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AUTHENTICITY DETECTION OF EYE IMAGES USING DEEP LEARNING TECHNOLOGY IN ONLINE EXAMS

The use of online education technologies is one of the most effective ways to achieve the universal goal of quality education throughout life for the sustainable development of UNESCO. During the writing of the article, the features that have appread in the field of application of online exam technologies will be described. The existing forms, methods and tools for conducting the exam in an online format, their potential and risks are analyzed. Attention is drawn to the fact that the methods and tools used for conducting online control have disadvantages, such as significant costs in organizing proctoring and difficulties in assessing one of the student's key competencies, namely, readiness to use systematized theoretical and practical knowledge to formulate and solve research problems.

This research introduces an innovative proctoring system that harnesses deep learning techniques, specifically the Yolo algorithm. The primary objective of this system is to accurately detect the eyes of the exam-taker by utilizing a standard web camera as the sole input source. The obtained results from the deep learning model are subsequently subjected to processing through the Cascaded Haar Classifier to yield a definitive outcome. The proposed approach demonstrates considerable proficiency in discriminating between authentic exam-takers and static images, achieving a notable level of accuracy. Leveraging the capabilities of deep learning in conjunction with the cascaded classifier enables real-time eye detection and localization within images or video frames, thereby establishing the proctoring system as a reliable and effective solution for ensuring academic integrity during online examinations.

***Key words**: Distance learning technologies, online examination, eye tracking, YOLO, Darknet Framework, Cascaded Haar Classifier, Proctoring system.*

Intoduction. Since mid-March 2020, Moscow universities have switched to distance learning due to the high-readiness regime in the conditions of the spread of coronavirus [1]. This situation was a definite challenge to Russian higher education, a test of its ability to quickly adapt to the remote form of work. Distance learning technologies have been used in teaching for more than a year, students and teachers have persona offices, mail, electronic space in the unified educational system of their university for placing educational materials, testing, attching completed assigments, practical work. However, this format of work is not comprehensive, it is used by teachers as necessary, in particular, to build an individual trajectory of education of a particular student, study group. Therefore, the promptness with which both teachers and students joined the online format of seminars, practical classes, lectures, allows us to conclude about the flexibility of our educational system, about significant developments in the field of digitalization of education.

The most pressing issue today is the issue of student certification, conducting current and final control. So, in the current conditions, the rectors of Russian universities spoke out for the willingness of universities to hold the session remotely [2].

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And then the point-rating eveluation system comes to the fore, which allows you to evaluate the current work in in accordance with the technological map of the discipline, and at the end, according to the results of the exam or test, to put a final grade. This is a convenient tool in the hands of a teacher. Discussions, discussion of essays, analytical notes, reports and practical classes can be organized during the semester in the format of webinars, and students can send calculation and graphic works, essays, summaries of articles to the teacher for verification by e-mail or attach assigments in their personal cabinets. This allows you to do, for example, the Microsoft Teams program, in which work, in particular, teachers of Moscow State Pedagogical University. MADI, RANHIGS and other universities of the capital.

The written form of the exam in the conditions of distance learning provides for students to attach documents with answers to the «Tasks» cell of MS Teams, Moodle, Zoom or send them by e-mail to the teacher. The advantage in the organization of the written exam is the possibility of checking the originality of the materials sent by the student through the «Anti-Plagiarism» system, the disadvantage is the lack of supervision of the examinee during the assigment, which does not allow to unambiguously determine who exactly performed the issued written assigment. [5]

The final chord is a test or exam, and here the question arises about how to conduct them in an online learning environment. But if teachers agree to set a credit for a discipline on the scale of a point-rating evalution system, in which, for example, the condition for obtaining a credit it 60 points or more scored by a student while working in a semester, then it is problematic to set an exam grade without an exam. After all, the exam is the stage of control that allows you to assess the depth of a student's knowledge, his scientific outlook and the ability to apply theoretical material in practice. This article raises the problem of conducting an online exam, analyzes the existing forms, methods and tools of its implementation, their potential and disadvantages, and also offers methodological recommendations for conducting the exam in an online format.

The present investigation employs a set of fundamental tools for proctoring purposes, encompassing identity verification of exam participants, the prohibition of additional web browsers, and the monitoring of student behavior. These sophisticated programs facilitate the administration of examinations in remote settings, enabling students to partake in assessments from their own homes via personal computers. The utilization of the YOLO (You Only Look Once) model in conjunction with a well-trained model enables real-time localization and extraction of the eye regions from the exam-taker's visual feed.

