*A Project report on*

# DETECTION OF ANOMALOUS BEHAVIOUR IN AN EXAMINATION HALL TOWARDS AUTOMATED PROCTORING

*Submitted in partial fulfillment of the requirements*

*For the award of the degree of*

## BACHELOR OF TECHNOLOGY

*in*

## COMPUTER SCIENCE & ENGINEERING

*By*


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**Rotarypuram Village, B K Samudram Mandal, Ananthapuramu- 515701**


**2023-2024**

# SRINIVASA RAMANUJAN INSTITUTE OF TECHNOLOGY

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Rotarypuram Village, BK Samudram Mandal, Ananthapuramu-515701

## DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING


## Certificate

This is to certify that the Project report entitled DETECTION OF ANOMALOUS BEHAVIOUR IN AN EXAMINATION HALL TOWARDS AUTOMATED PROCTORING is the bonafide work carried out by **B. Supraja, B. Yuva Kishore, C. Raveendra, M. Tharun Kumar** bearing Roll Number **204G1A05A5, 204G1A05C6, 204G1A0580, 204G1A05B1** in partial fulfilment of the requirements for the award of the degree of **Bachelor of Technology** in **Computer Science & Engineering** during the academic year 2023-2024.

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# DECLARATION

We, **Ms. B. Supraja** with reg no: 204G1A05A5, **Mr. B. Yuva Kishore** with reg no:204G1A05C6, **Mr. C. Raveendra** with reg no: 204G1A0580, **Mr. M. Tharun Kumar** with reg no: 204G1A05B1 students of **SRINIVASA RAMANUJAN INSTITUTE OF TECHNOLOGY**, Rotarypuram, hereby declare that the dissertation entitled **"DETECTION OF ANOMALOUS BEHAVIOUR IN AN EXAMINATION HALL TOWARDS AUTOMATED PROCTORING"** embodies the report of our project work carried out by us during IV year Bachelor of Technology under the guidance of **Mrs. N. Ushasree,** Department of CSE, and this work has been submitted for the partial fulfillment of the requirements for the award of the Bachelor of Technology degree.

The results embodied in this project have not been submitted to any other University of Institute for the award of any Degree or Diploma.

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To become a premier Educational Institution in India offering the best teaching and learning environment for our students that will enable them to become complete individuals with professional competency, human touch, ethical values, service motto, and a strong sense of responsibility towards environment and society at large.

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- Continually enhance the quality of physical infrastructure and human resources to evolve into a center of excellence in engineering education.

- Provide comprehensive learning experiences that are conducive for the students to acquire professional competences, ethical values, life-long learning abilities and understanding of the technology, environment and society.

- Strengthen industry institute interactions to enable the students work on realistic problems and acquire the ability to face the ever-changing requirements of the industry.

- Continually enhance the quality of the relationship between students and faculty which is a key to the development of an exciting and rewarding learning environment in the college.

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# ABSTRACT

The anomalous behavior is hard to be detected simultaneously in a complex scene such as detecting abnormal movements of examinee in examination rooms. Modelling activities of moving objects and classifying them abnormal or anomalous is a major research problem in video analysis. In this paper, we make use of the of neural networks and Gaussian distribution to help solve this problem by building a prototype of a monitoring system that consists of three stages; face detection using haar cascade detector, suspicious state detection using a neural network and lastly anomaly detection based on the Gaussian distribution. The main idea is to decide on-whether the student is in a suspicious state or not using a trained neural network and then decide that a student performs an anomalous behavior based on how many times he was found in a suspicious state in a defined time duration.

**Keywords:** Abnormal Behaviour, Real Time Alerts, Behavioural Analysis.

# CONTENTS

# LIST OF FIGURES

# LIST OF ABBREVIATIONS

| | |
|---|---|
| SVM | Support Vector Machine |
| RAM | Random Access Memory |
| GSI | Gray Scale Image |
| RTA | Real Time Alerts |
| DIP | Digital Image Processing |
| GDS | Guassian Distribution System |
| DFD | Data Flow Diagram |
| UML | Unified Modeling Language |

# CHAPTER 1

# INTRODUCTION

Computer vision and understanding of human behaviour is one of the most complicated, different, and grueling area that has entered important attention in the once times. The traditional approach to examination hall invigilation is supervised rigorous monitoring by investigator, which is heavy workload and frequently not veritably effective.

For illustration, examinees at the far end of the camera are likely to avoid discovery. While all conditioning begins with stir, minor normal movements by examinees, similar as movements of the hand during jotting, need to be ignored. The opinions made cannot be guaranteed to be correct. still, it's desirable that the software system depends on a sequence of countries not just a single state(frame) to decide anomalous geste .

Face discovery and recognition is the foremost step. Face recognition is a pivotal element of any invigilation operation. mortal face and gait are frequently regarded as the main biometric features that can be used for particular identification in visual surveillance systems. Facial expressions can be detected by observing changes in the uprooted facial features. Certain facial expressions, similar as winks, negating headshake, etc., are frequently used by some people to change information.

## 1.1 Problem Statement

The problem is to design and implement an automated proctoring system that can accurately identify and flag anomalous behaviours within an online examination hall. The system must leverage a combination of technologies, including computer vision, machine learning, and behavioural analysis, to monitor and detect the following types of anomalous behaviours : Impersonation Detection, Cheating Detection, Unusual Eye Movements and Screen Monitoring etc.

## 1.2 Objectives

- ✓ To monitor the abnormal behaviour of the persons in exam hall by using face detection process.
- ✓ To implement strategies that minimize false positive alerts, improving the accuracy of the automated proctoring system and reducing unnecessary disruptions.

## 1.3 Scope of the Project

The project aims to develop an automated proctoring system capable of detecting anomalous behavior in examination halls. This entails collecting and preprocessing various data sources such as video feeds, audio recordings, and biometric data, followed by feature extraction to capture relevant cues of misconduct. Machine learning or deep learning models will be developed to analyze these features and identify instances of cheating, collusion, or other rule violations. The system will integrate real-time monitoring, alerting proctors or administrators when anomalies are detected, and providing detailed reports for further action. Ethical considerations, including privacy and fairness, will be carefully addressed, along with legal and regulatory compliance. Continuous feedback, testing, and iteration will ensure the system's effectiveness and reliability in maintaining examination integrity.

## 1.4 Machine Learning

Machine Learning, a subset of artificial intelligence, enables computers to learnfrom data and improve performance without explicit programming. It involves algorithms trained on labeled datasets, predicting outcomes and making decisions. This documentation provides a concise introduction to key concepts, workflow, and applications, facilitating a foundational understanding of machine learning principles.

## 1.5 Deep Learning

Deep Learning, a subset of machine learning, leverages neural networks with multiple layers to model and solve complex tasks. This documentation offers a brief yet comprehensive overview, introducing key concepts and applications for understanding and implementing deep learning in diverse domains. In deep learning we have architectures like CNN, FNN, RNN, LSTM, GAN, and Autoencoders.

# CHAPTER 2
# LITERATURE SURVEY

**[1] M. Turk andA. P Pentland, “ Face recognition using eigenfaces ”, In Computer Vision and Pattern Recognition, Proceedings CVPR' 91., IEEEComputer Society Conference,pp. 586- 591,1991.**

In this study focuses on the issue of test cheating and how it has become a worry in the educational sector. Cheating, according to the authors, has started to spread not only at the university, but also at secondary and elementary levels. The authors recommend combining visual and aural characteristics to detect suspicious conduct during an exam, such as paper showing, cheating from gadgets. These characteristics are then utilised to build a machine learning model capable of detecting cheating in real time. Computer vision-based system for detecting and classifying various actions that are indicative of cheating during an exam. The system is designed to analyse multimedia data, such as video to identify suspicious behaviour that may indicate cheating. The model incorporates pre-processing stages such as trying to scale each of the frames inside the dataset as well as extracting five well-known features to accomplish this. These characteristics are then used to generate a visual vocabulary coding scheme, which is made up of different-sized words that encapsulate the visual incidences in each frame. The proposed approach concludes with the use of a Vector Support Device (SVM) to categorise the specified features.

**[2] A. Samal and P.A. Iyengar, “ Automatic recognition and analysis of mortal faces and facial expressions A check ”, Pattern recognition,Vol. 25,no. 1, pp. 65- 77, 1992.**

In author provides a technique to prevent cheating behaviour in educational institutions during exams. To prevent unauthorized access, the system evaluates the appearances and probable methods of cheating throughout the exam process and presents a revolutionary anti-cheating solution based on face movement recognition approach. Cheating during exams can be detected using facial expression detection. It assesses performance by administering it to a group of pupils and employing facilities and technology to detect anomalous conduct. The technology detects trying to cheat by focusing on a patient's facial gestures and motions, using a camera system and a camera to observe students' faces during an exam. The camera sends the footage to the detection, which examines it for unusual activity. The system attempts to detect students' faces in the first step. Inside the second step, a specific colour bounding box on all recognised faces can be tracked. Cheating detection is the classification of normal and abnormal student behaviour during an exam. Furthermore, it heavily relies on face recognition to detect any unusual behaviour of a student during an exam.

**[3] P. Viola and M. Jones, " Rapid object discovery using a boosted waterfall of simple features ", In Computer Vision and Pattern Recognition, Proceedings of the IEEE Computer Society Conference, vol. 1, pp. I- 511, 2001 .**

In author proposed cheating detection system in this study uses video surveillance to monitor students' behaviour during exams, especially abnormal behaviour. The system employs three distinct techniques. one to sense when students' heads move away from of the exam script, somebody to sense whenever a patient's iris moves to duplicate responses from other source materials, and another to sense contact between a patient's face and hands or between individual students, like the sharing of inculpatory materials. Once any of these behaviours is detected, an automatic alerts authority while reducing the failure rate that really can take place with manual monitoring.

**[4]C. Liu andH. Wechsler, " Gabor point grounded bracket using the enhanced fishermandirect discriminant model for face recognition ",IEEE Deals on Image processing,vol. 11,no. 4,pp. 467- 476, 2002 .**

In author developed model to identifying suspicious behaviour in examination rooms, a 63-layer CNN model dubbed "L4- BranchedActionNet". The model is based on Vgg with additional branches and was provided with training on the CUI-EXAM dataset. The SoftMax function, entropy coding, and an ant colony system are used for feature extraction and optimization (ACS). The enhanced features are then incorporated in to the SVM and Nearest neighbour classification techniques, with the square meter SVM outpacing the other models with a 0.9299 accuracy. The model was then tested on the CIFAR-100 set of data, and a precision of 0.89796 was obtained, confirming its efficacy. The proposed framework aims to classify students' suspicious activity in examination halls by using surveillance camera footage as input. The methodology is based on computer vision and includes several steps to process the data. Firstly, the images from the dataset are resized and converted to grayscale. This is followed by feature extraction, selection, and classification of the images. To improve the model's accuracy even further, the fused features are chosen using the principal component Analysis method. The features that have been chosen then are classified using a supported vector machine (SVM) and the K-Nearest Neighbour (KNN) algorithm. The proposed method's effectiveness is assessed using a freshly formed dataset.

# CHAPTER 3
# PLANNING

## 3.1 Machine Learning

Machine Learning is undeniably one of the most influential and powerful technologies in today‘s world. Machine learning is a tool for turning information into knowledge. In the past 50 years, there has been an explosion of data. This mass of data is useless; we analyse it and find the patterns hidden within. Machine learning techniques are used to automatically find the valuable underlying patterns within complex data that we would otherwise struggle to discover.

The hidden patterns and knowledge about a problem can be used to predict future events and perform all kinds of complex decision making. To learn the rules governing a phenomenon, machines have to go through a learning process, trying different rules and learning from how well they perform. Hence, why it‘s known as Machine Learning.

**Basic Terminology:**

- Dataset: A set of data examples, which contain features important to solving the problem.
- Features: Important pieces of data that help us understand a problem. These are fed into a Machine Learning algorithm to help it learn.
- Model: The representation (internal model) of a phenomenon that a Machine Learning algorithm has learnt. It learns this from the data it is shown during training. The model is the output you get after training an algorithm. For example, a decision tree algorithm would be trained and produce a decision tree model.

**Types of Machine Learning:**

There are multiple forms of Machine Learning; supervised, unsupervised, semi supervised and reinforcement learning. Each form of Machine Learning has differing approaches, but they all follow the same underlying process and theory.

