

**IOT-BASED HUMAN IDENTIFICATION AND MONITORING SYSTEM  
USING CLOUD AND MACHINE LEARNING**

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Submitted by

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**July, 2022**



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## **LIST OF ABBREVIATIONS AND SYMBOLS**

AI	Artificial Intelligence
RCNN	Regional-based Convolutional Neural Network
SIFT	Scale-invariant feature transform
RANSAC	Random sample consensus
IOT	Internet of Thing
SVM	Support Vector Machine
CV	Computer Vision.
CNN	Convolutional Neural Network

## **ABSTRACT**

The internet is the essential thing in our life, nowadays. But with ease there comes a challenge of creating security. Manual security or human guarding is not possible for the whole time for so many reasons. And now we are here at that stage of life where we are doing our daily life activities with internet. Artificial intelligence and machine learning is gaining a lot of popularity due to ease they provide. Now in this project we are adding these things together to solve a problem for security and intelligent surveillance applications. Here we see the use of artificial intelligence and machine learning when combined with Internet of Things can give its benefits to many fields including privacy, security and intelligent surveillance. A significant amount of research work is carried out in human identification and monitoring system but intelligent monitoring in real time is still an emerging topic due to emerging technologies such as Internet of Things and Computer vision. The objective is to provide security updates on the roadside. This project includes an IOT based human identification and monitoring system that used machine learning algorithm RCNN and computer vision to detect and monitor people. The constant developing urbanization and emergence of smart cities require better security surveillance and crowd monitoring systems. The growing availability of the internet of things devices in public and private areas. This article introduces an IOT based crowd surveillance system that uses machine learning model is to detect the person who is wanted without knowing him that he is being tracked. The RCNN model is used for object detection and to classify people.

**CHAPTER -1**  
**INTRODUCTION**

## **1.1 INTRODUCTION TO HUMAN IDENTIFICATION AND MONITORING:**

Human identification and monitoring are the very mathematical view of knowing a person's identity and keeping an eye on him. In today's life where there are thousands of easy ways for doing the simplest possible thing, security is a challenge. Whether we talk about internet space or physical space, security plays an important role for normal life and routine. If any intruder walks into our home that is our safest place we think about then, we will surely not feel safe and secure in our home too. And it can be more dangerous if we suddenly do know that the family shifted in our neighborhood recently has criminal history. And are wanted criminals. So now that we are sure that we really need a system that can ensure our safety and security of our lives and property. Secondly, in the era of technology where we are buying basic things like clothes, gadgets from the internet how are it possible that we manually write absent or present in the class. Of course, we need a system that can tell that the particular student is present on particular date. In this way we can have records for many days and in a much cheaper way. So these are the basic reasons why we need a system that can identify human, thought these are not the only reasons. So, we are living in 2022 where a simple mobile phone is made to make it user friendly. The proposed research is also taken from the same idea that in the society where our home is should be safe and secure. There is no social threat roaming around us. Especially when we do not know him. We do not know about every criminal. Do we?

So basically, human identification is the process of knowing who the person is? Knowing about him, identify him by face recognition techniques, biometrics or any other way. Human monitoring is keeping an eye on someone. Look after every activity of any individual. And it has many applications in various fields.



**Figure 1: Human Identification in a frame**

The internet is the essential thing in life today, almost all devices are connected to the internet network, and many have been implemented in virtually all areas of life that exist in society today, with the concept of smart city internet system plays very crucial role. This is because all have been connected to the internet network, and this system is expected to reduce many of the problems in the developing cities developed cities. With this an excellent precautionary method we can track any suspicious person without knowing them. Moreover, with this intelligent monitoring system we can help the government and police officers to track the criminal or wanted person without stopping them.

Intelligent monitoring system has been widely used after the world hit pandemic. All the departments of world were closed for much time but then nothing can be stopped for long run. Hence, intelligent monitoring plays a crucial role and monitors every movement which was manually recorded previously. In offices, schools, banks. Every organization installed these monitoring devices that monitors and identify every person and records data by using biometrics, unique ID, retina mapping or any means. Different algorithms are used for identification and

monitoring. For prediction purpose many algorithms are studied in this article that shows different result accuracies that are recorded. We see how RCNN machine learning architecture provides much efficient results for human prediction. After the world goes virtual and online activity increased with a massive rate the need for human identification and monitoring also increased. If we have a system that can tell us that if we are safe and secure and monitors any social threat that we are unknown about, by the use of artificial intelligence and machine learning, our safety facilities will be good in that manner. And over time we will be able to raise the safety measures and future damage can be prevented and also, we can take precautionary methods before time to protect.

## **1.2 TECHNOLOGIES USED IN THE RESEARCH:**

The reason behind human identification and monitoring in the surveillance field is, it is important to use a system that is entirely based of mathematical operations and model. This is why we have used machine learning algorithms in our analysis framework:

## **1.3 COMPUTER VISION:**

Now that we have classify our data using R-CNN machine learning algorithms and by that our system can classify between different object seen in the picture, this is the time we have to fetch information about those pictures that are digital, of course. Artificial intelligence provides vision to the computer same as we human do have, and this is called computer vision. As the name suggest, this technology gives vision to the computer that enables the computer to derive meaningful information from the digital images and videos. AI help the computer to think then it is safe to say that CV enables them to see, observe and understand.

OpenCV is used in this surveillance system to train the machine to look after every movement and catch the target if it is present in the frame, but it will do it with cameras, data and algorithms



in much less time than retinas, optic nerves basically a human will do and that is why we are making this system. CV needs huge amount of data to get it trained.

First of all, to train the model in computer vision we need a lot and lots of data. It will run and analyze over data over and over again until it gets trained by those training data sets that will be the supervisor for the model. Machine learning uses algorithm models that will teach the model to classify the digital images and learn to predict correct output. Algorithm enables the computer by itself using the pre trained inputs. A CNN will do its classification on the images by classifying it into thousands of pixels. It will build convolution neural network i.e., mathematical operations on functions and produce or predicts output. Computer vision will give eyes to the computer that will derive meaningful information from the digital images that it sees. We integrate it with python then it is capable of processing the Open CV array structure for analysis. It will tell us all the information about that person from seeing its image and tell us if the person is criminal. If the data matches from the dataset that has previous records of his criminal history, it will deliver results that name and location of that person from the image or a video and obviously in much less time than a human will do but with that privilege there come challenges.

#### **1.4.1 MACHINE LEARNING**

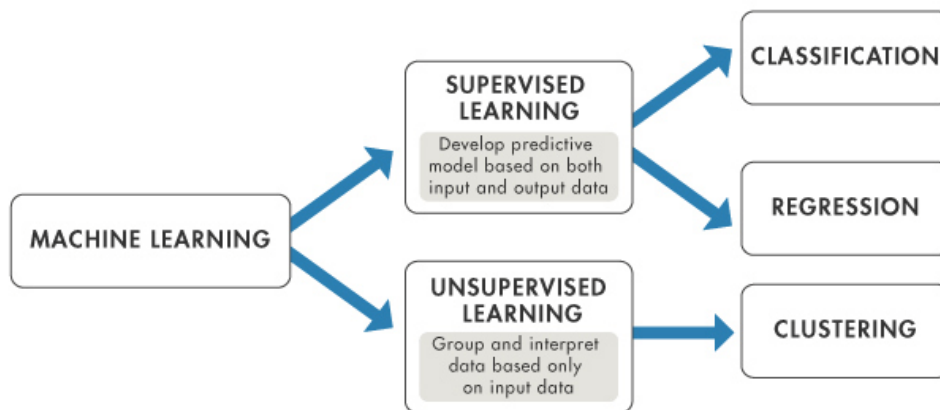
Machine learning is that kind of Artificial Intelligence (AI) at some level that allows its many applications or systems to become more and more accurate in giving results and predicting outputs that are more accurate without being explicitly programmed to do that particular task.



**Figure 2: Phases in machine learning**

They learn by their experience and previous environment and they become more and more accurate every time. Machine learning is of following types:

- Supervised learning
- Unsupervised learning
- Reinforcement learning



**Figure 3: Types of machine learning**

So, the method that we are using in our system is supervised learning. Let us quickly see about supervised learning.

- **Supervised machine learning** is the process where the machine is trained by giving set of datasets that are already tagged with their outputs that will supervise the machine to predict the output correctly. In this type of learning the models are trained with labeled datasets and then the machine is tested by giving the test datasets. And on the basis of

those training data, the machine will predict the correct output for the test datasets. Image classification is the need here why we are using supervised machine learning.

For classification, we will be using RCNN supervised pre- training algorithm. In other words, the model is trained for being used as an object classifier rather than detector.

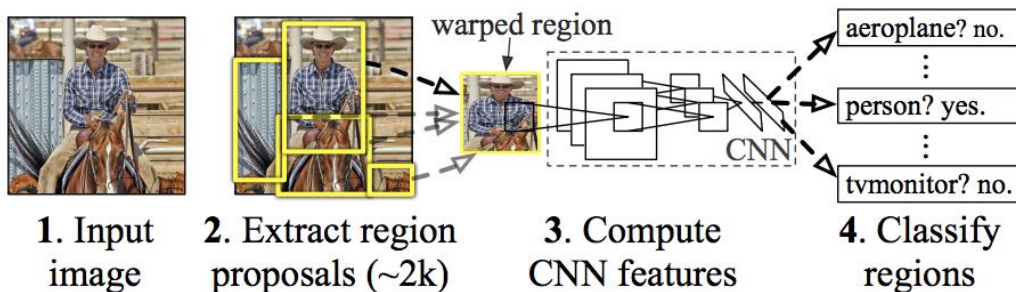
### ➤ RCNN

To solve the problem of selecting huge number of regions (locations), Ross Girshick et al. proposed a method where we use selective search to extract just 2000 regions from any image and he called them region proposals. Therefore, now, instead of trying to classify huge number of regions, you can just work with 2000 regions. These proposals are generated using the selective search algorithm which is written below:

Selective Search:

1. Generate initial sub- segmentation, we generate many candidate regions.
2. Use greedy algorithm to recursively combine similar regions into larger ones.
3. Use the generated regions to produce the final candidate region proposals.

RCNN is the complete innovation the existing art of object detection techniques. Although we have many other strong algorithms for object detection, RCNN is yet the fundamental and powerful and also simple algorithm that will allow its users to do task.



**Figure 4: R-CNN: Regions with CNN features**

➤ **Unsupervised machine learning:**

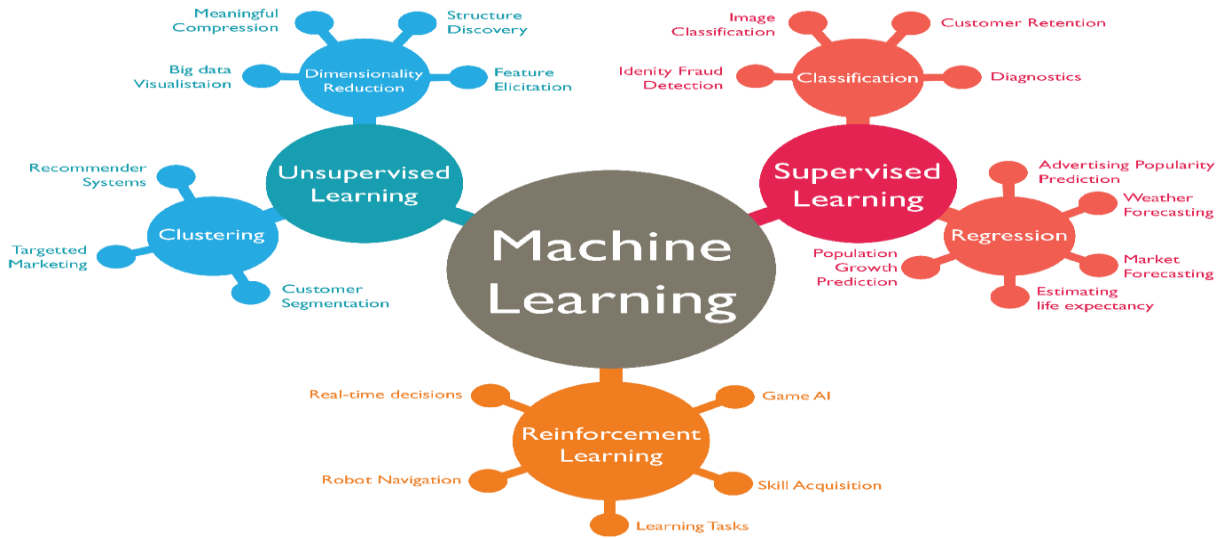
In this type of machine learning, the machine or the model is not fed with the trained datasets. Hence, the output that comes from unsupervised machine learning is not completely guaranteed correct. The main or the primary function of this learning is to find the hidden data from the major component of dataset.