Proctoring technologies serve as invaluable aids to educators in identifying areas of least comprehension among students and subsequently directing their attention during subsequent instructional sessions to address these specific deficiencies. A key characteristic of the proctoring system lies in its primary function, which is not centered on individual identification but rather focuses exclusively on analyzing the exam-taker's movements throughout the assessment process. Should a user's face deviate from the authorized trajectory, resulting in a loss of fixation, the system promptly issues a warning message to the individual.

As an outcome of incorporating the proctoring system, the instructor receives a comprehensive summary report containing crucial data on student behavior, which plays a pivotal role in the determination of assessment outcomes. Leveraging a combination of pertinent features, such as the duration of examination, frequency of authentic violations, and occurrences of suspicious behavior, the teacher gains the ability to construct a comprehensive overview of the entire task completion process[6]. This information aids the instructor in making informed decisions regarding the evaluation and enrollment of examination results.

The objective of this study was to construct a liveness detection model for online exams, employing computer vision techniques. To accomplish this aim, a dataset of approximately 4000 images of exam-takers was curated and utilized in training a model, integrating the YOLO (You Only Look Once) and Darknet Frameworks. The determination of the model's optimal weight was predicated on the calculation of the Mean Average Precision (mAP). Specifically, the model was trained to focus on the eye region of the exam-taker and subsequently predict whether the individual under examination was a genuine person or merely represented by an image.

Literary review. «High-quality online exams can no longer be considered a second-rate way of learning. They form students competencies no worse than face-to-face classes», said **Igor Chirikov**, head of the study, senior researcher at the University of California Berkeley and associate fellow at the HSE Institute of Education.

Most likely, the transition to an online format of higher education will be accelerated. The current situation caused by the Covid-19 pandemic has actually become a forced live experiment in this transition.

"We see that universities have adapted much faster in this situation, which have made better progress in creating and using online exams," says Chirikov. And the national platform with online courses from leading universities, in their opinion, gave Russia a great advantage for the rapid transfer of universities online.

"Now it is especially important to invest in the creation of advanced online platforms, interactive online content and the development of new teaching methods," says Igor Chirikov. This will expand access to quality education without significant additional costs and ensure the flexibility of student trajectories. In addition, it will help to prepare for various unforeseen situations, such as the coronavirus epidemic that has affected the whole world."[2]

Firstly, students can pass certification within e-courses, and there are now more than 1.2 thousand of them in TPU in a variety of disciplines. An external proctoring system is supposed to be used here — this is a system for monitoring and controlling remote testing, such technologies are used in many of the world's leading universities. Such a scheme is more suitable, of course, for an intermediate assessment of student success.

TPU also has its own platform for evaluating the results and competencies of students. On it, students will be able to perform tasks in the format of computer testing. The correctness of the answers is checked automatically. We are now also connecting a proctoring system to this platform. Examination tickets of the traditional form will also be placed on it. Students will upload answers to the questions directly to the teacher or discuss them at the webinar. Teachers will be at their workplaces, and students will be in dormitories or at home. This option ensures transparency of the procedure for the administration and students, and we recommend it to teachers who do not have exam tickets in the test form.

Admission of exams, tests, defense of course projects and works, practices in traditional oral form will also be organized through webinars. In the process, the student's identity will be identified, possible violations will be monitored, and the exam protocol will be maintained.

Teachers and heads of their departments will decide which of these schemes to choose, depending on their needs. Everything is flexible here [3].

Due to the transition of the educational process to a remote format at the K.A. Timiryazev RGAU-MSHA in the process of online exams, including state exams, it became necessary to ensure a high level of reliability and reliability of the diagnosis of educational results, for which proctoring was used. Even before the full transition to distance learning at the university, key provisions on the implementation of e-learning and the use of distance learning technologies in the implementation of educational programs were approved, including recommendations for the admission of current exams have been developed, term papers, student debts and the organization of the state final certification using information and communication technologies.

At the Faculty of Humanities and Pedagogy of the FSUE About 140 full-time teachers work at the RGAU-MSHA named after K.A. Timiryazev, who had to take exams in such an unusual format. More than 70% of teaching staff noted that during the certification procedures, some students tried to violate the requirements and recommendations of local regulations acts of the university related to the implementation of e -learning and DOT. Note that in the presence of an auto-proctoring system, this percentage could be much lower, since the automated system is much more objective [5].

