HEURISTIC BASED AUTOMATIC ONLINE PROCTORING SYSTEM

Conference Paper · July 2015

CITATIONS
0

READS
74

1 author:

Athi Narayanan
Amrita Vishwa Vidyapeetham
26 PUBLICATIONS **79** CITATIONS

SEE PROFILE

Heuristic-based Automatic Online Proctoring System

Vishnu Raj R S
mail2vishnurajrs@gmail.com

Athi Narayanan S
mail2athi@gmail.com

Kamal Bijlani
kamal@amrita.edu

Amrita E-Learning Research Lab, Amrita Vishwa Vidyapeetham University, Amritapuri, Kollam, Kerala, India.

***Abstract*- This paper proposes a novel multi-modal method for automatic online proctoring using a combination of image processing, audio processing and PC monitoring techniques. In the proposed system the remote proctor only has to inspect the examination room. The proposed system is evaluated with a dataset mimicking the malpractice scenarios; the accuracy of the system is demonstrated with false positive rate of 0.08 and true negative rate of 0.13.**

Keywords - E-learning, Proctoring system, Face Detection, Inference system, On-line examination

I. INTRODUCTION

Online courses and examinations have now become very popular with the advent of Massive Open Online Courses (MOOCs). The main motivation to propose this system is the common drawback we found in the existing online proctoring tools, that is manual online proctoring. By analysing these facts, we found that it is very useful to have a tool that can do online proctoring without any remote proctor present at the other end to monitor the whole exam.

II. RELATED WORK

In almost all the traditional system, it needs a feedback session to assess the quality of courses. But in a work [1] done by Stylianos Asteriadis, Paraskevi Tzouveli, Kostas Karpouzis & Stefanos Kollias they proposed a system which non-intrusively determines the quality of the courses by analyzing the user attention level which extracts the feedback from the student response. In another work [2] done by N.L Clarke, P. Dowland & S.M. Furnell they proposed a novel method to remote and electronically invigilate the students during examination which uses transparent authentication to provide a continuous, non intrusive verification of identity of the candidate.

III. PROPOSED SYSTEM

In the proposed system, the student needs to have a webcam equipped computer system and it should be placed in a way that his face can be clearly visible from the front view. As an initial checking process, the student will be asked to show the whole room in which the online exam is going to happen. The first part of proctoring is face detection. After detecting the face, the detected face is tracked to ensure the continuous presence of the student throughout the examination. Along with the video input, audio is also captured to detect whether there is any unwanted, specifically if there is anybody talking inside the room. Even in these cases, there is a possibility of student user trying copy from a file with in the computer or trying search in internet for answers. For avoiding that case, the active window details are also being collected to detect whether the student is trying to access some other folder or additional browsers in the computer. More characteristics like hand movements can also be detected and used to determine the user's nature while examination. Then all these are given as input to the heuristic based inference system. By analyzing all these inputs, the inference system is deciding whether there is any malpractice or not.

A. *Inference System - Detection of Malpractice*

The main goal of the Inference System is to make a decision regarding the user action. It has the following

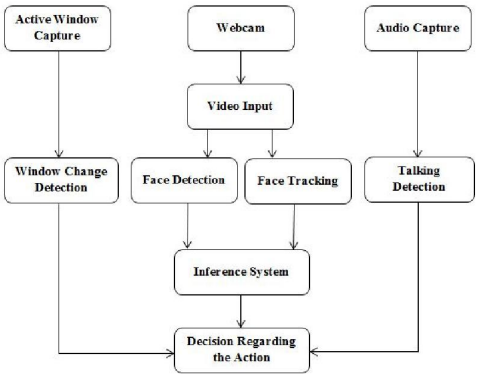

Figure 1. System Architecture of the proposed system

inputs from face detection, face tracking, audio capture and active window capture feature of the system. In TABLE I we can see set of rules to classify the action of the student.

IV. EXPERIMENTAL RESULTS

For the evaluation of the system, we used the following dataset. For the process of evaluation we have created our own dataset which includes twelve separate videos of duration 10 minutes and 10 attempts of malpractices each.

A. *Experiments*

The first part of proctoring is face detection. To evaluate the face detection feature of our system, we use the first video in the dataset. From the first frame itself the face is detected. Fig. 2 shows the detected face of the exam taking student. After detecting the face the next step is to track the detected face to ensure the continuous presence of the student throughout the examination. Since there are a lot of face movements that is happening in the second video of our dataset we use that video for evaluating the face tracking feature. Fig. 3 shows the face tracking output of our system. It shows the various movement of face during the online examination. For detecting that, the multiple face detection feature is evaluated. This evaluation is done using the fifth video in the dataset. Fig.4 shows the experimental output of

TABLE II: Inference System Rules to classify the action of the student

Number	Rules	Decision
Rule 1	Detected face missing from the frame at any point of time during the examination	Malpractice
Rule 2	Face moving far away from the initial position for more than 2 times	Warning
Rule 3	Face moving far away from the initial position for more than 4 times.	Malpractice
Rule 4	Multiple face detected in the frame during examination	Malpractice
Rule 5	Sound above the threshold of Mean centered amplitude for more than 2 times	Warning
Rule 6	Sound above the threshold of Mean centered amplitude for more than 4 times	Malpractice
Rule 7	Open any other window in the system other than the online examination browser window	Warning

978-1-4673-7334-0/15 $31.00 © 2015 IEEE
DOI 10.1109/ICALT.2015.127

multiple face detection. In the fifth video, the second person comes and sits near the student, to help him during the exam. Our system has successfully detected the multiple face. Video input alone cannot give clarity to the Inference system on the detection of malpractice. For evaluating the audio capture feature, we use the third video in the dataset. Fig.5 shows the plot of audio captured. In this video, the student is trying to talk to somebody. In that case our system has successfully detected the voice above the mean centred amplitude. Then we evaluated Active Window Capture feature. Here we made a real time online examination environment and tested our system. We started attending an online demo quiz [11] with our proposed system running on the background and tried to open other windows in between. All the activities were successfully tracked by our system. TABLE II shows the window change tracked by our system. Thus the overall system is evaluated. TABLE III shows the malpractice detection rate of the system. By evaluating the system with the dataset created, the accuracy of the system is demonstrated with false positive rate 0.08 and true negative rate 0.13.