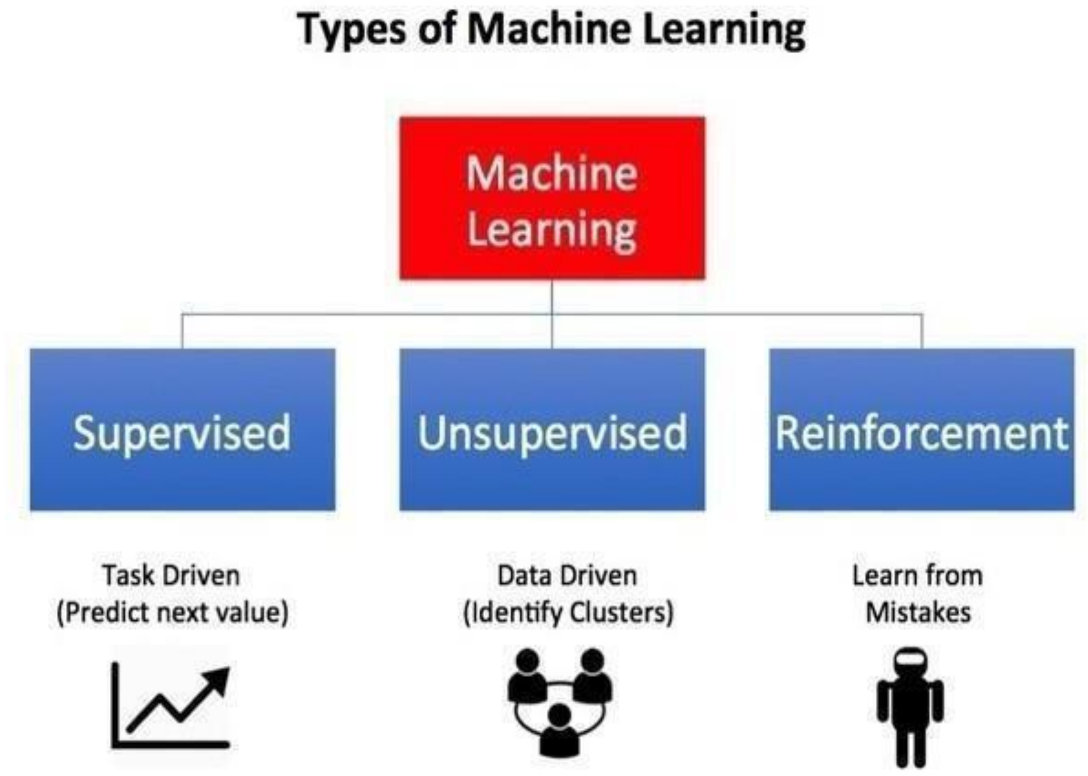


**Fig. 3.1:** Types of Machine Learning

**Supervised Learning:** It is the most popular paradigm for machine learning. Given data in the form of examples with labels, we can feed a learning algorithm these example-label pairs one by one, allowing the algorithm to predict the label for each example, and giving it feedback as to whether it predicted the right answer or not. Over time, the algorithm will learn to approximate the exact nature of the relationship between examples and their labels. When fully-trained, the supervised learning algorithm will be able to observe a new, never before-seen example and predict a good label for it.

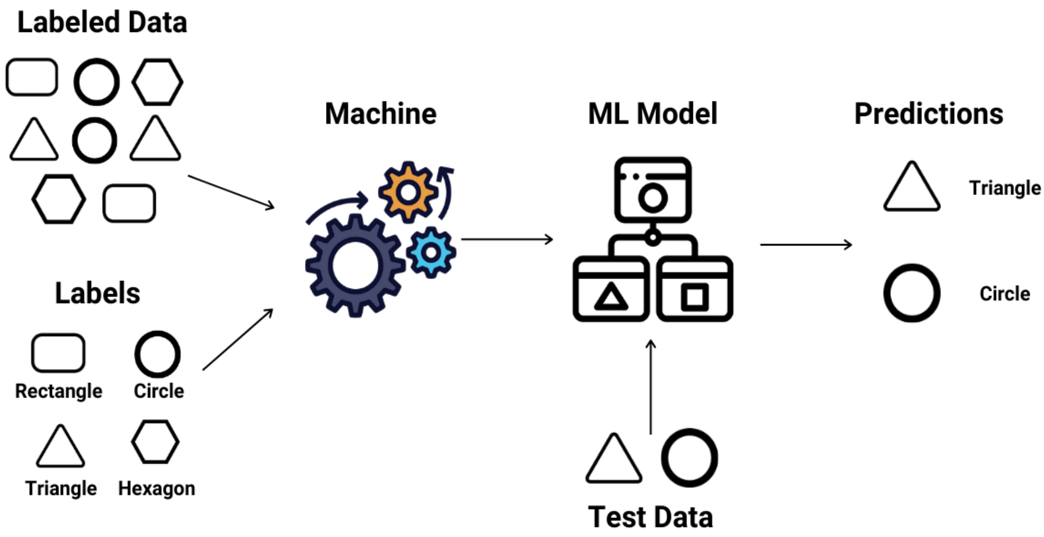


**Fig. 3.2:** Process of Supervised Learning

**Unsupervised learning**: It is very much the opposite of supervised learning. It features no labels. Instead, the algorithm would be fed a lot of data and given the tools to understand the properties of the data. From there, it can learn to group, cluster, and organize the data in a way such that a human can come in and make sense of the newly organized data. Because unsupervised learning is based upon the data and its properties, we can say that unsupervised learning is data- driven. The outcomes from an unsupervised learning task are controlled by the data and the way it‘s formatted.

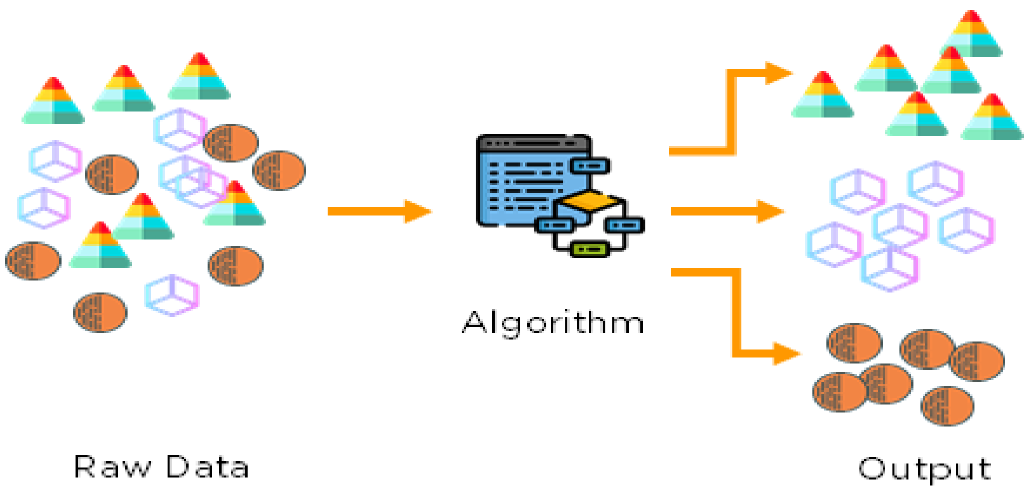


**Fig. 3.3:** Process of Unsupervised Learning

**Reinforcement learning**: It is fairly different when compared to supervised and unsupervised learning. Reinforcement learning is very behaviour driven. It has influences from the fields of neuroscience and psychology. For any reinforcement learning problem, we need an agent and an environment as well as a way to connect the two through a feedback loop. To connect the agent to the environment, we give it a set of actions that it can take that affect the environment. To connect the environment to the agent, we have it continually issue two signals to the agent: an updated state and a reward (our reinforcement signal for behaviour).

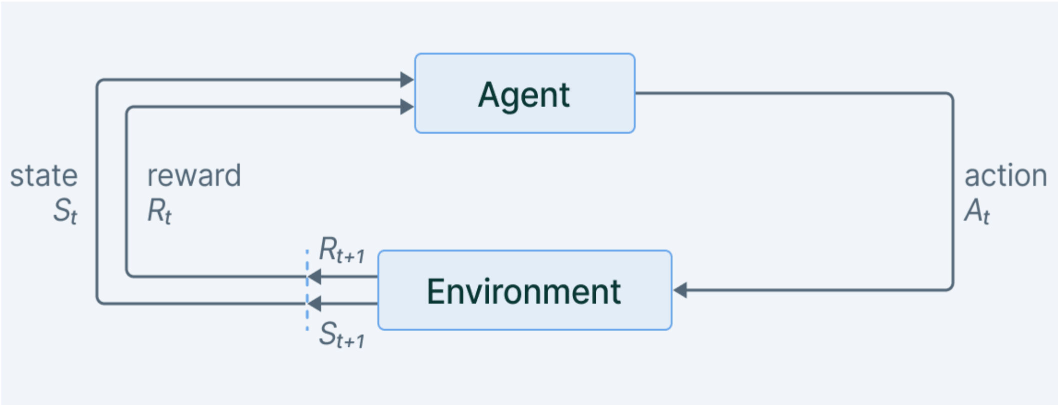


**Fig. 3.4:** Reinforcement Learning

## 3.2 Algorithm Used

**Neural Networks:**

The ability of neural networks to identify patterns, solve intricate puzzles, and adjust to changing surroundings is essential. Their capacity to learn from data has far-reaching effects, ranging from revolutionizing technology like natural language processing and self-driving automobiles to automating decision-making processes and increasing efficiency in numerous industries. The development of artificial intelligence is largely dependent on neural networks, which also drive innovation and influence the direction of technology.

Neural networks are complex systems that mimic some features of the functioning of the human brain. It is composed of an input layer, one or more hidden layers, and an output layer made up of layers of artificial neurons that are coupled. The two stages of the basic process are called backpropagation and forward propagation.

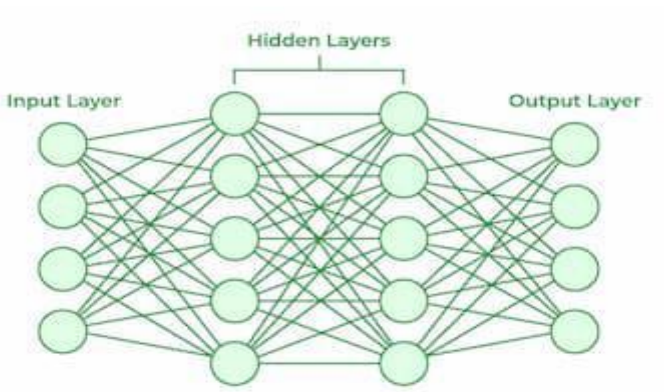


**Fig. 3.5:** Neural Networks

### Forward Propagation

**Input Layer:** Each feature in the input layer is represented by a node on the network, which receives input data.

**Weights and Connections**: The weight of each neuronal connection indicates how strong the connection is. Throughout training, these weights are changed.

**Hidden Layers:** Each hidden layer neuron processes inputs by multiplying them by weights, adding them up, and then passing them through an activation function. By doing this, non-linearity is introduced, enabling the network to recognize intricate patterns.

**Output:** The final result is produced by repeating the process until the output layer is reached.

### Backpropagation

**Loss Calculation:** The network's output is evaluated against the real goal values, and a loss function is used to compute the difference. For a regression problem, the Mean Squared Error (MSE) is commonly used as the cost function.

**Loss Function :** MSE = \frac{1}{n} \Sigma^{n}{i=1} (y{i} - \hat y_{i})^2

**Gradient Descent:** Gradient descent is then used by the network to reduce the loss. To lower the inaccuracy, weights are changed based on the derivative of the loss with respect to each weight.

**Adjusting weights:** The weights are adjusted at each connection by applying this iterative process, or backpropagation, backward across the network.

**Training:** During training with different data samples, the entire process of forward propagation, loss calculation, and backpropagation is done iteratively, enabling the network to adapt and learn patterns from the data.

**Actvation Functions:** Model non-linearity is introduced by activation functions like the rectified linear unit (ReLU) or sigmoid. Their decision on whether to "fire" a neuron is based on the whole weighted input.

### Haar Cascade Classifier

The algorithm can be explained in four stages:

- ✓ Calculating Haar Features
- ✓ Creating Integral Images
- ✓ Using Ada boost.
- ✓ Implementing Cascading Classifiers

It's important to remember that this algorithm requires a lot of **positive images** of faces and **negative images** of non-faces to train the classifier, similar to other machine learning models.

## Calculating Haar Features

The first step is to collect the Haar features. A **Haar feature** is essentially calculations that are performed on adjacent rectangular regions at a specific location in a detection window. The calculation involves summing the pixel intensities in each region and calculating the differences between the sums. Here are some examples of Haar features below.

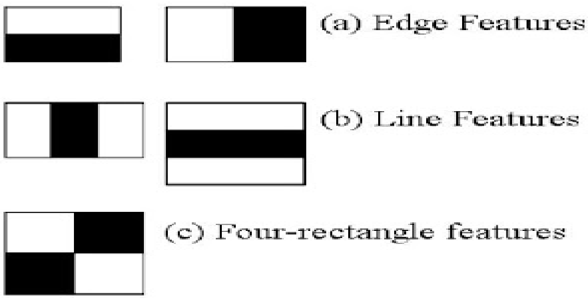


**Fig 3.6:** Types of Haar Features

These features can be difficult to determine for a large image. This is where **integral images** come into play because the number of operations is reduced using the integral image.

## Creating Integral Images

Without going into too much of the mathematics behind it (check out the paper if you're interested in that), integral images essentially speed up the calculation of these Haar features. Instead of computing at every pixel, it instead creates sub-rectangles and creates array references for each of those sub-rectangles. These are then used to compute the Haar features.

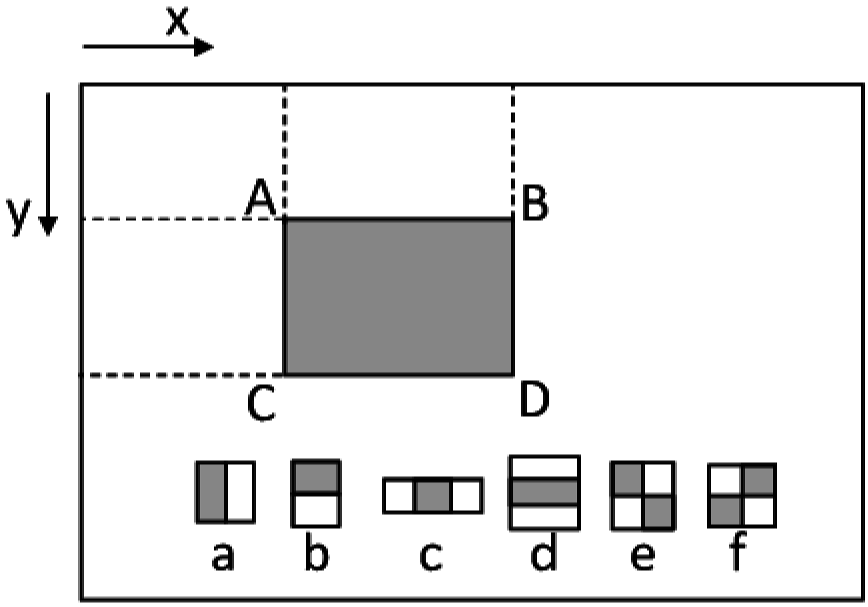


**Fig. 3.7:** Illustration for how an integral image works.

It's important to note that nearly all of the Haar features will be **irrelevant** when doing object detection, because the only features that are important are those of the object. However, how do we determine the best features that represent an object from the hundreds of thousands of Haar features? This is where **Adaboost** comes into play.