Method and materials. The security of facial recognition systems is becoming increasingly important as the technology becomes more widely used. Fake faces, for example, created from images or video clips of people, can be used to deceive facial recognition algorithms[7]. As a result, a real face recognition system usually includes a face liveness detection module that can distinguish a fake face from a real one. The determination of the liveliness of the face has aroused great interest, and many studies have been proposed. A real face has a three-dimensional structure in the physical world, while a fake face from a photo or video is a two-dimensional plane. The image of a fake face just seems to be a mirror image and has some degree of shape deformation compared to the image of a real face. It is impossible to distort the color and lose any important information during the second shooting.

The objectives of the proposed work are the following:

- Implement a reliable facial liveness detection system to detect fake attacks.
- Distinguish between a legitimate and illegitimate subject during the exam.
- To determine the photo image and the real face of the subject during the exam.

There are different methods used by different researchers to detect fraud. Some of the efforts made by the researchers are as follows:

This section aims to furnish comprehensive insights into two key aspects of the present research: the dataset utilized and the architecture of the employed deep learning model. Pertaining to the dataset, a thorough account will be provided regarding the source of the images, the total quantity of images included, the specific attributes characterizing these images, and the meticulous labeling procedure employed. Furthermore, we shall present statistical analyses outlining the distribution of classes within the dataset.

Furthermore, we will delve into a detailed discourse concerning the rationale underlying the choices made in dataset selection and model architecture. We will elucidate the series of experiments conducted to rigorously evaluate the performance of distinct architectures and hyper parameters. The intention is to establish a comprehensive understanding of the decisions made during the course of this study, as well as to determine the efficacy of the adopted strategies.

Proposed method. To realize our goal of developing a robust proctoring system with a stringent emphasis on accuracy, a diverse array of methodologies was harnessed throughout this investigation. To facilitate this, a sequence of experimental procedures was conducted, commencing with the curation of a bespoke dataset. Subsequently, the decision was made to employ the YOLO algorithm in synergy with the Darknet Framework for the training of our deep learning model. Additionally, during the testing phase, the Cascaded Haar Classifier was incorporated to refine the predictive outcomes. The complete sequence of operations undertaken in this study is visually depicted in Figure 1.

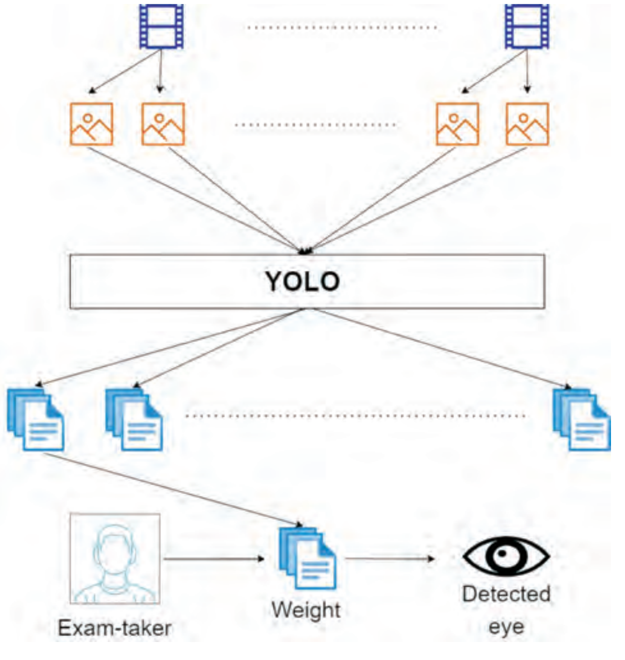

Figure 1 – Yolo learning process using Darknet framework

Dataset. To facilitate our experimentation, a dataset was required for training a deep-learning model, specifically designed to discern and localize the eyes of exam-takers. Although there exist publicly accessible datasets within the research community, they did not conform to our specific criteria aimed at simulating examination conditions accurately. For robust testing accuracy, it was imperative to obtain a dataset comprising images of individuals captured by a web camera at a close distance of approximately 50cm.

