

FACETICKET: EXAM HALL AUTHENTICATION SYSTEM USING FACE BIOMETRICS

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ABSTRACT

Authentication has always been the biggest obstacle throughout exams. Academic stakeholders must look for alternative ways to authenticate students for examinations because the manual paper-based clearance process is fundamentally flawed. The method of authenticating a student for an examination has obvious problems, such as the presentation of a fake clearance card, impersonation, and so on. The unethical manner associated with the examination is a grim issue. Identity cards and hall passes are typically utilised in the examination procedure to detect fraudulent activity. The current examination method primarily uses biometric systems and document image analysis tools to identify, recognise, and classify candidates. While the suggested methodology focuses on the picture or video for analysis, fraud is typically found through document image analysis. In this project, a deep learning model is created to automatically recognise faces and identify candidates who are impersonating them in an exam system. Convolutional neural networks, which are utilised in automated face detection and identification systems, can also be employed in exam systems for hall numbering, seating assignments, identity verification, and attendance tracking. The enrollment and authentication processes make up the two stages of the suggested deep learning model. We used a unique dataset that we had gathered ourselves in order to validate the suggested methodology.

Keyword : *Convolutional Neural Network, Deep Learning, Computer Vision.*

1. INTRODUCTION

The goal of education as a planned endeavour is to prepare students to become contributing, accountable, productive, and compassionate members of society. This can be done at the institutional or personal level. Through the teaching of pertinent concepts and abilities, they become familiar with the many customs of the community. Education pushes pupils to examine and assess their experiences, to doubt, to question, to research—in other words, to be curious, to think for themselves, and to become proficient. Tests and exams are an excellent tool for evaluating pupils' knowledge in specific courses. Exam results will indicate which portion of the class each student seemed to have learned and retained the most. Exams are a terrific method for teachers to learn more

about their pupils because each student is so unique. Because tests are stressful, teachers can learn more about their students' individual thought processes and argumentation styles via their work, which is a valuable skill to have for future class projects.

2. INTRODUCTION OF PROPOSED METHODOLOGY:

The examination system uses a face detection and recognition system to track attendance and verify identity. Fraud pertaining to hall passes and creates an automated system that uses image processing techniques to cross-check or impersonate passes. Malpractices are the main issue with examination systems. The primary issue that has been found is the lack of a reliable identity verification method for both offline and online examination systems. An examination system built on face detection and verification technology that combines the accuracy and security strength of the test is the answer to this issue. Impersonation is the act of posing as someone in order to commit fraud or taking on the look or character of someone else, and it is one of the primary issues that our project will attempt to address. Secondly, whether or not the candidate is authenticated is detected in the event of impersonation. If the individual is verified, his attendance is also noted. Whether the candidate is authenticated or not, an alarm must be set to notify the exam in-charge. Convolutional Neural Networks (CNNs) are a type of deep learning used for face recognition. CNNs represent a subset of Neural Networks that have demonstrated remarkable efficacy in domains like image recognition and classification. CNNs are a multi-layered type of feed-forward neural network. CNNs are made up of filters, kernels, or neurons with biases, parameters, and learnable weights. Every filter receives certain inputs, convolutionally processes them, and optionally applies a non-linearity to follow. Convolutional, pooling, Rectified Linear Unit (ReLU), and Fully Connected layers make up CNN's structure.

2.1 CODING PLATFORMS

Deep learning is a subsidiary of AI which basically works by training and testing the data. Google Colab and VS code were used as the platforms for the coding.

2.2 JUPYTER NOTEBOOK

Jupyter Notebook, which is a component of the Project Jupyter platform, is a crucial tool for making digital notebooks. Using the benefits of computational notebook formats, Jupyter Notebook offers efficient and interactive techniques for collaborative idea sharing, code explanation, data exploration, and prototyping. These notebooks represent a significant departure from console-based interactive computing. Rather, they provide an online platform that excels at recording the entire computing process. This involves writing code, testing it, fully documenting it, and presenting the results in an understandable manner. Jupyter Notebook essentially provides users with the resources they need to perform, document, and share their computational work with ease. An online programme that serves as an interactive authoring tool for computational notebooks and offers a quick-interaction environment.

