Face Recognition using open-cv

Guided by:
Dr.RVVSV Prasad
professor&HOD-Department of IT

Presented by:
G.DurgaPrasad (20A21A1224)
M.Kowsthabi (20A21A1240)

Topics covered:

- Objective
- Abstract
- Introduction to computer vision
- Architecture of face recognition
- Different approaches of Face recognition
- Algorithm
- Technologies used
- Implementation
- Uses &Advantages of facial recognition
- Conclusion

Objective:

Design and implement a robust facial recognition system aimed at accurately identifying individuals from digital images or video streams in real-time. The primary objectives include achieving high accuracy rates, ensuring scalability to handle large datasets, optimizing computational efficiency for real-time processing, enhancing security measures, and ensuring compatibility with diverse hardware and software platforms.

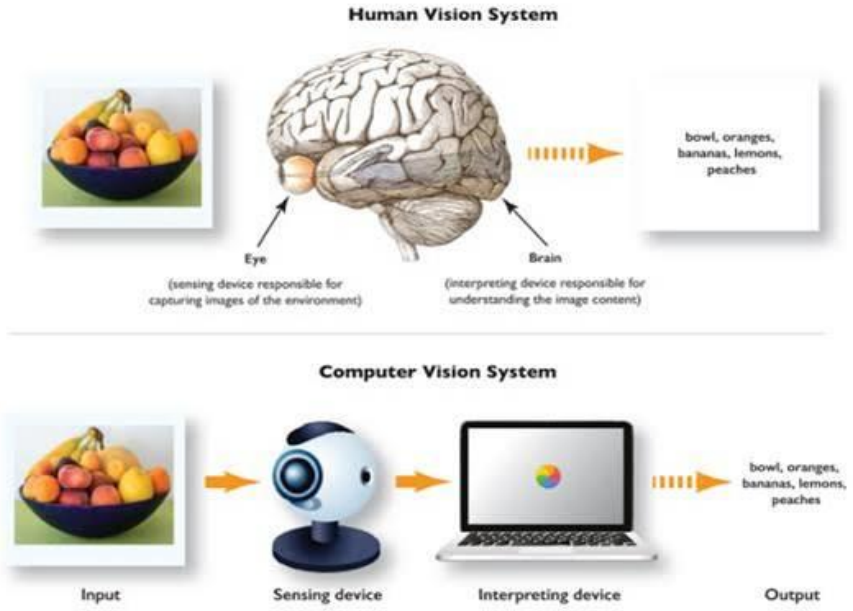
Abstract:

- The utilization of computer vision techniques, particularly with libraries like OpenCV, Face recognition has facilitated the development of robust and efficient face recognition systems.

- The system uses a combination of techniques in two topics; face detection and recognition. The face detection is performed on live acquired images without any application field in mind. Processes utilized in the system are white balance correction, skin like region segmentation, facial feature extraction and face image extraction on a face candidate. Then a face classification method that uses Convolutional Neural Network is integrated in the system.

Introduction to computer vision:

- The term Computer Vision (CV) is used and heard very often in artificial intelligence (AI) and deep learning (DL) applications. The term essentially means giving a computer the ability to see the world as we humans do.
- Computer Vision is a field of study which enables computers to replicate the human visual system.Computer vision projects translate digital visual content into explicit descriptions to gather multi-dimensional data. This data is then turned into a computer-readable language to the decision-making process. The main objective of this branch of artificial intelligence is to teach machines to collect information from pixels.



Architecture of Facial Recognition:

module.