In this unsupervised learning, the machine looks for new patterns and relations in the data on its own. And it is changing from time to time the data from its database. In this case, the machine has hardly any knowledge to learn with, and it continues to learn a lot from the same given input.

➤ **Reinforcement Learning:**

These algorithms are quite different yet they are the one that are most commonly used in today's highly advanced technologies. These are self-independent algorithms that is, they are capable to make completely new type of decisions on their own. Such programs make several errors and continue to improve their performance by taking lessons from their errors. They take expertise from themselves only and make better decisions the next time. They train their program better by correcting their own mistakes.

Reinforcement machine learning is a complicated type of machine learning that is safe to build software model rather it can be used to modify software as needed. Automatic cars, robots etc. are the perfect examples of this type of learning. As they are introduced to new task very often, automatic cars drove to several places and hence it will be learning through its own and its old mistakes.



**Figure 5: MACHINE LEARNING**

- **Advantages of machine learning**

Machine learning is currently used in variety of fields nowadays. This covers the medical, banking, financial, health care, robotics, automation, communication, gaming sector and various other sectors:

- When we order food from the online food delivery application, there also machine learning is employed. The machine learning algorithms takes our interest from our ordering history and thus the system knows our favorite food stops.
- Machine learning is used in social media apps like Instagram to make it an entertainment spot for us. And they also display ads on the base of our search history and make the platform more relevant and easier to use for us.

- **Disadvantages of machine learning**

- Sometimes it can be dangerous to know someone from this close that a machine knows our interest and dis interest. This information can lead to cybercrime and other malicious elements to enter in our virtual world and can cause damage.

- Machine learning is interpreting or making predictions. No one can say that this is the 100% true result to the problem. So, we just cannot rely on the predictions.
- Scientists are finding a greater level of machine learning and hence this is a two-way process. The cyber criminals are also on their research to know how it can be used for their interest.

### **1.4.2 Data Science**

Data science is collecting and storing data in a proper manner so that the data can be easily accessible and managed whenever it wants to be used. It is the science of collecting data or information in order to use it in our business and other plans and projects.

Data science can collectively improve the performance and ability to compete because the important transactions, reports and other documents are totally saved and in any environment hazards or fire burn, the data will be backed up and restored. So, there will be no information loss and the data are securely protected. However, it is difficult to prevent your manual files and records and protect them for a long period of time. But data science allows its users to prevent data for how much time they want.

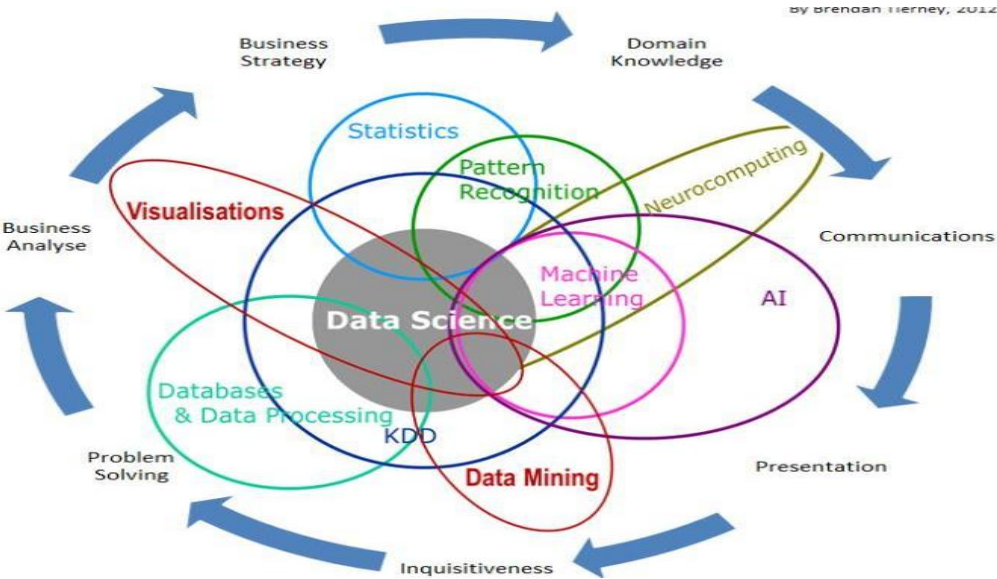
- **Advantages of Data Science**

What and when to do with data, is the art that data science does in the best possible manner. It makes very useful decisions that makes it so easier to use for us.

Data-driven decisions can make our task easier, in so much less time and efficient manner. They also improve our ability to work with the data.

Data science store data in a very crisp manner that everything seems to be very well organized. Old histories are very easy to find when we have data science and we can have all the information in a very less time.

Data science has its importance in every field because it provides ways to optimize data and tell its maximum use. There will be no loss of data if it is securely prevented.



**Figure 6: multidisciplinary fields of Data Science**

**CHAPTER 2**  
**SECURITY BACKGROUND**



## 2.1 Introduction to Data Security

Data security is the process of protecting data from unauthenticated and unwanted access and corruption throughout the life.

The employment of physical security, administrative, control as well as other security precautions to limit the data access leads to data security that reduces concerns data security from unauthenticated data access, like addition, deletion or disclosure.

Most data security processes are user-friendly in nature, focusing on issues such as:

- Is this user allowing to access the data?
- Is this user allowed to see the data?
- Is this user is misusing the information?
- Is this user allowed to use the network?

We see that this is amazing and vital, but there is struggle in the real-world challenges like there are thousands of servers in large business on a casual basis, as well as old-fashioned user groups and finding who is accessing them.

Data security is a practical approach that should be implemented at the time when data is created.

Masking the information prevents data from the internal workers of the company who are easily accessible to the information. For example, the 12-digit card number.

## 2.2 Security Issues with Big Data

Large organizations have large data and hence they have privilege to and monetary for data storage. The problem arises for small scale and medium scale organizations that have not that big budget that they spent on the data storage. It can be difficult for such organizations and very cost effective and complicated.

### **2.3. Data Security**

When we talk about network then network means interconnected nodes (or neurons) that communicate through each other and process information or data. And security is the prevention of data or information from unauthenticated user(s). Data security means protecting the whole network from unauthorized access so that no data loss can occur and no data can be misused.

Network security is the basic challenge of every system. As if any information is leaked or loss then there are many chances that it has been misused. The process of preventing the unwanted user access to a network is important. Hacking, trojan horse, spyware, malware, cyber-attacks and so on are the form of different attacks from which we have to secure our data. At several interval of time, we should monitor the network and employ hardware and software to improve network security. Data authentication is the protection of protecting all of devices from unwanted access. Data compliance is preserving data from unwanted access and corruption all over the world.

It is a task of keeping data from the hands of unauthorized access so that it cannot be tampered or destroyed or changed. For data security, an authorization check is performed authorizing the user access to the files. Data security is the practice of protecting digital information from unauthorized access, corruption, or theft throughout its entire lifecycle. It's a concept that encompasses every aspect of information security from the physical security of hardware and storage devices to administrative and access controls, as well as the logical security of software applications. It also includes organizational policies and procedures.

### **2.4 DATA SECURITY IN CLOUDS**

Cloud security is a type of Cyber Security, also called as cloud computing security. It has various set of policies, controls, procedures and technology that are used to secure cloud-based systems,

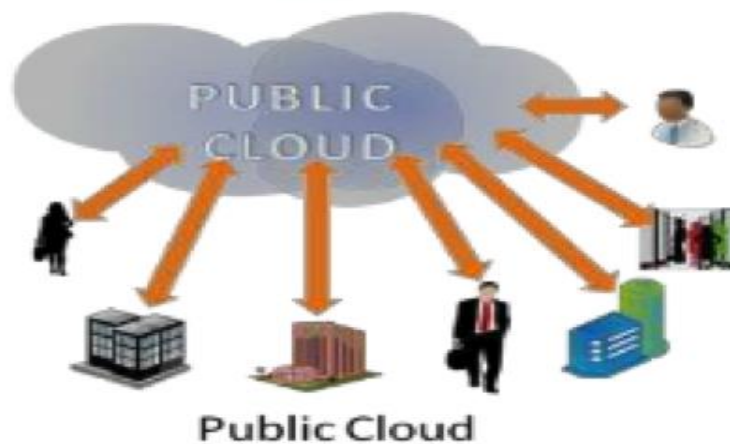
data and environment from both external and internal cyber security threats such as theft, leakage and destruction. The cloud security can be optimized according to the business need, from authentication to filtering of traffic. Since the management and optimization of these rules can be done from a single place, within the organization or even outside, overheads created by its administration can be reduced drastically.

## 2.5 TYPES OF CLOUD COMPUTING

On the basis of category of cloud computing used, the cloud security also differs. Following are the four chief categories of cloud computing, according to which cloud security also can be categorized:

### 2.5.1 Public Cloud

We refer to cloud as a public cloud when a third party provides computing services and infrastructure on demand and other organizations can also share the services through the internet. It provides all three kinds of infrastructures such as software-as-a-service (SaaS), infrastructure-as-a-service (IaaS) and platform-as-a-service (PaaS).



**Figure 7: Public Cloud**

### 2.5.2 Private Cloud

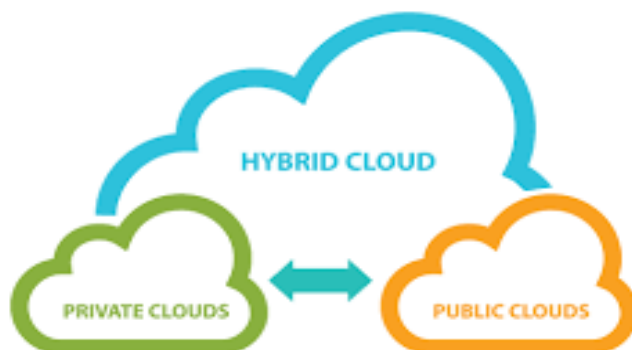
A cloud is called a private cloud if all the computing services and infrastructure provided by the cloud are for the specific use of one organization only.



**Figure 8:** Private Cloud

### 2.5.3 Hybrid Cloud

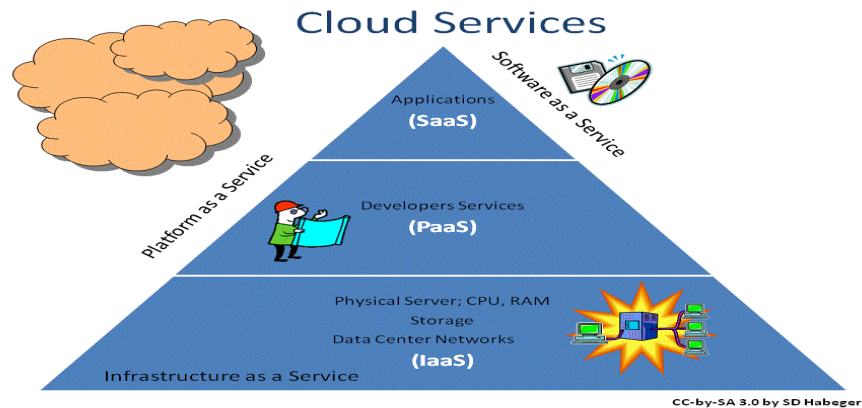
In a hybrid cloud an organization can combine its private cloud with the public cloud. The key is to balance this combination in such a way that the organization is able to use the optimal cloud solution for each of its application.