### Adaboost Training

Adaboost essentially chooses the best features and trains the classifiers to use them. It uses a combination of "**weak classifiers**" to create a "**strong classifier**" that the algorithm can use to detect objects.

Weak learners are created by moving a window over the input image, and computing Haar features for each subsection of the image. This difference is compared to a learned threshold that separates non-objects from objects. Because these are "weak classifiers," a large number of Haar features is needed for accuracy to form a strong classifier.

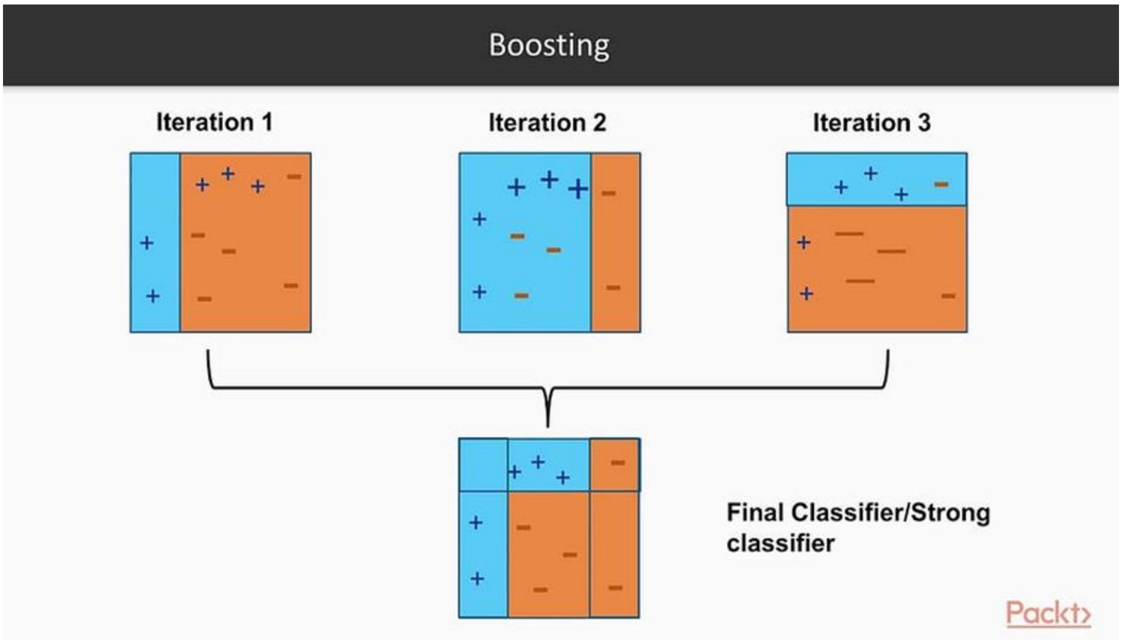


**Fig. 3.8:** Representation of a boosting algorithm.

The last step combines these weak learners into a strong learner using **cascading classifiers**.

### Implementing Cascading Classifiers

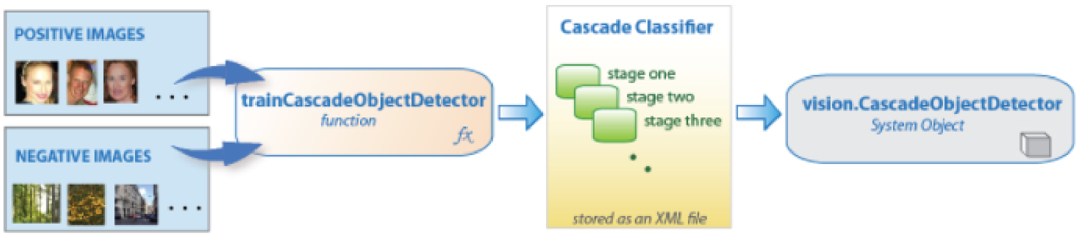


**Fig. 3.9:** A flowchart of cascade classifier

The cascade classifier is made up of a series of stages, where each stage is a collection of weak learners. Weak learners are trained using boosting, which allows for a highly accurate classifier from the mean prediction of all weak learners.

Based on this prediction, the classifier either decides to indicate an object was found (positive) or move on to the next region (negative). Stages are designed to reject negative samples as fast as possible, because a majority of the windows do not contain anything of interest.

It's important to maximize a **low false negative rate**, because classifying an object as a non-object will severely impair your object detection algorithm. A video below shows Haar cascades in action. The red boxes denote "positives" from the weak learners.

Haar cascades are one of many algorithms that are currently being used for object detection. One thing to note about Haar cascades is that it is very important to **reduce the false negative rate**, so make sure to tune hyperparameters accordingly when training your model.

So, what is actually going on in the background? Growing a tree involves deciding on which features to choose and what conditions to use for splitting, along with knowing when to stop. As a tree generally grows arbitrarily, you will need to trim it down for it to look beautiful. Let's start with a common technique used for splitting.

**Gussian Method Algorithm:**

- The Gaussian distribution, also known as the normal distribution, is a probability distribution that is symmetric and bell-shaped. It is characterized by its mean (average) and standard deviation (spread) parameters.
- The Gaussian distribution emerges naturally from the Central Limit Theorem, which states that the sum (or average) of a large number of independent and identically distributed random variables tends to follow a Gaussian distribution.
- The Gaussian distribution is described by its probability density function, which gives the likelihood of observing a particular value. The PDF is highest at the mean and decreases symmetrically on either side.
- A special case of the Gaussian distribution is the standard normal distribution, with a mean of 0 and a standard deviation of 1. Many statistical tests and methods rely on the standard normal distribution for simplicity.
- The Gaussian distribution is widely used in statistics, finance, physics, engineering, and various other fields due to its mathematical tractability and its ability to model natural phenomena.
- XGBoost is an algorithm that has recently been dominating applied machine learning and Kaggle competitions for structured or tabular data. XGBoost is an implementation of gradient boosted decision trees designed for speed and performance.

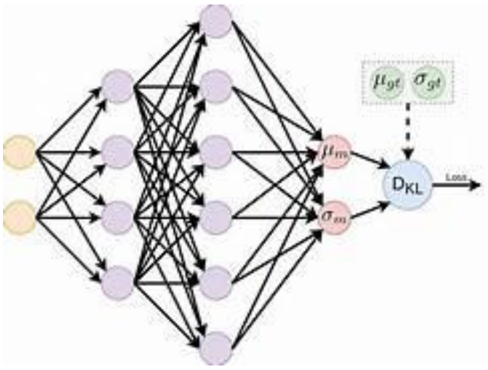


**Fig. 3.10:** GDS

- While the Gaussian distribution is widely applicable, it's important to recognize its limitations. Real-world data may not always follow a Gaussian distribution, and deviations from normality can impact the validity of statistical analyses based on Gaussian assumptions. In such cases, alternative distributions or non-parametric methods may be more appropriate.

# CHAPTER 4

# SYSTEM REQUIREMENTS SPECIFICATIONS

## 4.1 Functional Requirements

These are the requirements that the end user specifically demands as basic facilities that the system should offer. All these functionalities need to be necessarily incorporated into the system as a part of the contract. These are represented or stated in the form of input to be given to the system, the operation performed, and the output expected. They are basically the requirements stated by the user which one can see directly in the final product, unlike the non-functional requirements. Examples of functional requirements:

- video streaming
- Preprocessing
- Visualization.
- face recognition.
- Comparioson with database models.
- Detection of output behaviour of person with face.

**Benefits of functional requirements:**

- Helps you to check whether the application is providing all the functionalities that were mentioned in the functional requirement of that application.
- A functional requirement document helps you to define the functionality of a system or one of its subsystems.
- Functional requirements along with requirement analysis help identify missing requirements. They help clearly define the expected system service and behavior.
- Errors caught in the Functional requirement gathering stage are the cheapest to fix.
- Support user goals, tasks, or activities

## 4.2 Non-Functional Requirements:

NON-FUNCTIONAL REQUIREMENT (NFR) specifies the quality attribute of a software system. They judge the software system based on Responsiveness, Usability, Security, Portability and other non-functional standards that are critical to the success of the software system. Example of nonfunctional requirement, *"how fast does the website load?"* Failing to meet non-functional requirements can result in systems that fail to satisfy user needs. Non- functional Requirements allows you to impose constraints or restrictions on the design of the system across the various agile backlogs. Example, the site should load in 3 seconds when the number of simultaneous users are > 10000. Description of non-functional requirements is just as critical as a functional requirement.

They basically deal with issues like:

- Portability
- Security
- Maintainability
- Reliability
- Scalability
- Performance
- Reusability
- Flexibility

**Benefits of Non-Functional Requirements:**

- The nonfunctional requirements ensure the software system follows legal and compliance rules.
- They ensure the reliability, availability, and performance of the software system.
- They ensure good user experience and ease of operating the software.
- They help in formulating security policy of the software system.

## 4.3 Python Libraries:

Normally, a library is a collection of books or is a room or place where many books are stored to be used later. Similarly, in the programming world, a library is a collection of precompiled codes that can be used later on in a program for some specific well-defined operations. Other than pre-compiled codes, a library may contain documentation, configuration data, message templates, classes, and values, etc.

A Python library is a collection of related modules. It contains bundles of code that can be used repeatedly in different programs. It makes Python Programming simpler and convenient for the programmer. As we don’t need to write the same code again and again for different programs. Python libraries play a very vital role in fields of Machine Learning, Data Science, Data Visualization, etc.

## Working of Python Library

As is stated above, a Python library is simply a collection of codes or modules of codes that we can use in a program for specific operations. We use libraries so that we don't need to write the code again in our program that is already available. But how it works. Actually, in the MS Windows environment, the library files have a DLL extension (Dynamic Load Libraries). When we link a library with our program and run that program, the linker automatically searches for that library. It extracts the functionalities of that library and interprets the program accordingly. That's how we use the methods of a library in our program. We will see further, how we bring in the libraries in our Python programs.

## Python standard library

The Python Standard Library contains the exact syntax, semantics, and tokens of Python. It contains built-in modules that provide access to basic system functionality like I/O and some other core modules. Python Libraries are written in the C programming language. The Python standard library consists of more than 200 core modules. All these works together to make Python a high-level programming language. Python Standard Library plays a very important role. Without it, the programmers can't have access to the functionalities of Python. But other than this, there are several other libraries in Python that make a programmer's life easier.

Let's have a look at some of the commonly used libraries:

1. **Argparse:** Argparse is a Python module designed for parsing command-line arguments. It simplifies the process of creating user-friendly command-line interfaces by providing a convenient way to define, parse, and validate command-line arguments. Argparse allows developers to specify the expected command-line options, arguments, and subcommands, and it automatically generates help messages and error handling.

2. **NumPy:** The name "Numpy" stands for "Numerical Python". It is the commonly used library. It is a popular machine learning library that supports large matrices and multi-dimensional data. It consists of in-built mathematical functions for easy computations. Even libraries like TensorFlow use Numpy internally to perform several operations on tensors. Array Interface is one of the key features of this library.

3. **Dlib:** Dlib is a C++ library known for machine learning, computer vision, and image processing. It stands out as a comprehensive toolkit without specific dependencies, similar to Flask's classification as a micro web framework. Dlib doesn't include built-in database abstraction layers, form validation, or other components covered by third-party libraries. Nevertheless, Dlib supports extensions that seamlessly integrate additional features, such as object-relational mappers, image processing tools, and various machine learning functionalities. These extensions enhance Dlib's capabilities, offering flexibility and extensibility for diverse applications in the fields of computer vision and machine learning.
4. **OpenCV:** OpenCV is an open-source software library for computer vision and machine learning. The OpenCV full form is Open Source Computer Vision Library. It was created to provide a shared infrastructure for applications for computer vision and to speed up the use of machine perception in consumer products. OpenCV, as a BSD licensed software, makes it simple for companies to use and change the code. There are some predefined packages and libraries that make our life simple and OpenCV is one of them.

## Use of Libraries in Python Program

As we write large-size programs in Python, we want to maintain the code's modularity. For the easy maintenance of the code, we split the code into different parts and we can use that code later ever we need it. In Python, modules play that part. Instead of using the same code in different programs and making the code complex, we define mostly used functions in modules and we can just simply import them in a program wherever there is a requirement. We don't need to write that code but still, we can use its functionality by importing its module. Multiple interrelated modules are stored in a library. And whenever we need to use a module, we import it from its library. In Python, it's a very simple job to do due to its easy syntax. We just need to use import.

## 4.4 Hardware Requirements

The hardware requirements include the requirements specification of the physical computer resources for a system to work efficiently. The hardware requirements may serve as the basis for a contract for the implementation of the system and should therefore be a complete and consistent specification of the whole system. The Hardware Requirements are listed below:

| | |
|---|---|
| Processor | - I7/Intel Processor |
| Hard Disk | - 160GB |
| Keyboard | - Standard Windows Keyboard |
| Mouse | - Two or Three Button Mouse |
| Monitor | - SVGA |
| RAM | - 8GB |

1. **Processor:**

A processor is an integrated electronic circuit that performs the calculations that run a computer. A processor performs arithmetical, logical, input/output (I/O) and other basic instructions that are passed from an operating system (OS). Most other processes are dependent on the operations of a processor. A minimum 1 GHz processor should be used, although we would recommend S2GHz or more. A processor includes an arithmetical logic and control unit (CU), which measures capability in terms of the following:

- Ability to process instructions at a given time.
- Maximum number of bits/instructions
- Relative clock speed


**Fig. 4.1:** Processor

The proposed system requires a 2.4 GHz processor or higher.

