DEVELOPMENT OF A MONITORING SYSTEM FOR DISTANCE EDUCATION EXAMS

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1. ABSTRACT

Distance education systems have rapidly developed and become an important educational method. Distance education may use television and / or internet, smartphone applications and even social media. In this sense, each institution is making efforts to make distance education more current and more effective. One of the important points about distance education is the exams. New approaches are being tried to achieve successful tests in distance education. Although the distance education examinations can be successfully performed by utilising webcams and supervisors; there are some concerns. The increasing number of students, the rising costs and supervisors who do not take the safety of the exam seriously are some of the main concerns and these concerns have been caused distance education systems to search for systems where students can take the exams automatically. In this sense, it is seen that the development works of automatic systems based on examining the images obtained from webcams with computer vision methods are started. It is envisaged that image processing methods will provide successful results in order to determine the identity of the student who entering the examination with face recognition methods and to observe that the rules are obeyed during the examination. In this context, it will be possible to develop automatic test monitoring systems through the use of image processing methods and the examination of statistical information about the exam by using artificial intelligence methods. In this study, it is aimed to give a general overview of the system by examining the general structure of the system and the image processing methods to be developed for use in the exams of distance education systems.

Keywords: Distance Educations, Image Processing, Artificial Intelligence

2. INTRODUCTION

Today, distance education has made an important place in education system itself. Both higher education institutions and various certifying institutions and / or organizations provide distance education.

Manisa Celal BAYAR University describes distance education as follows: "Distance Education; Visual and audio lectures in a completely virtual environment through the existing computer technologies without the necessity of the student and the instructor to come to the campus completely independently from the time and place. It is also possible that the participant can watch and replay them at any time, is a rational, contemporary, innovative educational system that is in its environment. "(Manisa Celal Bayar Üniversitesi, 2017)

Distance education can be made via television and/or the internet (Varol & Varol, 2004), via smartphone applications (Varol, 2015) or even via social media (Varol, Ahmed, & Yıldırım, Distance Learning With Social Media,, 2013). In this sense, each university is making efforts to make distance education more current and more effective (Varol, Distance Education Studies of Firat University, 2010). New approaches have also been tried to achieve successful tests in distance education (Varol, New Approaches in Testing as a Distance, 2016).

Distance education is an educational system that is frequently used in our country and in other countries and has made itself widely accepted by large masses of users, therefore, has great importance. There are over 80 universities in our country which offers distance education.

Even though distance education allows students to study in their own home environment; Testing of given education through exams is a continuing problem of distance education. By the presentation of course videos and training materials online and the training of the relevant learners through video conferencing systems have been successfully overcome the problems in education part; however, there are still problems in testing the students in distance. The development of systems to detect and prevent cheat attempts is actively needed and solution pending today. Although systems have been developed in this regard for students to enter the exams with cameras and observer staff to monitor the students during the exam to prevent copy attempts through the cameras, there are problems in these systems. Points that should be taken into consideration are how well observers could follow the students and the cost of each examiner would be increased due to the fee to be paid.

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In this context, the development of automatic test follow-up and control systems for distance education systems is demanded in terms of decreasing costs and in order to carry out exams properly.

3. METHOD

An automatic control system has been examined as three main steps. The first step is to use eye detection algorithms to find the position of the user's eyes from the image obtained from the camera. The second step is the use of gaze detection algorithms to derive information on where the user is looking from the eye position information obtained from the eye finding algorithm. The third and final task is to extract information about when, how long and where the user looks at, to investigate this information with artificial intelligence algorithms, and to determine the attempt of a cheat.

3.1. Eye Detection

There are many eye detection methods with acceptable error rates (Asadifard & Shanbezadeh, 2010) (Chirchi & Waghmare, 2013) (Gwon, Cho, Lee, Lee, & Park, 2013) (Jung, Kim, Son, & Kim, 2017) (Lin & Yu, 2011) (Yuille, Hallinan, & Cohen, 1992). These eye detection methods usually tested with an eye database such as BioID (BioID Face Database - FaceDB, n.d.), ColorFeret (ColorFeret). These databases contain more than thousand frontal human face images in different light conditions, different gender and age. Some of the eye detection methods have more than the %95 success rate for 0.05 error margin which makes them more than capable in finding eye position of humans. By utilizing these methods it is possible to determine eye position of the user with high accuracy which is necessary for the first stage of the system.