**Figure 9:** Hybrid Cloud

## 2.5.4 CLOUD COMPUTING SERVICES

There are basically three types of computing services that are provided by the cloud providers.



**Figure 10:** Various cloud services offered

❖ **SaaS (Software-as-a-Service)**

In this service security of data and user access are the sole responsibilities of the user.

❖ **PaaS (Platform-as-a-Service)**

In this service the responsibility of the customer is also to secure application loaded on cloud along with the data and user access.

❖ **IaaS (Infrastructure-as-a-Service)**

In this service since the entire infrastructure is involved thus only securing the applications, users' access and data is not enough, the protection of operating systems and network traffic is also necessary by the user.

## 2.6 CLOUD SECURITY

Usually, concerns regarding security have been the primary challenge for organizations that need cloud services, especially public cloud services. But, in response to demand, the security provided by cloud service providers is growing rapidly and is outperforming on-premises security.

- ❖ Some of the best practices followed in cloud security include the following
- ❖ Shared responsibility for security
- ❖ Data encryption
- ❖ User identity and access management
- ❖ Collaborative management
- ❖ Security and compliance monitoring

## **2.7 Information Security Process:**

To secure data or information from unauthorized access, we have following criteria:

### **2.7.1 Authentication:**

Authentication is the computer access control approach in which a user is permitted access only after successfully presenting all required proofs such as log in ID, password, username, and so on. Authentication can be used to safeguard internet resources such as emails, websites etc. login ID password and other details are used to verify the user's identity.

### **2.7.2 Authorization:**

Authorization is the process where the system checks that what you want to access. It is the process of giving someone permission to access the data by ensuring that you are an authenticated user. Only the authorized network can be accessed for fetching data and information. authorization is sometimes seen as both the preliminary setting up of permissions by a system administrator and the actual checking of the permission values that have been set up when a user is getting access.

**CHAPTER 3**  
**LITERATURE REVIEW**



### 3.1 LITERATURE REVIEW

Let us see some research in human identification and different techniques used:

**TABLE 1**  
SUMMARY OF THE RELATED WORK

S.No.	Title Of Paper	Author	Year & Name of Journal	Summary	Pros and Cons	Remark
1.	Intelligent Traffic Monitoring System for smart city based on IOT.	Arman Syah Putra	2018, IEEE	Surveillance of every vehicle is done in terms of speed, distance to reduce many traffic problems.	Traffic congestion can be controlled. For every vehicle, unique address must be applied that will create huge data.	This model can be developed into developing cities for better scope.
2.	IOT Based Health Monitoring System.	Prajoona Valsalan et al.	2020, Journal of critical reviews	Remote patient monitoring system that will track health.	Compatible to every use. Need to be updated with respect to time.	Can be very helpful at time of any pandemic.
3.	IOT based health monitoring system for active & assisted living.	A. Abdelgawad et al.	2017	Low power wearable IOT device that will assist and monitor health.	Low power and easy to use. Needs an application to perform.	Very user friendly.
4.	An IOT based human detection system for industrial environment	Ahmed et al.	2021, Wiley Periodicals LLC	System is presented which will monitor people in a complex industrial environment.	Monitor every intrusion. Only from Top-View	An automated human detection system using artificial intelligence.
5.	Real Time traffic monitoring	M. Sarrab et al.	2020, Global transitions	IOT based system that will analyze,	Real time monitoring. Sensors can	Real time monitoring will help to

	system using IOT			store, collect traffic data and using AI makes better decisions for traffic management.	be power consuming, cost consuming.	control road accidents, congestions and other problems.
6.	IOT based human intrusion detection system using Lab View	K. Rambabu et al.	2019, IJITEE	To prevent theft and robbery in absence of human guard as human guarding 24*7 isn't possible without a miss.	Cost effective and low maintenance. Owner will be requested to give command.	Easy cost effective solution for security.

On the basis of substantial literature survey related to IOT based human identification and monitoring system using cloud and machine has been taken into consideration in this section.

**Ahmed et al. (2021)** in this paper, an IOT based overhead crowd monitoring system has been introduced where the system is able to detect and count the people in the screen. It consists of an IP camera that record people's video clips. Then it will forward to server using internet. SSD model with MobilenetV2 as base model is used for people detection which utilizes a supportive network for feature extraction, also called base network. The original SSD model used VGG-16 architecture as base network. The new trained features are then added to the pre-trained data set in order to increase detection ability. The transfer learning method is applied. To perform classification localization regression, different feature maps are used and thus for each detected location k bounding boxes are extracted. The counting accuracy of model is 92% and 95%, without and with additional training.

**M. Serrab et al. (2020)** this paper proposed the system which can monitor the real time traffic and hence can be helpful in minimizing the traffic congestion. The author chooses magnetic sensors (or magnetic sensor-based PCB) for collecting traffic information as they show good accuracy in vehicle detection. The components are installed at the roadside and a cloud-based central server. The roadside setup includes sensors and message boards and the server includes data storage, cloud services, and interfaces. And the components communicate with the help of Wi-Fi.

OpenStreetMap provide map data. It provides editing, exporting, and uploading functionalities. The database used in this paper is MongoDB. Magnetic sensors are used. NodeMCU is used to prototype IOT devices and Thingier. Io is used for deployment of data fusion. Test show that is system can be implemented in any smart city.

**K. Rambabu et al. (2019)** to detect the human intrusion in any private or public area is the basic need for this research so that the author helps in the security issues. The unauthorized entry can be restricted using this system. The system consists of raspberry pi based advanced security system programmed with python integrated with Lab View to avoid theft. Open CV method is also implemented where encodings are created on the faces present in the database. They do not require any memory storage because they don't work as a CCTV camera. This system is cost effective and can be used anywhere.

**Ahmed et al. (2021)** In this article a human detection system based on AI for complex industrial environment where different deep learning architectures are surveyed for human detection, i.e., Faster-RCNN, SSD, and YOLOv3. The author introduces an automated human detection system for a complex industrial area. The intelligent surveillance system utilized deep learning detection architectures such as Faster RCNN, SSD as a baseline for top view human detection. All deep

learning models are firstly tested on self-control cognitive video supervision (SCOVIS) data set, which contains images of people captured in a complex industrial environment. The model trained the architectures on the SCOVIS data set (a top view industrial data set) in which neither any supposition about the individual's visibility and pose nor any constraint on the environment is made. This model provides the detection accuracy of 90% and 95% with a pre trained and trained model. This data set is also used to capture the activities happening in the environment.

**P. Valsalan et al. (2020)** Health is always a major concern in human growth and development of advance technology. The goal of this research is to build a smart patient health tracking system. The system monitored body temperature, pulse rate and room humidity and temperature using sensors, which are also displayed on LCD. These values are then sent to medical server using wireless communication. These data are then received in an authorized personals smart phone with IOT platform and with the help of given values the doctors can diagnose the disease and state of health of patient.

**Arman Syah Putra (2018)** Traffic has always been a problematic issue in the developing countries ad to solve this problem to some extent this system is proposed. In this research Internet of Things is merged with some sensor monitoring to sense the coming vehicle and distance between the motion and speed sensor monitoring is used to sense the speed of vehicle so resolve the jamming of traffic. This system has huge application in developing the smart cities. Good traffic monitoring can make a big difference and can resolve many problems that occur due to congestion of roads. The author says that the system is expected to update the existing programs by using and analyzing the data sensors along smart cities.

**A. Abdelgawad et al. (2017)** In this system, the author has present an wearable IOT device that can assist its user about their health condition. Architecture is set up to analyze and assist health

data for its users. The system proposes an architecture where an IOT architecture is customized which can collect the data and relay it to the cloud server. Then it is processed and analyzed there. Feedback is created for every user based on the analyzed data and then it will be sent to the user for his assisted living.

**Jiang et al. (2021)** this system is built to manage ultra-large-scale crowd by monitoring the crowd. The author proposes a system where it uses advanced sensing and networking technologies which collect and process multimodal, multi-perspective, and real time large crowd data that will help in management and monitoring of large scale of crowd. The model is basically an infrastructure component of an intelligent system that is developed to provide intelligent decision-making system with the help of interactive digitalized environment. This model uses software defined networking technologies and cloud technologies to optimize the network and analyze the data. The main objective of this research is to obtain a full comprehensive scene overview of that ultra-large-scale crowd.

**Crowd Emotion Analysis Using 2D ConvNets** This paper aims to come up with a novel methodology of detecting crowd emotions and behaviour by making use of 2D Convolutional Neural Networks (ConvNets). The goal of this network is to perform a classification of the general behaviour of the crowd. In order to perform this experiment, the researchers built up a dataset of images that focused on six kinds of emotions such as anger, sadness, excitement, happiness, fright and neutral.

**Video crowd detection and abnormal behavior model detection based on machine learning method** The researchers in this paper learn various methods of data mining and improve the accuracy of detection of abnormal behaviour in crowd videos by machine. This paper brings

forward a new IDS video crowd. It conducts experiments by using Unix user's shell command data. The experiment has three parts.

**A lightweight neural network for crowd analysis of images with congested scenes:** This paper introduces a lightweight and low complexity end-to-end network to analyze crowd with congested scenes. This is called as a lightweight network since it uses only 0.86 M parameters. This is a very small number as compared to other neural networks.

#### **Abnormal Crowd Behaviour Detection Using Speed and Direction Models**

The purpose of this paper is to detect unusual crowd behaviour in a video sequence by using probability models of speeds. Firstly, two kinds of probability densities are assigned to each video frame. One represents the speed of the crowd and the other probability density represents the direction of the crowd. The author has used Expectation -Maximization algorithm (EM) for converting the optical flow vectors into models of probability for speed and direction for each video frame.

#### **Machine and Deep Learning for Crowd Analytics**

This aim of this paper is to create the combined distribution of the pixels in an image while considering the temporal information as well as the spatial information of the input and study the properties of the pixels of the image for multiple adjacent video frames. This leads to anomaly detection in crowd images or video frames.

### **3.2 Conclusion**

Many authors have implemented human detection and monitoring system for different objectives. We see that the rapid increase of computer vision gives new approach to the artificial intelligent field. For ultra large scale, like huge gathering such as when Haj is performed, the system is built to track the movement of large-scale crowd that monitors crowd to prevent any difficulty and to take all necessary precautions. For complex industrial environment, human detection and monitoring system is made that is based on artificial intelligence. Faster RCNN, SSD and YOLOv3; these deep learning architectures are studied for top view human detection. The model provides accuracy of 90% which is great. Results shown that with more training and experiments this field has great future and it can be incredibly beneficial in every field as medical, security surveillance and in other sectors. Computer vision has provided many ways that gives computer; the vision to see and artificial intelligence to new heights.

**CHAPTER 4**  
**PROPOSED WORK**



## 4.1 Proposed Work

The goal of the thesis is to create an algorithm that will assist the security surveillance department so that there could be some system that can identify any criminal or dangerous person roaming around the corner. The number of cases where these types of anti-social elements have caused great damage and then they pass their location and by changing some details they start living at different location, and then as per their nature they again cause damage to someone property and even life. There are many cases where homes were robbed and later, we get to know that the person has criminal history and he was living with fake identity. Furthermore, in India we have much knowledge of every citizen but we don't have proper tracking system and storage system, where all the datasets can be securely stored and can be easily accessed whenever we need.

The algorithm will predict variety of facts about that person, including his identity, fir number, date, location etc. and we will store this information in the datasets. The system will learn to predict this information from the datasets that has been provided to train the machine. We can add criminal id and details and feed the pictures of that person, the system will take its time to learn and then it can predict if the data matches with his identity. In this manner we can make our surroundings a better secure place and the system will tell us that this person is same or not.

The system's advantages are based on this algorithm:

- It will assist the police department in finding whether the person is the same who they are searching for or he is not. So that they can be more precautionary that they have to catch that person and what measures should be taken to do the task.
- The system will keep everyone updated on the criminal activities. Anyone who has seen suspected one can share his knowledge and hence we can prevent the person from escaping.