2. **Ethernet connection (LAN) OR a wireless adapter (Wi-Fi):**

Wi-Fi is a family of radio technologies that is commonly used for the wireless local area networking (WLAN) of devices which is based around the IEEE 802.11 family of standards. Devices that can use Wi-Fi technologies include desktops and laptops, smartphones and tablets, TV‘s and printers, digital audio players, digital cameras, cars and drones. Compatible devices can connect to each other over Crop Yield Prediction and Fertilizer Analysis Using Machine Learning Wi- Fi through a wireless access point as well as to connected Ethernet devices and may use it to access the Internet. Such an access point (or hotspot) has a range of about 20 meters (66 feet) indoors and a greater range outdoors. Hotspot coverage can be as small as a single room with walls that block radio waves, or as large as many square 22ilometers achieved by using multiple overlapping access points.

**Fig. 4.2:** Ethernet Connection

**Hard Drive:** A hard drive is an electro-mechanical data storage device that uses magnetic storage to store and retrieve digital information using one or more rigid rapidly rotating disks, commonly known as platters, coated with magnetic material. The platters are paired with magnetic heads, usually arranged on a moving actuator arm, which reads and writes data to the platter surfaces. Data is accessed in a random access manner, meaning that individual blocks of data can be stored or retrieved in any order and not only sequentially. HDDs are a type often on volatile storage, retaining stored data even when powered off. 32 GB or higher is recommended for the proposed system.

**Fig. 4.3:** Hard Disk

**Memory (RAM):** Random-access memory (RAM) is a form of computer data storage that stores data and machine code currently being used. A random- access memory device allows data items to be read or written in almost the same amount of time irrespective of the physical location of data inside the memory. In today's technology, random-access memory takes the form of integrated chips. RAM is normally associated with volatile types of memory (such as DRAM modules), where stored information is lost if power is removed, although non- volatile RAM has also been developed. A minimum of 8 GB RAM is recommended for the proposed system.

**Fig. 4.4:** RAM

## 4.5 Software Requirements

The software requirements are description of features and functionalities of the target system. Requirements convey the expectations of users from the software product. The requirements can be obvious or hidden, known or unknown, expected or unexpected from client‘s point of view.

| | | |
|---|---|---|
| Operating System | : | Windows 11 |
| Server side Script | : | HTML, CSS & JS |
| Programming Language | : | Python |
| Libraries | : | Open CV, Numpy, DLIB. |
| IDE/Workbench | : | PyCharm |
| Technology | : | Python 3.6+ |

1. **PyCharm**: PyCharm is the most popular IDE for Python, and includes great features such as excellent code completion and inspection with advanced debugger and support for web programming and various frameworks. The intelligent code editor provided by PyCharm enables programmers to write high quality Python code. The editor enables programmers to read code easily through colour schemes, insert indents on new lines automatically, pick the appropriate coding style, and avail context-aware code completion suggestions.

   At the same time, the programmers can also use the editor to expand a code block to an expression or logical block, avail code snippets, format the code base, identify errors and misspellings, detect duplicate code, and auto-generate code. PyCharm offers some of the best features to its users and developers in the following aspects Code completion and inspection Advanced debugging Support for web programming and frameworks such as Django and Flask.

**Fig. 4.5:** PyCharm image

**2. Python:** It is an object-oriented, high-level programming language with integrated dynamic semantics primarily for web and app development. It is extremely attractive in the field of Rapid Application Development because it offers dynamic typing and dynamic binding options. Python is relatively simple, so it's easy to learn since it requires a unique syntax that focuses on readability. Developers can read and translate Python code much easier than other languages. In turn, this reduces the cost of program maintenance and development because it allows teams to work collaboratively without significant language and experience barriers. Additionally, Python supports the use of modules and a package, which means that programs can be designed in a modular style and code can be reused across a variety of projects.


**Fig. 4.6:** Python Icon.

# CHAPTER 5

# DESIGN

## 5.1 Existing Systems:

In the existing system, implementation of machine learning algorithms is bit complex to build due to lack of information about the data visualization. Mathematical calculations are used in existing system for model building this may takes the lot of time and complexity. To overcome all this, we use machine learning packages available in the scikit-learn library.

- Fuzzy clustering.
- Otsu method.
- KNN classifier algorithm.

**Disadvantages:**

- Approximate result at the regulation of  speed and direction
- It cannot work on the problems of scattering and at non co-ordinate system.

## 5.2 Proposed System:

Proposed several machine learning models to classify the personality through the posts, but none have adequately addressed this misdiagnosis problem. Also similar studies that have proposed models for evaluation of such performance classification mostly do not consider the heterogeneity and the size of the data. Therefore, we propose a Haar Features algorithm, Neural Networks algorithm, Preprocessing, Face Detection Process to identify the images.

**Advantages:**

- High Accuracy
- Reduce time complexity

## BLOCK DIAGRAM:

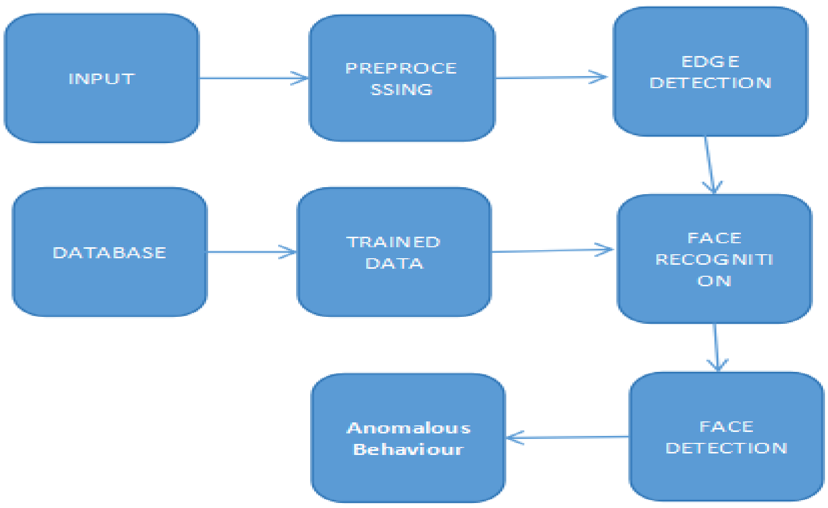


**Fig. 5.1:** Block Diagram

## DATA FLOW DIAGRAM:

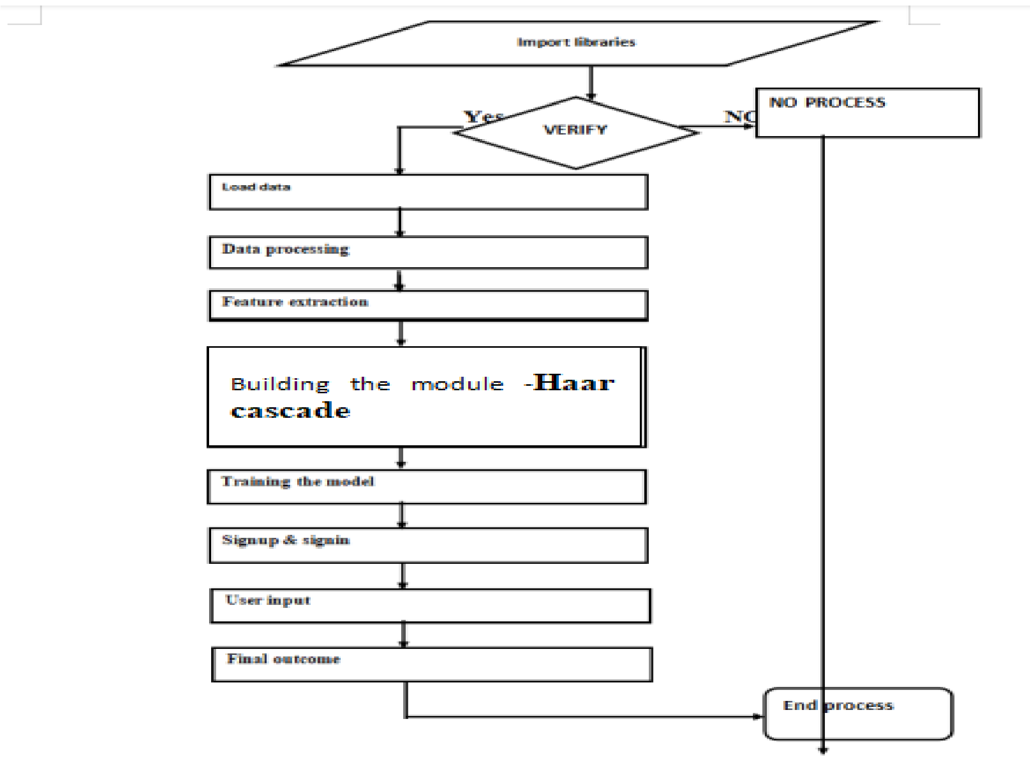


**Fig. 5.2:** Data Flow Diagram

1. The DFD is also called as bubble chart. It is a simple graphical formalism that can be used to represent a system in terms of input data to the system, various processing carried out on this data, and the output data is generated by this system.
2. The data flow diagram (DFD) is one of the most important modeling tools. It is used to model the system components. These components are the system process, the data used by the process, an external entity that interacts with the system and the information flows in the system.
3. DFD shows how the information moves through the system and how it is modified by a series of transformations. It is a graphical technique that depicts information flow and the transformations that are applied as data moves from input to output.
4. DFD is also known as bubble chart. A DFD may be used to represent a system at any level of abstraction. DFD may be partitioned into levels that represent increasing information flow and functional detail.

### 5.3 UML DIAGRAMS

The Unified Modeling Language (UML) is used to specify, visualize, modify, construct and document the artifacts of an object-oriented software intensive system under development. UML offers a standard way to visualize a system's architectural blueprints, including elements such as:

- actors
- business processes
- (logical) components
- activities
- programming language statements
- database schemas, and
- Reusable software components.

UML combines best techniques from data modeling (entity relationship diagrams), business modeling (work flows), object modeling, and component modeling. It can be used with all processes, throughout the software development life cycle, and across different implementation technologies. UML has synthesized the notations of the Booch method, the Object-modeling technique (OMT) and Object-oriented software engineering (OOSE) by fusing them into a single, common and widely usable modeling language. UML aims to be a standard modeling language which can model concurrent and distributed systems.

**Sequence Diagram:**

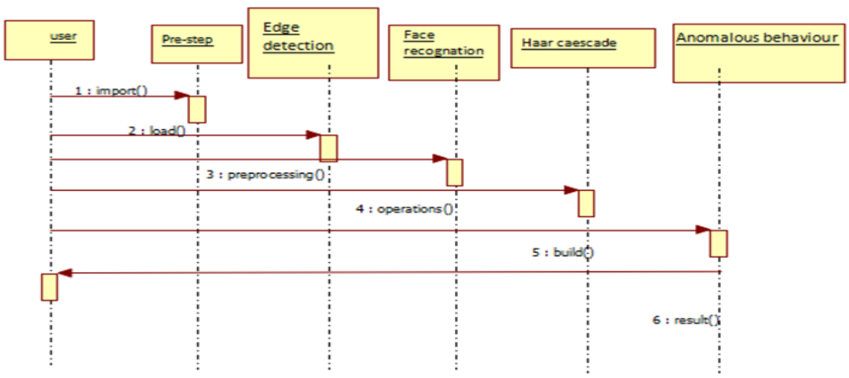


**Fig. 5.3:** Sequence Diagram

Sequence Diagrams Represent the objects participating the interaction horizontally and time vertically. A Use Case is a kind of behavioral classifier that represents a declaration of an offered behavior. Each use case specifies some behavior, possibly including variants that the subject can perform in collaboration with one or more actors. Use cases define the offered behavior of the subject without reference to its internal structure. These behaviors, involving interactions between the actor and the subject, may result in changes to the state of the subject and communications with its environment. A use case can include possible variations of its basic behavior, including exceptional behavior and error handling.

**Activity Diagram-:**

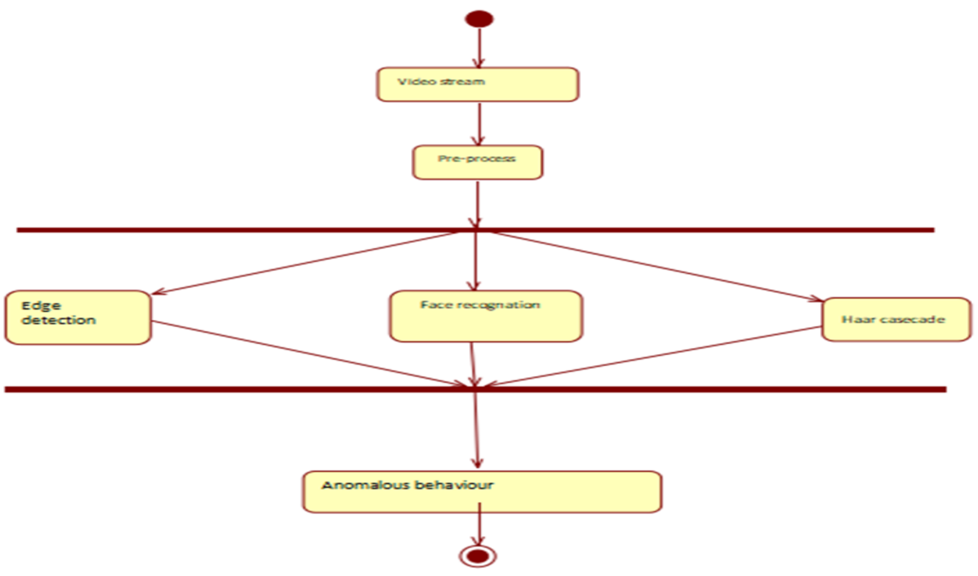


**Fig. 5.4:** Activity Diagram

Activity diagrams are graphical representations of Workflows of stepwise activities and actions with support for choice, iteration and concurrency. In the Unified Modeling Language, activity diagrams can be used to describe the business and operational step-by-step workflows of components in a system. An activity diagram shows the overall flow of control.

