



FACE RECOGNITION AND IMAGE IDENTIFICATION USING MACHINE LEARNING MODEL

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ABSTRACT

The Face Recognition and Image Identification using Machine Learning Model was implemented by the programming language Python. Python is one of the most familiar programming languages for machine learning. In Python programming, the Python libraries was helpful for the face recognition and image identification process. Some of the important python libraries like face_recognition, pandas, ImageTk, Image and many more. We use the Tkinter library, it is the graphical user interface. It is useful to make the machine learning model. The Machine Learning Model is very helpful to identify the image. For example, it identifies the gender who is he/she and show the details about the image, which is already stored in the excel sheet, we can access the data with the help of the pandas python library and further. It also uses the webcam to recognize the face and show the details of the face. This Model is useful for the security purpose and mainly used in the cyber security.

KEYWORDS: *Machine learning, Face Recognition, Image Processing, Image Identification, python, pandas, tkinter, Graphical User Interface.*

1. INTRODUCTION

The Face Recognition and Image Identification in machine learning are mainly implement by using the high-level programming language like python because it contains many greater numbers of libraries related to the Face Recognition and Image Identification. And the face recognition is also implemented by the high-level programming language like C++ and mid-level programming language like C because the python libraries like face_recognition and OpenCV are developed by the C++ and C programming languages. In this paper we only use the python programming language for face recognition and image processing. In the python, the OpenCV, pandas, face_recognition, tkinter are most important libraries used to implement this system. The Face Recognition plays a vital role in security purpose. The first step in the face recognition is face detection that is detect with the help of the image processing and the detected face is further analysis for who is he/she. From the

below Figure – 1 we clearly understand the face recognition can be implemented by using the image processing. So, let us see the Image Processing and Face Recognition in the detailed manner.

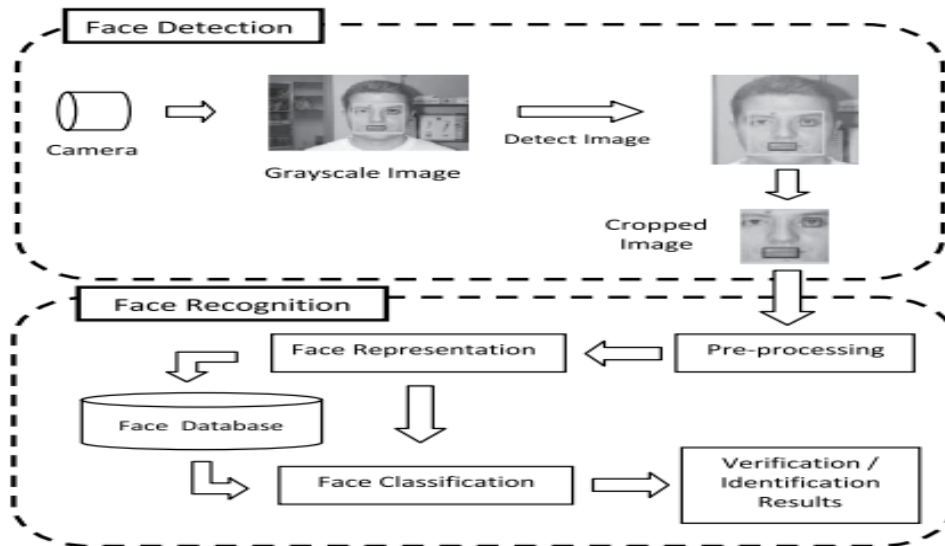


Figure – 1: Steps for Face Recognition.

2. MACHINE LEARNING

Machine learning is an AI technique that teaches computers to learn from experiences. Machine learning algorithms use computational methods to learn information directly from data without relying on a predetermined equation as a model. Deep learning is a specialized form of machine learning. Machine learning algorithms are trained to make classifications or predictions.

3. IMAGE PROCESSING

Image processing is the process of transforming the image into a digital form. The image processing system usually treats all images as 2D signals when applying certain predetermined signal processing methods.