2.3 PYTHON

Python is a broadly useful deciphered, intelligent, object-situated, and undeniable level programming language like Perl, Python source code is additionally accessible under the GNU Overall population Permit (GPL). Python programs for the most part are more modest than other programming dialects like Java. Developers need to type somewhat less and space necessity of the language, makes them clear constantly. Python language is being utilized by practically all tech-goliath organizations like - Google, Amazon, Facebook, Instagram, Dropbox, Uber... and so forth.

2.4 TENSOR FLOW

TensorFlow is a start to finish open-source stage for AI. It has an extensive, adaptable biological system of tools, libraries, and local area assets that allows specialists to push the cutting edge in ML, and empowers engineers to effectively fabricate and send ML-controlled applications.

TensorFlow furnishes an assortment of work processes with natural, significant level APIs for the two novices and specialists to make AI models in various dialects. Designers have the choice to send models on various stages like on servers, in the cloud, on portable and edge gadgets, in programs, and on numerous other JavaScript stages. This empowers designers to effortlessly go from model structure and preparing to sending considerably more.

2.5 KERAS

Keras is a profound learning Programming interface written in Python, running on top of the AI stage TensorFlow. It was created with an emphasis on empowering quick experimentation. Allows a similar code to run on central processor or on GPU, seamlessly. User-accommodating Programming interface which makes it simple to rapidly model profound learning models. Built-in help for convolutional networks (for PC vision), repetitive organizations (for grouping handling), and any mix of both. Upholds erratic organization designs: multi-input or multi-yield models, layer sharing, model sharing, etc. This implies that Keras is proper for building basically any profound learning model, from a memory organization to a brain Turing machine.

2.6 PANDAS

Pandas is a quick, strong, adaptable and simple to utilize open source information examination and control device, based on top of the Python programming language. Pandas is a Python bundle that gives quick, adaptable, and expressive information structures intended to make working with "social" or "named" information both simple and instinctive. It means to be the key undeniable level structure block for doing functional, certifiable information examination in Python. Pandas is primarily utilized for information examination and related control of plain information in Information outlines. Pandas permits bringing in information from different record configurations, for example, comma-isolated values, JSON, Parquet, SQL data set tables or questions, and Microsoft Succeed.

2.7 NUMPY

NumPy, which represents Mathematical Python, is a library comprising of multi-faceted exhibit objects and an assortment of schedules for handling those clusters. Utilizing NumPy, numerical and consistent procedure on exhibits can be performed.

NumPy is a universally useful exhibit handling bundle. It gives an elite exhibition multi-faceted cluster article, and instruments for working with these exhibits.

2.8 MATPLOTLIB

Matplotlib is an extensive library for making static, enlivened, and intuitive representations in Python. Matplotlib makes simple things simple and hard things conceivable.

Matplotlib is a plotting library for the Python programming language and its mathematical math expansion NumPy. It gives an article arranged Programming interface to implanting plots into applications utilizing universally useful GUI tool stash like Tkinter, wxPython, Qt, or GTK.

2.9 SCIKIT LEARN

Scikit-learn is a Python module for AI based on top of SciPy and is dispersed under the 3-Proviso BSD permit. Scikit-learn (previously scikits.learn and furthermore known as sklearn) is a free programming AI library for the Python programming language. It highlights different characterization, relapse and bunching calculations including support-vector machines, irregular timberlands, inclination helping, k-implies and DBSCAN, and is intended to interoperate with the Python mathematical and logical libraries NumPy and SciPy.

