

# Proctored Online Examination System Using Deep Learning and Computer Vision

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## ABSTRACT

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This paper focuses on the online examination system developed with the goal to make online examinations more accessible and reliable using deep learning models for the proctoring system. It also covers the various technologies and languages used in the development process, including but not limited to HTML3, CSS5, BOOTSTRAP5, Django, Python. The developed system is reliably able to detect and counter any attempts at cheating during the exam, and provides a user-friendly system interface with focus on ease of use and simplicity.

**Keywords** : Online Examination System, Django, Opencv, Facial Feature Detection.

## I. INTRODUCTION

Today, the Covid-19 pandemic has completely changed the way our world works. Everything from healthcare, government, to education has been affected by it. Its times like these that call for revolutions in our systems. Our education system is currently undergoing such drastic change, with immense focus on minimizing physical contact, and switching to virtual alternatives.

Our goal while developing this web based system has been the same, to change the way we've perceived exams, to take things online while ensuring the system prevents any attempts at cheating. To achieve this, we've developed the system as simple and reliable as possible, and have used Tensorflow 2.5, and the OpenCV libraries to train and deploy the face

detection model. The back-end is completely developed using the Django framework, in Python3.

## II. EXISTING EXAMINATION SYSTEMS

Our education system has always been dependent on physical examinations. However, that is not an option anymore due to risks of COVID-19 infection. Over 1,00,000 new positive patients are found every single day in the state of Maharashtra (\*as of the writing of this paper). With schools and colleges closed down, and the risk of another lockdown to be put in effect, the authorities have made attempts to take things online.

However, after multiple exams being conducted online, it is observed that students have scored remarkably high in tests without any camera based

proctoring, indicating ill-measures taken by students during the exams. To tackle this, platforms have implemented different forms of proctoring system. However, their reliability is still not on par with physical examinations.

### III. SYSTEM DESIGN BASICS

Our system is web-based, which is needed for it being easily accessible with a basic internet connection. The front-end for the system is developed using HTML3, CSS5, and some bootstrap components. This includes

- Home Page
- Login/Sign-up page
- User account home, and dashboard.
- User specific feature pages, etc

The back-end is completely done using the Django framework, and the SQLITE3 database. This includes- Three types of User Profiles (Admin, Student, Teacher)

Separate login/sign-up access for each.

Complete logic for the quiz system.

User identification and based on it access and working of user specific features.

The proctor system has following features implemented so far:

- Face Tracking
- Gaze Detection
- Mouth and Gesture detection

The complete system design will be explained in detail as we move forward.

### IV. RESEARCH AND LEARNING CURVE

Great development has been done so far in fields of image detection and UI design. Platforms like Django, Bootstrap make UI design, back-end work a

pleasurable breeze IF you have experience and knowledge using them.

However, without proper knowledge, time has to be dedicated to perform research and study in respective technologies. Our research was focused on learning the different libraries available for face detection, and using Tensorflow to implement a model using those libraries that can efficiently perform the required task without excess load on a user's system.

On average it took us around 1 week to learn these technologies, with 2-3 hours of time invested every day. Similar times can be expected if you have a good object-oriented coding background.

Documentation is openly available for the same, while research papers were acquired and studied from IEEE, and are mentioned at the end of the paper.

### V. DETAILED SYSTEM WORKING

The entire system is based on the three main user types, i.e. student, teacher, admin. This has been implemented in the Django User model using one to one relationship to the User model itself. (Check Django Documentation online for more information.)

Their roles are as follows-

#### A. Student -

- A student will be able to register/login to the system. For registration, student needs to enter appropriate details followed by uploading their profile picture. For logging in, they need to enter the username and password they entered during the registration system.
- After logging in, student can perform two main actions, take an exam and check scores of previous attempts.

- The exams are divided by their respective courses, and each exam has a certain number of questions with their respective marks and time limit.
- Once a student starts an exam, the timer starts on the server side and tracks the exam throughout the time limit. During that, the student is monitored using the proctoring system (more details in next section), and if the system detects three major malpractices, it automatically disqualifies the student.
- Every attempt of the student is recorded and the results of which are available to be checked at their desire.

#### B. Teacher -

- A teacher is responsible for adding proper quizzes to the system, adding questions and has a certain salary for their activities,
- After registration (process is similar to student), a teacher's account has to be accepted by an admin before they can make any changes to the system. During that, the admin also enters appropriate salary for the teacher.
- As mentioned above, a teacher can add quizzes based on their course, and has to enter the following details regarding a quiz - quiz name, course, total questions, time limit.
- After creating a quiz, a teacher can add questions for that particular quiz from the add questions menu.

#### C. Admin -

- The admin has the most privileges and responsibilities in the system.
- The admin can check and update any teacher or student profile in the system.
- They can also add/change quizzes and add/remove questions.
- They can also check results of all student attempts so far in the system.

- Along with this, admin access allows a user to directly change values in the database using Django admin module.

The logic for all the above operations is implemented using the Django framework. The user-specific login system uses Django's built-in "login" and "login\_required" functions, where the latter is also useful in preventing unauthorized access to any features of the system. Django uses the Python language for everything, making it extremely convenient and easy to learn. There's a plethora of built-in features like support for multiple relational databases, built-in function libraries being constantly updated by the community, etc. The database used in our system is SQLITE3, due to its simplicity and low system load.

The front end for the system was developed using HTML3, CSS5, JavaScript. Some components from the BOOTSTRAP frameworks like "cards" and "jumbotron" were also used for making the design more responsive and visually appealing.

- So, Where is Deep Learning working?

Online exam is not about just conducting the examination. To make it more realistic and trustworthy, monitoring examinee during exam is the most essential part. To add this functionality, deep learning and computer vision has a lot to offer. Automated proctoring of examinee using webcam can be used to monitor the examinee.

During a test, it is required for the user to keep their webcam active. Using the real-time captured data from webcam, data is sent to trained models which further help in monitoring examinee. It will check for following functionalities:

- A. Face spoofing: To identify whether the examinee is real or a photograph or image as per the

captured image, Face spoofing is used. Caffe module of OpenCV's DNN module is used to check the user. After capturing image, required region of face is taken into consideration and further transformed into color-spaces. Later, calculation of histogram and sending required data to the model is carried out to get expected output which is then checked as per the probability function.

- B. Head pose estimation: To check in which direction the examinee is looking, Head Pose estimation is used.
- C. Eye tracking: Extracting features and facial landmarks from data allows the algorithm to map the region near the eyes. This mapped region is then used to detect the sight of the user.

By carefully analyzing these features and the extracted information, Monitoring of examinee is done.

## VI. ADVANTAGES

Simple and user friendly yet eye catching UI, variety of features, and the proctoring system can be termed as the jewels of the system. Our Proctoring AI tracks multiple facial features, making it more reliable at detecting malpractice. The system itself has moderate system load, and is able to run smoothly on weak system.

The system tests were performed on a laptop with following specifications-

- Second Gen Intel I3 processor.
- 6GB Ram
- 128GB SSD
- Intel HD Graphics 2000

During testing, the implemented models were able to give 5-10 fps constantly.

## VII. CONCLUSION

Proposed paper gives a good idea about design and development process of an online examination system using a web-based application and monitoring the user throughout the session using different deep learning and computer vision algorithms and libraries.

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