- It will save a lot of time and energy as criminal activities are increasing day by day.
- A record has been created for infinite time for every wanted human and hence history can be created that can be managed and stored in a very efficient manner.
- The combine formula of human detection and monitoring helpful in preventing any social harm.
- It can be very helpful in human-to-human interaction because it will deliver the identity of the person.
- It will definitely strengthen the security perspective.
- Identity theft can be reduced with the help of this system as it also comes under the security surveillance approach.

Through this approach we are going to identify that the person in the given photo is the same criminal who is in recorded database or not:

Step 1- we will first create database of different person and storing their information into the database.

Step 2- After that we will check the information that are stored are valid or not.

Step 3- Then the machine is fed with large amount of data and by RCNN it learns the feature extraction and use datasets for training and study.

Step 4- Then pickle is created for which the machine takes some time to learn with datasets.

Step 5- After that if we check by any photo then it will tell us that this is the same person or not.

So, here we use RCNN algorithm for object detection and identification. Computer vision has implemented that gives the computer ability to see.

The function of methodology is described as below:

- **RCNN** Instead of working on number of regions, the RCNN algorithm proposes a bunch of boxes in the original image and let look for any object is present in any of the boxes. It uses selective search algorithm to extract those bounding boxes from an image and these boxes are called regions. It is a two-staged detection algorithm. In the first stage it identifies a subset of regions in an image that might contain object. And in the second stage the object is classified in each region.

Computer vision toolbox enables to use algorithms like RCNN. Pixel level segmentation is done for an individual detected object.

- Finding regions in the image that might contain an object and these regions are called regional proposals.
- Extract CNN features from those regional proposals.
- Then classify the objects using the extracted features.

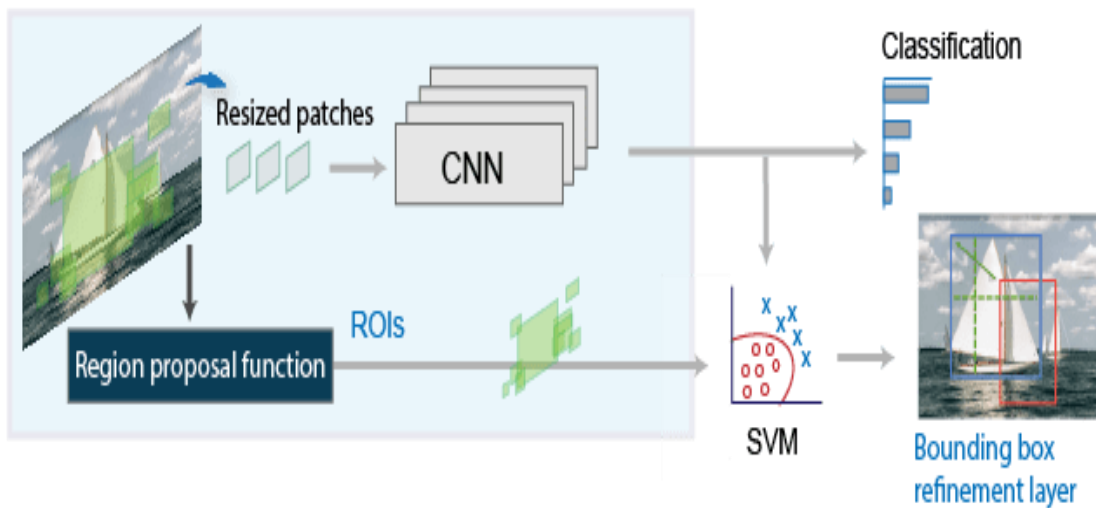


Fig 11 Image Classification using CNN and SVM

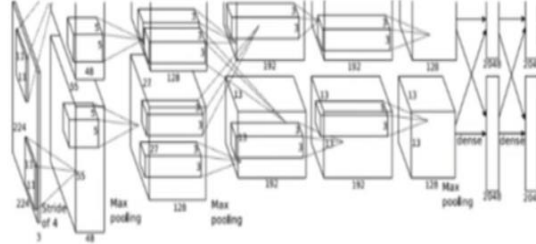
The regional proposals are then resized and taken out of the original image. Then CNN classify these resized cropped images. The region proposals are then classified by SVM that is training using CNN features.

- Find regions in the image that may contain object. These regions are called regional proposals.
- Extract CNN features.

**TABLE 2: Classify the object using those features.**

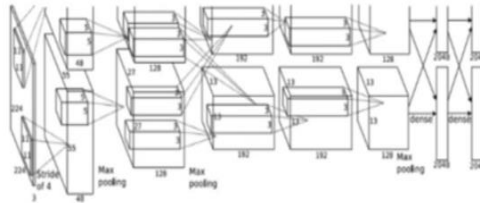
<b>RCNN Detector</b>	<b>Description</b>
trainRCNNObjectDetector	<ul style="list-style-type: none"> <li>• Slow training and detection</li> <li>• Allows custom region proposal</li> </ul>
trainFastRCNNObjectDetector	<ul style="list-style-type: none"> <li>• Allows custom region proposal</li> </ul>
trainFasterRCNNObjectDetector	<ul style="list-style-type: none"> <li>• Optimal run-time performance</li> <li>• Does not support a custom region proposal</li> </ul>

computer vision is an incredible emerging field that has been gaining huge amounts of attraction in the recent years (since CNN and RCNN) and self-driving cars have taken centre stage. Another integral part of computer vision is object detection. Object detection aids in pose estimation, vehicle detection, surveillance etc. The difference between object detection algorithms and classification algorithms is that in detection algorithms, we try to draw a bounding box around the object of interest to locate it within the image. Also, you might not necessarily draw just one bounding box in an object detection case, there could be many bounding boxes representing different objects of interest within the image and you would not know how many beforehand.



CAT:  $(x, y, w, h)$

**Figure 11: Training the machine**

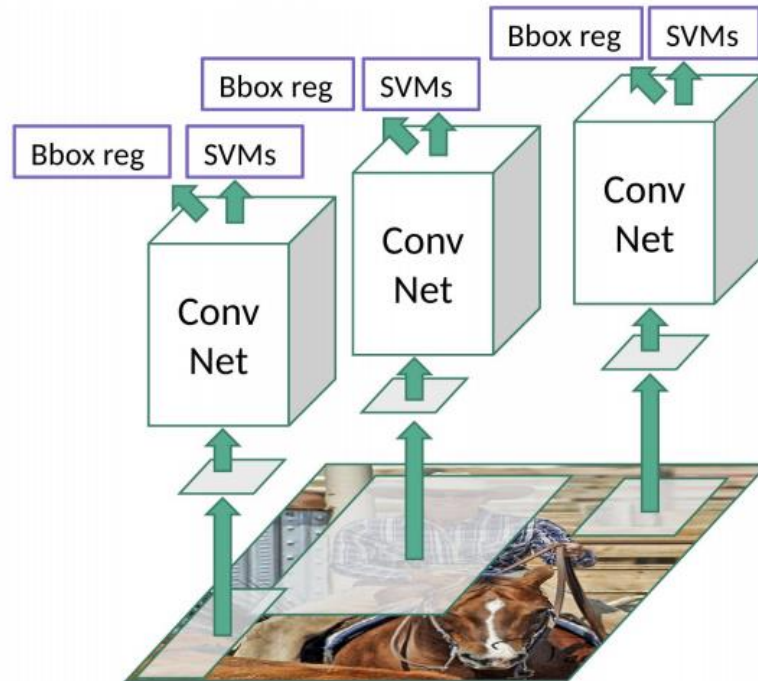


DUCK:  $(x, y, w, h)$   
 DUCK:  $(x, y, w, h)$

....

**Figure 7: training and testing the machine by giving input image**

[SVM](#) to classify the presence of the object within that candidate region proposal. In addition to predicting the presence of an object within the region proposals, the algorithm also predicts four values which are offset values to increase the precision of the bounding box. For example, given a region proposal, the algorithm would have predicted the presence of a person but the face of that person within that region proposal could've been cut in half. Therefore, the offset values help in adjusting the bounding box of the region proposal.



**Figure13: regional proposals are fed to network.**

**But there are some limitations with R-CNN**

- It still takes a huge amount of time to train the network as you would have to classify 2000 region proposals per image.
- It cannot be implemented real time as it takes around 47 seconds for each test image.
- The selective search algorithm is a fixed algorithm. Therefore, no learning is happening at that stage. This could lead to the generation of bad candidate region proposals.

**COMPUTER VISION**

The real-time detection of humans is emerging as a significant trend with data scientists. Successfully detecting a person in an image or video means you are building an application that will merge object detection and image classification. Artificial intelligence provides vision to the computer same as we human do have, and this is called computer vision. As the name suggest,

this technology gives vision to the computer that enables the computer to derive meaningful information from the digital images and videos. AI help the computer to think then it is safe to say that CV enables them to see, observe and understand.

#### **4.2 Aim of the research**

In simple words, this study aims to work on the emerging field of artificial intelligence that allow machines to do anything as we humans do. There are many researches done in the field of human identification and monitoring for various different objectives. Some researches use human identification in complex industrial environment for keeping watch over their workers and staff. Many papers have been presented for human identification in a house for preventing any intrusion in their home. For various reasons human detection algorithms are used to built a system. Robotics, automatic cars, smart mobiles, homes and many more are the examples where computer vision technology is used to make our environment easier and more flexible to use. This paper studies all the recent algorithms which are used for human detection and identification and also shows comparative results that which algorithm is best to use and more efficient to use. One thing that anyone may ask that do we really need a system that detects human. Then what should be the answer. In this era where every basic task is performed through internet and smart applications then if our big problems life human intrusion, theft, robbery can be prevented using this system. One thing we need to study is that when to use which algorithm and what are the challenges that we might face using a particular algorithm. The future work totally depends upon the flaws and complications we face during implementation of the system. In this paper we are also defining the challenges that came across the implementation of the algorithm. We study different algorithms that are used for the same purpose and then we compare the results. Results comparison shows how much our system is capable of in compare to

the other algo. To keep an eye on criminals without knowing them about tracking is the key aim of the project. Matching the given data from its database and tell us that the person is same and also his details. This is a small step that can make big difference in making our society more protected. And we may have more knowledge about the scenario. But we need good amount of information and data to train the model so that it can match and show the results.

### **4.3 Objectives of the research:**

The main objective of the research is:

1. To present an automated IOT based human detection system for monitoring.
2. To study the generalization performance of machine learning architectures by testing it on entirely different datasets.
3. To compare the detection results of datasets.
4. The proposed system will detect human and also identify them.

Identification is essential at different reasons such as identifying a criminal, identifying a missing person or identifying any intruder in our security area. The primary purpose of this thesis is to show how human identification can change the perspective of how we see the world and there is how much space to grow. In this thesis, we also compare different algorithms that are used for human identification. Computer vision has changed the whole game in this artificial intelligence field. Computer vision provides different algorithms that are compared in this thesis. Their performance rate is also measured that are later shown in result analysis. The primary goal of this thesis is understanding the phenomenon of artificial intelligence algorithms and their future upgradations. How can make our surrounding a secure place using machine learning, deep learning and artificial intelligence.



In this thesis we also study different algorithms that are used for human identification such as CNN, RANSAC, SIFT.

These are comparatively new algorithms that work good under some circumstances but very cost effective. And hence they are not providing as good results as CNN and RCNN have given. That shows us that the neural network algorithms are more effectively in human identification and more experiments should be performed for making those algorithms good enough to use. We also find that if we train a system with more data and under more circumstances, the accuracy rate can be improved. In future, backpropagation will be introduced in this system to reduce the loss function.