2.10 PILLOW

Pillow is Alex Clark and Contributors' amiable PIL fork. The Python Imaging Library (PIL) was created by Fredrik Lundh and his collaborators. To display the image, the image class within it uses the Python pillow library. There are a few built-in features in the pillow package's image modules, like the ability to load and create new images.

2.11 OPENCV

An open-source computer vision library is called OpenCV. It gives the system the ability to recognise faces or other objects. The term "computer vision" (abbreviated as "CV") in OpenCV refers to the branch of research that assists computers in comprehending the content of digital images, including photos and videos.

2.12 MYSQL

Based on the popular language for organising and accessing database records, Structured Query Language, MySQL is a relational database management system. Under the terms of the GNU licence, MySQL is free and open-source software. Oracle Company provides support for it. MySQL database, which explains how to use different SQL queries to manage databases and alter data. These queries include drop tables, create tables, update records, delete records, and select records. To aid with your understanding of the MySQL database, there are additional questions for the MySQL interview.

The most widely used database management system software available today for relational database management is MySQL. The database software is open-source and is backed by Oracle Corporation. Compared to Oracle Database and Microsoft SQL Server, it is a database management system that is easy to use, scalable, and fast. It is frequently combined with PHP scripts to create robust and dynamic web-based or server-side enterprise applications. The Swedish business MySQL AB is responsible for its development, marketing, and support. The product is written in both C and C++ programming languages. MySQL is pronounced My Ess Que Eil, not My Sequel, according to official pronunciation. You are free to pronounce it anyway you please. Both large and small businesses use MySQL.

2.13 WAMPSEVER

An environment for Windows web development is called WampServer. With Apache2, PHP, and a MySQL database, you may use it to construct web apps. In addition, PhpMyAdmin makes database management simple. Using a MySQL database and PHP Apache2, you may create online applications using WAMPServer, a dependable web development tool. Developers from all around the world choose this programme because of its many functionality and user-friendly design. There are no fees or subscriptions associated with using the software.

2.14 BOOTSTRAP 4

A set of free and open-source tools called Bootstrap is used to make responsive websites and web apps. The most widely used HTML, CSS, and JavaScript framework for creating mobile-first, responsive websites is this one. It resolves a number of issues that we previously encountered, including the interoperability between different browsers. These days, websites work flawlessly on all screen sizes (Desktop, Tablets, Phablets, and Phones) and with all browsers (IE, Firefox, and Chrome). All credit goes to Twitter's Mark Otto and Jacob Thornton, the creators of Bootstrap, albeit the project was eventually made open-source. Simple to utilise: Anyone may begin using Bootstrap with only a basic understanding of HTML and CSS. Features that respond: The responsive CSS of Bootstrap adapts to computers, tablets, and phones. Mobile-first styles are a component of Bootstrap's fundamental architecture. Compatibility of browsers: Modern browsers such as Chrome, Firefox, Internet Explorer 10+, Edge, Safari, and Opera can all use Bootstrap 4.

2.15 FLASK

One web framework is Flask. This indicates that you can create a web application using the tools, frameworks, and technologies that flask offers. This online application could be as little as a few webpages, a blog, a wiki, or as large as a commercial website or a web-based calendar programme. One common term for Flask is "micro framework." It seeks to maintain an application's core functionality basic and expandable. Neither a formal validation support nor an integrated abstraction layer for database handling are included in Flask. Rather, Flask facilitates the addition of such features to the application through extensions. Despite being relatively new in comparison to other Python frameworks, Flask has already been well-liked by Python web developers and has a lot of promise. Let's examine Flask, the purported "micro" Python framework, in more detail. Flask was made with ease of use and extensibility in mind. Building a strong foundation for web applications of varying complexity is the goal behind Flask. You are then free to connect any extensions you believe you will require. You are also allowed to create your own modules. Flask works well for a wide range of projects. It works particularly well for prototyping. Flask belongs to the micro-framework's categories. Micro-frameworks typically have minimal or no reliance on outside libraries. There are advantages and disadvantages to this. The framework's light weight, low dependency count, and ability to monitor security flaws are its advantages. On the other hand, there are instances when you will need to work more independently or add plugins to your list of dependents, which increases your workload. Regarding Flask, these are its dependencies: The Web Server Gateway Interface, or WSGI, has become the de facto standard for developing Python web applications. A standard interface for web servers and web applications is called Web Server Gateway Interface (WSGI). A WSGI toolkit called Werkzeug-It implements utility functions, response objects, and requests. Building a web framework on top of it is made possible by this. Werkzeug serves as one of the foundations for the Flask framework.

