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BANK LOCKER AUTHENTICATION SYSTEM USING FACIAL RECOGNITION

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Abstract : Security and Authentication of individuals is necessary for our daily lives especially in Bank lockers. A smart digital door lock system for bank automation is equipment that uses digital information such as a user's data and face recognition as the method for authentication in the system. In this system the bank will collect the face imprints of each person for accessing the lockers. Only authenticated people can recover the money, documents from the lockers as faces are stored for the individual identity of a person. For facial recognition, this project uses the CNN algorithm. In this project, only authenticated user can access the lockers as faces are stored for the individual identity of a person. Facial recognition alone cannot determine whether the person is real or not. Therefore, liveness detection is implemented. In liveness detection, the system detects if it interacts with a real person or a spoof artefact used by other person such as a face photo. To detect whether the person is live or not the project uses eye blink detection. In this system the owner of a particular locker needs to authenticate his/her identity by verifying their face following with an One Time Password authentication feature. Here the person will receive an OTP received on their registered mobile number, proceeding with it; the valid one will allow the owner to access the particular locker whilst incorrect will not.

I. INTRODUCTION

Although the popularity performance of biometric system is nowadays quite satisfactory for many applications, much work continues to be necessary to permit convenient, secure and privacy-friendly systems to be designed. In face recognition, the same old attack methods could also be classified into several categories. The thought of classifying relies on what verification proof is provided to face verification system. In this paper, we have proposed a technique of live face detection to resist the attack employing artefacts like a stolen photo, stolen face photos, recorded video, 3D face models. Liveness detection has been a really active research topic in fingerprint recognition and iris recognition communities in recent years. It is that the act of differentiating the feature space into live and non-living. But in face recognition, approaches are pretty much limited to cope with this problem. Imposters will attempt to introduce an oversized number of spoofed biometrics into system

In banking sector most, advanced technologies are not being used. Bank safety is an important issue at present. Our money is not safe in bank lockers when people cheat and misuse bank account and take unauthorized access to bank account. For safety purpose locks or alarms are installed in the bank lockers. For the safety of bank lockers latest technologies are used. Designing of our prototype, involves the image comparing technique. Also, manpower used in managing these lockers is vast in banks whereas there are less people to attend to the consumers, banks can deploy more employees instead of wasting manpower in locker management system as our project will automate the locker system in banks.

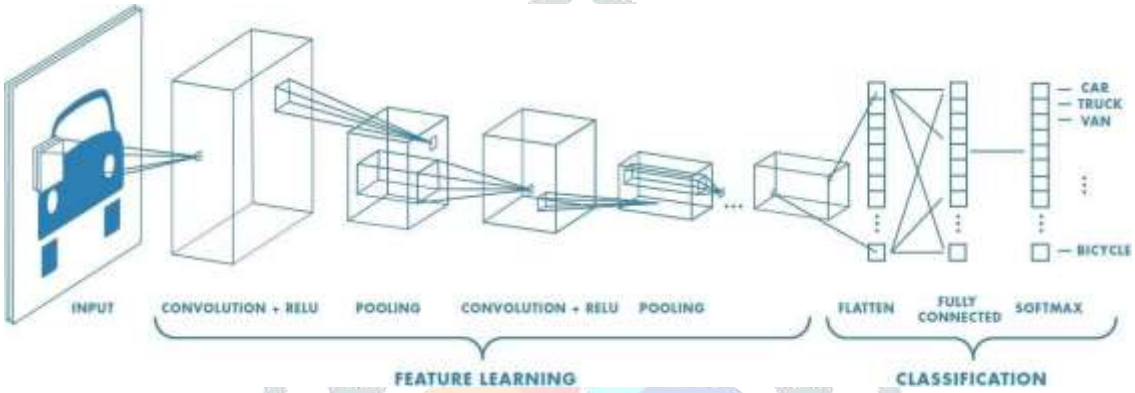
I. RESEARCH METHODOLOGY

Present-day bank security systems use the mechanical key method in which one key was given to the user and the other one was kept by the bank. That's why a more secure system with SMS-based and GSM technology has become the need of the hour. A system that activates, authenticates, and validates the user and only then unlocks the locker.