#### **4.4 Explanation of Flow Chart:**

**Step 1** First of all any artificial intelligence-based camera or any other IOT device needs to be installed.

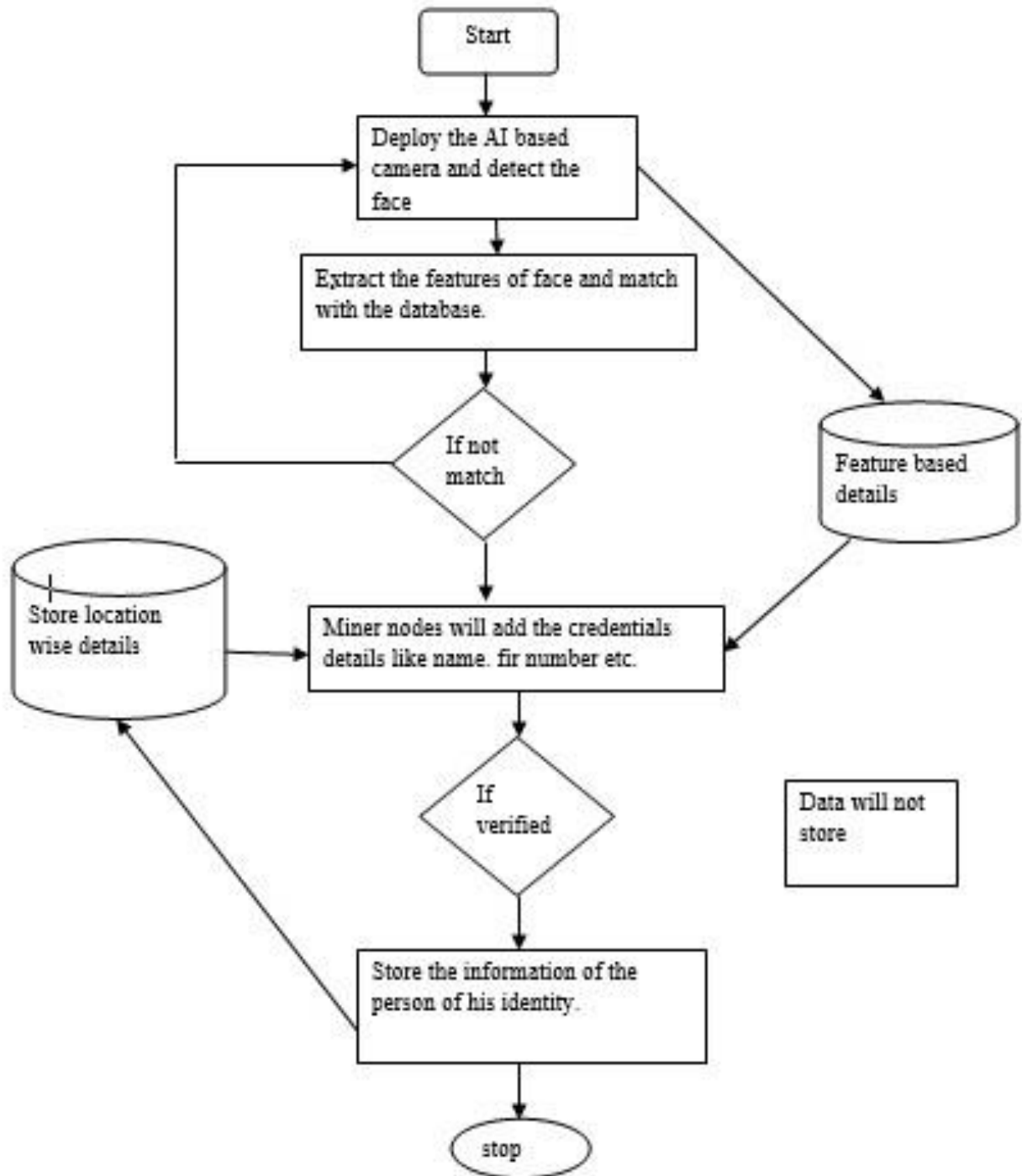
**Step 2** Whenever the system is fed with data to identify then the system will start extracting the features of the data and start verifying by the centralized database where we have all records of each criminal.

**Step 3** If the features are matched then the nodes will start verifying the details of the person and display all the details like identity, location, fir number etc.

**Step 4** If the features were not matched, then the system will tell that there is no match.

End

#### 4.5 Flow Chart:



## 4.6 Algorithms used

1. IOT device detects the face of the person and extract the features of each face.

2. if features of face are matched from the database

Then get the detail of person

Else

Continue to detect another face.

3 The person detail such as Aadhar number, address and person's ID will be verified by the miner's node of blockchain network. Miners  $m_1, m_2, \dots, m_3$  further verify the person detail.

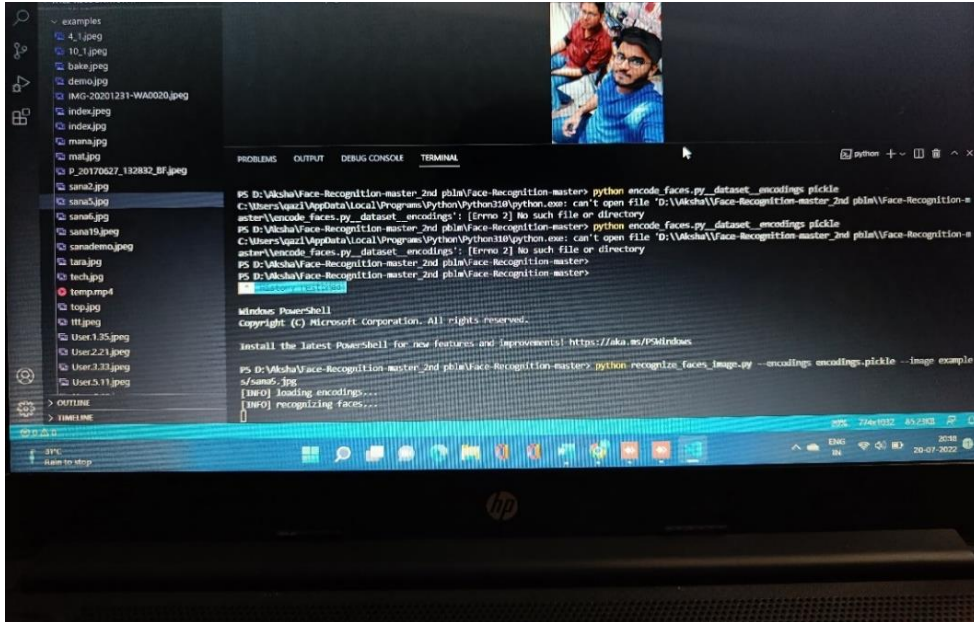
4 if minor nodes  $m_1, m_2, \dots, m_n$  also find the person.

**CHAPTER 5**  
**RESULT AND DISCUSSION**

## 5.1 Result analysis:

- In the initial step, we first give the system to work upon different data. 30-35 photos of each person are fed to the machine as input so that it will learn the features by RCNN approach. All of this information needs some space where it is stored in a systematic manner and can be accessible when ever the data is called. A folder is created named database where we have stored many pictures of different person having said that every person has its own folder where his photos are stored.
- The dataset has been created and now it the time to recheck the valid information, so that in future we can easily store and delete data records.
- Now all the data are fed to the machine as input so that it can extract the features and learn about the person's identity. This is done through machine learning algorithms RCNN classifier.
- Thus, we will run the pickle command and this will take some time as the machine is working on many photos as its huge data.
- After all this is done, we can now test the data by providing any image and it will tell the details if matched. If the features of the given image is matched then only the details can be shown by the machine.

Let us see some screenshots I have taken when the system is tested:



## Testing our system by giving some input

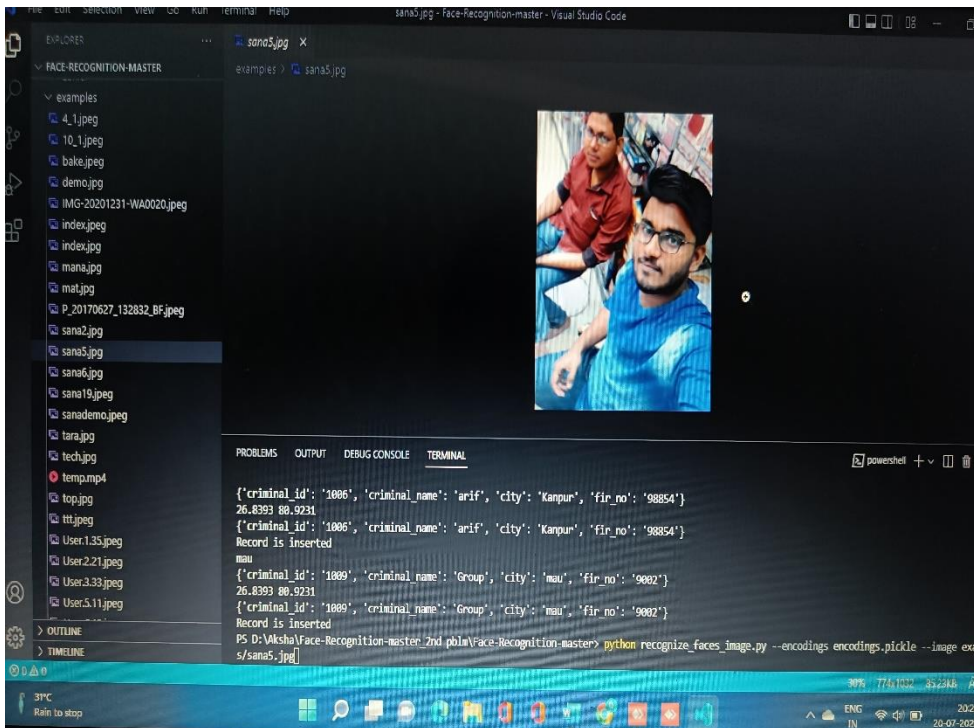
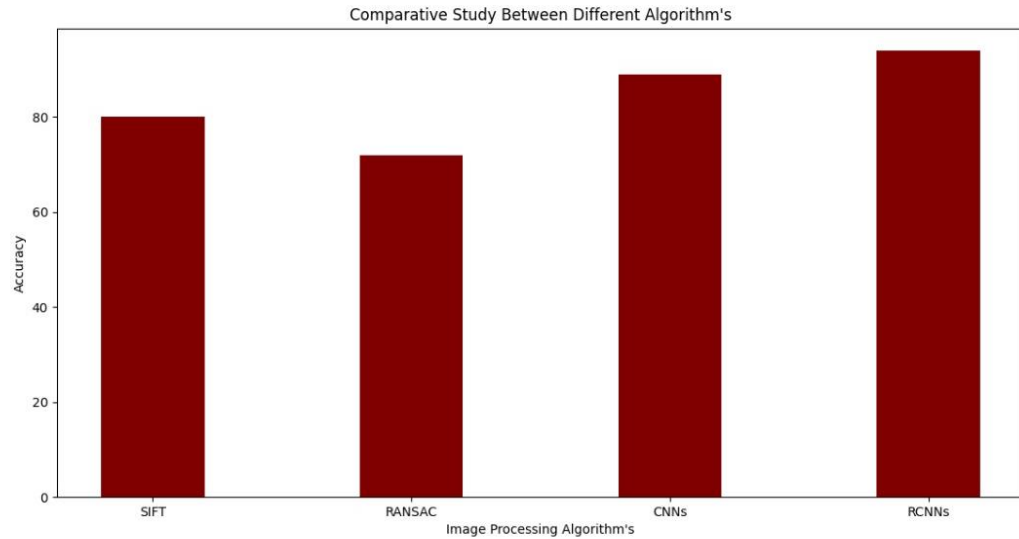


Figure 8: system identified the person

## 5.2 COMPARATIVE STUDY:

A case study has been done for analyzing the other different approaches and to know the efficient way for human identification and monitoring. For this purpose, different algorithms are studied. In this thesis SIFT, RANSAC AND CNN approaches are also read to know that what will be the best efficient algorithm that can be used for human identification. Every technology has some challenges but what human nature is we have to find an efficient way and, on that algorithm, we will do experiments and results can be improved. Let us first see the comparative study between different algorithms.



**Figure 14: comparative study**

## 5.3 Comparative study & accuracy

Algorithm	SIFT	RANSAC	CNN	RCNN
ACCURACY	80%	67%	90%	92%

**CHAPTER-6**  
**CONCLUSION AND FUTURE WORK**



## **Conclusion and Future Work**

The constantly developing urbanization and the emergence of smart cities require better security surveillance and crowd monitoring systems. The growing availability of the Internet of Things (IoT) devices in public and private organizations also provide intelligent and secure surveillance solutions for real-time monitoring in public spaces. This article introduces an IoT-based crowd surveillance system that uses a deep learning model to detect and count people using an overhead view perspective. The R-CNN model with computer vision as the basic network is used for the detection of people. The detection model's accuracy is enhanced with a transfer learning approach. In order to assess performance, experiments are performed using different video clips. Results indicate that by using these AI techniques, we get accuracy of 92% and it can be even improved more by training it with more data and experiments.