2.16 JINJA2

A well-liked Python templating engine is called Jinja2. To render dynamic web pages, a web templating system combines a template with a specific data source.

3. ALGORITHMNS AND METHODS

WORKING OF FACIAL RECOGNITION

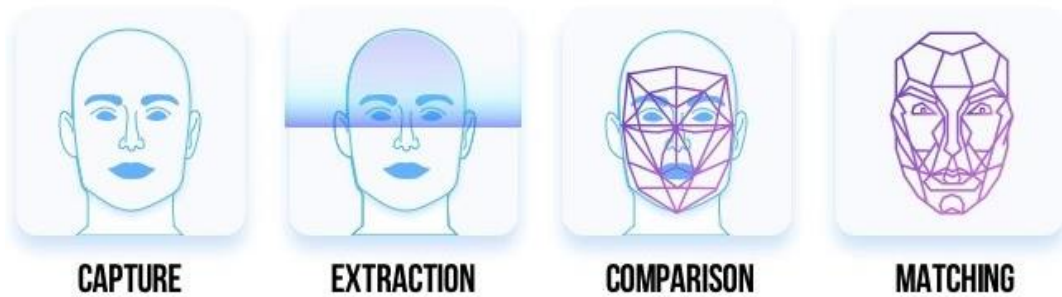


Fig 3.1 Working of Facial Recognition

1. **Concept of feature vector:** Every Machine Learning algorithm takes a dataset as input and learns from this data. The algorithm goes through the data and identifies patterns in the data. The challenging part is to convert a particular face into numbers – Machine Learning algorithms only understand numbers.
2. This numerical representation of a “face” (or an element in the training set) is termed as a feature vector. A feature vector comprises of various numbers in a specific order.
3. You can take various attributes to define a face like:
 - o Height/width of face (cm)
 - o Color of face (R,G,B)
 - o Height/width of parts of face like nose & lips (cm)
 - o We can consider the ratios as feature vector after rescaling
4. A feature vector can be created by organising these attributes to into a table, say, for a certain set of values of attributes your table may look like this:

Height of face (cm)	Width of face (cm)	Average color of face (R, G, B)	Width of lips (cm)	Height of nose(cm)
23.1	15.8	(255, 224, 189)	5.2	4.4

Table 3.1 Measurements of Edges

Image now becomes a vector that could be represented as [23.1, 15.8, 255, 224, 189, 5.2, 4.4]. Now can add a number of other features like hair color & spectacles. Keep in mind that a simple model gives the best result. Adding a greater number of features may not give accurate results (See overfitting and underfitting).



$[-0.23, -0.54, \dots, 0.27]$

Machine learning helps you with two main things:

Deriving the feature vector: As it is a difficult process to involve all features by name, we convert it to feature vector. This is then used by the algorithm. A Machine Learning algorithm can intelligently label out many of such features.