Regrettably, several available datasets for eye tracking were acquired using professional-grade cameras or from considerable distances, thereby rendering them unsuitable for our intended objectives. Consequently, we deemed it necessary to curate our own dataset, custom-tailored to meet the desired requirements. To this end, we enlisted the participation of eighty volunteers, each recorded through a webcam-equipped notebook for video capture, with a duration of approximately 25 to 30 seconds per video. In an effort to ensure temporal consistency among the images, our aim was to extract four images from each one-second video segment. Ultimately, this data collection process yielded an assemblage of over 4000 images (Figure 2).

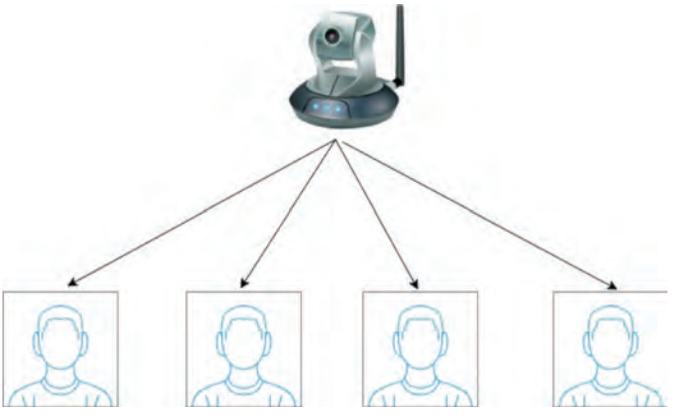

Figure 2 – A set of four images was extracted from each one-second segment of video capture.

Used deep learning models and Training process. For training our model, we employed the YOLO algorithm, which stands for "You Only Look Once." YOLO represents an intelligent convolutional neural network (CNN) designed specifically for real-time object detection tasks. This algorithm adopts a unique approach by employing a single neural network to process the entire image and subsequently divides the image into regions to predict the respective bounding boxes and associated probabilities for each region.

To obtain the desired predictions, we trained the YOLO algorithm using our custom dataset. To facilitate this process, each image in the dataset was meticulously labeled using the LabelImg software, as depicted in Figure 3. LabelImg is a graphical image annotation tool, coded in Python and featuring a user-friendly GUI built on the Qt framework. This software facilitated the task of annotating the images by defining the regions of interest required for training the YOLO model effectively.

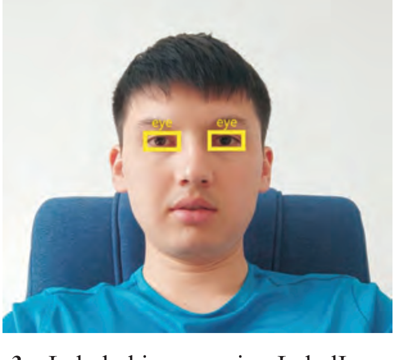

Figure 3 – Labeled image using LabelImg software

Within our dataset, a singular labeled class named “eye” was meticulously generated. This particular label served the purpose of both training the model and subsequently detecting the eyes of the exam-taker during the testing phase.

Once the process of labeling the images was successfully completed, we proceeded to train our model employing the Darknet platform. The training process was conducted on a laptop equipped with a 9th generation Intel i7-9750H processor, a GeForce GTX 1650 graphics card featuring 4GB memory, and 32GB DDR RAM (as depicted in Figure 4). This computational setup provided the necessary resources to carry out the training of the deep learning model effectively.

