascade of Simple Features” in IEEE Computer Society Conference on Computer Vision and Pattern Recognition, 2001. CVPR 2001. Proceedings of the 2001 DOI: 10.1109/CVPR.2001.990517

[12] Zhang, Kaipeng, Li, Zhifeng Qiao, Yu, ‘‘Joint Face Detection and Alignment Using Multitask Cascaded Convolutional Networks” in IEEE Signal Processing Letters,2016. DOI: 10.1109/LSP.2016.2603342

[13] Koenig, Michael, and Kenneth Neveroski. "The origins and development of knowledge management." Journal of Information & Knowledge Management 7.04 (2008): 243-254. DOI: 10.1142/S0219649208002111

[14] J. Ramberg and B. Modin, ‘‘School effectiveness and student cheating: Do students’ grades and moral standards matter for this relationship?’’ Social Psychol. Educ., vol. 22, no. 3, pp. 517–538, Jul. 2019. DOI: 10.1007/s11218-019-09486-6

[15] Yousef Atoum, Liping Chen, Alex Liu, Stephen Hsu “Automated Online Exam Proctoring” January 2019 IEEE Transactions on Multimedia PP(99):1-1 DOI: 10.1109/TMM.2017.2656064

[16] M. Ghizlane, B. Hicham, and F. H. Reda, ‘‘A new model of automatic and continuous online exam monitoring’’ in Proc. Int. Conf. Syst. Collaboration Big Data, Internet Things Secur. (SysCoBIoTS), Dec. 2019, pp. 1–5. DOI: 10.1109/SysCoBIoTS48768.2019.9028027

[17] Vahid Kazemi, Josephine Sullivan ‘‘One Millisecond Face Alignment with an Ensemble of Regression Trees’’ in Conference: Computer Vision and Pattern Recognition, Columbus, Ohio, USA, June 2017. DOI:10.13140/2.1.1212.2243

[18] Jasmin, M., and S. Beulah Hemalatha. "Security for industrial communication system using encryption/decryption modules." International Journal of Pure and Applied Mathematics 116.15 (2017): 563-568.

[19] M. Reale, S. Canavan, L. Yin, K. Hu and T. Hung, "A multi-gesture interaction system using a 3-D iris disk model for gaze estimation and an active appearance model for 3-D hand pointing", IEEE Trans. Multimedia, vol. 13, no. 3, pp. 474-486, Jun 2011. DOI: 10.1109/TMM.2011.2120600.