Matching algorithms: Once the feature vectors have been obtained, a Machine Learning algorithm needs to match a new image with the set of feature vectors present in the corpus.³³

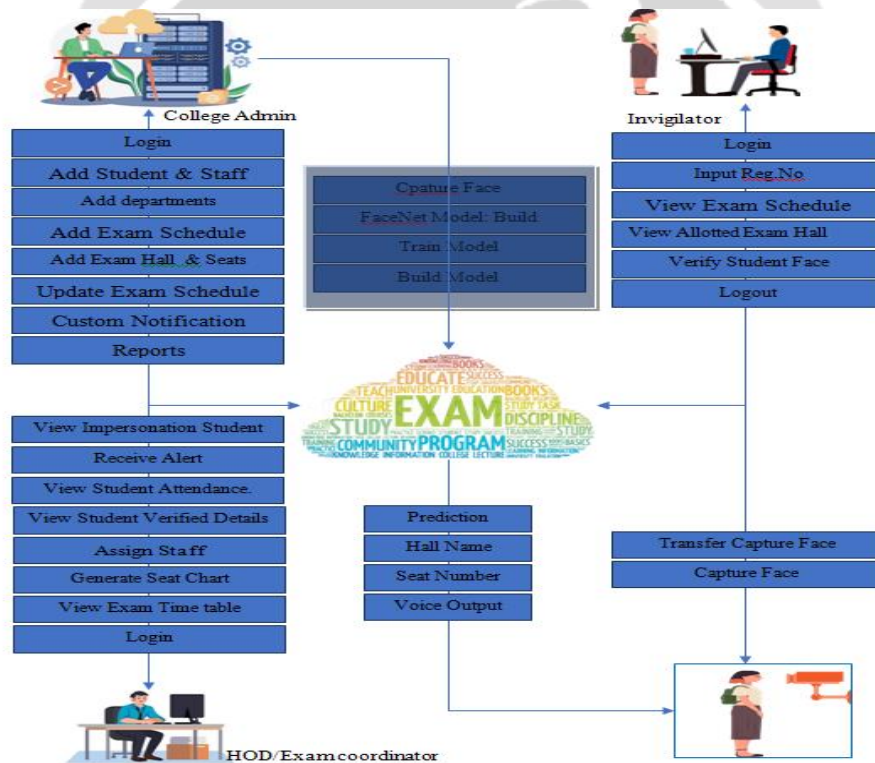


Fig 3.2 Flowchart for the Authentication System

4. DCNN BASIC ARCHITECTURE

There are two main parts to CNN architecture

A convolution tool that separates and identifies the various features of the image for analysis in a process called as Feature Extraction. A fully connected layer that utilizes the output from the convolution process and predicts the class of the image based on the features extracted in previous stages.

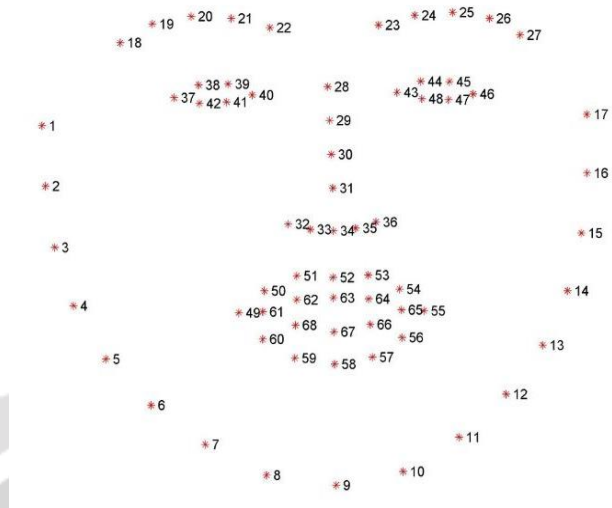


Fig 4.1 Face Landmark Points

There are mostly two steps to detect face landmarks in an image which are given below:

- Face detection: Face detection is the first methods which locate a human face and return a value in x,y,w,h which is a rectangle.
- Face landmark: After getting the location of a face in an image, then we have to through points inside of that rectangle.