3.2. Gaze Detection

After the first stage which is finding positions of eyes, the second stage of our system is finding the gaze of the user. In order to find the gaze of the user, we need to make an assumption. Our assumption is the camera is in the top middle of the monitor. This assumption is always true for laptops but for desktop computers user must place his/her camera to top middle of his monitor.

In order the find gaze a gaze detection algorithm must be utilized. (Xia et al., 2016) published a gaze tracking algorithm with use of corner detector. This algorithm is good choice for the job.

To find our region of interest which is the monitor; users will be asked to look four corners of the computer monitor and then the user will be asked to look middle of the monitor. Figure 1 is showing where the user will be asked to look, gray squares are for finding where monitor are and the black square is for confirmation.

![Figure 1 Points of interest for finding gaze](image)

By using these five points; the gaze of the user will be categorized in 9 main area. In Figure 2 these areas are shown.

![Figure 2 Categorized gaze areas](image)
User data will be collected during his/her exam. Collected data will contain which categorized area has gazed by the user and what was the duration of the gaze, which question was shown on the monitor, and timestamps for each gazed area. After collecting these data third step of the system will use these data to evaluate exam of the user by using artificial intelligence methods.

**Artificial Intelligence**

The third step of the system is to use data with artificial intelligence methods to determine if the user made his exam according to rules. In order to use artificial intelligence methods, the user data will be used to create a database table. As seen in Table 1 database tables contains six columns. UserID and QuestionID columns are unique and define student and the answered question respectively. Timestamp column specifies the exact time of the start of the gaze and Gaze Duration column represents the duration of the gaze. Eye coordinates column represent positions of the eyes (left eye x coordinate, left eye y coordinate, right eye x coordinate, right eye y coordinate) and finally, Gaze Area column specifies the area where the gaze is directed.

<table>
<thead>
<tr>
<th>UserID</th>
<th>QuestionID</th>
<th>Timestamp</th>
<th>Gaze Duration</th>
<th>Eye Coordinates</th>
<th>Gaze Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>1042</td>
<td>23</td>
<td>13.56.07</td>
<td>2s</td>
<td>255,253, 305,254</td>
<td>Top Left</td>
</tr>
<tr>
<td>1042</td>
<td>23</td>
<td>13.56.09</td>
<td>10s</td>
<td>248,257, 295,258</td>
<td>Monitor</td>
</tr>
<tr>
<td>1042</td>
<td>23</td>
<td>13:56:19</td>
<td>3s</td>
<td>252,260, 290,259</td>
<td>Bottom</td>
</tr>
</tbody>
</table>

The user’s data can be inspected in three different manners. First, a rule based inspection will be made in user’s data. Such as if the user looked other places than the monitor for a duration of more than 10 seconds for more than %25 of the questions it is a strong possibility for that user to be cheating. These rules will be made according to the general idea of how one can cheat. Secondly, by utilizing clustering algorithms a training set consisting of students who are cheating and not cheating will be clustered and classification algorithms will be used to determine to which cluster the data of the student are belonging. Finally, the data of all students entering the examination will be analysed analytically.

4. **OTHER REQUIREMENTS**

In order to create a full system there are other requirements which are ID detection and detection of cheat by talking or listening.

Today, authentication via camera is very easy and common application. There are various applications that can verify the user ID by taking advantage of biometric features. Some game consoles and even some android application are using this feature to identify the users.

The matter of cheating by talking is also easily detectable thanks to applications which can convert voice to text. In our system such an application can be used to create text file for all talk that takes place during exam. After that this text file can be compare with the text of exam. Text file of the exam should contain exam specific words which needed answer a question. If user’s text file contains these words then we can assume that user was cheating.

5. **CONCLUSION AND SUGGESTIONS**

This study focuses on the need for automated testing in distance education systems and includes methods that can be used in the realization of such a system with today’s technology. It has been argued that such a system will cause lower cost, more stability and more security for distance education systems. It is possible for a human to make mistakes however automated systems do not make such mistakes and are able to improve and evolve as new updates are made. We believe that it is possible to develop an automated monitoring system for distance education. Such a system can identify the identity of the user if it is authentic, can monitor the user during the exam and detect inappropriate behaviors in the exam rules, and can achieve higher success at less cost than using real people to monitor students.
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