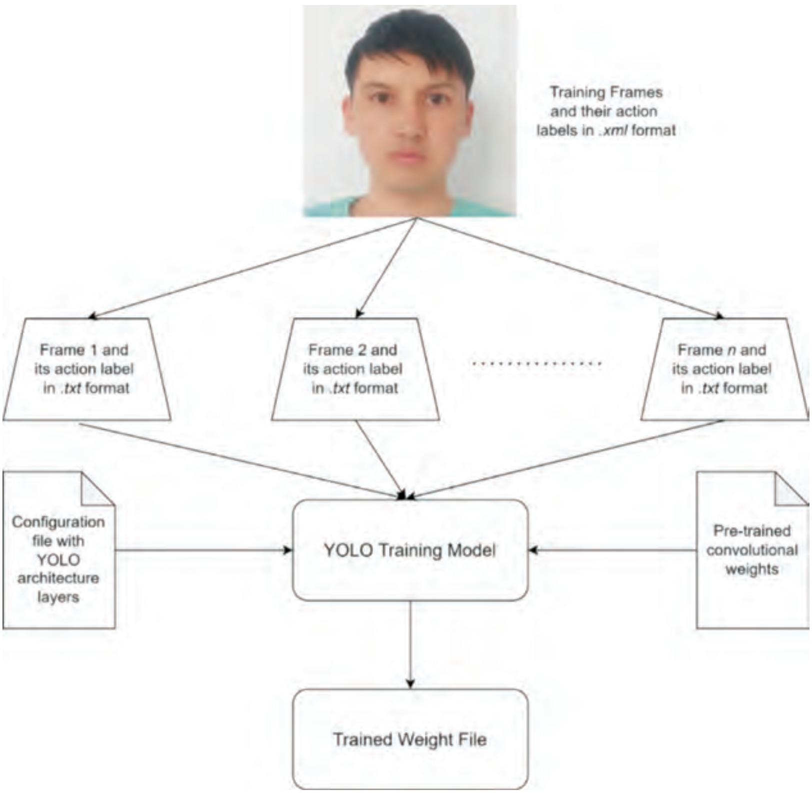

Figure 4 – Yolo learning process using Darknet framework

Darknet is an extensively employed open-source framework renowned for its proficiency in executing neural networks at a high level of performance. Its development was undertaken through the utilization of C and CUDA programming languages, endowing it with compatibility for both Central Processing Units (CPUs) and Graphics Processing Units (GPUs). This characteristic renders Darknet a flexible and adaptable option for sophisticated implementations of deep neural networks. Notably, Darknet encompasses various advanced applications of deep learning, including the real-time object detection capability provided by the You Only Look Once (YOLO) algorithm, ImageNet classification, and Recurrent Neural Networks (RNNs), among others.

Testing process and accuracy metrics. Before commencing the training process, the dataset was divided into two distinct subsets: 80% allocated for training purposes and the remaining 20% reserved for testing. The test dataset played a crucial role in assessing the accuracy of the trained models and subsequently determining the optimal model for selection.

In order to evaluate the effectiveness of object detection, we employed the Mean Average Precision (mAP) metric. This widely-used evaluation metric is also known as Average Precision (AP) and finds extensive application in various domains, including document/information retrieval and object detection tasks (as illustrated in Figure 5). The choice of mAP was predicated on its ability to provide a comprehensive assessment of the model's performance by computing the average precision across multiple classes and multiple detection outcomes, thereby offering a robust evaluation of object detection accuracy.

$$mAP = \frac{1}{n}\sum_{k=1}^{k=n} AP_k$$

Figure 5 – AP_k = the AP of class k and n = the number of classes

In order to prevent overfitting and to discern weights that exhibited superior accuracy, we employed the Mean Average Precision (mAP) metric across all scales. The outcomes of this analysis are presented in Table 1.

Table 1 – Eight different weights with percentages

	Weights							
Percentage	Weight 1	Weight 2	Weight 3	Weight 4	Weight 5	Weight 6	Weight 7	Weight 8
	85.17 %	84.21 %	89.59 %	92.28 %	85.27 %	69.45 %	72.36 %	64.21 %

Upon a thorough evaluation of the generated models, it was observed that weight number four demonstrated the highest accuracy, achieving an impressive performance of 92.28%. This noteworthy outcome serves as a testament to the suitability of our curated dataset for the precise task of eye tracking. Furthermore, Figure 6 illustrates corroborating results that reinforce the efficacy of our dataset in facilitating accurate eye tracking. The remarkable accuracy achieved by the model trained with weight number three provides further evidence of the dataset's efficacy in enabling precise and reliable eye tracking capabilities.

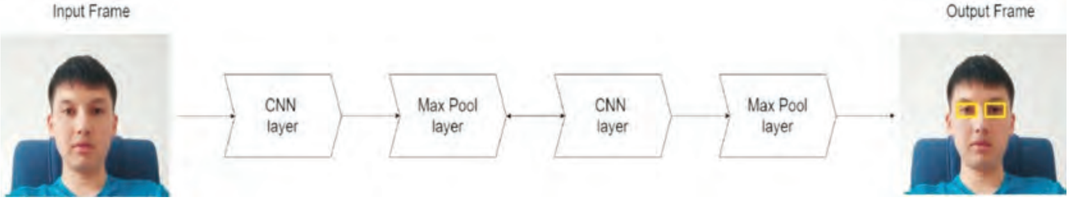

Figure 6 – Testing process

Iris detection with the Cascade Classifier. In the subsequent phase, we employed image processing techniques, particularly the Cascade Classifier with OpenCV, to facilitate iris detection. Notably, one of the well-regarded iris recognition algorithms, namely "haarcascade," was utilized. This algorithm is recognized for its computational efficiency, expeditious processing, and commendable accuracy.