3.1 ALGORITHM DETAILS:

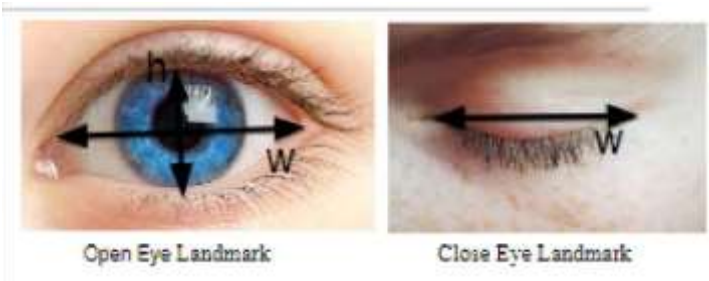
Artificial Intelligence has been witnessing a monumental growth in bridging the gap between the capabilities of humans and machines. Researchers and enthusiasts alike, work on numerous aspects of the field to make amazing things happen. One of many such areas is the domain of Computer Vision. The agenda for this field is to enable machines to view the world as humans do,perceive it in a similar manner and even use the knowledge for a multitude of tasks such as Image & Video recognition, Image Analysis & Classification, Media Recreation, Recommendation Systems, Natural Language Processing, etc. The advancements in Computer Vision with Deep Learning has been constructed and perfected with time, primarily over one particular algorithm —a **Convolutional Neural Network**.

Fig architecture CNN



A **Convolutional Neural Network (CNN)** is a Deep Learning algorithm which can take in an input image, assign importance (learnable weights and biases) to various aspects/objects in the image and be able to differentiate one from the other.

HAAR feature-based cascade classifiers based on the "Rapid Object Detection using a Boosted Cascade of Simple Features" is a machine learning approach in which a cascade function is trained using a large number of positive and negative images. It is then used to detect objects in other images. Here, this method is used for face detection.



- Liveness Detection

The eye blink detection technique is used to identify liveness. Eye blink detection algorithm uses eye aspect ratio as given in equation. Eye aspect ratio is approximately constant while the eye is open, but will rapidly fall to zero when a blink is taking place.

Eye Aspect Ratio:

Eye Aspect Ratio = w/h where,

- 'w' is the width of the eye
- 'h' is the height of the eye

Euclidean Distance Formula:

Euclidean Distance $d = \sqrt{(x2 - x1)^2 + (y2 - y1)^2}$

where,

- "d" is the Euclidean distance (here, d is 'h' or 'w')
- (x1, y1) is the coordinate of the first point of the eye
- (x2, y2) is the coordinate of the second point of the eye