Let us see some basics about the Image Processing,

Image - Visual representation of a real-life object (a person or any other object) in a two-dimensional form is called an image. An image is nothing but a collection of pixels in different color spaces. Figure – 2 shows the normal image.

Pixels - You might think of a complete image as a set that consists of small samples. These samples are called pixels. They are the smallest elements in any digital image. Have you ever zoomed in on an image to such an extent that you see small squares? Those are pixels. So, pixels are subsamples of an image. when we combine the images that give us the complete image. Figure – 3 shows how pixels, with various colors, may look.



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Figure – 2: Normal image

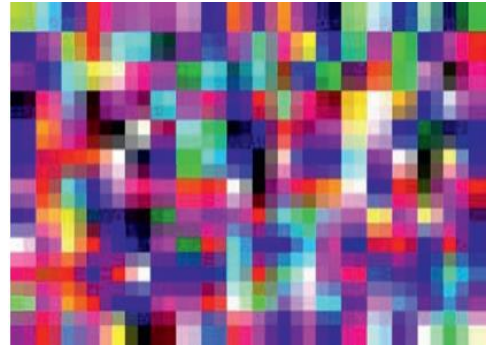


Figure – 3: Pixels of various colors

4. TYPES OF IMAGE PROCESSING

There are five main types of image processing:

- Visualization
- Recognition
- Sharpening and restoration
- Pattern recognition
- retrieval

5. IMAGE FILE FORMATS

The following are some of the most widely used image formats:

- JPEG : Joint Photographic Experts Group
- JPEG2000 : New JPEG format developed in 2000
- TIFF : Tagged Image File Format
- GIF : Graphics Interchange Format
- BMP : Bitmap
- PNG : Portable Network Graphics
- WebP : Format developed by Google
- SVG : Scalable Vector Graphics

Mostly we are using the jpeg or jpg format for image processing because it contains less data than other formats and smaller in size.

6. PYTHON IMAGE PROCESSING USING SCIKIT LEARN LIBRARY

The Scikit Learn Library is simple and efficient tools for predictive data analysis. Accessible to everybody, and reusable in various contexts. Built on NumPy, SciPy and matplotlib. It is an open source, commercially usable library and contains collection of algorithms for image processing. It is an image processing library for the python



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programming language. It includes algorithms for segmentation, geometric transformations, color space manipulation, analysis, filtering, etc. It is mainly used for ,

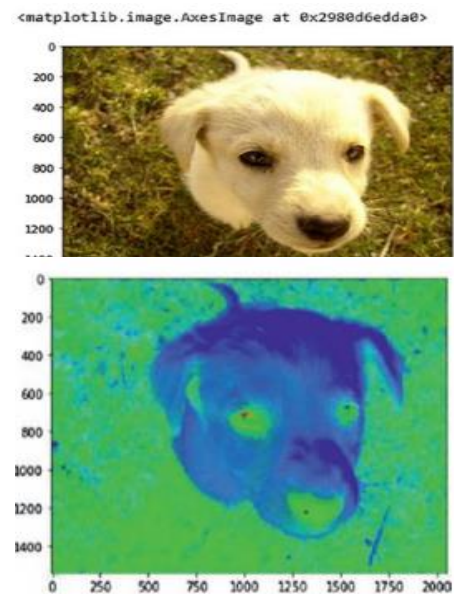
1. Spam detection,
2. Image recognition.

Let us see how use the SciKit Learn Library to process the image,

Code – 1:

```
from skimage import io
img = io.imread('puppy.jpg')
io.imshow(img)
```

Output:



Code – 2: RGB to HSV

```
from skimage import io
from skimage import color
from skimage import data
img = io.imread('puppy.jpg')
img_hsv = color.rgb2hsv(img)
figure(0)
io.imshow(img_hsv)
```

Output:

These are some image processing using the scikit learn libraries in python programming language.