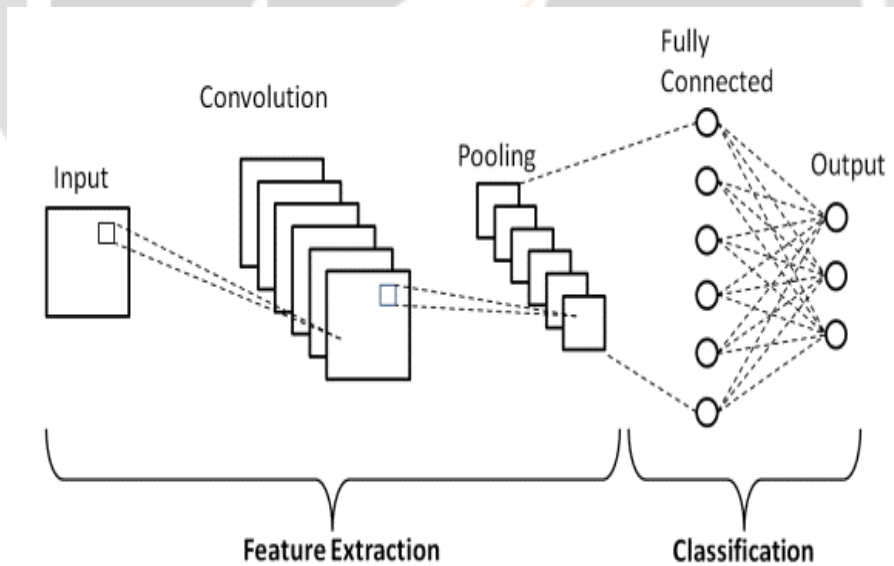


Fig 4.2 CNN

4.1 LAYERS IN CNN

There are three types of layers that make up the CNN which are the convolutional layers, pooling layers, and fully-connected (FC) layers. When these layers are stacked, a CNN architecture will be formed. In addition to these three layers, there are two more important parameters which are the dropout layer and the activation function which are defined below.

4.2 CONVOLUTIONAL LAYER

This layer is the first layer that is used to extract the various features from the input images. In this layer, the mathematical operation of convolution is performed between the input image and a filter of a particular size $M \times M$. By sliding the filter over the input image, the dot product is taken between the filter and the parts of the input image with respect to the size of the filter ($M \times M$).

The output is termed as the Feature map which gives us information about the image such as the corners and edges. Later, this feature map is fed to other layers to learn several other features of the input image.

4.3 POOLING LAYER

In most cases, a Convolutional Layer is followed by a Pooling Layer. The primary aim of this layer is to decrease the size of the convolved feature map to reduce the computational costs. This is performed by decreasing the connections between layers and independently operates on each feature map. Depending upon method used, there are several types of Pooling operations.

In Max Pooling, the largest element is taken from feature map. Average Pooling calculates the average of the elements in a predefined sized Image section. The total sum of the elements in the predefined section is computed in Sum Pooling. The Pooling Layer usually serves as a bridge between the Convolutional Layer and the FC Layer

4.4 FULLY CONNECTED LAYER

The Fully Connected (FC) layer consists of the weights and biases along with the neurons and is used to connect the neurons between two different layers. These layers are usually placed before the output layer and form the last few layers of a CNN Architecture. In this, the input image from the previous layers is flattened and fed to the FC layer. The flattened vector then undergoes few more FC layers where the mathematical functions operations usually take place. In this stage, the classification process begins to take place.

4.5 DROPOUT

Usually, when all the features are connected to the FC layer, it can cause overfitting in the training dataset. Overfitting occurs when a particular model works so well on the training data causing a negative impact in the model's performance when used on a new data. To overcome this problem, a dropout layer is utilized wherein a few neurons are dropped from the neural network during training process resulting in reduced size of the model. On passing a dropout of 0.3, 30% of the nodes are dropped out randomly from the neural network.