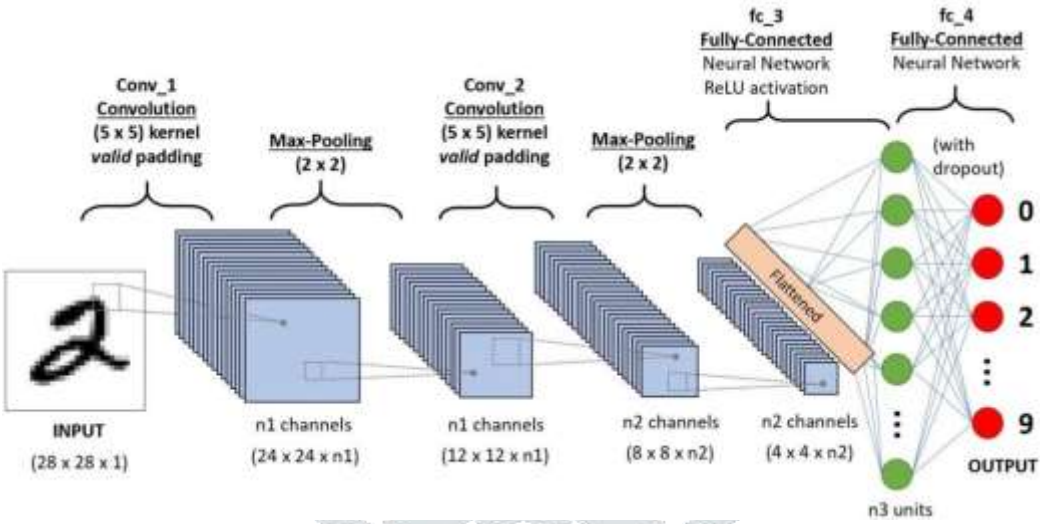


Fig A CNN sequence to classify handwritten digits

The pre-processing required in a ConvNet is much lower as compared to other classification algorithms. While in primitive methods filters are hand-engineered, with enough training, ConvNets have the ability to learn these filters/characteristics. The architecture of a ConvNet is analogous to that of the connectivity pattern of Neurons in the Human Brain and was inspired by the organization of the Visual Cortex. Individual neurons respond to stimuli only in a restricted region of the visual field known as the Receptive Field. A collection of such fields overlap to cover the entire visual area.

Input Image

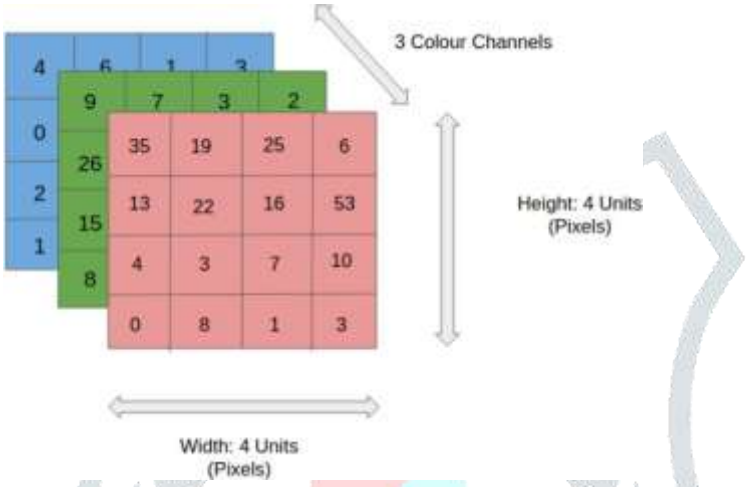


Fig 4x4x3 RGB Image

In the figure, we have an RGB image which has been separated by its three color planes — Red, Green, and Blue. There are a number of such color spaces in which images exist — Grayscale, RGB, HSV, CMYK, etc.

Convolution Layer — The Kernel

Convoluting a 5x5x1 image with a 3x3x1 kernel to get a 3x3x1 convolved feature. The filter moves to the right with a certain Stride Value till it parses the complete width. Moving on, ithops down to the beginning (left) of the image with the same Stride Value and repeats theprocess until the entire image is traversed.

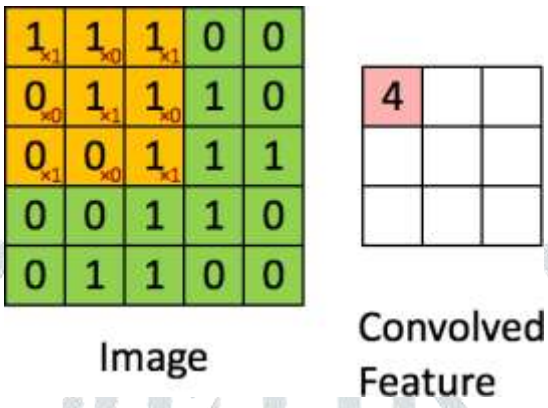


Fig convolution

Pooling Layer

Similar to the Convolutional Layer, the Pooling layer is responsible for reducing the spatial size of the Convolved Feature. This is to **decrease the computational power required to process the data** through dimensionality reduction. Furthermore, it is useful for **extracting dominant features** which are rotational and positional invariant, thus maintaining the process of effectively training of the model.