7. FACE RECOGNITION

Face detection is the first step in automated face recognition. Its reliability has a major influence on the performance and usability of the entire face recognition system. Given a single image or a video, an ideal face detector should be able to identify and locate all the present faces regardless of their position, scale, orientation, age, and expression. Furthermore, the detection should be done irrespectively of extraneous illumination conditions and the image and video content. Face detection can be performed based on several cues: skin color (for faces in color images and videos), motion (for faces in videos), facial/head shape, facial appearance, or a combination of these parameters. Most successful face detection algorithms are appearance-based without using other cues. The processing is done as follows: An input image is scanned at all possible locations and scales by a sub window. Face detection is posed as classifying the pattern in the sub window as either face or nonface. The face/nonface classifier is learned from face and nonface training examples using statistical learning methods.

8. FACE DETECTION TECHNIQUES:



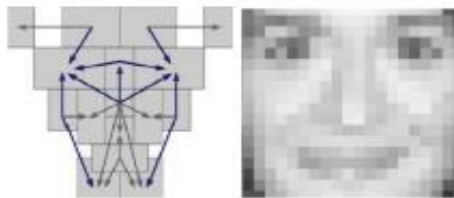
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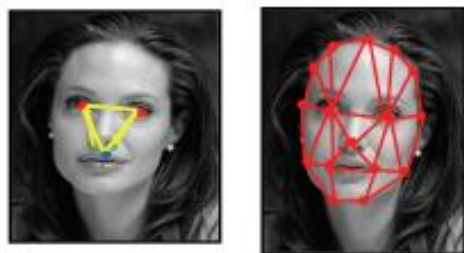
Knowledge-based - Translate knowledge about typical face to a set of rules.



Structural matching - Statistical models of shape appearance based on a set of landmarks.



Template matching - Standard patterns stored to describing the face or facial features.



Feature invariant - Find features of the face invariant to appearance variations (facial features, edges, shape, texture, skin color)



Appearance-based - Learn face characteristics from a representative set of example images using classic machine learning techniques.

It is artificial intelligence (AI) based computer technology used to find and identify human faces in digital images. Face detection technology can be applied to various fields like security, biometrics, law enforcement,



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entertainment and personal safety to provide surveillance and tracking of people in real time. Face detection has progressed from rudimentary computer vision techniques to advances in machine learning (ML) to increasingly sophisticated artificial neural networks (ANN) and related technologies. It now plays an important role as the first step in many key applications. It includes face tracking, face analysis and facial recognition. Face detection has a significant effect on how sequential operations will perform in the application.

9. HOW FACIAL IDENTIFICATION WORKS

The first step is Image is captured and second step is eye locations are determined and third step is image is converted to grayscale and cropped and fourth step is image is converted to a template used by the search engine for facial comparison results and fifth step is image is searched and matched using a sophisticated algorithm to compare the template to other templates on file and sixth step is to duplicate licenses are investigated for fraud.

10. MAKING GUI APPLICATION FOR IMAGE IDENTIFICATION USING PYTHON

To make the Graphical User Interface for Image Identification using the python libraries like tkinter, pandas, face_recognition, PIL. This GUI is about the

Image Identification that means, first upload the image what you want to process it in your system.

Next find the file location of the image and put it in the GUI application and you see the result who is he/she in the image.

11. HOW THE GUI WORKS

First of all, you put the necessary details about the image that means who is he/she and enter the details in the excel sheet and save it using the csv (comma separated value). Next you will merge excel sheet data to your code using the pandas python library.

With the help of the pandas (Python Data Analysis) you can frame the data for reference and store the details in the particular empty list for further reference. Next put other image but in the same person in your system and find the image location and put in the GUI interface and click the search button in the interface. Quickly you get the result who is he/she and their details.