4.6 ACTIVATION FUNCTIONS

Finally, one of the most important parameters of the CNN model is the activation function. They are used to learn and approximate any kind of continuous and complex relationship between variables of the network. In simple words, it decides which information of the model should fire in the forward direction and which ones should not at the end of the network. It adds non-linearity to the network. There are several commonly used activation functions such as the ReLU, SoftMax, tanH and the Sigmoid functions. Each of these functions have a specific usage. For a binary classification DCNN model, sigmoid and SoftMax functions are preferred a for a multi-class classification, generally SoftMax us used.

5. RESULT AND DISCUSSION

A comparative evaluation based on the accuracy of the proposed face recognition Deep Convolutional Neural Network (DCNN) system, compared to Support Vector Machine (SVM), Linear Discriminant Analysis (LDA), Principal Component Analysis (PCA), as statistical approach, Multi-Layer Perceptron (MLP), Combined Radial Basis Function (CRBF), as neural network approach, Deep Restricted Boltzmann Machine (DRBM), Deep Belief Neural Nets (DBNN).The results show that the proposed DCNN achieves higher accuracy compared to other approaches.

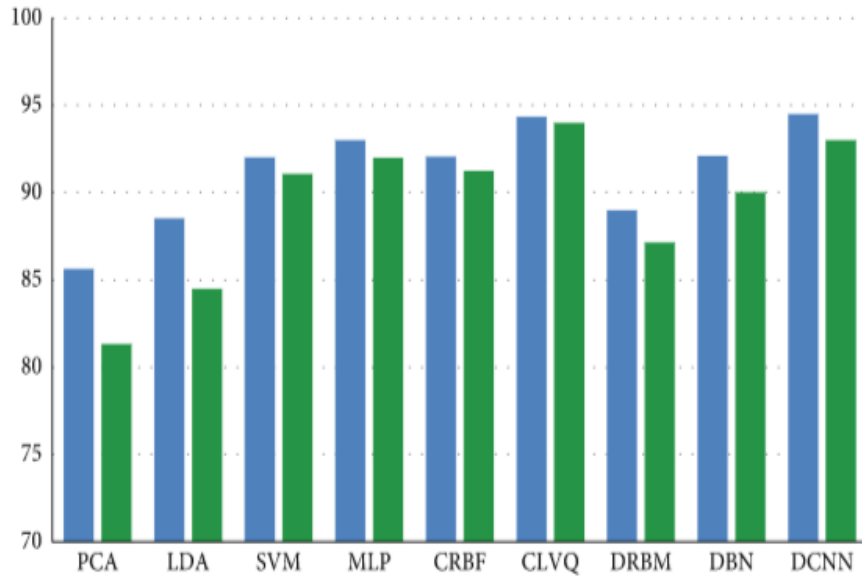


Fig 5.1 Face Recognition Accuracy

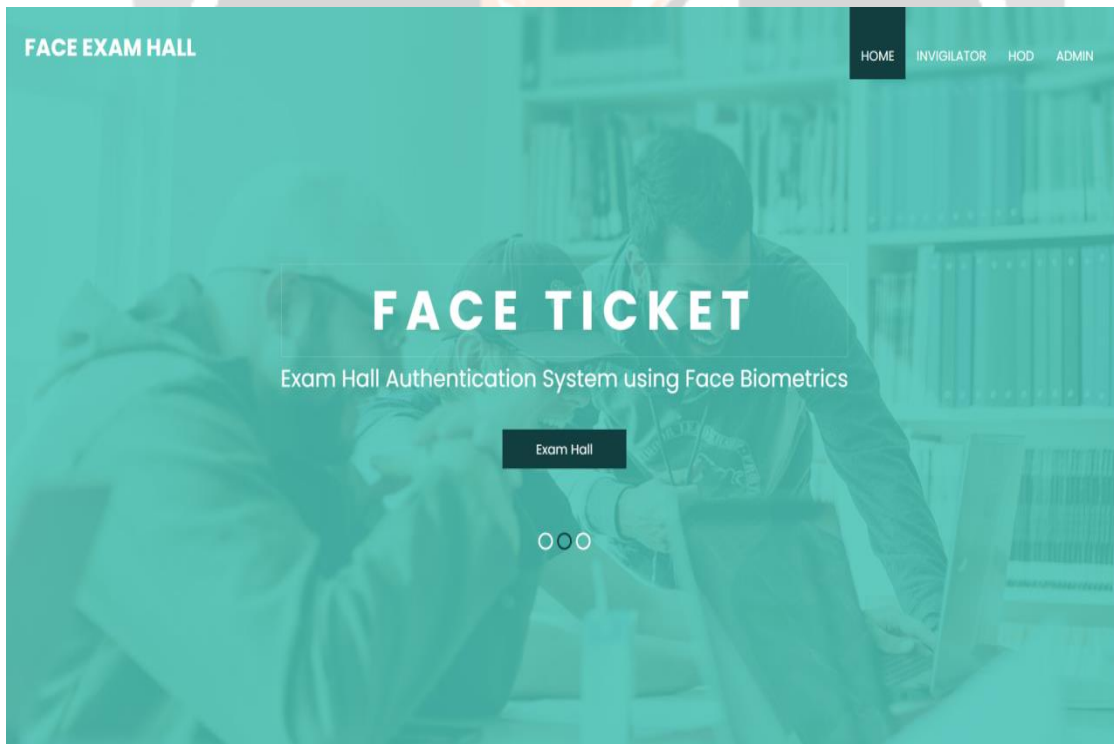


Fig 5.2 Home Page of FaceTicket

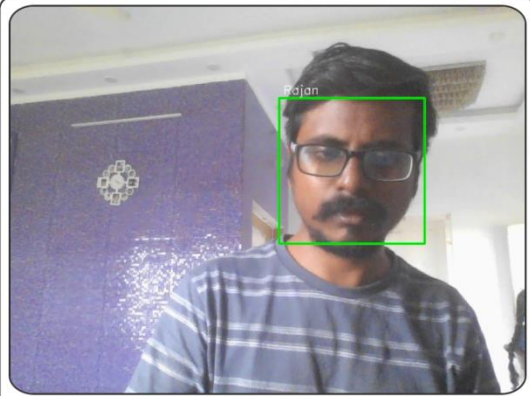
Student Verification

Register No.

Name	: Rajan	Register No.	: 101
Department	: CSE	Batch Year	: 2020-2024
Exam	: Board Exam 2024	Subject	: P152001 - Python