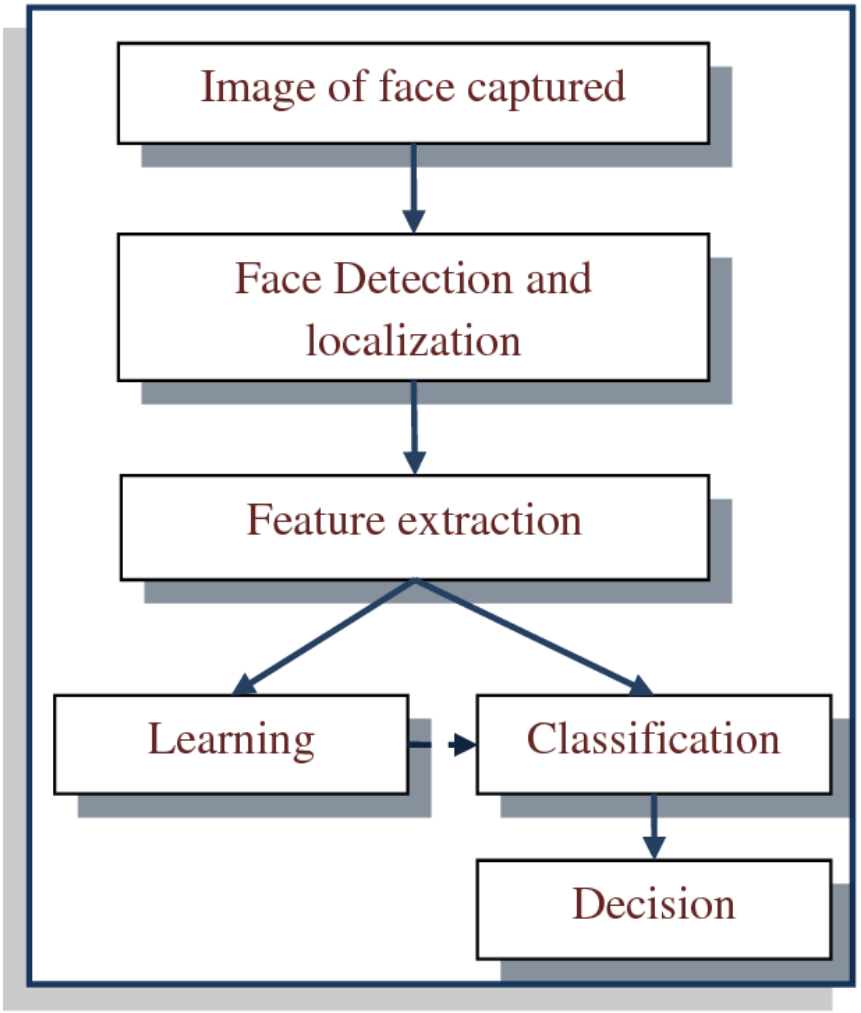


Fig. 1: Basic architecture of an artificial face recognition

Different approaches of Face recognition:

1. OpenCV
2. DLIB
3. Face recognition
4. TensorFlow

Face Recognition using Face Recognition Library:

Steps involved in face recognition library:

Face detection: The face recognition library provides a face locations() method that locates all faces in an image or video frame and gives their bounding box coordinates. These bounding box coordinates specify the location and dimensions of each identified face.

Face Landmarks: Face landmarks(), a function in the library, finds and returns the positions of various facial landmarks, including the eyes, nose, mouth, and chin. These markers might be helpful for tasks like face alignment, emotion identification, and facial expression analysis.

Face encodings: A function named face_encodings() is offered by the face_recognition library, and it computes a 128-dimensional numerical representation or encoding for each identified face. These encodings, which may be used for face comparison and identification, capture the distinctive traits of every face. The encodings can be kept in a database and contrasted with fresh face encodings for recognition.

Face matching: The compare_faces() method provided by the library compares two sets of face encodings and provides a boolean result indicating whether or not they match. This feature can be used to compare a detected face to a database of recognized faces for identification or verification purposes.

User database: A database of recognized faces and their related face encodings is necessary for face recognition. This database is a resource for locating and validating people. By saving each person's face encodings and distinct labels, the face_recognition library enables you to build and maintain such a database.