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16. Review Paper: "IOT Based Human Identification and Monitoring System Using Cloud and Machine Learning."

**IOT-BASED HUMAN IDENTIFICATION AND MONITORING SYSTEM USING CLOUD  
AND MACHINE LEARNING**

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COMPUTER SCIENCE AND ENGINEERING, INTEGRAL UNIVERSITY, LUCKNOW

**Abstract-** This review paper thinks of the use of artificial intelligence and machine learning when combined with Internet of Things can give its benefits to many fields including privacy, security and intelligent surveillance applications. A significant amount of research work is carried out on human identification and monitoring system but intelligent monitoring in real time is still an emerging topic due to emerging technologies such as Internet of Things and Computer Vision. The objective is to provide security updates on the roadside. This article introduces an IOT based human detection monitoring system that used machine learning algorithms RCNN and compute vision to detect and monitor people. The constant developing urbanization and emergence of smart cities require better security surveillance and crowd monitoring systems. The growing availability of the internet of things devices in public and private organizations also provide intelligent and secure surveillance solution for real-time monitoring in public areas. This article introduces an IOT based crowd surveillance system that uses machine learning model to detect the person who is wanted without knowing him that he is being tracked. The R-CNN model is used for object detection and to classify people.

**Keywords:** R-CNN, Machine Learning, Open CV, Internet of Things.

**INTRODUCTION:**

The internet network is the essential thing in life today, almost all devices are connected to the internet network, and many have been implemented in virtually all areas of life that exist in society today, with the concept of smart city internet system very crucial role. This is because all have been connected to the internet network, and this system is expected to reduce many of the problems in the developing cities or developed cities. With this an excellent precautionary method we can track any person without knowing them. Moreover, with this intelligent monitoring system we can help the government and police officers to track the criminal or wanted person without stopping them. The proposed internet of things (IOT) monitoring which applied such as monitor sensor monitoring.

Intelligent systems have been widely utilized for information processing in modern society due to the rapid growth of artificial intelligence (AI) applications. AI and Internet of Things has recently developed as one of the hot research topics, it merges AI technologies with the IOT infrastructure and offers more effective IOT service.

The abrupt changes in motion, cluttered scenes, camera viewpoints, a close interaction between individuals, and occlusion are the crucial factors that might influence the performance of human detection.

Generally the primary purpose of the work is given as follows:

1. To present an automated IOT based human detection system for monitoring.
2. To study the generalization performance of machine learning architectures by testing on an entirely different data set.
3. To compare the detection results of trained and pre trained architectures.
4. The proposed system will detect human faces and also identify them.

In this review paper we discuss the introduction and basic details of the topic and then in next section we will discuss the literature review and their summary, then we see the methodologies, next in the last it will provide the conclusion of this paper.

**RELATED WORK**

On the basis of substantial literature survey related to IOT based human identification and monitoring system using cloud and machine has been taken into consideration in this section.

**Ahmed et al. (2021)** in this paper, an IOT based overhead crowd monitoring system has been introduced where the system is able to detect and count the people in the screen. It consist of an IP camera that record people's video clips. Then it will forward to server using internet. SSD model with MobilenetV2 as base model is used for people detection which utilizes a supportive network for feature extraction, also called base network. The original SSD model used VGG-16 architecture as base network. The new trained features are then added to the pre-trained data set in order to increase detection ability. The transfer learning method is applied. To perform classification localization regression, different feature maps are used and thus for each detected location  $k$  bounding boxes are extracted. The counting accuracy of model is 92% and 95%, without and with additional training.

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OpenStreetMap provide map data. It provides editing, exporting, and uploading functionalities. The database used in this paper is MongoDB. Magnetic sensors are used. NodeMCU is used to prototype IOT devices and Thinger. Io is used for deployment of data fusion. Test show that is system can be implemented in any smart city.

**K. Rambabu et al. (2019)** to detect the human intrusion in any private or public area is the basic need for this research so that the author helps in the security issues. The unauthorized entry can be restricted using this system. The system consist of raspberry pi based advanced security system programmed with python integrated with Lab View to avoid theft. Open CV method is also implemented where encodings are created on the faces present in the database. They do not require any memory storage because they don't work as a CCTV camera. This system is cost effective and can be used anywhere.

**Ahmed et al. (2021)** In this article a human detection system based on AI for complex industrial environment where different deep learning architectures are surveyed for human detection, i.e., Faster-RCNN, SSD, and YOLOv3. The author introduces an automated human detection system for a complex industrial area. The intelligent surveillance system utilized deep learning detection architectures such as Faster RCNN, SSD as a baseline for top view human detection. All deep learning models are firstly tested on self-control cognitive video supervision (SCOVIS) data set, which contains images of people captured in a complex industrial environment. The model trained the architectures on the SCOVIS data set (a top view industrial data set) in which neither any supposition about the individual's visibility and pose nor any constraint on the environment is made. This model provides the detection accuracy of 90% and 95% with a pre trained and trained model. This data set is also used to capture the activities happening in the environment.

**P. Valsalan et al. (2020)** Health is always a major concern in human growth and development of advance technology. The goal of this research is to build a smart patient health tracking system. The system monitored body temperature, pulse rate and room humidity and temperature using sensors, which are also displayed on LCD. These values are then sent to medical server using wireless communication. These data are then received in an authorized personals smart phone with IOT platform and with the help of given values the doctors can diagnose the disease and state of health of patient.

**Arman Syah Putra (2018)** Traffic has always been a problematic issue in the developing countries ad to solve this problem to some extent this system is proposed. In this research Internet of Things is merged with some sensor monitoring to sense the coming vehicle and distance between the motion and speed sensor monitoring is used to sense the speed of vehicle so resolve the jamming of traffic. This

system has huge application in developing the smart cities. Good traffic monitoring can make a big difference and can resolve many problems that occur due to congestion of roads. The author says that the system is expected to update the existing programs by using and analyzing the data sensors along smart cities.

**A. Abdelgawad et al. (2017)** In this system, the author has present an wearable IOT device that can assist its user about their health condition. Architecture is set up to analyze and assist health data for its users. The system proposes an architecture where an IOT architecture is customized which can collect the data and relays it to the cloud server. Then it is processed and analyzed there. Feedback is created for every user based on the analyzed data and then it will be sent to the user for his assisted living.

**Jiang et al. (2021)** this system is built to manage ultra large scale crowd by monitoring the crowd. The author proposes a system where it uses advanced sensing and networking technologies which collect and process multimodal, multi-perspective, and real time large crowd data that will help in management and monitoring of large scale of crowd. The model is basically an infrastructure component of an intelligent system that is developed to provide intelligent decision making system with the help of interactive digitalized environment. This model uses software defined networking technologies and cloud technologies to optimize the network and analyze the data. The main objective of this research is to obtain a full comprehensive scene overview of that ultra large scale crowd.

**TABLE :SUMMARY OF THE RELATED WORK**

S.No.	Title Of Paper	Author	Year & Name of Journal	Summary	Pros and Cons	Remark
1.	Intelligent Traffic Monitoring System for smart city based on IOT.	Arman Syah Putra	2018, IEEE	Surveillance of every vehicle is done in terms of speed, distance to reduce many traffic problems.	Traffic congestion can be controlled. For every vehicle, unique address must be applied that will create huge data.	This model can be developed into developing cities for better scope.
2.	IOT Based Health Monitoring System.	Prajoona Valsalan et al.	2020, Journal of critical reviews	Remote patient monitoring system that will track health.	Compatible to every use. Need to be updated with respect to time.	Can be very helpful at time of any pandemic.
3.	IOT based health monitoring system for active & assisted living.	A. Abdelgawad et al.	2017	Low power wearable IOT device that will assist and monitor health.	Low power and easy to use. Needs an application to perform.	Very user friendly.
4.	An IOT based	Ahmed et al.	2021, Wiley	System is presented	Monitor every	An automated

	human detection system for industrial environment		Periodicals LLC	which will monitor people in a complex industrial environment.	intrusion. Only from Top-View	human detection system using artificial intelligence.
5.	Real Time traffic monitoring system using IOT	M. Sarrab et al.	2020, Global transitions	IOT based system that will analyze, store, collect traffic data and using AI makes better decisions for traffic management.	Real time monitoring. Sensors can be power consuming, cost consuming.	Real time monitoring will help to control road accidents, congestions and other problems.
6.	IOT based human intrusion detection system using Lab View	K. Rambabu et al.	2019, IJITEE	To prevent theft and robbery in absence of human guard as human guarding 24*7 isn't possible without a miss.	Cost effective and low maintenance. Owner will be requested to give command.	Easy cost effective solution for security.

## METHODOLOGY

### Computer Vision

Computer vision is the phenomenon which we use to understand the videos and images how they are stored and how we can manipulate them to retrieve the data from them. Computer vision is mostly used for artificial intelligence.

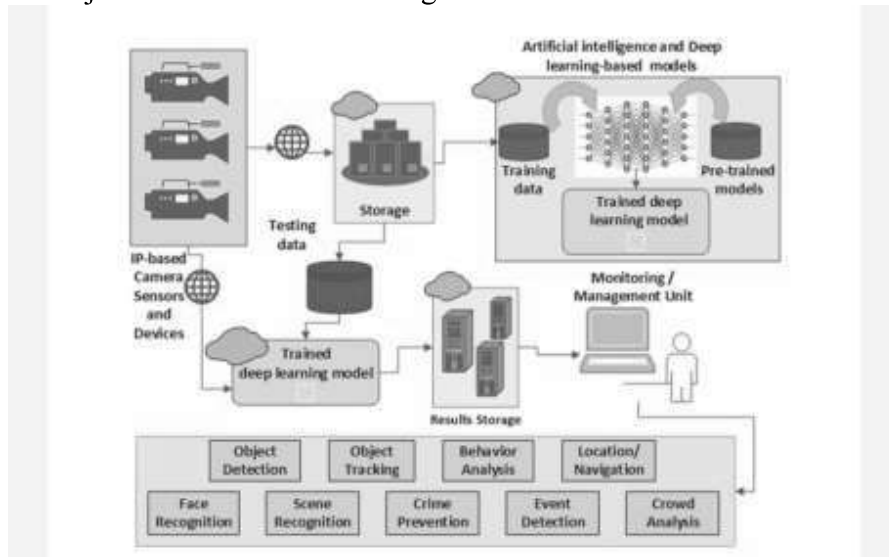
Open CV is the huge open-source library for the computer vision, machine learning, and image processing and now we are using it in real-time operation which is the new benefit of artificial intelligence. By using it, one can process images and videos to identify them. We integrate it with python then it is capable of processing the Open CV array structure for analysis.

The open CV was mainly focused to operate on real time operations and all things were written C/C++ to take advantage of multi-core processing. It has C++, Python and java interfaces that supports Windows, Linux, Mac OS, iOS and Android.

Open CV Functionality:

- Image / video , processing
- Feature detection
- Geometry based monocular
- Computational photography

Researchers also took advantages of different deep learning techniques and presented counting and detection system utilizing the fish-eye camera. Ahmed et al adopted You Only Look Once architecture for overhead view person detection and counting. Also utilized a pre trained SSD model for overhead view person detection. Ahmed et al. applied two deep learning methods Faster-RCNN and Mask-RCNN, to detect multi class objects in overhead view images.