The Cascaded Haar Classifier, as a machine learning classifier, operates based on Haar functions and is encapsulated within the cv2.CascadeClassifier class. OpenCV is bundled with several XML files, each housing Haar functions tailored for diverse objects. These Haar functions function analogously to feature maps within conventional convolutional neural networks (CNNs). In essence, they compute features for numerous image regions, summing pixel intensities and subsequently computing the differences between these sums. Consequently, an image-downsampling process generates a simplified feature map that serves as a basis for detecting patterns within images. In our context, we utilized the "haarcascade_eye.xml" file for iris detection.

In order to optimize the speed and precision of iris detection, we capitalized on the output generated by the YOLO algorithm, which had already identified the eye regions in the images. Concretely, we extracted the eye regions from the original frames, converted them to grayscale, and then applied the Haar-cascade classifier XML file to detect the iris. The schematic representation of this approach is depicted in Figure 7. This method enabled us to efficiently and accurately detect the iris in the images, consequently enhancing the overall performance of our model.

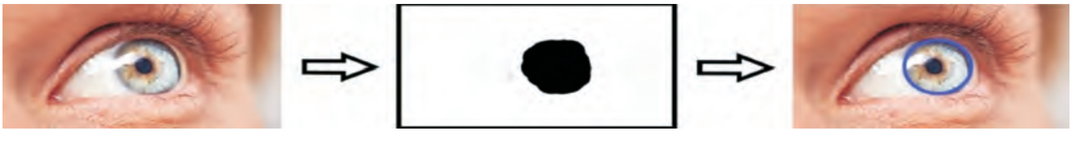

Figure 7 – Iris detection

Consequently, we integrated the outcomes obtained from YOLO with image processing techniques, which yielded a novel result encompassing iris detection. The visualization of this outcome is displayed in Figure 8.

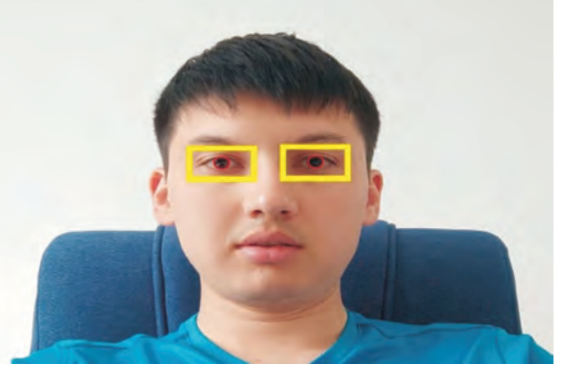

Figure 8 – Final result

At present, we have successfully obtained the precise coordinates of both the eyes and the iris. The graphical depiction of this outcome is illustrated in Figure 9.

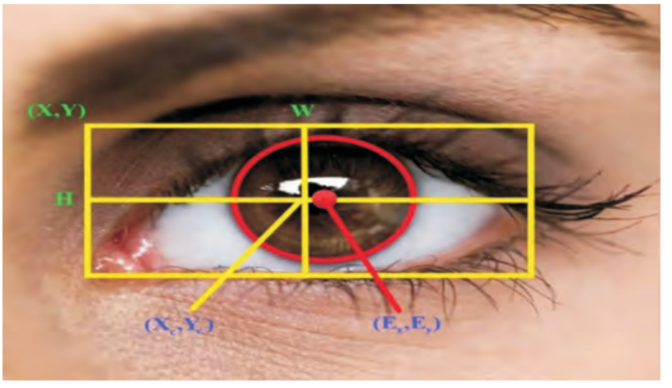

Figure 9 – Eye and iris coordinates. (X, Y) are the top coordinates of the eye region. W is the width of the eye and H is the height of the eye. E_x and E_y are the midpoint coordinates of the iris. (X_c, Y_2) are midpoint of eye region.

Using existing coordinates we can easily calculate X_c, Y_c.

$$X_c = X - \frac{H}{2} - \frac{H}{2} \qquad Y_c = Y + \frac{W}{2} + \frac{W}{2}$$

With the acquired coordinates of both the eyes and the iris, we are now able to compute the distance between the midpoint of the eye region and the iris.

$$D = \sqrt{(E_x - X_c)^2 + (E_y - Y_c)^2}$$

Results. Liveness Detection of survivability is a method of verifying that a person is really present, and not just from a photo or video. This is a common tool used in security applications, for example, to prove that someone is who they say they are.