12. GUI REAL APPLICATION

It is mainly used the cyber security for thief data analysis that means generally the cyber security officers have the thief data set. If any theft is occurred with the help of the camera's they capture the image of the thief and load the image into your system and put the image location of the thief in the GUI interface it searches the thief face is already present in the thief data set if it is present, it returns the details of the person otherwise it returns the not present in the data set.

It is first step of the face recognition system. Basically, you understand this area only you will have the better understand about the face recognition systems, etc. It is not only useful for the cyber security for the personal security also it is useful.



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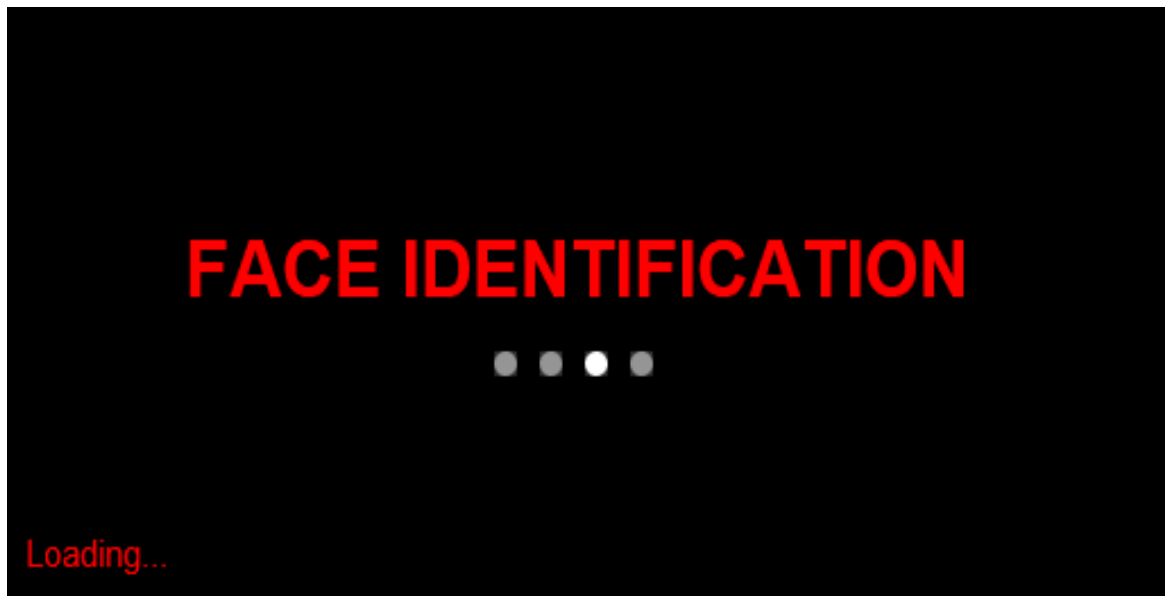
13. NECESSARY THINGS NEEDED TO MAKE THE GUI INTERFACE FOR IMAGE IDENTIFICATION

- Python IDE
- Tkinter python library
- Pandas python library
- face_recognition python library
- Image and ImageTk using PIL
- Excel file in csv format

The Python IDE (Integrated Development Environment) like spyder, PyCharm, Sublime, Visual Studio Code, etc. But mostly we use the original python script like 3.10 because it is very fast and easy to install the python libraries. Let us see the Face Identification Machine Learning Model by uploading the image in the add image section and search the image in the search image section. For further more information about the below model the code is imported into the GitHub: <https://github.com/Subramaniam2003/Face.git>

14. FACE IDENTIFICATION MACHINE LEARNING MODEL:

LOADING SCREEN:



HOME SCREEN:



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FACE IDENTIFICATION



ADD DATA

SEARCH DATA

ADD DATA SCREEN:

ADD DATA



ENTER IMAGE LOCATION :

ENTER THE NAME :

ENTER THE GENDER :

ENTER THE DOB :

ENTER PHONE NUMBER :

ENTER THE ADDRESS :