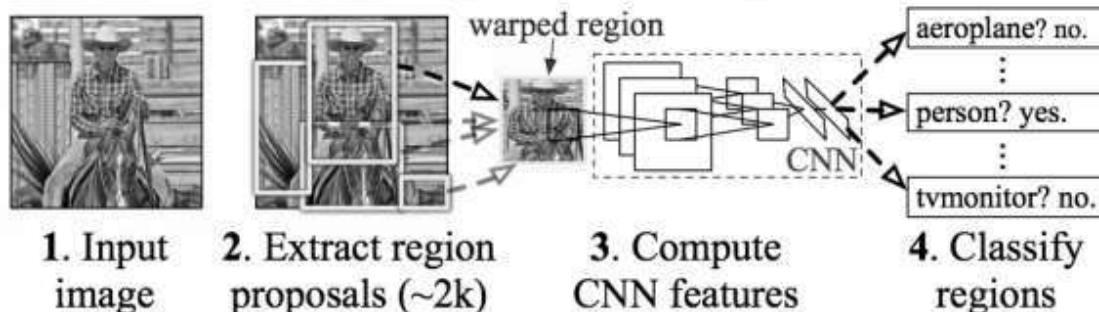
### R-CNN

To solve the problem of selecting huge number of regions (locations), Ross Girshick et al. proposed a method where we use selective search to extract just 2000 regions from any image and he called them region proposals. Therefore, now, instead of trying to classify huge number of regions, you can just work with 2000 regions. These proposals are generated using the selective search algorithm which is written below:

Selective Search:

1. Generate initial sub- segmentation, we generate many candidate regions.
2. Use greedy algorithm to recursively combine similar regions into larger ones.
3. Use the generated regions to produce the final candidate region proposals.

### R-CNN: Regions with CNN features



The problems of R-CNN are then solved to build a faster object detection algorithm and it was called as fast R-CNN. In this algorithm, instead of feeding region proposals we feed input images to generate a convolution feature map.



### RESULT ANALYSIS:

Computer vision concepts have been rapidly viewing new radical theories each year and therefore we are moving towards jaw- dropping researches from AI.

This research proposed an IOT based system model to collect, process, and store real-time traffic data in which human identification and monitoring is done using cloud and machine learning.

By the literature survey for this topic I came to know that researchers have proposed many research to propose a system that can monitor and identify people in many task like traffic scheduling, human intrusion in lab View, crowd monitoring etc. using different techniques: that show that Artificial intelligence is used in many ways and there are multiple ways to make our lives easier and secure using machines and internet.

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# **IOT-BASED HUMAN IDENTIFICATION AND MONITORING SYSTEM USING CLOUD AND MACHINE LEARNING**

***Abstract-*** Machine learning can give its benefits to many fields including privacy, security and intelligent surveillance applications. A significant amount of research work is carried out on human identification and monitoring system but intelligent monitoring in real time is still an emerging topic due to emerging technologies such as Internet of Things and Computer Vision. The objective is to provide security surveillance system. This article introduces an IOT based human detection monitoring system that used machine learning algorithms RCNN and compute vision to detect and monitor people. The constant developing urbanization and emergence of smart cities require better security surveillance and crowd monitoring systems. The growing availability of the internet of things devices in public and private organizations also provide intelligent and secure surveillance solution for real-time monitoring in public areas. This article introduces an IOT based crowd surveillance system that uses machine learning model to detect the person who is wanted without knowing him that he is being tracked. The R-CNN model is used for object detection and to classify people. This study demonstrates the accuracy, efficiency, applications and effectiveness of machine learning architectures of R-CNN, CNN, SIFT and RANSAC in different environment. Experimental results shows that R-CNN achieve promising results with accuracy 92% which is greater than the rest of machine learning architectures. It is also seen that with more training datasets and more experiments, the average accuracy can be significantly improved.

**Keywords:** R-CNN, Machine Learning, Open CV, Internet of Things.

## **INTRODUCTION:**

The internet network is the essential thing in life today, almost all devices are connected to the internet network, and many have been implemented in virtually all areas of life that exist in society today, with the concept of smart city internet system very crucial role. This is because all have been connected to the internet network, and this system is expected to reduce many of the problems in the developing cities or developed cities. With this an excellent precautionary method we can track any person without knowing them. Moreover, with this intelligent monitoring system we can help the government and police officers to track the criminal or wanted person without stopping them. The proposed internet of things (IOT) monitoring which applied such as monitor sensor monitoring.

Intelligent systems have been widely utilized for information processing in modern society due to the rapid growth of artificial intelligence (AI) applications. AI and Internet of Things has recently developed as one of the hot research topics, it merges AI technologies with the IOT infrastructure and offers more effective IOT service.

The abrupt changes in motion, cluttered scenes, camera viewpoints, a close interaction between individuals, and occlusion are the crucial factors that might influence the performance of human detection.

Generally, the primary purpose of the work is given as follows:

1. To present an automated IOT based human detection system for monitoring.
2. To study the generalization performance of machine learning architectures by testing on an entirely different data set.
3. To compare the detection results of trained and pre trained architectures.
4. The proposed system will detect human faces and also identify them.

In this study, an automated human detection is introduced. The intelligent surveillance system utilized machine learning detection architectures that is RCNN and computer vision as a baseline for real time human detection. All learning models are first trained, containing images of people in real time environment and some selfie pictures and group pictures. As RCNN is computationally expensive and extremely slow, a variant of it called fast RCNN was developed. RCNN discards the usage of SVM in classification.

Though RCNN improves the prediction accuracy, the model has to be optimized for reducing the training time.

## **METHODOLOGY:**

Artificial intelligence when combined with Internet of Things can give incredible results and also will give new direction in the field of machine learning and deep learning. It may give new uses and new dimensions to the world. The methods which we use to build this security are extremely new but the strongest. We are going to discuss the methods that are used in this system:

Let us first discuss machine learning that is the root or the base of the system-

### **MACHINE LEARNING**

Machine learning is that kind of Artificial Intelligence (AI) at some level that allows its many applications or systems to become more and more accurate in giving results and predicting outputs that are more accurate without being explicitly programmed to do that particular task. They learn by their experience and previous environment and they become more and more accurate every time. Machine learning is of following types:

- Supervised learning
- Unsupervised learning
- Reinforcement learning

So, the method that we are using in our system is supervised learning. Let us quickly see about supervised learning.

**Supervised machine learning** is the process where the machine is trained by giving set of datasets that are already tagged with their outputs that will supervise the machine to predict the output correctly. In this type of learning the models are trained with labeled datasets and then the machine is tested by giving the test datasets. And on the basis of those training data, the machine will predict the correct output for the test datasets. Image classification is the need here why we are using supervised machine learning.

For classification, we will be using RCNN supervised pre- training algorithm. In other words, the model is trained for being used as an object classifier rather than detector.

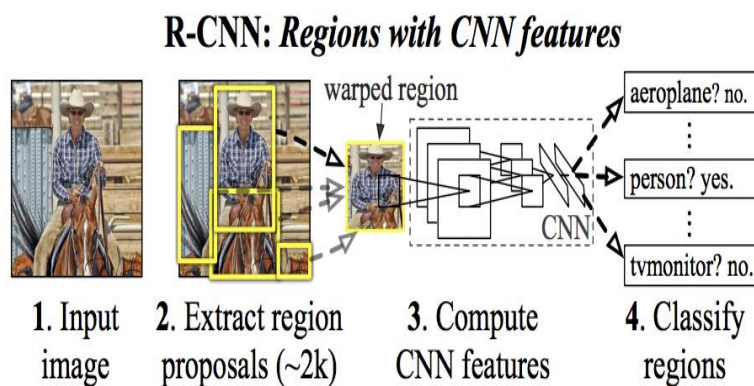
### **RCNN**

To solve the problem of selecting huge number of regions (locations), Ross Girshick et al. proposed a method where we use selective search to extract just 2000 regions from any image and he called them region proposals. Therefore, now, instead of trying to classify huge number of regions, you can just work with 2000 regions. These proposals are generated using the selective search algorithm which is written below:

Selective Search:

1. Generate initial sub- segmentation, we generate many candidate regions.
2. Use greedy algorithm to recursively combine similar regions into larger ones.
3. Use the generated regions to produce the final candidate region proposals.

RCNN is the complete innovation the existing art of object detection techniques. Although we have many other strong algorithms for object detection, RCNN is yet the fundamental and powerful and also simple algorithm that will allow its users to do task.



## OTHER MACHINE LEARNING OBJECT DETECTION ALGORITHMS:

In this study, we have also read some other machine learning architectures that are used in previous researches for image processing. Let us see some other algorithms and analyze the merits and demerits of different algorithms:

### SIFT:

The SIFT or **Scale- Variant feature transform** is actually a computer vision algorithm, that is used to match features in images that include object recognition, robotic mapping, image stitching, 3D modeling etc. SIFT keypoints are first extracted from the from the set of training datasets that are stored in database, when it has been fed with the new image it matches those keypoints and compare each feature of new image from the stored database. This algorithm is robust to change in environment, illumination, noise and minor changes in viewpoint. They are also highly distinctive, easy to extract and allows correct object detection. But high dimensionality can be an issue for this algorithm. This algorithm can cancel noise and still detect images taken in different backgrounds. But till now it is still quite slow algorithm, take long time to perform and not as effective algorithm when compared to others.

## RANSAC:

RANSAC is short form of **Random sample consensus**, which is an iterative method to calculate the parameters of a mathematical model from a set of observed data. It gives results with the sense of certain probability. Basically, this algorithm is a learning technique for machines to calculate the parameters by random sampling of data. This is an iterative algorithm that enables machine to learn. Minimum data is first collected as input that contains least outliers and then cardinality of the sample data is sufficient for predicting the parameters. Then the machine checks that which part of the whole datasets is the perfect match for those sample datasets and in this way, it predicts the object. RANSAC will fail when it is fed with two or more data models as for any one model.

## CNN:

CNN or Convolutional Neural Network is a deep learning method that is used for image datasets, classification by training model with artificial neural networks. In deep learning, CNN is used for imager classification and recognition. It is a very strong algorithm and it predicts results with the maximum accuracy. It has three layers: the input layer, which is the input that has been fed by the user for training the machine; the hidden layer: that is where the activation function is followed and number of artificial neurons that are based on the size of the model; the output layer, which is the output from the hidden layer and is the result. We can also backpropagate to minimize the loss.

Comparison graph between these algorithms:

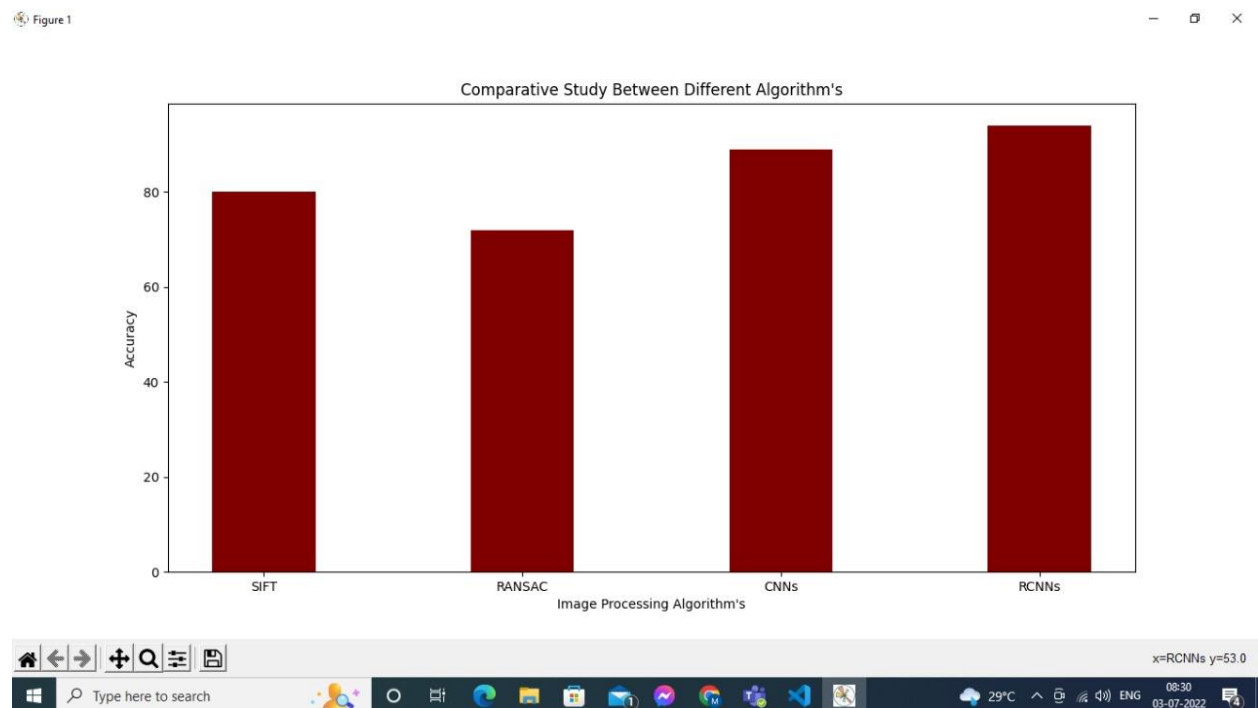


Figure 1: Results showing accuracy with different algorithms used.