**Use case diagram:**

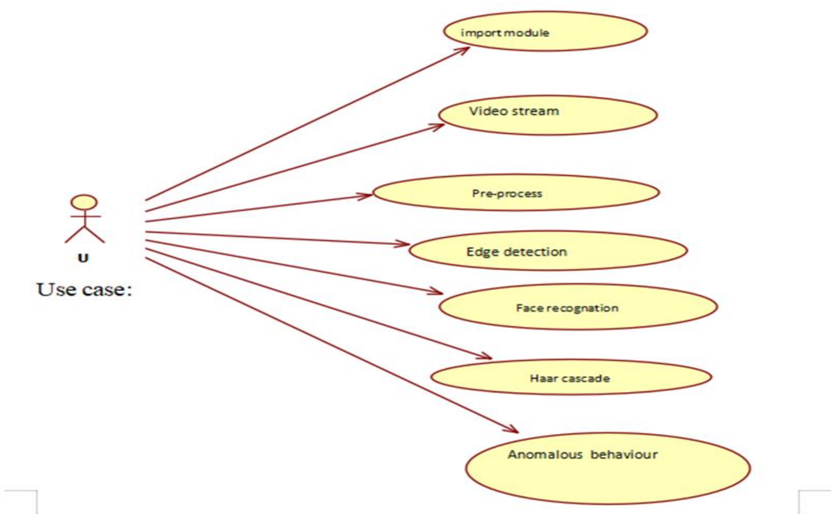


**Fig. 5.5:** Use case Diagram

- UML is a standard language for specifying, visualizing, constructing, and documenting the artifacts of software systems.
- UML was created by Object Management Group (OMG) and UML 1.0 specification draft was proposed to the OMG in January 1997.
- OMG is continuously putting effort to make a truly industry standard.
- UML stands for **U**nified **M**odeling **L**anguage.
- UML is a pictorial language used to make software blue prints.

**Collaboration Diagram:**

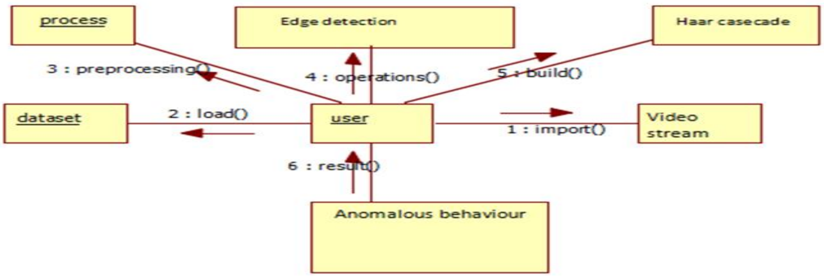


**Fig. 5.6:** Collaboration

A collaboration diagram resembles a flowchart that portrays the roles, functionality, and behavior of individual objects as well as the overall operation of the system in real time. Objects are shown as rectangles with naming labels inside. These labels are preceded by colons and may be underlined. The relationships between the objects are shown as lines connecting the rectangles. The messages between objects are shown as arrows connecting the relevant rectangles along with labels that define the message sequencing

**Class Diagram:**

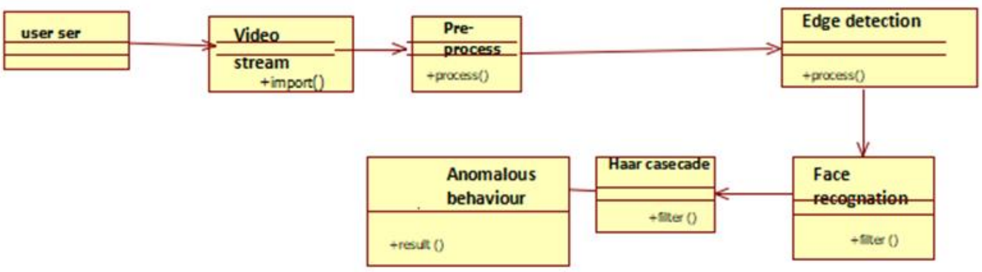


**Fig. 5.7:** Class Diagram

The class diagram is the main building block of object-oriented modeling. It is used for general conceptual modeling of the systematic of the application, and for detailed modeling translating the models into programming code. Class diagrams can also be used for data modeling. The classes in a class diagram represent both the main elements, interactions in the application, and the classes to be programmed.

In the diagram, classes are represented with boxes that contain three compartments:

The top compartment contains the name of the class. It is printed in bold and centered, and the first letter is capitalized.

The middle compartment contains the attributes of the class. They are left-aligned, and the first letter is lowercase.

The bottom compartment contains the operations the class can execute. They are also left-aligned, and the first letter is lowercase.

**Component Diagram:**

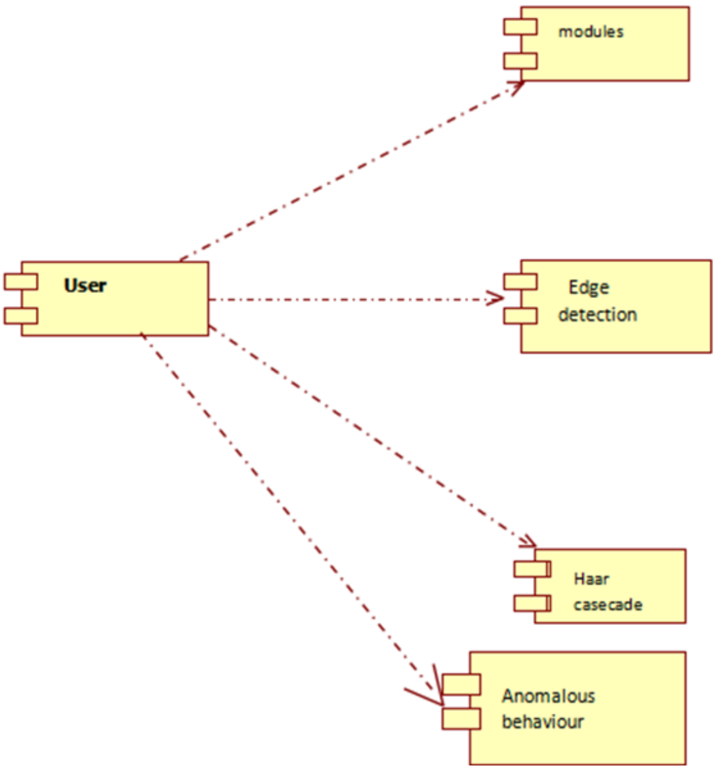


**Fig. 5.8:** Component Diagram

Component diagram is a special kind of diagram in UML. The purpose is also different from all other diagrams discussed so far. It does not describe the functionality of the system, but it describes the components used to make those functionalities.

Thus, from that point of view, component diagrams are used to visualize the physical components in a system. These components are libraries, packages, files, etc.

Component diagrams can also be described as a static implementation view of a system.

Static implementation represents the organization of the components at a particular moment. A single component diagram cannot represent the entire system but a collection of diagrams is used to represent the whole.

The purpose of the component diagram can be summarized as −

- Visualize the components of a system.
- Construct executables by using forward and reverse engineering.
- Describe the organization and relationships of the components.

**ER Diagram:**

An entity relationship diagram (ERD) shows the relationships of entity sets stored in a database. An entity in this context is an object, a component of data. An entity set is a collection of similar entities. These entities can have attributes that define its properties. By defining the entities, their attributes, and showing the relationships between them, an ER diagram illustrates the logical structure of databases.

ER diagrams are used to sketch out the design of a database.

**Data flow diagram:**

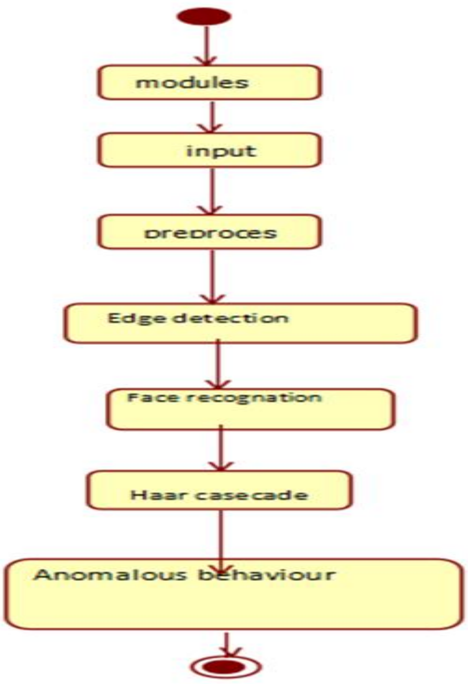


**Fig. 5.9:** Data Flow Chart

Also known as DFD, Data flow diagrams are used to graphically represent the flow of data in a business information system. DFD describes the processes that are involved in a system to transfer data from the input to the file storage and reports generation. Data flow diagrams can be divided into logical and physical. The logical data flow diagram describes flow of data through a system to perform certain functionality of a business. The physical data flow diagram describes the implementation of the logical data flow.

Systems development is a systematic process which includes phases such as planning, analysis, design, deployment, and maintenance. System Analysis is a process of collecting and interpreting facts, identifying the problems, and decomposition of a system into its components. System analysis is conducted for the purpose of studying a system or its parts in order to identify its objectives. It is a problem solving technique that improves the system and ensures that all the components of the system work efficiently to accomplish their purpose. Analysis specifies what the system should do.

System Design is a process of planning a new business system or replacing an existing system by defining its components or modules to satisfy the specific requirements. Before planning, you need to understand the old system thoroughly and determine how computers can best be used in order to operate efficiently. System Design focuses on how to accomplish the objective of the system.

# CHAPTER 6
# IMPLEMENTATION

Automated proctoring systems play a crucial role in maintaining the integrity of examinations by detecting anomalous behavior in real-time. These systems leverage advanced technologies like facial recognition and eye-tracking to monitor test-takers for signs of cheating, such as looking away from the screen or accessing unauthorized materials. By promptly flagging suspicious activities, automated proctoring ensures fairness and discourages academic dishonesty, while also offering scalability and consistency in monitoring multiple exam sessions simultaneously. Overall, the integration of automated proctoring technology enhances the credibility of assessments and promotes a level playing field for all students.

## 6.1. Modules

**1. System:**

**Model Training:** The System stores the dataset given by the user.

**Model Training:** The system takes the data from the user and fed that data to the selected model.

**Model Predictions:** The system takes the data given by the user and predict the output based on the given data.

**Message Generation:** System takes student reactions as input and generates a alert message.

**2. User:**

**Load Dataset:** The user can load the dataset he/she want to work on.

## 6.2. Work flow of a the System:

1. **Data Collection:** Gather data from various sensors and sources, including webcams, microphones, and screen activity, to monitor test-takers during examinations.
2. **Pre-processing**: Clean and preprocess the collected data to remove noise and irrelevant information, ensuring accurate analysis.
3. **Feature Extraction**: Extract relevant features from the preprocessed data, such as facial expressions, eye movements, keystrokes, and screen activity patterns.

4. **Anomaly Detection**: Utilize machine learning algorithms, such as neural networks or statistical models, to detect anomalies in the extracted features, indicating potential cheating behavior.
5. **Threshold Setting**: Establish threshold values for each feature to distinguish between normal and abnormal behavior, considering factors like duration of gaze shifts, frequency of keyboard inputs, and deviations from typical screen interaction patterns.
6. **Real-time Monitoring**: Continuously monitor test-takers in real-time during examinations, comparing their behavior against established thresholds to promptly flag any anomalies.
7. **Alert Generation**: Generate alerts or notifications for proctors or instructors when suspicious behavior is detected, providing relevant data and evidence for further investigation.
8. **Intervention Decision**: Enable proctors to review flagged incidents and make informed decisions regarding intervention, such as warning the student, invalidating the exam attempt, or taking disciplinary action.
9. **Feedback Loop**: Incorporate feedback from proctors and instructors to refine the anomaly detection algorithms and improve the system's accuracy and effectiveness over time.
10. **Documentation and Reporting**: Maintain comprehensive documentation of flagged incidents, interventions, and outcomes for auditing purposes, ensuring

# CHAPTER 7

# SYSTEM STUDY &TESTING

## 7.1 Feasibility Study

The feasibility of the project is analysed in this phase and business proposal is put forth with a very general plan for the project and some cost estimates. During system analysis the feasibility study of the proposed system is to be carried out. This is to ensure that the proposed system is not a burden to the company.

Three key considerations involved in the feasibility analysis are:

- Economical feasibility.
- Technical feasibility
- Social feasibility

## 7.2 Economical Feasibility

This study is carried out to check the economic impact that the system will have on the organization.The amount of fund that the company can pour into the research and development of the system is limited. The expenditures must be justified. Thus, the developed system as well within the budget and this was achieved because most of the technologies used are freely available.

## 7.3 Technical Feasibility

This study is carried out to check the technical feasibility, that is, the technical requirements of the system. Any system developed must not have a high demand on the available technical resources. This will lead to high demands on the available technical resources.This will lead to high demands being placed on the client.

## 7.4 Social Feasibility

The aspect of study is to check the level of acceptance of the system by the user. This includes the process of training the user to use the system efficiently. The user must not feel threatened by the system, instead must accept it as a necessity. The level of acceptance by the users solely depends on the methods that are employed to educate the user about the system and to make him familiar with it.

## 7.5 System Testing

The purpose of testing is to discover errors. Testing is the process of trying to discover every conceivable fault or weakness in a work product. It provides a way to check the functionality of components, sub-assemblies, assemblies and/or a finished product It is the process of exercising software with the intent of ensuring that the Software system meets its requirements and user expectations and does not fail in an unacceptable manner. There are various types of test. Each test type addresses a specific testing requirement.