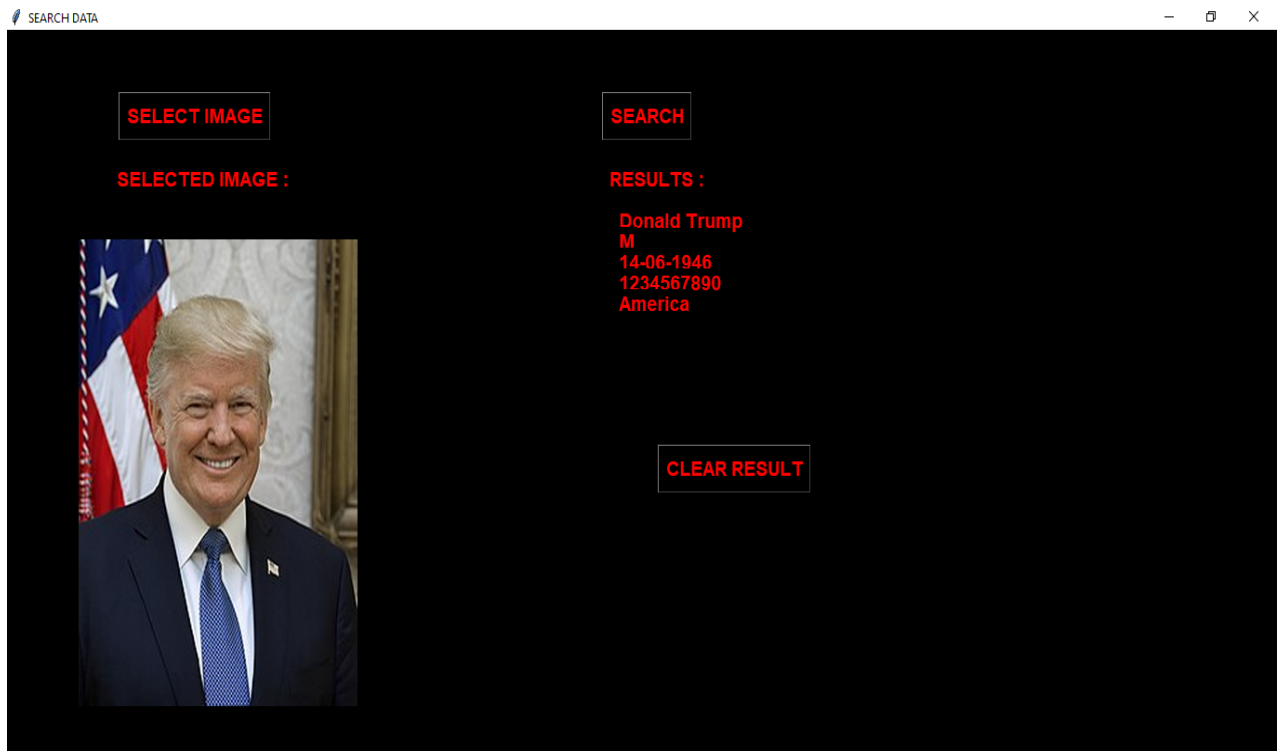
SUBMIT

CLEAR

SEARCH DATA SCREEN:



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15. APPLICATION OF FACE RECOGNITION:

1. Security companies are using face recognition to secure their premises.
2. Immigration checkpoints use face recognition to enforce smarter border controls.
3. Fleet management companies can use face recognition to secure their vehicles.
4. IOT benefits from face recognition by allowing enhanced security measures and automatic access control at home.
5. Law Enforcement can use face recognition technologies as one part of AI- driven surveillance systems.

16. CONCLUSION

This article describes the importance of the python programming language and their libraries like face_recognition, pandas, tkinter, etc. The tkinter is very useful to make the Graphical User Interface to get the input and show the output in the particular window. With the help of the tkinter library you can design the window, get the user input and show the output, etc. The face_recognition is the important library that contains the machine learning techniques to detect the face and show the result.

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