## COMPUTER VISION

Now that we have classify our data using R-CNN machine learning algorithms and by that our system can classify between different object seen in the picture, this is the time we have to fetch information about those pictures that are digital, of course. Artificial intelligence provides vision to the computer same as we human do have, and this is called computer vision. As the name suggest, this technology gives vision to the computer that enables the computer to derive meaningful information from the digital images and videos. AI help the computer to think then it is safe to say that CV enables them to see, observe and understand.

Open CV is used in this surveillance system to train the machine to look after every movement and catch the target if it is present in the frame, but it will do it with cameras, data and algorithms in much less time than retinas, optic nerves basically a human will do and that is why we are making this system. CV needs huge amount of data to get it trained.

In this system we are working on datasets that need to be stored and for storage what can be better than cloud storage. For cloud storage we will be using Back4app.

## BACK4APP

Back4app is the most reliable open-source service provider that enables its user to build the extensible and scalable and web applications at a great speed.

The whole complications are done at backend that the user is unaware. The user is served with automatic scaled cloud space that can be increased or decreased as per need.

Let us see some important features of Back4app:

- Data as spreadsheets: back4app enables its users to store in spreadsheets so it allows the developers to create, update, and sync their data of application.
- Scalable hosting: When a user request for cloud space, then it may be happened that he don't know about the exact space he needed. Back4app made things easier as it hosts scalable hosting solutions.
- Push and Email Notifications: Back4app is the inspiring backend solutions that provides centralized notifications queue.
- Pricing structure: Thankfully we can start with free account and then as per need we can be charged for the space.

## PROPOSED METHODOLOGY:

**Step 1:** IOT device camera detects the face of the person's and extract the features of each face.

**Step 2:** if features of face is matched from the database, then get the detail of person

Else

Continue to detect face.

**Step 3:** The person detail such as adhar number, person's id, location will be verified by the miner nodes of blockchain network. Miners m1, m2, m3, ....., mn. Further verify the person details.

**Step 4:** If (minor nodes m1, m2, .....,mn also find the person)

Then store the information of person on each station with time, date, person id

Else

Continue to step1.

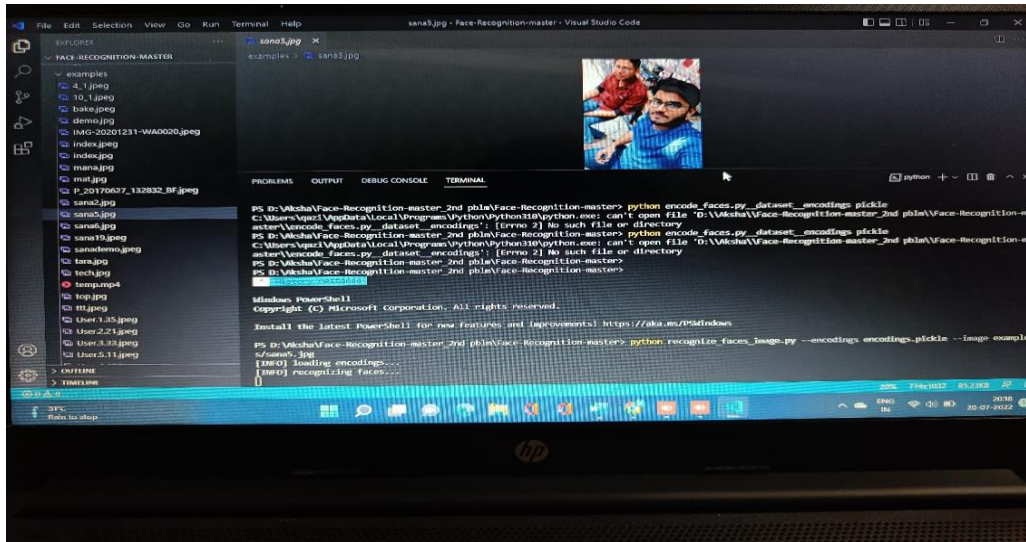
### **RESULT ANALYSIS:**

This article featured a human detection system which based on artificial intelligence for not very complex environment. In this study different machine learning algorithms are explored and we also see their performance results for images, videos, and selfies. We have seen that CNN and RCNN have greater performance accuracy than other. These algorithms are very strong and with more experiments their performance will be more increased. The model delivers the average accuracy of 92% which is the greatest among all. For additional training will obviously increase the performance. In future work backpropagation can be implemented for reducing the loss and more accurate results and also to monitor people we can add many IOT devices like camera, location tracker etc. in order build this as a whole working model. The detection results are also compared with other architectures that gives 80%, 67%, 90% for SIFT, RANSAC, CNN algorithms respectively for image processing. Moreover, further studies a detailed study is performed on the output results that highlight the challenges and limitations for more future work.

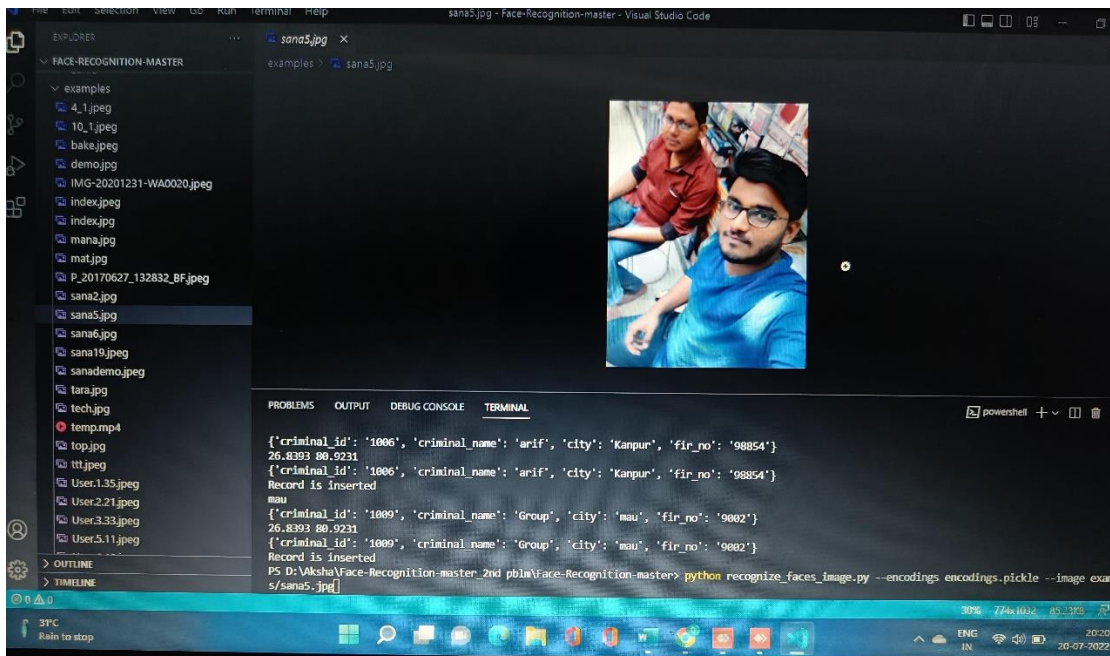
Let us see the results of the system:

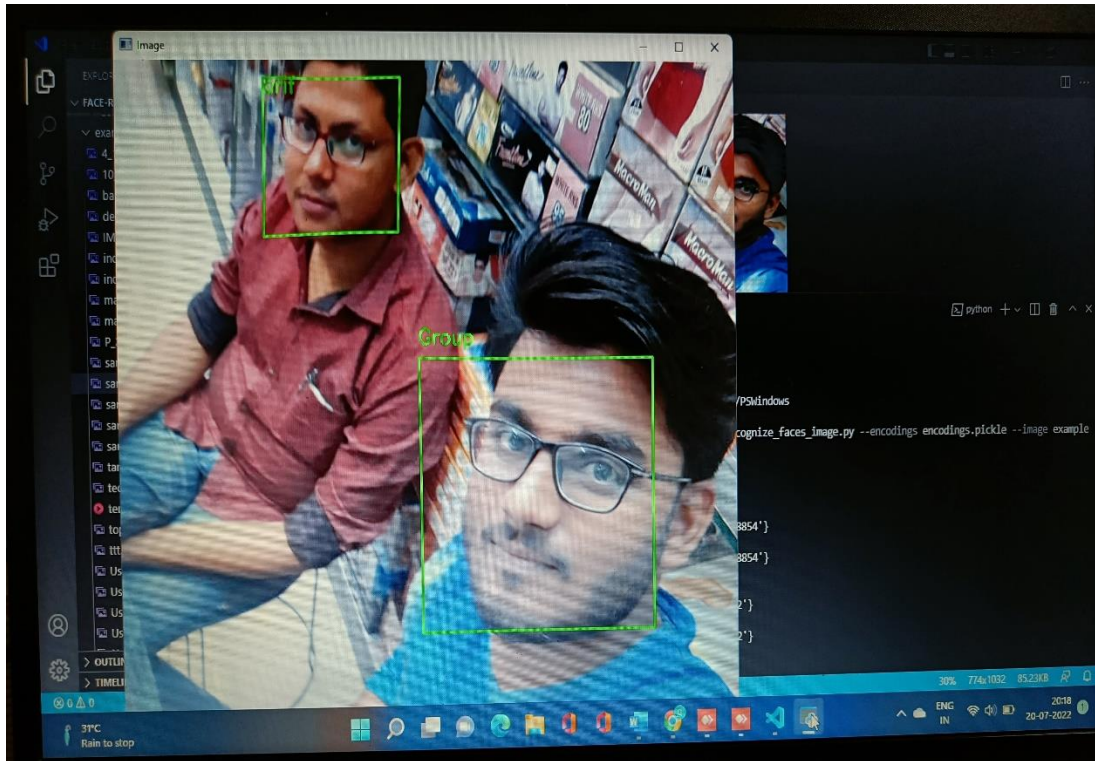
Here we see that when we take a data at set it run the system is fetching the details and processing-





After processing the data, the system matches the given data that if the given person is criminal or not, if its data is matching with the criminal records or not. But one person matches the records and the system tells all details of that person like name, fir number, location etc.





## **CONCLUSION:**

This paper was written with the purpose of highlighting the researchers do in the past in the field of “IOT Based Human Identification and Monitoring by using machine learning and cloud computing”. Here we addressed different techniques and methods that are used in the field of artificial intelligence that are used by the researchers for many reasons. Human identification and monitoring are the basic requirement of today’s modern life. At college, hospitals, banks and even at our home, there is a requirement of identifying any person as he may can be an intruder and cause harm to our property and even life. By using these emerging technologies there is a bright future where we have secure surroundings and the criminals and social threats will be terrifying of roaming around streets and public areas. They have terror of being caught and behinds bars. The detection results are also compared with other architectures that gives 80%, 67%, 90% for SIFT, RANSAC, CNN algorithms respectively for image processing. Moreover, a detailed study is performed on the output results that highlight the challenges and limitations for more future work. Experimental results shows that R-CNN achieve promising results with accuracy 92% which is greater than the rest of machine learning architectures. It is also seen that with more training datasets and more experiments, the average accuracy can be significantly improved.

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16. Review Paper: “IOT Based Human Identification and Monitoring System Using Cloud and Machine Learning.”

**AQSA FATIMA**  
**by Prakriti Mishra**

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