Exam Date	: 20-03-2024 - Forenoon	Hall	: EH1 - Seat No.: 1

[Verify Face](#)

Face Verify



Student: Rajan [101]
Exam: P152001 - Python - Board Exam 2024
Hall: EH1 - Seat No.: 1

Exam Attendance Details

20-03-2024

Sno	Reg. No.	Name	Attendance
1	101	Rajan	Present

6. CONCLUSION

Traditionally student's attendance in exam hall were taken manually by professor and it has to consume too much time of students as well as professor. A facial recognition system is a technology capable of matching a human face from a digital image or a video frame against a database of faces, typically employed to authenticate users through ID verification services, works by pinpointing and measuring facial features from a given image. In the proposed system, we have developed face recognition system ready to be implemented for the purpose of live examinee authentication with minimal human interaction to verify the candidate using Convolutional Neural Network. This System represent an analysis of different technologies which are used for taking attendance system. Further it can be replaced by fully computerized system. This system can be implemented for better results regarding the management of attendance during exam. This system will save time; decrease the amount of work the administration has to do. The proposed classifier performance evaluation was presented as a confusion matrix, in terms of sensitivity, specificity, precision, accuracy, and F1score. Results indicated that the proposed classifier has achieved higher recognition accuracy than ten other classifiers of the state of art.

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