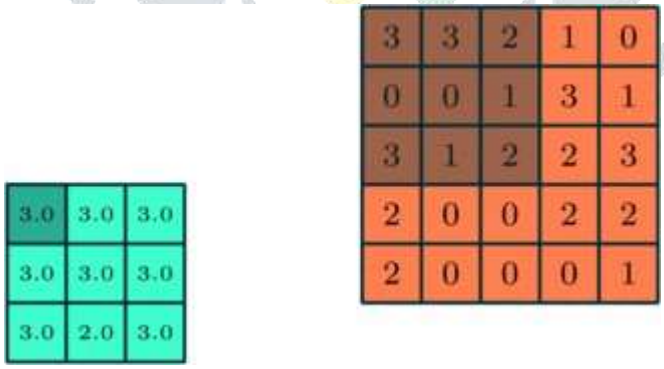


Fig 3x3 pooling over 5x5 convolved features

There are two types of Pooling: Max Pooling and Average Pooling. Max Pooling returns the maximum value from the portion of the image covered by the Kernel. On the other hand, Average Pooling returns the average of all the values from the portion of the image covered by the Kernel.

Max Pooling also performs as a Noise Suppressant. It discards the noisy activations altogether and also performs de-noising along with dimensionality reduction. On the other hand, Average Pooling simply performs dimensionality reduction as a noise suppressing mechanism. Hence, wecan say that Max Pooling performs a lot better than Average Pooling.

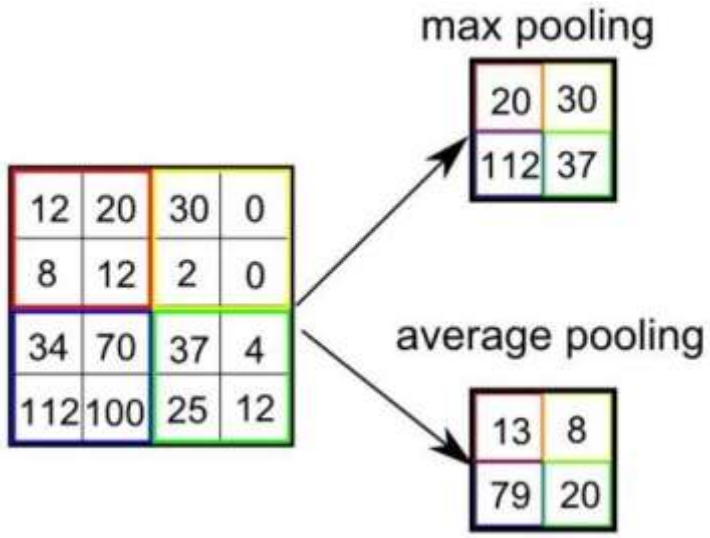


Fig Types of Pooling

The Convolutional Layer and the Pooling Layer, together form the i-th layer of a Convolutional Neural Network. Depending on the complexities in the images, the number of such layers maybe increased for capturing low-levels details even further, but at the cost of more computational power.

After going through the above process, we have successfully enabled the model to understand the features. Moving on, we are going to flatten the final output and feed it to a regular Neural Network for classification purposes.

