# 18CSE388T – ARTIFICIAL NEURAL NETWORK

## *Face Recognition System*

**Done by**

**Guru Parvesh (RA2011032010032)**


Department of computational intelligence
School of computing
SRMIST
Kattankulathur

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# Report:

## 1) Problem Statement:

In this modern age there is rapid increase in number of vehicles and so is the number of car theft attempts, locally and internationally. With the invention of strong stealing techniques, owners are in fear of having their vehicles being stolen from common parking lot or from outside their home. Thus the protection of vehicles from theft becomes important due to insecure environment. Real time vehicle security system based on computer vision provides a solution to this problem. The proposed vehicle security system performs image processing based real time user

authentication using face detection and recognition techniques and microprocessor based control system fixed on board with the vehicle. As the person enters the parked car overcoming the existing security features, the infrared sensor attached to the driver's seat of the vehicle activates the hidden camera fixed in appropriate position inside the vehicle. As soon as the image is acquired from the activated camera, face of the person is detected using Viola Jones algorithm. The extracted face is recognized using the enhanced Linear Discriminant Analysis (LDA) algorithm which discriminates much of the features rather than looking for exact pattern based on Euclidean distance and also reliable to be used with large samples of data. Performing authorization involves setting the threshold value and comparing with that of Euclidean distance above which the person is not authenticated. The face of the person which is classified as unknown is sent to the mobile of the owner as a MMS through the operating GSM modem. The owner upon receiving the information commands the system and the fuel is regulated using the relay in accordance with the command of the owner. This would be effective to authenticate the person under different environment and to have an efficient way of vehicle security.

## 2) Introduction:

The use of vehicle becomes important everywhere in the world and also preventing it from theft is required. Vehicle manufacturers are attaining the security features of their products by introducing advanced automated technologies to avoid the thefts particularly in case of cars. Biometric and non-biometric methods usually provide such security features. Sometimes these systems fail due to hacked password and encryption of decrypted data, but it is almost impossible to make replica of distinctive characteristics. Biometric systems are modern and use techniques like fingerprint recognition, iris recognition and face recognition. Of these face recognition and detection systems are more sophisticated, easy to deploy and people can be identified without their knowledge. Some advantages of facial recognition method for vehicle security application are:-

1. More convenient, sensed as soon as one is seated in position.
2. Low cost and a better approach to be used with existing methods.
3. Requires no active part of the user.

In vehicle security system, the objective is to prevent the theft of vehicle and ensure safety of vehicle by avoiding the means of theft. One level of ensuring authentication of driving is through face

recognition system that authenticates a user being an authorized person to have access to the ignition system. The microprocessor based control system fixed inside the vehicle uses GPS receiver, GSM modem and captures image from the camera on detection of person in the parked vehicle. Face is detected and recognized using algorithm overcoming the pose and illumination constraints. The recognized image is compared with the authorized image of users in the database. If matched, the system allows operating the vehicle. If not matched, it sends MMS of face and GPS values to the owner. Shihab A Hameed et al, (2011) in their work focused on the MMS and database technology with good response time. This helps the owner in making decision about the control of vehicle. The owner decides and commands the system to prevent the access of the vehicle or to allow the person to operate the vehicle.

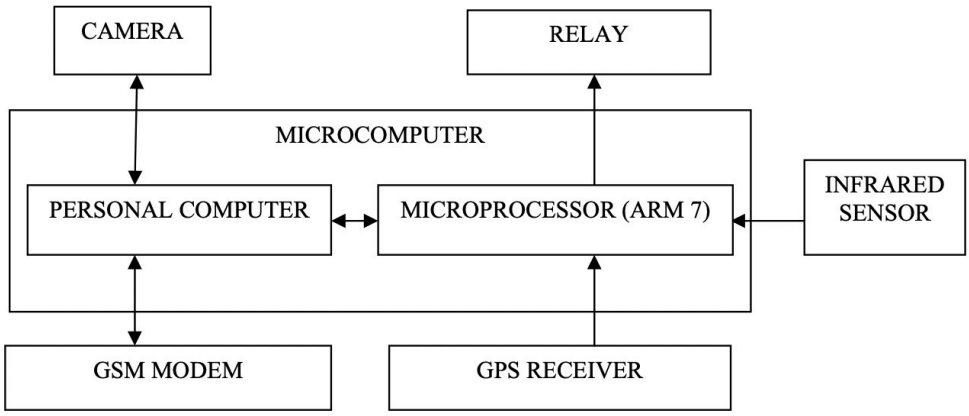
## Computer Vision Based Security System

In recent years, computer vision has played a significant role in biometric identification and user recognition. Biometric identification based security systems are considered to be the most secure especially due to their ability to identify people with minimal ambiguity. It uses a face detection and recognition system that identifies and verifies a person automatically by extracting unique features of face from an image or video captured by the camera.