Algorithm used:

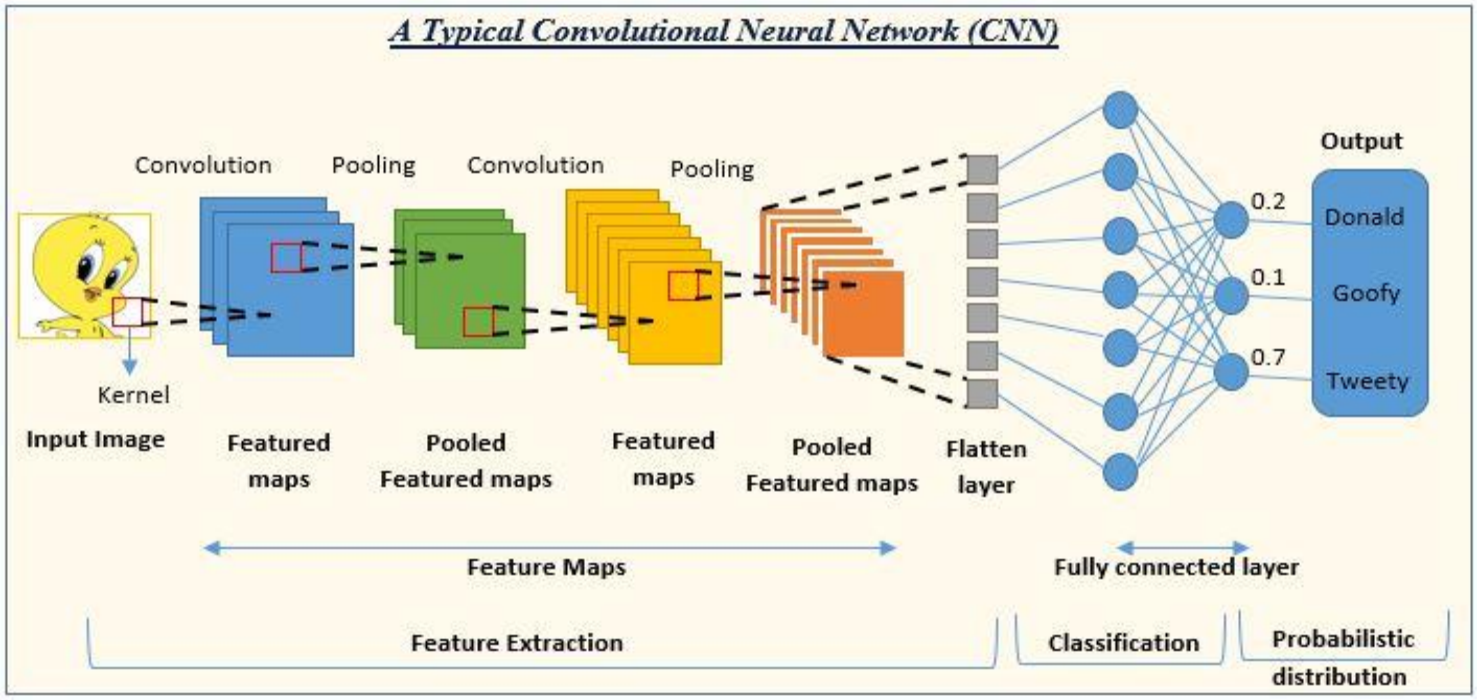
- Convolutional Neural Network (CNN)is a type of artificial neural network that are well-suited for image classification tasks.It learn to extract features from images and use those features to classify the images into different categories.

- For example, a shallow CNN might only be able to learn to identify simple facial features, such as the shape of the nose or the position of the eyes.

- A deep CNN, on the other hand, can learn to identify more complex facial features, such as the texture of the skin or the shape of the chin.Once a CNN has been trained on a dataset of facial images, it can be used to identify faces in new images.