Classification — Fully Connected Layer (FC Layer)

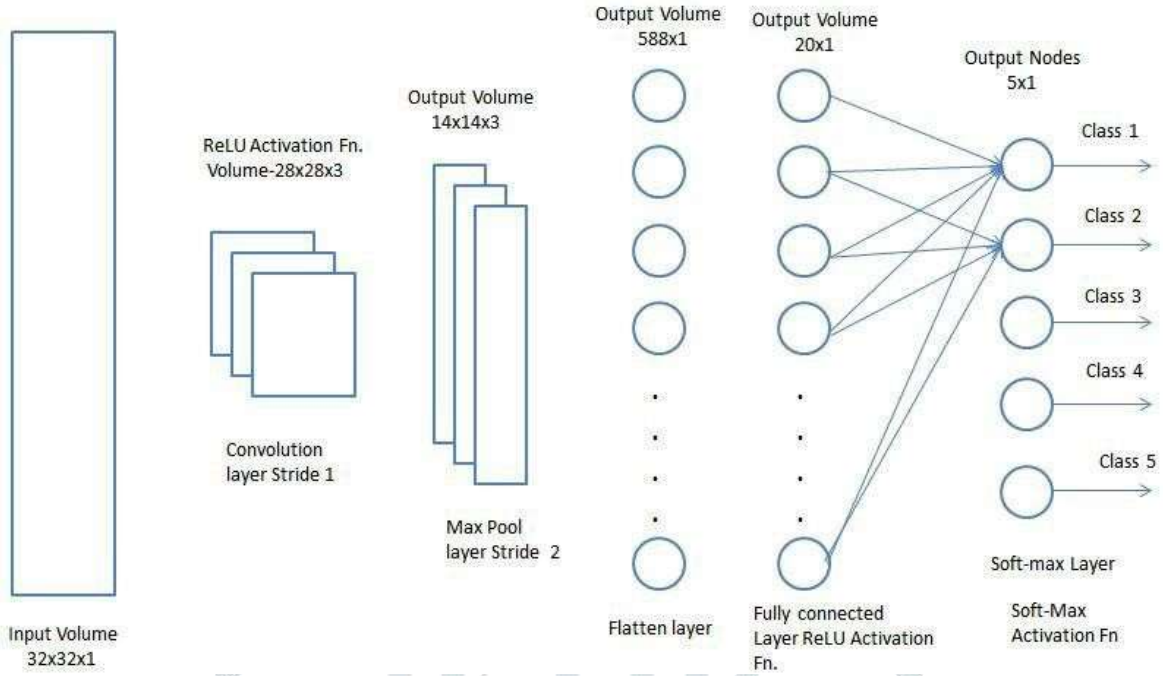
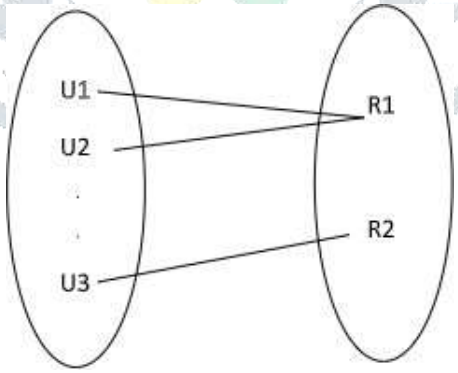


Fig classification of CNN

Adding a Fully-Connected layer is a (usually) cheap way of learning non-linear combinations of the high-level features as represented by the output of the convolutional layer. The Fully-Connected layer is learning a possibly non-linear function in that space.

3.2 Theoretical framework

Mapping



Where,

- U1: image captured by camera
- U2: OTP entered by user.
- R1: Resultant output provided by system (locker unlocked successfully)
- U3: Wrong or incorrect data submitted.
- R2: Locker not opens

Many users can obtain one result or multiple results.

Set Theory:

S = {s, e, X, Y, }Φ

Where,

s = Start of the program.

1. Log in user.
2. scan real-time image of user
3. Processing.
4. Feature Extraction.
5. Classification
6. Face recognition
7. OTP matching
8. Final Result.

e = End of the program.

1. Resultant output provided by the system.
2. Authenticated/ unauthenticated user
3. Log out the user. X =

Input of the program.

Input should be scan image and OTP Y = Output of the program.

Locker unlocked

X, Y U∈

Let U be the Set of System. U= {Client, I,

S, C, A, D, R}

Where Client, I, S, C, A, D, R are the elements of the set.Client=User

I=Input data.