Implementation of biometric authorization emerged successful when employed in the vehicles as machine vision technology provides a new level of theft detection and extra security by monitoring the presence of intruders inside the vehicle.

## 3) Methodology

The real time extendable emergency system with microcomputer comprises image processing control unit and microprocessor to prevent the parked vehicle from theft. Face detection and recognition system use enhanced algorithm for authentication. The entire security system comprising each component is shown in Fig. 1. Bagavathy et al, (2011) realized the importance of using ARM processor in real time applications. Hence ARM 7 microprocessor is used as the control unit in the system. The passive infrared sensor attached to the seat of the driver activates the hidden camera fixed inside the vehicle through the ARM 7 microprocessor control of the microcomputer once the intruder enters the car. The camera acquires the image of the person inside the car fixed in an appropriate position in front of the driver seat. Once the image of the person is acquired, the system now tries to detect the face.




Block Diagram of Security System.

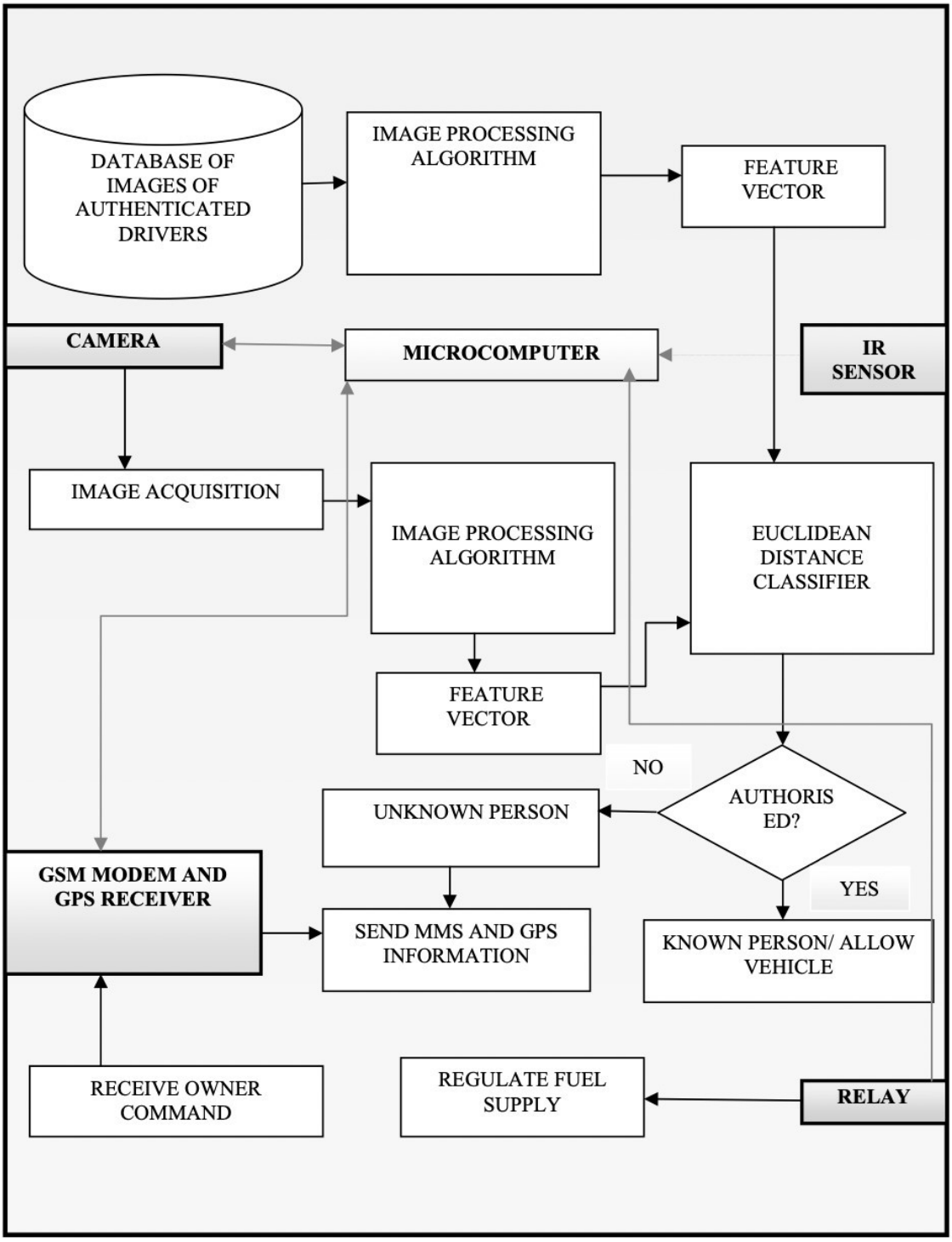
## 3.1 Image Processing

The microcomputer which contains the image processing unit embedded within it performs the face detection and authorizes the person. The processing of image involves two parts, face detection and face recognition.

### *3.1.1 Face Detection*

We humans can easily distinguish between places, objects, and people based on images, but computers have traditionally had.

difficulties with understanding these images. Thanks to the new


DATABASE OF IMAGES OF AUTHENTICATED DRIVERS
IMAGE PROCESSING ALGORITHM
FEATURE VECTOR
CAMERA
MICROCOMPUTER
IR SENSOR
IMAGE ACQUISITION
IMAGE PROCESSING ALGORITHM
EUCLIDEAN DISTANCE CLASSIFIER
FEATURE VECTOR
NO
AUTHORIS ED?
UNKNOWN PERSON
GSM MODEM AND GPS RECEIVER
YES
SEND MMS AND GPS INFORMATION
KNOWN PERSON/ ALLOW VEHICLE
RECEIVE OWNER COMMAND
REGULATE FUEL SUPPLY
RELAY

applications that can interpret visual information.

As always, let's start with the basics. From time to time, you can hear terms like "Computer Vision" and or "Image Recognition".

These terms are synonymous, but there is a slight difference between the two terms. Let us explain.

Computer vision is a wide area in which deep learning is used to perform tasks such as image processing, image classification, object detection, object segmentation, image coloring, image reconstruction, and image synthesis. In computer vision, computers or machines are created to reach a high level of understanding from input digital images or video to automate tasks that the human visual system can perform.