## 7.6 Unit Testing

Unit testing involves the design of test cases that validate that the internal program logic is functioning properly, and that program inputs produce valid outputs. All decision branches and internal code flow should be validated. It is the testing of individual software units of the application .it is done after the completion of an individual unit before integration. This is a structural testing, that relies on knowledge of its construction and is invasive. Unit tests perform basic tests at component level and test a specific business process, application, and/or system configuration. Unit tests ensure that each unique path of a business process performs accurately to the documented specifications and contains clearly defined inputs and expected results.

## 7.7 Integration Testing

Integration tests are designed to test integrated software components to determine if they actually run as one program. Testing is event driven and is more concerned with the basic outcome of screens or fields. Integration tests demonstrate that although the components were individually satisfaction, as shown by successfully unit testing, the combination of components is correct and consistent.

**Test Results**: All the test cases mentioned above passed successfully. No defects encountered.

## 7.8 Acceptance Testing

User Acceptance Testing is a critical phase of any project and requires significant participation by the end user. It also ensures that the system meets the functional requirements.

**Test Results**: All the test cases mentioned above passed successfully. No defects encountered.

## 7.9 Functional Testing

Functional tests provide systematic demonstrations that functions tested are available as specified by the technical requirements, system documentation, and user manuals.

Functional testing is centered on the following items:

Valid Input : identified classes of valid input must be accepted.

Invalid Input : identified classes of invalid input must be rejected.

Functions : identified functions must be exercised.

Output : identified classes of application outputs must be exercised.

Systems/Procedures: interfacing systems or procedures must be invoked.

## 7.10 White Box Testing

White Box Testing is a testing in which in which the software tester has knowledge of the inner workings, structure and language of the software, or at least its purpose. It is purpose. It is used to test areas that cannot be reached from a black box level.

## 7.11 Black Box Testing

Black Box Testing is testing the software without any knowledge of the inner workings, structure or language of the module being tested. Black box tests, as most other kinds of tests, must be written from a definitive source document, such as specification or requirements document, such as specification or requirements document. It is a testing in which the software under test is treated, as a black box .you cannot "see" into it. The test provides inputs and responds to outputs without considering how the software works.

## 7.12 Test Objectives

- All field entries must work properly.
- Pages must be activated from the identified link.
- The entry screen, messages and responses must not be delayed.

**Features to be tested**

- Verify that the entries are of the correct format
- No duplicate entries should be allowed
- All links should take the user to the correct page.

# CHAPTER 8

# RESULTS

The examination monitoring system effectively utilized the Haar Cascade Classifier for precise face detection, ensuring high accuracy in identifying individuals. Gaussian Distribution based anomaly detection proved proficient in detecting abnormal behaviors within environments, enhancing security measures. examination The neural network, trained  suspicious state detection, demonstrated remarkable adaptability and contributed significantly to the system's overall accuracy by discerning between normal and suspicious states effectively. In evaluating image compression techniques, JPEG offered efficient lossy compression, suitable for scenarios tolerant of quality loss, while JPEG 2000 provided a versatile solution with both lossy and lossless options. PGF in rapid encoding , decoding times, making  for real-time applications.

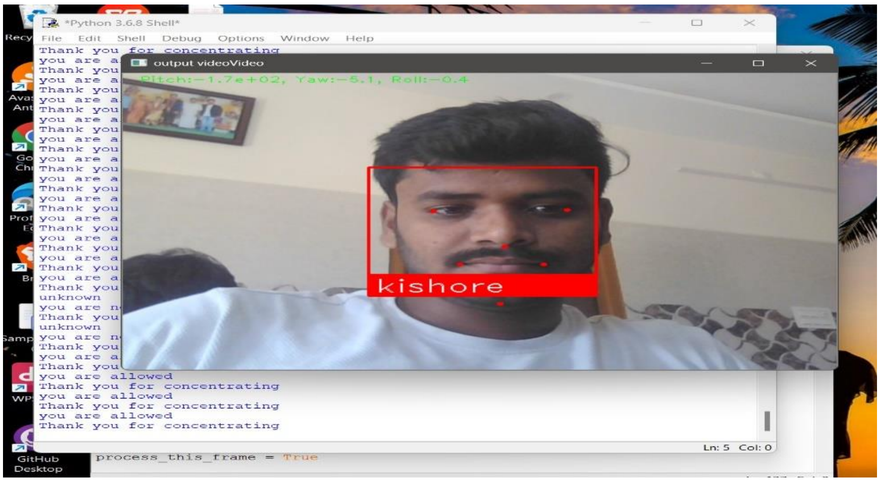


**Fig. 8.1:** video capturing the face

The above page shows us, The Sitting posture of the student in an examination hall and detects the head movements of the student.

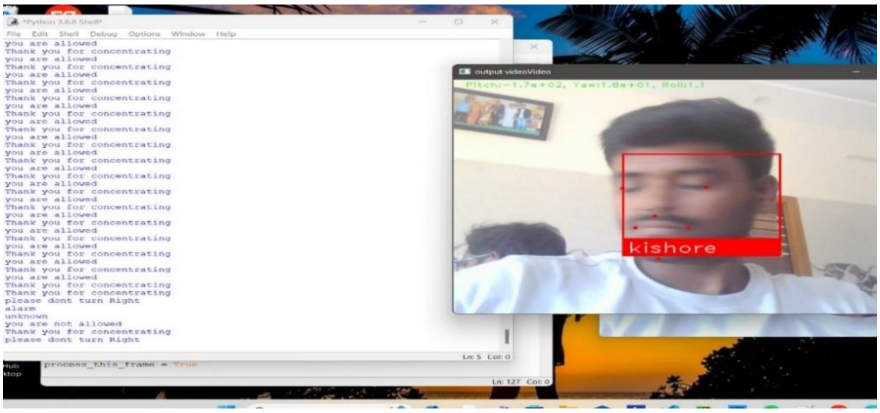


**Fig. 8.2:** Suspicious Activity (By Turning Face Right)

The above page shows us, Suspicious Activity done by the student when He/ She turns Face towards Right side.

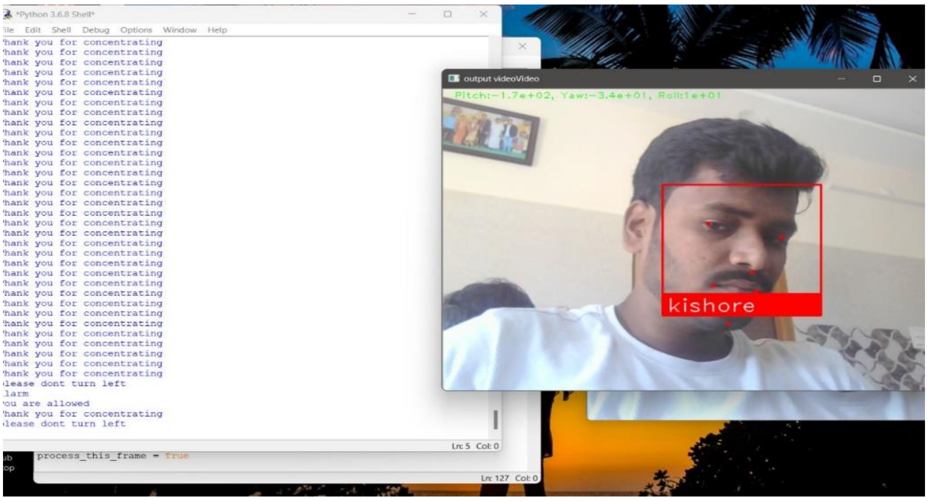


**Fig. 8.3:** Suspicious Activity (By Turning Face Left)

The above page shows us, Suspicious Activity done by the student when He/ She turns Face towards Left side.

# CONCLUSION

The implementation of Haar cascade for detecting anomalous behavior in examination halls holds great promise in upholding the integrity of examinations. By utilizing this technology, educational institutions can effectively monitor exam halls for any irregularities or suspicious activities, thereby deterring cheating and ensuring a fair assessment environment.

However, it is crucial to approach the deployment of such surveillance systems with careful consideration of privacy concerns and ethical implications. Educational institutions must prioritize the protection of students' privacy rights while implementing Haar cascade-based monitoring systems. This entails establishing clear policies and protocols for data collection, storage, and access, as well as obtaining informed consent from all stakeholders involved.

Furthermore, customization of the Haar cascade algorithm to suit the specific needs and dynamics of examination settings is essential. Fine-tuning the parameters of the algorithm can help optimize its performance in accurately detecting anomalous behavior while minimizing false positives and respecting individuals' privacy.

Additionally, robust oversight mechanisms must be put in place to ensure the ethical use of Haar cascade-based surveillance systems. This includes regular audits, transparency in system operation, and accountability measures to prevent misuse or abuse of the technology.

With proper planning, customization, and oversight, Haar cascade-based surveillance systems can indeed make valuable contributions to maintaining the integrity of examinations. By providing educators with the tools to effectively monitor exam halls and deter cheating, these systems promote fairness, transparency, and meritocracy in educational assessment processes. Moreover, they empower institutions to uphold academic standards and foster a culture of integrity and honesty among students.

# REFERENCES


**[1]** Prakash, P. V., &Srivenkatesh, M., (2024)., Hybrid Deep Learning Algorithms for Predicting Nutrient Deficiencies in Paddy Crops Using CNN and Super Resolution Fenerative Adversarial Neural Networks, International Systems and Applications in Engineering, 12(16s), 520-526.

**[2]** Chen, Y., & Jiang, H. (2018). "Deep learning based image classification for crop diseases." Computers, Materials & Continua, 57(1), 61-71. DOI: 10.32604/cmc.2018.05236

**[3]** Singh, A., Ganapathysubramanian, B., Sarkar, S., & Singh, A. K. (2018). "Deep learning for plant stress phenotyping: Trends and future perspectives." Trends in Plant Science, 23(10), 883-898. DOI: 10.1016/j.tplants.2018.06.003

**[4]** Reddy, P., Raghavendra, A., & Reddy, S. (2019). "Machine learning approaches for crop yield prediction and classification of crop diseases." Journal of King Saud University-Computer and Information Sciences. DOI: 10.1016/j.jksuci.2019.03.022

**[5]** LeCun, Y., Bengio, Y., & Hinton, G. (2015). " Deep learning" Nature, 521(7553), 436-444. DOI: 10.1038/nature14539

**[6]** Krizhevsky, A., Sutskever, I., & Hinton, G. E. (2012). "ImageNet Classification with Deep Convolutional Neural Networks" In Advances in Neural Information Processing Systems (NIPS), 1097-1105. Link to Paper

**[7]** Goodfellow, I., Bengio, Y., Courville, A., & Bengio, Y. (2016). "Deep Learning" MIT Press. Link to Book

**[8]** He, K., Zhang, X., Ren, S., & Sun, J. (2016). "Deep Residual Learning for Image Recognition" In Proceedings of the IEEE Conference on Computer Vision and Pattern Recognition (CVPR), 770-778. DOI: 10.1109/CVPR.2016.90

**[9]** Szegedy, C., Vanhoucke, V., Ioffe, S., Shlens, J., &Wojna, Z. (2016). "Rethinking the Inception Architecture for Computer Vision" In Proceedings of the IEEE Conference on Computer Vision and Pattern Recognition (CVPR), 2818-2826. DOI: 10.1109/CVPR.2016.308.

**[10]** Simonyan, K., & Zisserman, A. (2014). "Very Deep Convolutional Networks for

Large-Scale Image Recognition." arXiv preprint arXiv:1409.1556. Link to Paper

**[11]** Huang, G., Liu, Z., Van Der Maaten, L., & Weinberger, K. Q. (2017). "Densely Connected Convolutional Networks." In Proceedings of the IEEE Conference on Computer Vision and Pattern Recognition (CVPR), 4700-4708. DOI: 10.1109/CVPR.2017.243

**[12]** Amritha T, Gokulalakshmi T, Umamaheshwari P, T Rajasekar M.Tech, "Machine Learning Based Nutrient Deficiency Detection in Crops", International Journal of Recent Technology and Engineering (IJRTE), ISSN: 2277-3878, Volume-8 Issue-6, March 2020.

**[13]** Lili Ayu Wulandhari, Alexander Agung Santoso Gunawan, Arie Qurania, PrihastutiHarsani, Triastinurmiatiningsih Ferdy Tarawan, Riska Fauzia Hermawan, "Plant Nutrient Deficiency Detection Using Deep Convolutional Neural Network", ICIC Express Letters Volume 13, Number 10, October 2019.

**[14]** A. Pushpa Athisaya Sakila Rani, N. Suresh Singh, "Protecting the environment from pollution through early detection of infections on crops using the deep belief network in paddy", Total Environment Research Themes 3-4 (2022) 100020.

**[15]** Ukritwatchareeruetai, Pavit Noinongyao, Chaiwat Wattanapaiboonsuk, Puriwat Khantiviriya, Sutswat Duangsrisai, "Identification of plant Nutrient Deficiencies Using Convolutional Neural Networks", IEECON 2018.

# DETECTION OF ANAMALOUS BEHAVIOUR IN AN EXAMINATION HALL TOWARDS AUTOMATED PROCTORING

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**Abstract:**Detecting anomalous behavior, especially within complex environments like examination rooms where identifying abnormal movements of examinees is crucial, poses a significant challenge. Addressing this issue requires a comprehensive approach integrating neural networks and statistical techniques such as Gaussian distribution. Our proposed monitoring system comprises three fundamental stages: initial face detection employing a haar-cascade detector, followed by identification of suspicious states utilizing a trained neural network, and ultimately, anomaly detection based on statistical analysis leveraging Gaussian distribution. The core concept entails determining whether a student exhibits suspicious behavior through neural network analysis and subsequently evaluating the frequency of such occurrences within a defined time frame to ascertain anomalous conduct. This integrated methodology aims to enhance the efficacy of anomaly detection in dynamic settings, facilitating prompt intervention and ensuring the integrity of examination processes.