S=Dataset.

C= CNN algorithm A=Application (Web or Mobile).D= Display captured data.

R=Result or output.

SPACE COMPLEXITY:

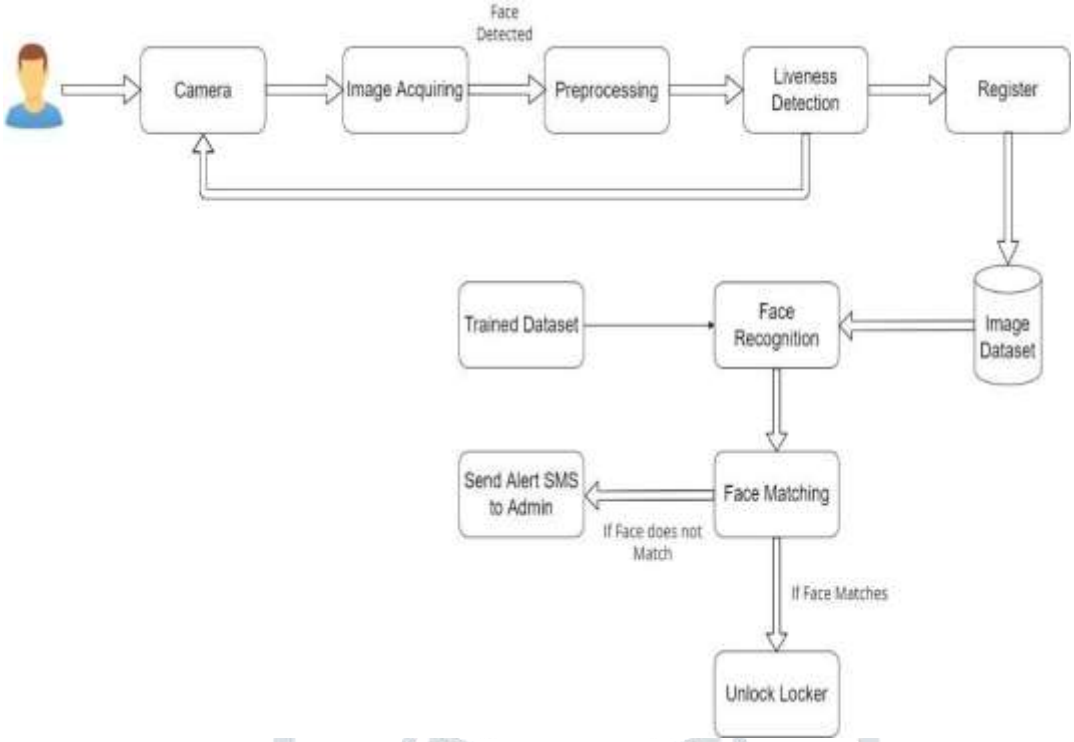
The space complexity depends on Presentation and visualization of discovered patterns.More the storage of data more is the space complexity.

TIME COMPLEXITY:

Check No. of patterns available in the database= n

If (n>1) then retrieving of information can be time consuming. So the time complexity of this algorithm is O(n^n).

