**Introducing Face Recognition to Search Module**

**Abstract:**

Once a patient is created, the system allows retrieving them through either their patient id or name. Our aim is to create extra criteria that can detect and retrieve the records using face recognition.

**Approach:**

**Face Detection:**

This is the most promised application in the field of computer vision. The aim of this procedure is to concentrate on the section of an image that actually holds a face.



**Neural Networks:**

There has been a keen successful role of neural networks in face detection models with much accurate results out. There are various types of algorithms working for face detection using neural networks.

**Face Recognition:**

It is a mechanism where we map the similarity between an unknown image to the known image and get results out according to the algorithm opted. This technology uses machine learning to detect, analyze and match faces. The face recognition mechanism generally operate in two modes :

→ Authentication of a facial image: It is basically 1x1 comparision between faces where one of the image is for authentication and other is for input to the method.

→ Identification or facial recognition: It compares the input facial images with all facial images from a data set to find out the matching image out in the data set. It is basically 1xN comparision.

There are various methods and algorithms to accomplish face recognition in real time and they are classified as follows:

* Geometric/ Template based method
* Piecemal/ Wholistic based method
* Appearance/ Model based method
* Statistical/ Neural network based methods
* Template matching
* Statistical approach

**Deep learning:**

It is a Machine Learning technique that instructs machines to replicate actions done by human and to learn them through an example provided. In this a computer model learns to perform classification directly from images, text, or sound. These models can bypass the accuracy profoundly exceeding a natural human levels performance and processing. We train these models by using huge set of labeled data and also neural network architectures that contain multiple layers.



It became more useful in the recent years due to two reasons :

→ It requires large amounts of labeled data

→ It requires more kind of computing power that only high performance GPUs can perform efficiently due to the parallel architecture

One of the most popular and known deep neural networks are convolutional neural networks. It convolves feature set that is extracted from input data and uses 2-D convolutional layers then processing this 2-D data to generate results. They eliminate the need for feature extraction that is done manually and so on you need not worry about the feature set that is being used in image classification. They are not pre-trained features but they instantly learn when they are processing the collection of images.



**Proposal Network:**

Here we use a fully convolutional neural network to extract candidate windows and their bounding box regression vectors. Here we use the estimated regression vectors to calibrate the candidates. After this, we employ non-maximum suppression to combine highly overlapped candidates. This is known as proposal network in MTCNN.



**Face Detection using Haar Cascade:**

Object Detection using Haar feature-based cascade classifiers is an effective object detection method proposed by Paul Viola and Michael Jones in their paper, "Rapid Object Detection using a Boosted Cascade of Simple Features" in 2001. It is a machine learning based approach where a cascade function is trained from a lot of positive and negative images. It is then used to detect objects in other images.

**Face Detection using MTCNN:**



In Multi-Task Cascaded Convolutional Neural Network (MTCNN), face detection and face alignment are done jointly, in a multi-task training fashion. This allows the model to better detect faces that are initially not aligned. This models uses several convolutional neural networks that are combined together to give individual pieces of useful information for achieving a task.This depends on locating facial landmarks and thereby draw a bounding box around the detected face. It consists of three separate networks called PNet, R-Net and O-Net. So for every image that we input to this network, it creates an image pyramid and establish multiple copies of that image in different sizes.

**Face Recognition:**

In Modern computer science, face recognition is a fundamental task of recognizing a person based on its unique facial feature’s obtained from a face. Face Recognition is a series of several related problems:

1. First, look at a picture and Detect all the faces in it.
2. Second, Crop each face and be able to understand that even if a face is turned in a weird direction or in bad lighting, it is still the same person.
3. Third, be able to pick out unique features(face-embedding) of the face that you can use to tell it apart from other people— like how big the eyes are, how long the face is, etc.
4. Finally, Using the unique features of a detected face compare it with already known Face in Database to determine the person’s name or ID number.

Face recognition is quite different from face detection:

•**Face Detection**: Its main goal is to find all the faces (location and size) in a picture and depending on requirement extract the faces to be used by the face recognition algorithm.

•**Face Recognition**: With the faces already extracted, cropped, resized, we can apply the face recognition algorithm which would be responsible for finding unique features from a face which best describe the image.

We would like recognize a person by just giving one image of that person’s face to our system. But, if it fails to recognize the face, it means that this person’s image is not stored in the system’s database.

**One Shot Learning:**

In deep learning, we need huge amount of data and the results proportionally improve with the amount of data we have. However, this approach is more convenient and we need to learn from only few data. In order to recognize an object or a face from the pictures of the same object, we need not keep hundreds of pictures of it to train the machine to recognize them. According to brain analogy it is more complicated and powerful and we need to memorize many categories of data such as feelings, prior knowledge and interactions.

The idea of one shot learning is to learn an object class from only a few data. This is an object categorization problem in computer vision. One-shot learning can be implemented with the help of a Siamese neural network.

**Different Face Recognition Algorithms with statistics:**



**Implementation:**

Face embedding is multidimensional numerical vector representation of a face which gives the unique identity of the face. So the Facenet we are using has 128 dimensions and creates a model that maps any persons face in generic. When we provide an input image to the model it gives us 128 bytes of numerical vector data that may be generated by comparison with model mapped generic face representation. These embedding points are crucial and easily comparable by measuring Euclidean distance. We used techniques to directly map facial features into 128 dimensions of numerical data that uniquely define the face and using Euclidean distance we can easily compare one face with another.



**Requirements:**

* OpenCV using python to implement the project.

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