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| **Project Title** | EX Libris A Latin expression referring to stamps on books by libraries or persons to authenticate and prove ownership. It reflects how this eProctoring software verifies student identity and integrity of academic work. Additionally, the letters “ex” are a derivative from the word “exam”, which further highlights the project’s function. | | |
| **Track** | **Team 5 (AiZ)** | | |
| **Supervisor** | Dr. Ayman Ezzat, Dr. Ahmed Bahaa & Dr. Islam ElSharaawy | **Mentor Name** | Dr. Islam ElShaarawy |
| **Team Name** | Team 5 ( AiZ) | | |
| **Team Members** | Abdelrahman Adel ID: 121237 | Ahmed Issa ID: 191947 | Elham Gomaa ID:183091 |
| Hanaa Moustafa ID:172451 | Huda Fouad ID: 184025 | Text. |
| **Problem Summary** | As remote education is given province all over the world in 2020, the need for an affordable and easy-to-use eProctoring software keeps increasing. An ideal software will further facilitate the eProctoring process through real-time monitoring, object and object recognition. Accordingly, EX Libris was created to detect whether who takes the exam is real person or not, and to monitor if students are distracted, or using any sources and objects in the environment. Additionally, enhancing student performance is also taken into account as EX Libirs alerts students if they fall asleep during exams, and paves the way for getting feedback on exam difficulty by assessing student’s reaction to it. Although the software relies on computer vision, and image segmentation (i.e. face feature localization, gaze estimation, head pose estimation, and object detection), it is affordable and user-friendly. | | |
| **Methodology** | Image Segmentation (Python, Matlab)   * Edge detection, and Prescaling:   All edges are detected by Greyscaling images; the pixels of edges are differentiated by their color variation (i.e. black and white).   * Face Detection:   Edge detection contributes to feature extraction; the central point of the face is marked up, and about 10-20 centimeters are added to estimate the area, in-which the face appears. Hence, faces are marked up by squares on account of face dimensions. This feature also detects the existence of more than one person indicated by multiple face detection. | | |
|  | * Facial feature extraction:   Edge detection plays a role in recognizing the dimensions of facial features, which means that higher percentage of specific dimensions indicates the existence of particular feature. On that account, edges of facial features are marked up by tiny circles   * Gaze Estimation:   Facial feature extraction and edge detection are integrated in order to detect the placement of the eye pupil according to its location when it moves around whether nearer or further from the edges of the eye (i.e. face feature). An oval shape is used to highlight the pupil’s location; hence, highlighting where the person is looking.   * Facial Expression & Lip Movement Detection:   By integrating edge detection and facial feature extraction, EX Libirs can recognize facial expressions on account of facial lines, variations in dimensions of features’ edges or particular movements for over 50 expressions. Accordingly, Lip Movement Detection how mouth edges move and change making an oval shape in order for EX Libirs to highlight that the person is surprised. This applies to anger in the case of change in eyebrow shape and edges along-with changes in facial lines on the forehead and in between eyebrows.   * Drowsy Driver feature & Blinking Detection:   Gaze detection is employed to detect whether a person’s eyes are open, closed, or blinking on account of the permanent or momentary disappearance of the tracked pupil. If person’s eye is closed or if person is asleep, an alert shows up. If someone does not blink for more than 20 seconds, an alert shows up indicating that this is a fake image nor a real person. This is based on the fact that an average human being blinks about 10 times every 4 seconds.   * Object Detection:   -Glasses/Sunglasses:  The integration of edge detection and face feature recognition allow EX Libris to detect the frame of glasses or sunglasses on account of the existence of black lines or frames of glasses under and in between the eyes.  -Other objects (Smartphone included):  EX Libris can detect over 68 objects including smart devices, including TVs, Smartphones, Tables, Cameras, Charis, remote controls…etc. It is pretrained to detect such objects using image segmentation and edge detection. | | |
| **Achievements and Skills Gained** | 1. Creatively adding new features to projects as well as using these features to solve errors. EX Libris allows users to select/turn on the needed features. This does not only give space for customization, but it also solved the problem of code integrate causing lags and delays in object detection. 2. Determining the appropriate user interface by choosing tkinter in order to provide a user-friendly experience and on demand features that are easily accessible. 3. Providing software that solves significant issues with minimum costs; attempting to create the ideal software for educational institutions. It is affordable, user-friendly, inclusive (i.e. takes both exams and students into account). | | |

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| **Main Results** | Face feature Extraction & Object (Glasses/Sunglasses) Detection: |
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|  | Head Pose Estimation: |
|  | Gaze Estimation: |
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|  | After 10 seconds of looking left with Gaze Estimation: |
|  | Facial expression recognition: |
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|  | Object Detection (SmartPhone): |
|  | Drowsy Driver Feature: |
|  | Alert after 10 Seconds of person closing eyes with Drowsy Driver feature: |
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| **Discussion and Conclusion** | EX Libiris can be considered as the answer to modern virtual education problems. It is an affordable and multidisciplinary eProcting software. Its simple user interface allows proctors to choose from the following features:   * Object Detection: smartphones, glasses/sunglasses, TV…etc – up to 68 objects. * Multiple Face Detection: more than one face/person in the same room. * Face Feature Extraction: face recognition – feature markup. * Facial Expression Recognition & Lip Movement: detects facial expressions, which can also be used to asses the difficulty of exams based on frequency of demonstrating sad and angry expressions. * Drowsy Driver feature: detects if student is asleep by showing an alert after 10 seconds, and tracks blinking rate to indicate if image is fake by showing an alert after 6 seconds of not blinking. * Head Pose Estimation: detects and alerts if student looks away for more than 10 seconds. |
| **References** | **Sources:**   * Libs:   CV2, Numpy, Imutils, Tkinter & Keras.   * Github Repos:   <https://github.com/TianxingWu/realtime-glasses-detection>  <https://github.com/antoinelame/GazeTracking>  <https://github.com/serengil/tensorflow-101/tree/master/python>  <https://github.com/gauravtheP/Real-Time-Facial-Expression-Recognition>  <https://github.com/opencv/opencv/tree/master/data/haarcascades>  **Readings:**  <https://arxiv.org/pdf/1806.10890.pdf>  <https://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.1043.1518&rep=rep1&type=pdf>  <https://www.ijcsmc.com/docs/papers/July2013/V2I7201329.pdf>  <http://www.math.hkbu.edu.hk/~zeng/Teaching/math3615/ls.pdf>  <https://www.oreilly.com/library/view/programming-computer-vision/9781449341916/ch01.html>  <https://www.mathworks.com/discovery/edge-detection.html>  <https://drive.google.com/drive/u/0/folders/1JHwGIIV4nhG4bHCI-kQU5S8rJQrTtBTQ> |
| **Future Work and Suggestions** | * All features of EX Libirs can be used to track the productivity of employees by detecting whether they are in a professional environment (i.e. without TVs or any distracting objects in the background) during meetings, if they remain awake and focused on tasks during working hours. This cuts down costs as the same software can be used for the entire institution. Thus, it can be used in other domains than eProctoring. * Using a larger data set and machine learning are recommended for enhanced and distinctive facial expression detection. * Adding identity verification feature to confirm student identity by cross-referencing detected image with database of ID pictures. |
| **Group Photo** | None. (Remote teamwork) |