In our fast-changing, constantly connected world, security is more important than ever. The number of online attacks and cyber-scams is only growing and becoming more dangerous: According to a report by the FTC Consumer Sentinel Network, the number of reported identity thefts doubled from 2019 to 2020 and is expected to grow in the coming years[8]. That's why more and more companies are turning to liveness detection as a means of protecting their data and building trust between the company and its customers.

Liveness detection can also be used as a way to verify the identity of the user who logs in. This is especially important for sensitive systems, such as those used by banks or other financial institutions.

At this stage, we possess the capability to compute the distance between the midpoint of the eye region and the iris for every frame extracted from the real-time video. By monitoring these distances over a specific duration, typically 15-20 seconds, we can ascertain whether the video depicts a genuine individual or merely a static photo in front of the web camera. This determination is based on the observation that the facial features and iris of a real person are subject to constant changes, thereby leading to fluctuations in the coordinates and distances between the eye region and the iris. Conversely, a static image would exhibit minimal alterations in these coordinates and distances over the designated time period, consequently signifying its non-live nature.

In order to assess the efficacy of our proposed solution, we conducted extensive testing involving a sample of more than 200 volunteers. The results of our method demonstrated an impressive accuracy of 91.8% in detecting images of exam-takers. This outcome substantiates the effectiveness of our approach, affirming its suitability for real-world application.

Discussion. This research capitalizes on deep learning methodologies and a pre-trained model to achieve real-time detection of eye regions. Leveraging deep learning in this context presents a highly effective means of processing vast datasets, rendering it a well-suited approach for the task at hand. Moreover, the augmentation of our dataset through additional data collection facilitates enhanced model training, thereby potentially elevating its performance and precision. Additionally, the comparative evaluation of the collected data in tandem with other deep learning techniques affords valuable insights, aiding in the selection of the most appropriate and optimal approach.

In the current era of the 21st century, ensuring adherence to academic ethics has emerged as a paramount priority in establishing a conducive and proficient educational environment. Consequently, novel technologies are being actively developed and integrated to curtail practices that contradict the fundamental principles of academic integrity, particularly in the context of distance learning[9]. These technological advancements aim to minimize instances of academic misconduct, ultimately fostering a more robust and trustworthy educational landscape.

Upon examining international practices, it becomes evident that a promising approach to address this matter is through the implementation of proctoring functions. Proctoring solutions offer the capacity for educational institutions to conduct remote monitoring and supervision of participants during online examinations. By leveraging proctoring technologies, administrators can establish a secure examination environment, effectively deterring and deterring instances of academic dishonesty among students.

One of the key advantages of proctoring technologies is their ability to facilitate online exams for students regardless of their geographical location. This flexibility empowers students to undertake examinations from anywhere in the world, thereby promoting academic integrity as they are consciously aware of being under artificial surveillance. Consequently, the presence of proctoring technology instills a sense of accountability and encourages students to maintain an atmosphere of academic honesty, thereby minimizing unnecessary disruptions during exams.

Conclusion. It is important to acknowledge that no existing automatic proctoring system can ensure complete immunity against deceptive behaviors. The primary objective of such systems is primarily geared towards establishing an environment in which devising dishonest tactics becomes futile, encouraging students to channel their efforts into thoroughly acquainting themselves with course lectures and study materials in preparation for examinations.

The scientific novelty of this article lies in its exploration of the potential integration of proctoring system capabilities within domestic educational practices. The study's theoretical and practical significance is manifested through the examination of theoretical frameworks and practical mechanisms for implementing a proctoring system as a means of conducting remote exams.

In this research, we devised an online proctoring system by deploying a deep learning model and the Cascade Classifier technique. The resulting system demonstrates a remarkable capability to accurately predict whether the exam taker is a genuine individual or a mere image. The seamless integration of this system with any online examination platform empowers educators with a valuable tool to uphold the integrity of the examination process. The synergistic utilization of deep learning and Cascade Classifier technologies empowers the system to efficiently identify and localize the eyes within image or video frames in real-time, thus presenting a dependable and effective solution for online proctoring.