**Keywords: Abnormal interactions, Real-time alerts, Behavioural analysis.**

## INTRODUCTION

Digital Image Processing (DIP) stands as a cornerstone in the contemporary landscape of technology, permeating diverse sectors from medical diagnostics to multimedia communication. Among the myriad applications within DIP, the compression of images has become a focal point for achieving efficient storage and transmission. This delves into a meticulous exploration and comparison of three influential image compression techniques: JPEG, JPEG 2000, and Progressive Graphics File (PGF). As society becomes increasingly reliant on visual information,optimizing the balance between image quality and resource consumption becomes imperative. The evolution of image compression algorithms mirrors the dynamic needs of a technologically advancing society. Against this backdrop, this seeks to unravel the nuances and distinctions among these three methodologies, navigating the intricacies of both lossy and lossless compression scenarios. By emphasizing critical parameters such as compression efficiency and decoding times, our investigation aims to provide a comprehensive understanding of the trade-offs inherent in each technique. A rich contextualization is established through an extensive review of the historical development of image compression algorithms. The empirical foundation for our evaluation is a diverse test set encompassing natural images and aerial ortho-photos, ensuring a broad and representative analysis. The judicious selection of quantitative metrics, including Peak Signal-to-Noise Ratio (PSNR), compression ratios, and encoding/decoding times, positions this project as a rigorous and insightful exploration into the performance intricacies of each compression technique. In the subsequent sections, we present our findings, shedding light on the unique strengths and weaknesses exhibited by each algorithm. As technology propels us into an era where visual data is omnipresent, the implications of our study extend beyond the immediate comparison, offering practical insights for decisionmakers, researchers, and practitioners navigating the complex landscape of image compression technologies. Through this endeavor, we contribute to the ongoing discourse within digital image processing, paving the way for informed choices and advancements in this ever-evolving field.

## LITERATURE SURVEY

[1] A proposed system is introduced, designed to provide continuous monitoring of student behavior through the utilization of a fixed camera. Comprising three distinct layers, namely Face Detection, Suspicious State Detection, and

Anomalous Detection, this system offers a comprehensive approach to behavior analysis. Behavior evaluation is conducted over a sequence of n-frames, employing the Gaussian distribution method. Determination of anomalous behavior is derived from the frequency of students being identified in a suspicious state within a predefined time duration. This framework aims to enhance surveillance capabilities within educational settings, enabling proactive intervention and ensuring the maintenance of a secure and conducive learning environment.This presents a comprehensive approach to exam hall surveillance using face detection and machine learning algorithms. It highlights the integration of face detection with other monitoring techniques to enhance anomaly detection. These studies collectively highlight the significance of using face detection to monitor abnormal behaviour in exam halls. They discuss various aspects such as accuracy, privacy concerns, integration with other technologies, and the potential benefits of implementing face detection-based proctoring systems.

[2] A proposed an iterative approach to refining automated proctoring algorithms. It proposes learning from past false positives to adapt algorithms and improve their ability to differentiate between legitimate and suspicious behaviours.This research explores the integration of natural language processing (NLP) and computer vision techniques to detect cheating. It presents algorithms that analyze text inputs, identify plagiarized content, and combine it with image analysis to detect the presence of unauthorized materials

Surveillance videos serve as valuable resources for capturing the actions of subjects, discerning between normal behaviors and anomalies. In this context, object recognition, particularly face recognition, has been effectively implemented utilizing the Viola Jones algorithm. The focus of attention lies on two specific activities: passing cheats and viewing a neighbor's answer sheet. To analyze these activities, interest points are extracted from individual frames utilizing the Speeded-Up Robust Features (SURF) algorithm, while the detection of interest points is facilitated by approximating the Hessian Matrix. Human behavior, within this framework, is perceived as a stochastic progression of actions, underscoring the dynamic and probabilistic nature of behavioral patterns observed in surveillance footage.[3].

In the controlled environment of examination halls, the meticulous tracking of behavior and the comprehensive training of systems to recognize various anomalies are paramount to mitigate the risk of false negatives [4].To achieve this, behavior detection methodologies have been deployed, leveraging spatial- temporal shape and flow correlation techniques. These methods enable the extraction of training templates, which serve as reference points for behavior identification. The Mean Shift algorithm is then employed for video segmentation, facilitating the delineation of relevant regions within the footage. Subsequently, each frame of the input video undergoes comparison with the template image, enabling the calculation of matching distances. By establishing an appropriate threshold, potential matches are effectively located within the video stream, enhancing the system's capacity to identify aberrant behavior accurately and efficiently.

In the realm of outdoor video surveillance, the focus shifts towards the detection of mobile objects within dynamic outdoor environments. This entails utilizing a reference image containing features that exhibit high trackability . Through the establishment of feature correspondences between adjacent frames in the input video, motion detection is effectively tracked, employing methodologies such as the Lucas-Kanade tracker [5] .To ensure the accuracy and reliability of tracking, ineffective features are systematically rejected, while new features contributing to unexplored image areas are incorporated to enhance overall performance. However, a significant challenge lies in the selection of a robust feature set capable of accurately tracing anomalous behavior. This task is compounded by the variability in environmental conditions under which the video recordings are captured, necessitating adaptive strategies to address the diverse patterns inherent in outdoor surveillance scenarios[6].

The system is engineered to offer adaptability across diverse conditions, providing users with the flexibility to select and train it to detect specific behaviors of interest. This versatility enables its utilization across a spectrum of scenarios, ranging from routine surveillance to security-related monitoring applications. Central to its functionality is a method for anomaly detection within video streams, leveraging HOG (Histogram of Oriented Gradients) features. By harnessing the discriminative power of HOG features, the system effectively identifies deviations from expected behavior, thereby enhancing its efficacy in detecting anomalies and ensuring heightened situational awareness across varied contexts [7].

The system is designed with the capability to discern between normal and abnormal behaviors as specified by the user's requirements. Within this framework, four distinct types of abnormal behaviors are identified: peeking into neighboring answer sheets, passing papers between individuals, signaling to neighbors, and turning around during the examination process. Through meticulous analysis and pattern recognition techniques, the system can effectively detect instances of these specified abnormal behaviors within the monitored environment. By accurately distinguishing between normal and aberrant actions, the system enables proactive identification and intervention, thereby upholding the integrity and fairness of the examination process. This functionality underscores the system's versatility and adaptability in addressing a spectrum of user-defined behavioral scenarios, ensuring comprehensive surveillance and monitoring capabilities[8].

## PROPOSED SYSTEM

To utilizes the Haar-features algorithm to enable accurate and real-time detection of cheating behaviours in an automated proctoring context. By combining facial detection and behavioural analysis with threshold tuning, the system aims to provide educators with a powerful tool to ensure exam integrity and minimize disruptions to legitimate test-takers. Aims to utilize the AdaBoost algorithm, a popular ensemble learning technique, to enhance cheating detection capabilities within an automated proctoring framework. The proposed system aims to leverage cheating detection capabilities within an automated proctoring framework.

MATERIAL AND METHODOLOGY

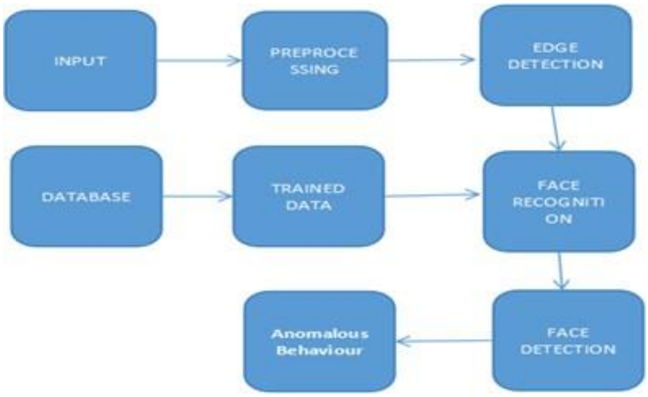



**Fig1.Block diagram for suggestedapproach**

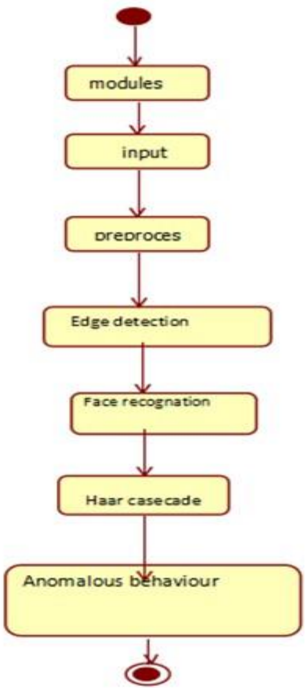
The user will first register using his email address and password in the diagram. Following page login, he or she will upload a file and be able to view it or retrieve it by using a term as a key. By employing that keyword, the user can so share the file with others. The credentials are crucial for the system in the main.

## Methodology Overview

### Architecture:

The flow diagram that follows provides an explanation of how the system operates. The steps that make up the overall process are as follows.

**STATE CHART:**




## System Implementation

### A. VIDEO STREAMING:

Video streaming technology has emerged as a pivotal method for delivering audio and video content over the Internet, reaching millions of users across various devices such as personal computers, PDAs, mobile smartphones, and streaming devices. The proliferation of broadband networks, coupled with advancements in video and audio compression techniques, has catalyzed the growth of video streaming technology. This growth is further fueled by the increasing quality and diversity of audio and video services available over the internet. Within video streaming, two primary transmission modes exist: download mode and streaming mode. Download mode entails the complete downloading of the content file before playback, necessitating significant downloading time and storage space. Conversely, in streaming mode, content is played back in real- time as it is received and decoded, obviating the need for complete downloading and enabling seamless viewing experiences. Moreover, the integration of pre-processing conversion techniques, such as converting RGB to grayscale and black-and-white images, enhances the efficiency and utility of video streaming technology, further solidifying its prominence in the digital landscape.

**1. Pre-processing:**

Video streaming technology has emerged as a pivotal method for delivering audio and video content over the Internet, reaching millions of users across various devices such as personal computers, PDAs, mobile smartphones, and streaming devices. The proliferation of broadband networks, coupled with advancements in video and audio compression techniques, has catalyzed the growth of video streaming technology. This growth is further fueled by the increasing quality and diversity of audio and video services available over the internet. Within video streaming, two primary transmission modes exist: download mode and streaming mode. Download mode entails the complete downloading of the content file before playback, necessitating significant downloading time and storage space. Conversely, in streaming mode, content is played back in real- time as it is received and decoded, obviating the need for complete downloading and enabling seamless viewing experiences. Moreover, the integration of pre-processing conversion techniques, such as converting RGB to grayscale and black-and-white images, enhances the efficiency and utility of video streaming technology, further solidifying its prominence in the digital landscape.

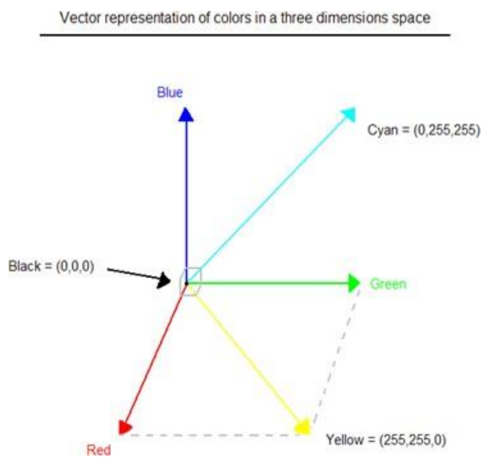



Fig 3 Vector representation of colours in 3 dimensions.

In the realm of color representation in digital imagery, colors are encoded using three bytes to delineate their decomposition across the three primary colors: Red, Green, and Blue. This method of representation inherently lends itself to a mathematical interpretation, particularly to mathematicians accustomed to working with vectors in multidimensional spaces. By conceptualizing colors as vectors within a three- dimensional space, where each axis corresponds to one of the primary colors, mathematicians can leverage a host of geometric mathematical concepts. These concepts include norms, scalar products, projections, rotations, and distances, which can be applied to manipulate and analyze colors with precision and rigor. This mathematical framework not only facilitates a deeper understanding of color representation but also enables the development of sophisticated algorithms and techniques for color processing and analysis in various fields such as computer graphics, image processing, and computer vision.

**B. GRAY SCALE IMAGE:**

A grayscale image, also referred to as a black-and-white image, is a digital representation where each pixel carries only intensity information. Unlike color images, grayscale images contain varying shades of gray, ranging from black (0) at the lowest intensity to white (255) at the highest intensity. These shades of gray represent the varying levels of brightness or darkness within the image, allowing for nuanced depiction of objects and scenes. Grayscale images are distinct from one-bit black-and- white images, which consist solely of black and white pixels, often used for binary or bi-level representations. Grayscale images, on the other hand, offer a spectrum of gray tones between black and white, enabling more detailed and nuanced visual representation in various applications such as photography, medical imaging, and digital art.

Grayscale images, synonymous with monochromic images, represent a visual definition devoid of polychromatic variation. generally, grayscale images arise from the dimension of light intensity at each pixel within a single band of the electromagnetic diapason, similar as infrared, visible light, or ultraviolet. In cases where only a specific frequence is captured, these grayscale images are supposed monochromic proper. still, grayscale images can also be synthesized from full- color images through colorful styles of conversion. This versatility in their origin underscores the rigidity of grayscale images across different operations, allowing for precise representation of light intensity and easing nuanced visual analysis in fields ranging from photography to scientific imaging.