Whereas, image recognition is a field of computer vision that interprets images to aid decision-making. Image recognition is the final stage of image processing, which is one of the most important tasks of computer vision

4)**Vehicle Control**

When the image processing unit classifies the person as unknown, the unauthenticated face image is sent to the owner mobile through Multimedia Messaging Service (MMS) using GSM

modem. Also the system updates the GPS information about the location of vehicle to the owner mobile. The owner based on the received information commands the control unit of the system. If the owner commands to stop the vehicle operation, the relay which is in connection with the engine control unit blocks the ignition unit and stops the vehicle in movement. If the owner wants the person to be authorized, he is allowed to operate the vehicle. This provides a level of security in the vehicle which is critical in the modern world of improved techniques of theft.

**5)** Implementation **Steps:**

1) **Setting face recognition libraries:**

```
# installing dlib  pip
install dlib
```

It is a modern C++ toolkit that contains ML-related algorithms and tools.

```
# installing face recognition pip
install face recognition
```

**face recognition** The actual face recognition library can be installed after dlib.

```
# installing opencv  pip install
opencv
```

**Note**: Sometimes installing dlib throws error in that case install install the C++ development toolkit using vs  code community .

**Opencv** for some image pre-processing

```
import cv2 import numpy
as np import
face_recognition
```

**Importing Libraries**

## 2. Loading Image:

We are done with installing and importing the libraries. It's time to load some sample images to the face_recognition library.

The library face_recognitionsupports only the BGR format of images. While printing the output image we should convert it into RGB using OpenCV.

**Face_recognition** Loads images only in BGR format.

```
import cv2 import numpy
as np import
face_recognition img_bgr
=
face_recognition.load_image_file('student_images/modi.jpg')
img_rgb = cv2.cvtColor(img_bgr,cv2.COLOR_BGR2RGB)
cv2.imshow('bgr', img_bgr) cv2.imshow('rgb', img_rgb)
cv2.waitKey
```

## 3)Detecting and Locating Faces:

The library face_recognitioncan quickly locate faces on its own, we don’t need to use haar_cascade and other techniques.