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ОНЛАЙН ЕМТИХАНДАРДА ТЕРЕҢ ОҚЫТУ ТЕХНОЛОГИЯСЫН ҚОЛДАНА ОТЫРЫП КӨЗ КЕСКІНДЕРІНІҢ ШЫНАЙЫЛЫҒЫН АНЫҚТАУ

ЮНЕСКО-ның тұрақты даму аясында сапалы білім берудің әмбебап мақсатына жетуде білім берудің онлайн технологиялары тиімді болып табылады. Мақалада онлайн емтихан технологияларын қолданудағы ерекшеліктер сипатталады. Онлайн форматтағы емтихан жүргізудің қолданыстағы формаларына, әдістері мен құралдарына талдау жасалып, оларды қолданудағы мүмкіндіктері мен келеңсіз жақтары сипатталады. Онлайн бақылауды жүргізудің қолдану әдістері мен құралдарының кемшіліктері ретінде олардың сынақ кезіндегі көп уақыт шығыны мен оқушылардың зерттеу есептерін шешудегі олардың негізгі жүйелі білімдері мен дағдыларын бағалауды ескеру мүмкіндіктерінің күрделігі сипатталады.

Бұл жұмыста терең оқыту технологиясы ретінде ұсынылған Yolo алгоритміне негізделген инновациялық прокторинг жүйесі келтірілген. Жүйенің негізгі мақсаты жалғыз сигнал көзі ретінде стандартты веб камерасын қолдана отырып емтихан тапсырушының көзін бақылау және тану. Терең оқыту моделінде алынған нәтижелер қорытынды шешім алу мақсатында Хаар каскадтық классификаторы арқылы өңделеді. Ұсынылған әдіс жоғарғы дәлдікпен емтихан тапсырушының көзінің шынайы кескінінің тұрақты кескіннен айырмашылығын анықтап береді. Терең оқыту технологиясын каскадты классификатормен үйлестіре қолдану мүмкіндігі нақты уақыт режимінде ұсынылған кескіндегі немесе видеокадрларда емтихан тапсырушының көзінің шынайы кескінін дәл тануға мүмкіндік береді, ал ол кезегінде онлайн емтихан кезінде академиялық адалдықты сақтау мақсатында прокторинг жүйесіннің тиімділігін және сенімділігін білдіреді.

Түйін сөздер: *қашықтан оқыту технологиясы, онлайн-емтихан, айтрекинг, Yolo, Darknet Framework, Хаар каскадты классификаторы, прокторинг жүйесі.*

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ОПРЕДЕЛЕНИЕ ПОДЛИННОСТИ ИЗОБРАЖЕНИЙ ГЛАЗ С ИСПОЛЬЗОВАНИЕМ ТЕХНОЛОГИИ ГЛУБОКОГО ОБУЧЕНИЯ В ОНЛАЙН-ЭКЗАМЕНАХ

Использование технологий онлайн-образования является одним из наиболее эффективных способов достижения универсальной цели качественного образования в рамках устойчивого развития ЮНЕСКО. В работе описаны особенности, появившиеся в области применения технологий онлайн-экзаменов. Анализируются существующие формы, методы и инструменты проведения *экзамена в онлайн-формате, их потенциал и риски. Обращается внимание на то, что методы и инструменты, используемые для проведения онлайн-контроля, имеют недостатки, такие как значительные затраты на организацию прокторинга и сложности в оценке одной из ключевых компетенций обучающегося, а именно готовности использовать систематизированные теоретические и практические знания для формулировки и решения исследовательских задач.*

В этой работе представлена инновационная система прокторинга, в которой используются методы глубокого обучения, в частности алгоритм Yolo. Основная цель этой системы — используя стандартную веб-камеру в качестве единственного источника входного сигнала, точно распознавать глаза экзаменуемого. Полученные результаты в модели глубокого обучения впоследствии подвергаются обработке с помощью каскадного классификатора Хаара для получения окончательного результата. Предлагаемый подход демонстрирует значительную способность и точность различения изображения подлинных экзаменующихся и статичные изображения. Использование возможностей глубокого обучения в сочетании с каскадным классификатором позволяет в режиме реального времени обнаруживать и локализовать глаза на изображениях или видеокадрах, тем самым делая систему прокторинга надежным и эффективным решением для обеспечения академической честности во время онлайн-экзаменов.

Ключевые слова: *технологии дистанционного обучения, онлайн-экзамен, айтрекинг, YOLO, Darknet Framework, каскадный классификатор Хаара, система прокторинга.*