**C. FACE DETECTION:**

In face detection, the Haar cascade detector stands as a prominent method, leveraging Haar wavelets for feature extraction from images and subsequent feature evaluation. This approach enables the detection of key facial features across various sizes and locations within the image. Integral images play a crucial role in expediting feature extraction, providing a specialized representation of the image that accelerates computation. Classifier training and feature selection further refine the process, enhancing the accuracy and efficiency of face detection. Through the utilization of a cascaded classifier, all detected features are efficiently combined, culminating in a robust and reliable mechanism for identifying faces within images. This comprehensive approach to face detection underscores the importance of leveraging both advanced algorithms and computational techniques to achieve accurate results in real-world applications.

**Haar cascade classifier:**

**Haar – Cascade**

Haar-like features are rectangular patterns utilized for data analysis, forming the basis of classifiers in cascade systems. These classifiers combine multiple Haar-like features to efficiently detect objects or patterns in images. Haar wavelets, mathematical functions generating square wave outputs, serve as fundamental components in feature extraction and evaluation processes within various computational tasks.

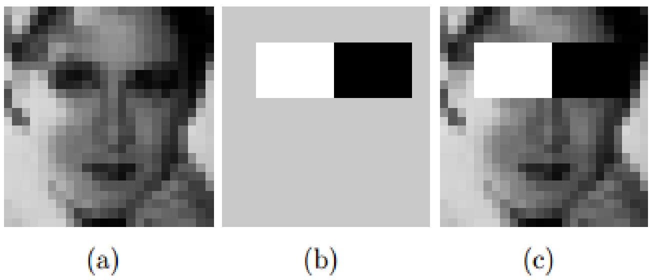



Fig 4. Haar-like Features

Figure 4 depicts Haar-like features, with the template background shaded gray to emphasize pattern support, while only black or white-marked pixels are utilized during feature calculation, optimizing computational efficiency and accuracy. To achieve acceptable performance in face detection, the algorithm must minimize both false negative and false positive rates, given the absence of an objective distribution describing the prior probability of an image containing a face. Adaboost, a committee learning algorithm, facilitates the extraction of facial characteristics from images by combining weak classifiers into a strong one via a voting mechanism. Weak classifiers, unable to meet predefined classification targets in error terms, are enhanced through this process. Efficiency considerations are vital, necessitating algorithms that operate within reasonable computational budgets. Techniques such as integral images and attention cascades have notably enhanced the efficiency of the Viola-Jones algorithm, enabling robust performance on standard PCs with real-time image sequences captured from webcams or cameras.

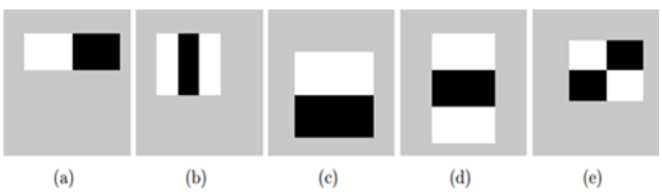



Fig-5.Haar-like features with different sizes and orientation.

The variability in size and position of a pattern's support, provided that its black and white rectangles maintain equal dimensions, border each other, and retain relative positions, allows for a manageable number of features to be extracted from an image. For instance, a 24 × 24 image can yield a total of 162,336 features across five distinct patterns. These features, derived from the constraints imposed on the pattern's structure, are assumed to encapsulate all the requisite information necessary for characterizing a face. In practice, these derived features serve as key elements in the process of facial characterization and recognition, contributing to the efficacy of face detection algorithms such as the Viola-Jones method.

Consider the integral image, a key element in image processing for efficient computation of pixel sums within specified rectangular regions. For instance, in determining the sum of pixels within rectangular D, denoted as S(D), a formula utilizing integral image values is employed. Specifically, S(D) is calculated as the difference between the integral image value at position 4 and the sum of integral image values at positions 3 and 2, with an additional summand at position 1. This computation accounts for the overlapping regions of rectangles A, B, and C within rectangle D. Integral images are defined as the accumulation of pixel values, where each pixel's value is the sum of all preceding pixels in the image. This framework facilitates efficient calculation of pixel sums across various regions of interest, enabling expedited image processing tasks such as feature extraction and object detection.

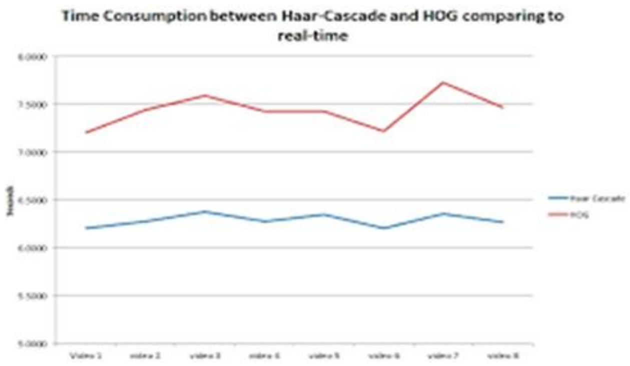



Fig-6.Time consumption Haar-Cascade in real time

## PERFORMANCE ANALYSIS

In machine learning, the confusion matrix serves as a crucial tool for assessing the performance of an algorithm. Presented in this matrix offers a comprehensive breakdown of classification outcomes, with each column representing instances of the expected class and each row representing instances of the actual class. By detailing the counts of false positives, false negatives, true positives, and true negatives, the confusion matrix provides deeper insights into the algorithm's performance beyond simple accuracy percentages. Notably, the diagonal values within the matrix reflect the accuracy of each detected action, offering valuable information for evaluating the effectiveness and reliability of the system.

### A. Evaluation Factors

In the realm of pattern recognition and information retrieval, the performance of a model hinges on its ability to accurately predict actual events. During the training phase, the model relies on labeled data sets containing the true values it aims to predict. Subsequently, the model undergoes evaluation against separate labeled data, ensuring its generalizability beyond the training set. True positives and true negatives denote correctly predicted observations, while false positives and false negatives pertain to incorrect predictions, highlighting the nuances in interpretation rather than the actual events themselves. Precision and Recall metrics are crucial in this context, with Precision gauging the ratio of correct positive predictions relative to all positive predictions, including those misclassified as positive when the actual events were negative. This nuanced understanding of classification outcomes enables a comprehensive assessment of model performance in binary classification tasks.

Precision measures the proportion of accurately predicted positive observations, considering all instances predicted as positive, even those where the actual events were negative.

$$\text{Precision} = \frac{\text{TP}}{(\text{TP} + \text{FP})}$$

Recall, synonymous with sensitivity or true positive rate, quantifies the proportion of correctly predicted positive events relative to all positive events, irrespective of whether they were accurately identified by the model.

$$Recall = \frac{TP}{TP + FN}$$

Accuracy, as an intuitive performance measure, assesses the ratio of correctly predicted observations, providing a straightforward evaluation of model effectiveness.

$$\text{Accuracy} = \frac{(TP + TN)}{(TP + FP + TN + FN)}$$

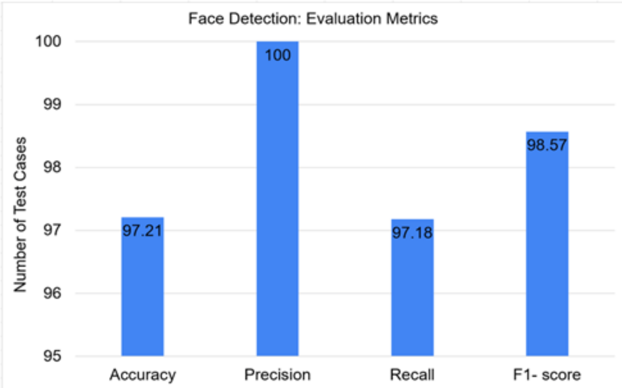



Fig-7.face detection results

**Results and Discussion:**

The examination monitoring system effectively utilized the Haar Cascade Classifier for precise face detection, ensuring high accuracy in identifying individuals. Gaussian Distributionbased anomaly detection proved proficient in detecting abnormal behaviors within examination environments, enhancing security measures.

The neural network, trained for suspicious state detection, demonstrated remarkable adaptability and contributed significantly to the system's overall accuracy by discerning between normal and suspicious states effectively.

In evaluating image compression techniques, JPEG offered efficient lossy compression, suitable for scenarios tolerant of quality loss, while JPEG 2000 provided a versatile solution with both lossy and lossless options. PGF excelled in rapid encoding and decoding times, making it ideal for real-time applications.

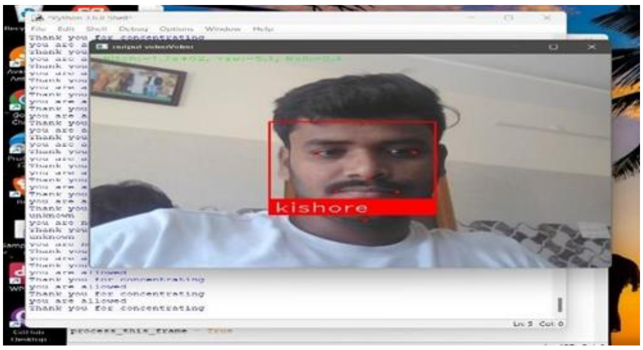



Fig-8.video capturing the face

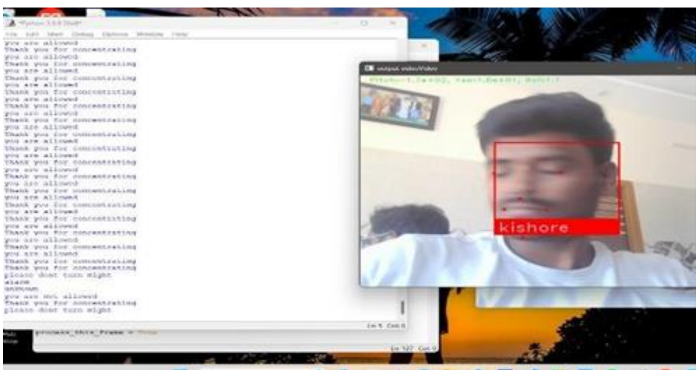



Fig-9.SuspiciousActivity(ByTurning FaceRight)

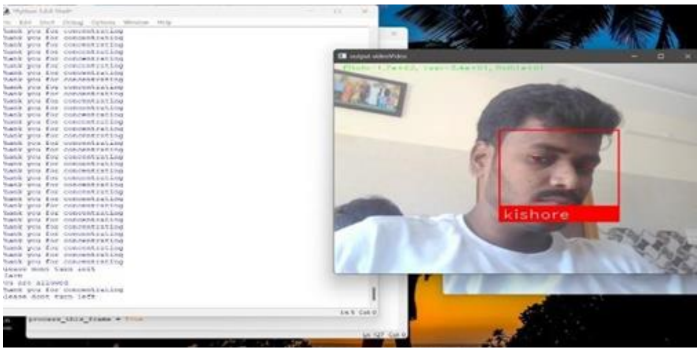


Fig-10.Suspicious Activity(By Turning Face Left)

Statistical analysis, including T-tests and ANOVA, revealed significant performance differences among image compression techniques, aiding in the selection of the most efficient method based on speed and effectiveness.

Real-time simulation underscored PGF's efficiency, particularly in scenarios prioritizing swift data transfer and processing, making it well-suited for applications like live streaming and interactive multimedia, where rapid processing is paramount.

**FUTURE SCOPE**

The future of detecting anomalous behavior in examination halls using Haar cascade technology holds great potential for improving the integrity and fairness of examinations while also enhancing security measures. Continued research and development in this area are likely to lead to further advancements and innovations in the years to come. Furthermore, with the integration of advanced machine learning algorithms and real-time monitoring systems, the accuracy and efficiency of anomalous behavior detection are expected to increase significantly. As technology evolves, the capabilities of Haar cascade technology in exam hall surveillance are poised to play a pivotal role in ensuring a level playing field for all examinees.

## CONCLUSION

The utilization of Haar cascade for detecting anomalous behavior in an online examination halls presents a promising solution for maintaining the integrity of examinations. However, it's essential to address privacy concerns and ensure the ethical implementation of such systems in educational settings. With proper planning, customization, and oversight, Haar cascade-based surveillance systems can significantly contribute to fair and transparent examinationprocesses.

## REFERENCES


[1] Ben-Musa, Ahmad Salihu, Sanjay Kumar Singh, and Prateek Agrawal "Suspicious Human Activity Recognition for Video Surveillance System."(2014).

[2] Yong, Lu, and He Dongjian. "Video-based detection of abnormal behaviour in the examination room." Information Technology and Applications (IFITA), 2010 International Forum on. Vol. 3. IEEE, 2010.

[3] T. Darrell,B. Moghaddam andA.P. Pentland, "Active face trackingand pose estimation in an interactive room ", IEEE Computer Society Conference

[4] C. Liu andH. Wechsler, " Gabor point grounded bracket using the enhanced fishermandirect discriminant model for face recognition ",IEEE Deals on Image processing,vol. 11,no. 4,pp. 467- 476, 2002.

[5] H. Rowley,S. Baluja, andT.Kanade, " Neural networkgrounded face discovery ". IEEE Deals on Pattern Analysis and Machine Intelligence,vol. 20, no. 1,pp. 23- 38,1998.

[6] Cotsaces,C .,Marras,I.,Tsapanos,N., Nikolaidis,N., &Pitas,I.( 2010, November) In Electronics and Telecommunications(ISETC),2010 9th International Symposium on(pp. 3- 8). IEEE. "Human-centered_Video_Analysis_for_Multimedia_Postproduction".

[7] P. Viola,M.J. Jones andD. Snow, " Detecting climbers using patterns of stir and appearance ", Ninth IEEE International Conference on Computer Vision,pp. 734- 741, 2003.

[8] T. Darrell,B. Moghaddam andA.P. Pentland, “Active face trackingand pose estimation in an interactive room ”, IEEE Computer Society Conference on Computer Vision and Pattern Recognition,pp. 67- 72, 1996

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5th & 6th April 2024

*Organized by Department of Electrical & Electronics Engineering*

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