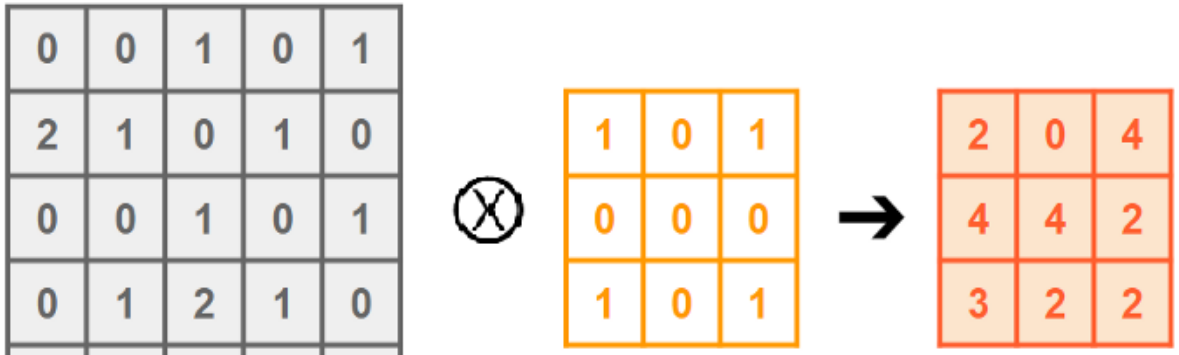
- This process is called facial recognition

Architecture of CNN:

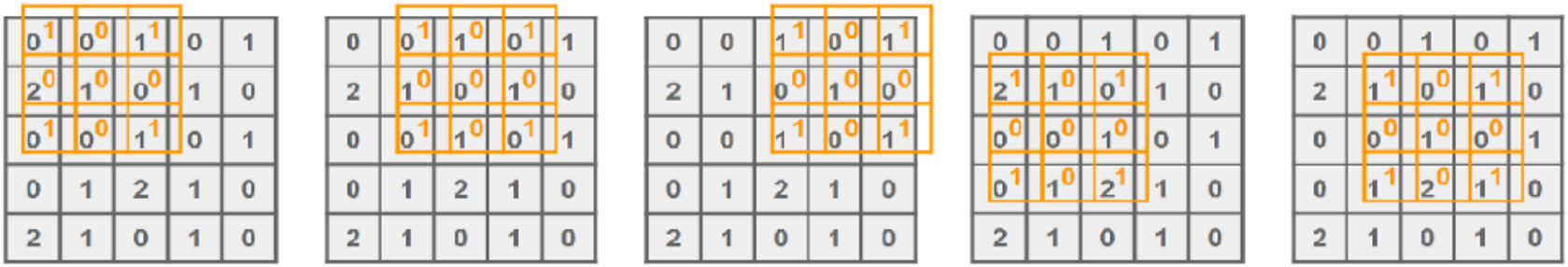


Operation at Convolution layer :

Here the slide=1;



(n x n)*(f x f) =(n-f+1)x(n-f+1)



