Facial Recognition based Attendance Marking System

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Abstract

Face recognition technology has seen dramatic performance improvements in recent years, and such systems are now widely used for security and commercial applications. An automated, enterprise-level system for facial recognition, employee identification, and vehicle license plate recognition from a real-time video stream was developed to reduce manual effort, save productive time, and improve on-site security.

The intelligent presence marking from the live video stream is a real solution that is connected with the daily activities of dealing with employees. In order to recognize the faces, asset tags and vehicle number plates are recognized with high accuracy. The matching faces are used to indicate the presence of the employees. The designed system manages the attendance lists of employees, their vehicles, and assets in real-time and can be checked by employees from anywhere in the world.

Why facial recognition and how businesses can harness its potential

A face remains the most common way to identify or authenticate a person. You can find a photo of this in most of the identity papers that we have in our wallets. A lot of information can be provided about a person's face, clothing, and appearance. Today, a person's face has become the epicenter of the most fascinating and promising developing forensic technology - facial recognition.

Since the face is a unique method of identifying people, face recognition has received a lot of attention worldwide and is growing rapidly to ensure safe and reliable security. Because of its high level of security and reliability, it is becoming increasingly important for companies and government organizations.

Face recognition now has more advantages compared to other biometric systems such as palm print and fingerprint, since face recognition does not require human interaction and can be performed without the knowledge of a person that is of great use in identifying human activities in various security applications such as airports, Crime investigation, face tracking, forensics, etc.

A major advantage of a face recognition system is that it is able to identify masses of people since the test does not require the test person's cooperation. Properly designed systems installed at airports, multiplexes, and other public places can identify people from the crowd without passers-by noticing the system.

Role of technology in creating an efficient & robust solution

Face recognition systems are used to identify a person using an image or video. This technology has been around for decades, but its use has become more noticeable and accessible in recent years as it now enables innovative solutions such as personal photo applications and secondary authentication for mobile devices.

Basically, face recognition takes place in two steps. The first involves the extraction and selection of features and the second the classification of objects. Later developments introduced different technologies into the process. Some of the most notable include the following techniques:

1. Traditional

Some face recognition algorithms identify facial features by extracting landmarks or features from an image of the subject's face. These functions are then used to search for other images with suitable functions. Common recognition algorithms include principal component analysis using intrinsic faces, linear discriminant analysis, elastic bundle graph adaptation using the Fisher face algorithm, hidden Markov model, learning in the multilinear subspace using the tensor representation, and neuronally motivated dynamic link adaptation.

2. 3-dimensional recognition

Three-dimensional face recognition technology uses 3D sensors to capture information about the shape of a face. This information is then used to identify characteristic features on the surface of a face, such as B. the contour of the eye sockets, nose, and chin.

3. Face recognition by combining different techniques

Combined techniques have an advantage over other systems. It's relatively insensitive to changes in expression, including blinking, frowning, or smiling, and has the ability to compensate for the growth of mustache or beard and the look of glasses. The system is also uniform in terms of race and gender.

To understand these new features, let's look at how facial recognition works.

Systems with face analysis capabilities enable users to understand where faces are in an image or video and what attributes these faces have. Once a face is recognized, a facial recognition system determines the position, size, posture, and unique properties of the head. Every face has numerous characteristic landmarks - the different peaks and valleys that make up the facial features. These landmarks are called nodes. Every human face has about 80 knots. Some of the nodes measured by the software include:

- Distance between the eyes
- Width of the nose
- Depth of the eye sockets
- The shape of the cheekbones
- The length of the jawline

The system translates node measurements into a numeric code or set of numbers called a facial print that represents the features on a subject's face that can be compared to the faces in the database. A match is then checked based on facial expression.

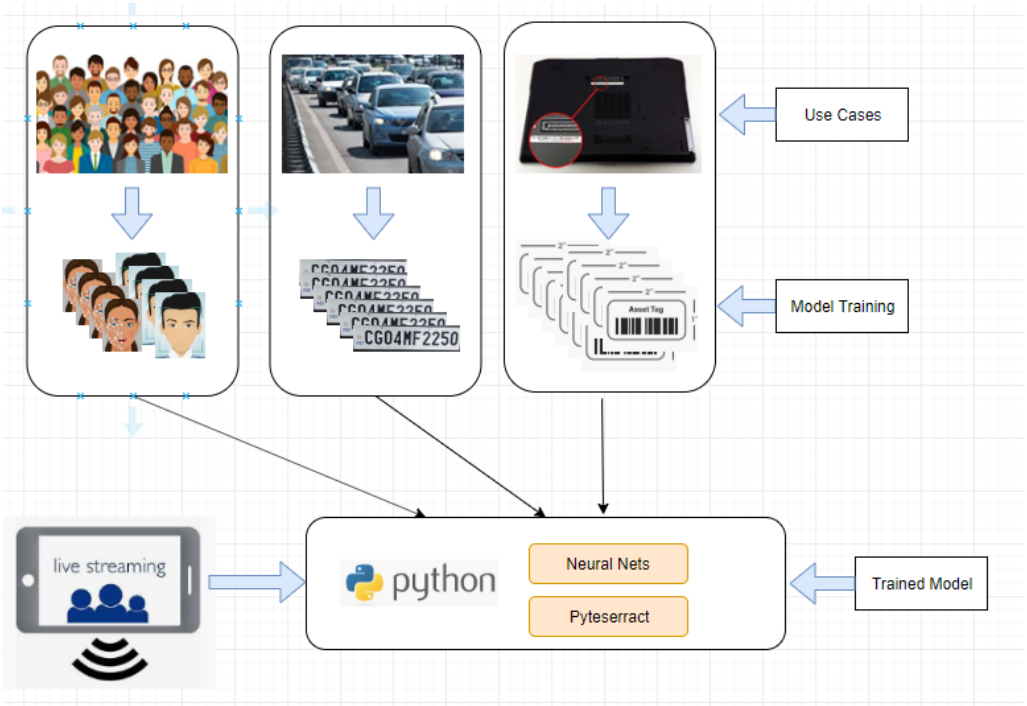
How technology can upgrade existing systems:

- **Greater accuracy:** 3D mapping, deep learning, and other advances make facial recognition more reliable and more difficult to deceive.
- **Better security:** Research shows that there is a 1: 50,000 chance that a phone with a Touch ID will be unlocked with the wrong fingerprint. With 3D face modeling, the probability drops to almost 1 in 1,000,000.
- **Comfortable and smooth:** FRT is easy. It can be used passively without the user's knowledge.
- **Smarter integration:** Face recognition tools are generally easy to integrate with existing security infrastructures and save time and money when developing new software.
- **Automation:** Thanks to automated and precise security around the clock, security personnel no longer have to visually monitor entry points, carry out security checks, and display security cameras.

Proposed solution and designing

The Coforge team has developed a centralized face recognition and presence tagging application that can identify employee assets and their vehicle number plates so that employees are automatically present in the office environment without employee intervention. The system consists of two steps, in the first step faces/ asset tags/vehicle registration numbers are recognized in the live video stream and compared with the database for verification.

The designed system uses Facenet in the backend. The facenet system can generally be used for several open-source implementations of the third party model and for the availability of pre-trained models. It can also be used to extract high-quality features from faces called face embedding, which can then be used to train a face identification system.



During the registration process, our system acquires Image for training and updates the database. After entering the images it trains the Facenet deep convolutional network model with the images. Facenet learns a mapping from face images to a compact Euclidean space where distances directly correspond to a measure of face similarity. This is a one-time process and is required only at the registration process.

Once the user is registered he/she can be marked using the embedding created from the model. Our model compares embedding with the mapping of the live video stream. It then identifies and marks the user's attendance in the database.

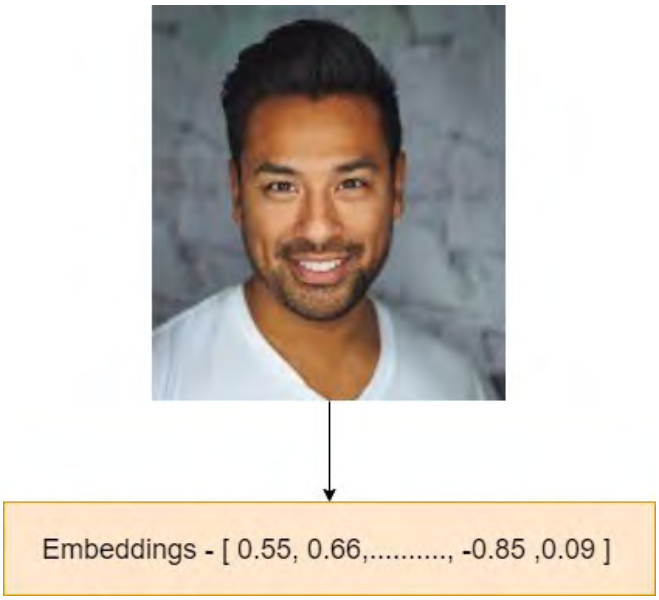


Fig: Representation of facial embedding's created from the facial features of a person.

For the vehicle and asset marking our model identifies the vehicles/assets and matches it with the database of vehicle/assets in the background. Our model uses Pytesseract for extracting text from images. It then marks the entry timing and exit timing accordingly into the database.

Summary and limitations

We intend to streamline the human resources management system using real-time video stream analysis. However, our model has some limitations:

- Poor image quality limits the effectiveness of facial recognition: if a user moves too quickly, the image quality may be affected.
- Small image sizes make facial recognition difficult. Therefore, the user has to step closer to the camera to mark himself.
- Different angles of view can affect the reliability of face recognition. Anything less than a frontal view affects the ability of the algorithm to generate a template for the face. The more direct the image (both the registered and the test image) and the higher the resolution, the higher the score of the resulting matches.

Of course, no technology is completely risk-free. Face recognition is very data-intensive, which can hinder processing and storage. Despite huge advances, recognizing faces from multiple camera angles or with obstacles (such as hats) is still not perfect. There has also been controversy regarding data protection issues, particularly in retail. For this reason, facial recognition should be combined with other multi-factor methods to improve user access, never as the only factor in itself.

References

- Face recognition based attendance marking system: (K.Senthamil Selvi, 2014)
- FaceNet: A Unified Embedding for Face Recognition and Clustering: (Florian Schroff, 2015)
- DLIB: https://github.com/davisking/dlib

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