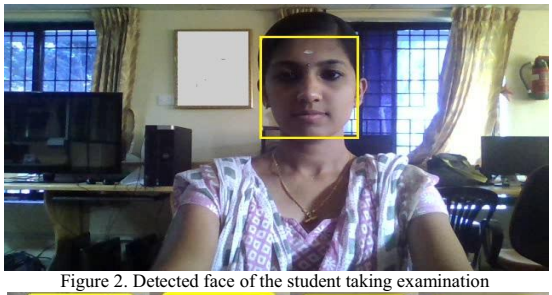

Figure 2. Detected face of the student taking examination

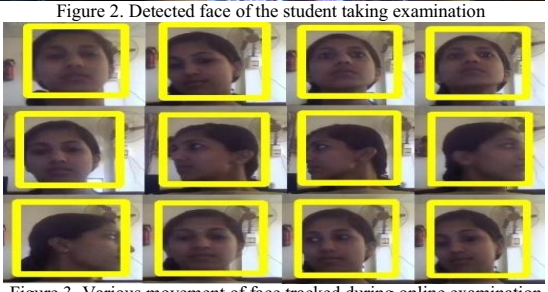

Figure 3. Various movement of face tracked during online examination

Figure 4. Multiple face detected during the online examination

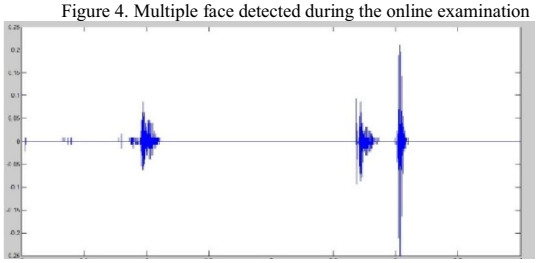

Figure 5. Audio captured during the online examination

TABLE II. Window change recorded during online examination

Window Name	Start Time	End Time
Minnesota State Colleges and Universities - Take this quiz- Mozilla Firefox	Thu Jan 01 13:55:54 IST 2015	Thu Jan 01 13:56:15 IST 2015
Google - Mozilla Firefox	Thu Jan 01 13:56:16 IST 2015	Thu Jan 01 13:56:48 IST 2015
My need to take this course now is- Google Search - Mozilla Firefox	Thu Jan 01 13:56:48 IST 2015	Thu Jan 01 13:56:59 IST 2015
Minnesota State Colleges and Universities - Take this - Mozilla Firefox	Thu Jan 01 13:56:59 IST 2015	Thu Jan 01 13:57:21 IST 2015
Local Disk (D:)	Thu Jan 01 13:57:21 IST 2015	Thu Jan 01 13:57:39 IST 2015

TABLE III. Malpractice Detection Rate of the proposed system

Dataset Video	Total Number of Malpractices Done	Total number of Malpractices detected	False positive
Video 1	0	1	1
Video 2	10	6	0
Video 3	10	13	3
Video 4	10	10	0
Video 5	10	10	0
Video 6	10	6	0
Video 7	10	9	0
Video 8	10	7	0
Video 9	10	9	0
Video 10	10	14	4
Video 11	10	8	0
Video 12	10	11	1

V. CONCLUSION

The paper has proposed a novel method of a heuristic-based automatic online proctoring combining image processing, audio processing and PC monitoring techniques. This removes the necessity to have a remote proctor throughout the examination to control cheating.

REFERENCES

[1] Stylianos Asteriadis and Paraskevi Tzouveli and Kostas Karpouzis and Stefano Kollias, ”Estimation of behavioural user state based on eye gaze and head pose- application in e-learning environment”, Multimedia Tools and Applications February 2009 Volume 41,Issue 3,pp469-493,DOI 10.1007/s11042-008-0240-1.

[2] N.L Clarke, P.Dowland and S.M.Furnell, ”e-invigilatr:A Biometric-Based Supervision System for e-Assessment” Proc.Information Society(i- Society),2013 International Conference- pp.238-242.

[3] ProctorU: Real People Real Proctor. http://www.proctoru.com

[4] Software Secure- Test Proctoring Solutions for Distance Learning. http://www.softwaresecure.com

[5] Tegrity - http://www.tegrity.com/.

[6] Live Online Proctoring Refined-Bvirtual Inc. http:// www.bvirtualinc.com/

[7] Proctor Cam - http://www.proctorcam.com/

[8] Respondus. Respondus – Assessment Tools for Learning Systems. http://www.respondus.com/.

[9] Loyalist Certification Services. http://www.loyalistexams.com/.

[10] Kryterion Testing Solutions. http://www.kryteriononline.com/.

[11] Minnesota State Colleges and Universities – Take the online education quiz. http://www.mnscu.edu/online/distancelearningquiz.php