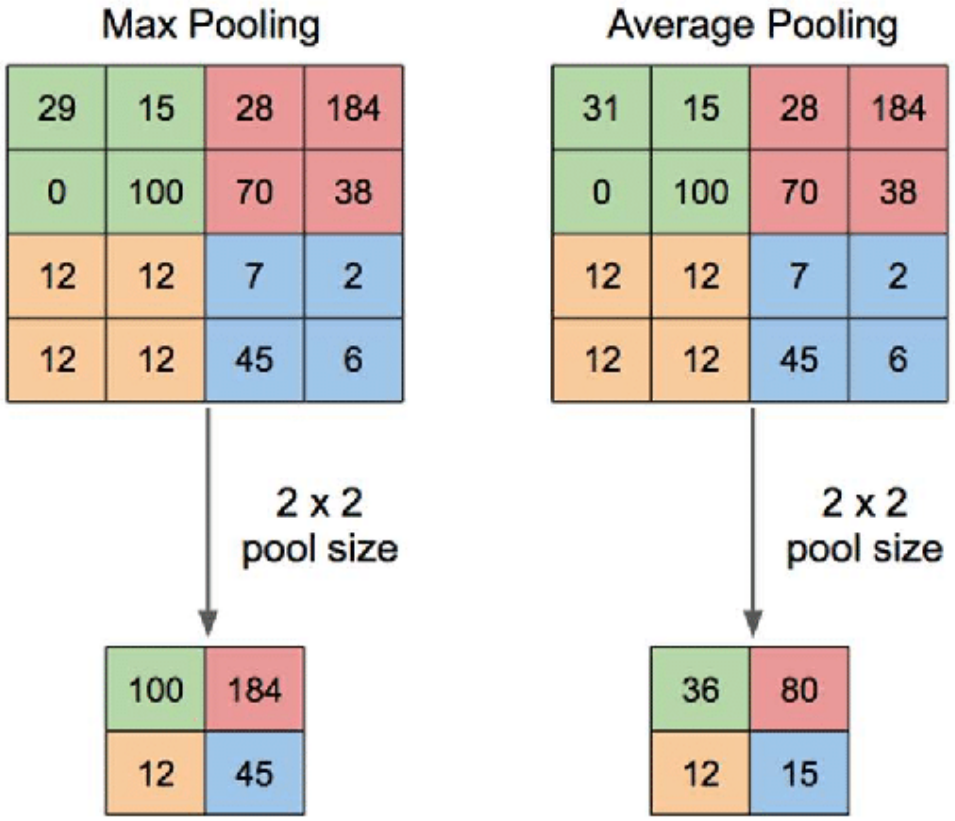
Calculation:

(1,1)→0*1+0*0+1*1+2*0+1*0+0*0+0*1+0*0+1*1=2

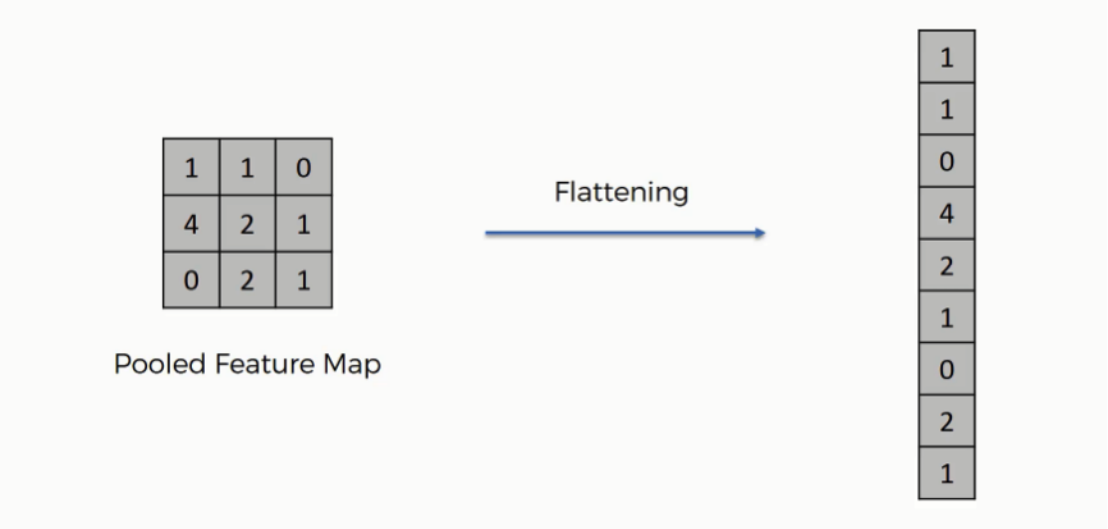
Operation at Pooling layer:

There are 2 pooling operations:

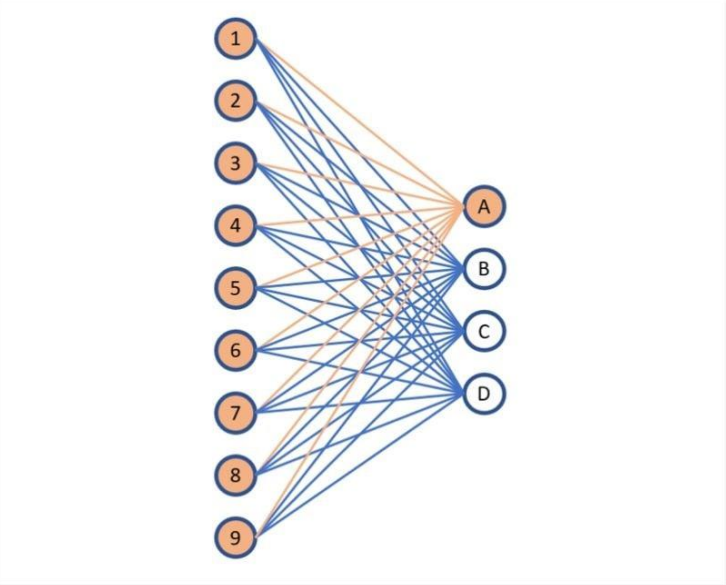
1. **Max pooling:** Take the max value from the pool.
2. **Average pooling:** Take the average value from the pool.



Flatten Layer:



Fully Connected Layer:



Technologies:

- Python
- Artifical Intelligence
- Machine Learning
- Deep Learning
- Jupyter notebook(IDE)

Hardware Requirement:

- WebCamera

Implementation:

- Import the necessary packages
- Load the known face images
- Launch the live camera
- Record the images from the live camera frame by frame
- Make the face detection using the face_recognization.face_location() command
- Make the rectangle around the faces
- Make the face encoding for the faces captured by the camera
- if the faces are matched then Label the person image else Unknown.

Uses of face recognition:

- Unlocking phones
- Airports and border control
- Finding missing persons
- Marketing and advertising
- Student or worker attendance system
- Healthcare and Medicine
- Human-Computer interaction
- Emotion recognition and analysis
- Surveillance and monitoring

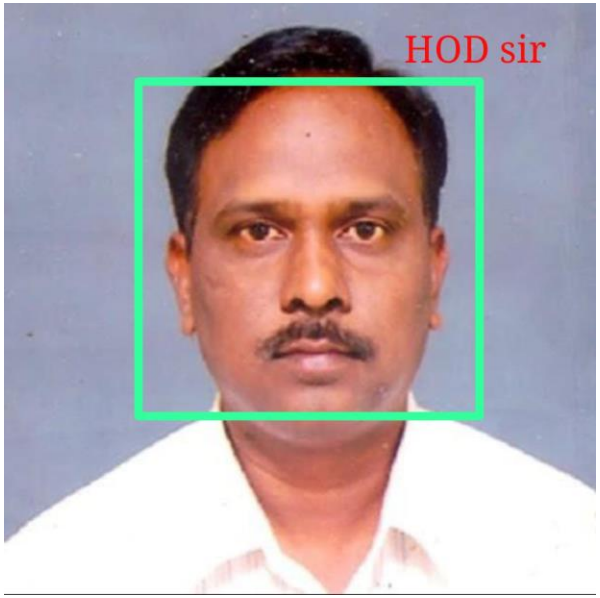
Advantages:

- Open Source and Accessibility
- Robust Face Detection
- Efficient Feature Extraction
- Scalability and Performance
- Integration with Machine Learning
- Real-World Applications:
- Cross-Platform Compatibility

Result:

Input:

Output:



Conclusion:

- Face recognition systems are currently associated with many top technological companies and industries making the work of face recognition easier.

- The use of python programming and OpenCV makes it an easier and handy tool or system which can be made by anyone according to their requirement.

Thank you