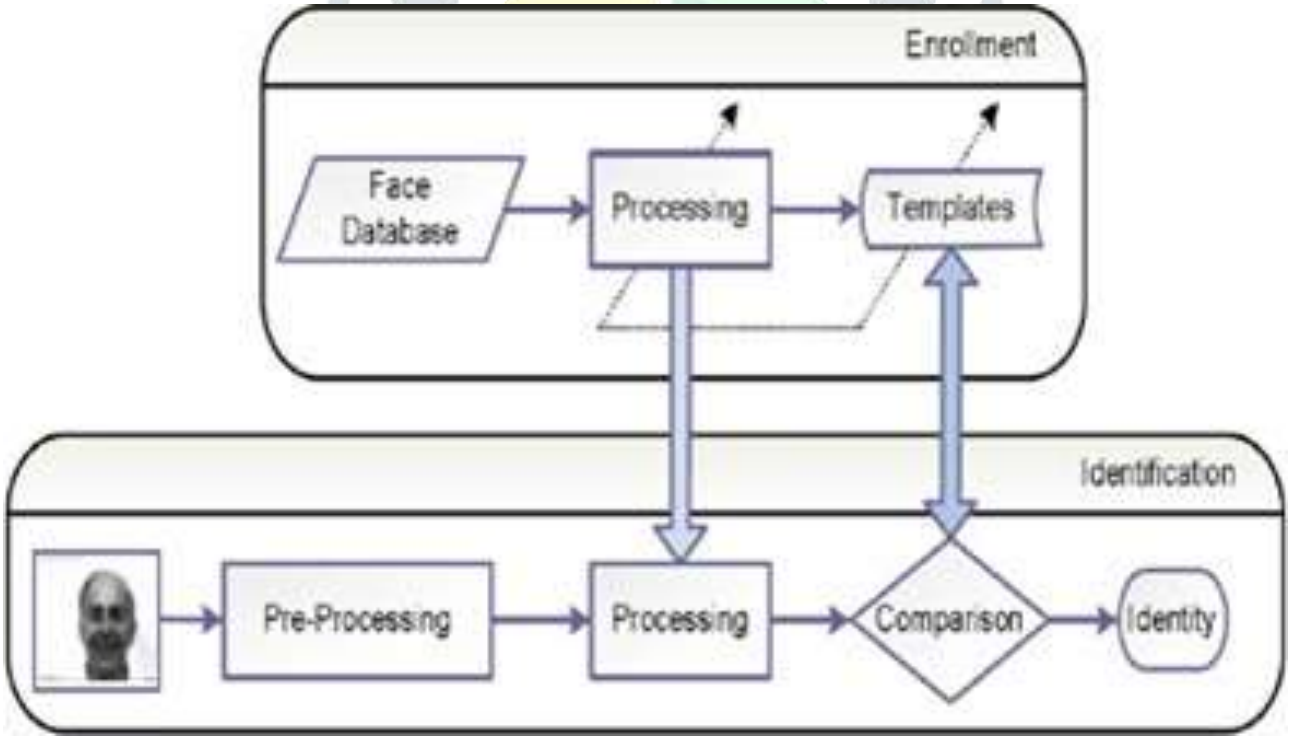
IV. RESULTS AND DISCUSSION



Figures and Tables:

Sr. No	Title of paper	Year	Author	Advantage	Limitation	Scope Of Improvement
1	Autonomous Face Detection System from Real-time Video Streaming for Ensuring the Intelligence Security System	2020	Tanvir Ahmed , Al Amin , Mohammad Ashraful Hoque	Multiple faces detection	In this system, video qual ity absolutely depends on the camera.	**Tedious Work will Be handle**
2	Enhancing bank security system using Face Recognition, Iris Scanner and Palm Vein Technology	2018	Raj Gusain, Hem ant Jain , Shivendra Pratap	Vascular Pattern thinning is highspeed and compact technique	In this system, video quality absolutely depends on the camera.	**Palm Vein Technology can be used in future covering security systems login control and in banking and financial sectors.**

3	Design of Face Detection and Recognition System for Smart Home Security Application	2017	Dwiana Ratna Wati ,Dika Abadianto	In this face detection has good performance in the variation of light source distance position as well as angle position.	The use histogram as a feature is considered to have poor accuracy.	**Resolve the distance be tween the person and the camera which is less than 240 cm**
4	**Deep Learning based Face Liveness Detection in Videos**	**2017**	**Yaman AKBULUT, Sami**	**The obtained results s how that the LRF-ELM method produced mor e accurate results**	**Snuffing attacks are not effectively handled**	**Algorithm lies in its extension to constraints propagation**



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