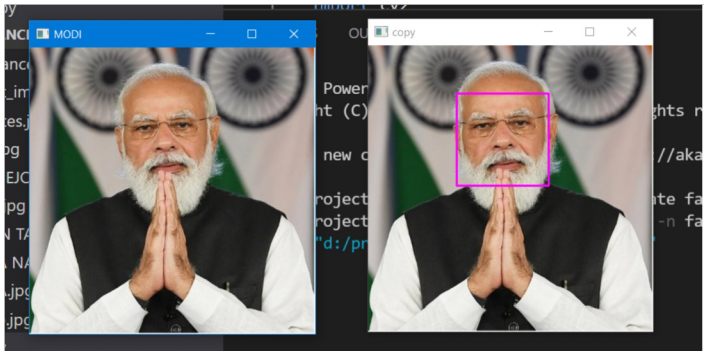
```
img_modi=face_recognition.load_image_file('student_images/modi
.jpg') img_modi_rgb = cv2.cvtColor(img_modi,cv2.COLOR_BGR2RGB)
face = face_recognition.face_locations(img_modi_rgb)[0] copy =
img_modi_rgb.copy() cv2.rectangle(copy, (face[3],
face[0]),(face[1], face[2]),
(255,0,255), 2) cv2.imshow('copy', copy)
cv2.imshow('MODI',img_modi_rgb)
cv2.waitKey(0)
```

## 4)Sample Image Recognition:

The library face_recognition is based on deep learning, it supports single-shot learning which means it needs a single picture to train itself to detect a person.

```
img_modi =
face_recognition.load_image_file('student_images/modi.jpg')
img_modi = cv2.cvtColor(img_modi,cv2.COLOR_BGR2RGB) face =
face_recognition.face_locations(img_modi)[0] train_encode =
face_recognition.face_encodings(img_modi)[0] test =
face_recognition.load_image_file('student_images/modi2.jpg')
test = cv2.cvtColor(test, cv2.COLOR_BGR2RGB) test_encode =
face_recognition.face_encodings(test)[0]
print(face_recognition.compare_faces([train_encode],test_encod
e)) cv2.rectangle(img_modi, (face[3], face[0]),(face[1],
face[2]),
(255,0,255), 1) cv2.imshow('img_modi',
img_modi) cv2.waitKey(0)
```

Output:



## 6) Result

The security system based on computer vision is realized with the microcomputer using MATLAB in the personal computer and ARM 7 microprocessor as the controlling unit. The database is maintained with 5 authorized users under different environments as shown in Fig. 3 and the image is acquired for face detection. The face is detected using the cascade detector in the acquired image

Fig. 3: Database images of Authorized persons.

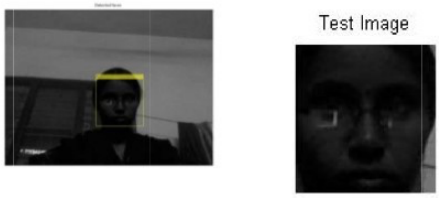




**Fig. 4**: Face detected image **4(a).** Test Image **4(b)**. Recognized image **4(c).** Authorized

## 7)Inference :

It is faster and more convenient compared to other biometric technologies like fingerprints or retina scans. There are also fewer touchpoints in facial recognition compared to entering passwords or PINs. It supports multifactor authentication for additional security verification, Facial recognition is a more accurate way to identify individuals than simply using a mobile number, email address, mailing address, or IP address. For example, most exchange services, from stocks to cryptos, now rely on facial recognition to protect customers and their assets.

## 8)Conclusion

An embedded automotive security system involving face recognition is presented. The system can be used to reduce the increased vehicle theft and allows the owner to identify the intruder thereby having the vehicle under his/her control. The results obtained through the face recognition shows that it can be relied upon to ensure safety of vehicle. The system is also reliable to be used in other authorization applications involving robotics, border management, banking security involving ATMs etc.

## 9) References


1. P Bagavathy, R Dhaya and T Devakumar (2011), Real time car theft decline system using ARM processor, *Proceedings of International Conference on Advances in Recent Technologies in Communication and Computing*, pp. 101- 105.
2. [2] S K Hese and M R Banwaskar (2013), Performance Evaluation of PCA and LDA for Face Recognition, *International Journal of Advanced Research in Electronics and Communication Engineering*, Maharashtra, India, **2**, *2*, pp.149-152.

3. [3] Shihab A. Hameed, Shaima Abdulla et al. (2011), New Automobile Monitoring and Tracking Model: Facilitate Model with Handhelds, *4th International Conference on Mechatronics*, Malaysia.
4. [4] P Viola and M Jones (2002), Fast and robust classification using asymmetric AdaBoost and a detector cascade, NIPS14.