Virtual Contact Discovery using Facial Recognition

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Abstract - *We are surrounded by data. We produce a significant amount of data ourselves too. One major challenge we face today is storing and handling this data. Even though we have abstractions such as metadata to help us out, current components that are employed give us a lot to desire for. We are working in this niche to implement a metadata retrieval system using a handy component - our face. We are implementing an example of contact discovery using our facial encodings as the identifying component. We are relying on some Machine Learning models in our stack, so we will also be working on setting up the machine learning pipeline efficiently to give us fast and accurate results.*

***Key Words*: Contact Discovery, Facial Recognition, DeepFace, Face encodings, Machine Learning**

1. INTRODUCTION

Carrying meta-data in real life is dependent on using an auxiliary component (url links, systems, rfid/nfc tags etc). The aim of this project is to come up with a solution to use facial as an auxiliary component and associate some form of metadata with it (contact removing the need to carry another physical component and having a better user experience.

1.1 Objectives

The objectives are but not limited to:

i) Although the project has its main components as facial detection and verification, the main goal of the project is to find, explore and if possible to set guidelines and ways to optimize the deployment of machine learning models as this particular area has lesser resources to explore as compared to the minor but important phases of this project that are facial detection and verification.

ii) Optimize the backend logic for real-time performance and accuracy.

iii) Create a user friendly and intuitive flow in the frontend.

1.2 Scope

The applications and the scope of the project would include but is not limited to:

i) This can be implemented in a B2B or B2C environment to provide additional features to the end-user.

ii) In forensic science to identify a suspect.

iii) Face-scanning and verification can be used by companies employing drivers. A selfie could be a mode of authentication to verify the identity of the driver and the passenger before the journey begins and also to give access to the driver to operate the vehicle assigned. Some companies in this domain are currently testing this concept in their trial phase.

iv) To implement a cashless system where the face is used as the identifying element

2. LITERATURE SURVEY

In order to authenticate users through ID verification services, facial recognition systems are often used to match a human face from a digital image or video frame against a database of faces. These systems operate by identifying and quantifying facial features from an image. Development began on similar systems in the 1960s, beginning as a form of computer application. Since their inception, facial recognition systems have seen wider uses in recent times on smartphones and in other forms of technology. There are APIs already in place in the domain of facial recognition and detection like Kairos (Finding faces and features), Animetrics (Deep-learning powered face recognition), etc. Our Goal through this project is to optimize and deploy so the latency and accuracy are satisfactory in a resource-restricted environment.

A. Intelligent detection and recognition system for mask-wearing based on improved RetinaFace algorithm [7]: In this paper, Bin Xue et al. have designed a smart detection and system for mask-wearing. The system is mainly composed of face mask detection and face recognition algorithm. The main functions of the system can be divided into parts: face mask detection, face recognition, and voice prompts. The paper implements

RetinaFace which is a cutting-edge deep learning algorithm that uses facial landmarks.

B. Deep Face Recognition [6]: The authors of this work investigate the possibility of applying deep learning to facial recognition. The DeepFace procedure consists of two phases. First, it adjusts an image's angles such that the subject's face is facing forward. It makes use of a 3-D representation of a face to achieve this. After that, a numerical description of the face is produced via deep learning. DeepFace implies that two photos that have sufficiently similar DeepFace descriptions have the same face.

C. ArcFace: Additive Angular Margin Loss for Deep Face Recognition [3]: In this paper, Jiankang Deng et al. implement ArcFace to obtain highly discriminative features for face recognition. The ArcFace has a clear geometric interpretation due to the exact correspondence to the geodesic distance on the hypersphere. It factors in concepts like Inter-Loss and Intra -Loss

D. Neural Networks (CNNs) and VGG on Real-Time Face Recognition System [2]: In this paper, the authors have suggested a system where the three main components of the suggested system are database collecting, and facial recognition to identify specific people, and performance evaluation. The system gathers the faces in real-time as the initial phase. 24 unique people are represented in the database as 1056 photos with a 112*92 resolution. For improving recognition accuracy, Convolutional Neural Networks (CNN) and [2]VGG-16 Deep Convolutional Neural Networks (DCNN) is introduced in the second step. Finally, precision, recall, F1-score, and accuracy are used to evaluate the performance of these two classifiers. These classifiers accurately identify faces in real-time.

3. IMPLEMENTATION

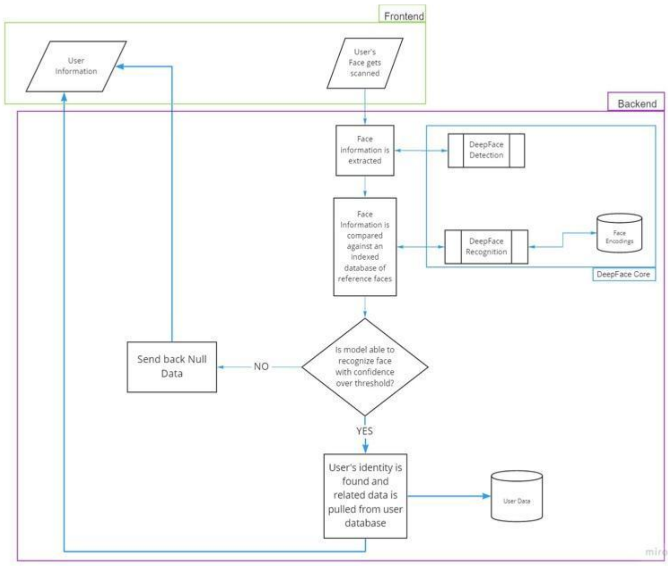

Fig. 1 Proposed Architecture

Data Acquisition: Data set which was provided by our framework over which our model has been pre-trained. Although we were given a pre-trained model, some of the requirements did not match up to our expectations. We also are creating our own dataset by using user input.

Two Use Cases:

The two use cases of our application that we take under consideration:-

- Case 1: Registering a new user (Reference image upload)
- Case 2: Scan and Identify the user (Identification)

Working:

Case 1: When a user sends a registered query, The image is uploaded to the backend wherein first the encodes are calculated and these encodings are then uploaded to an RDBMS. The encodings are of the dimension 3x224x224. These encodings represent the model's attempt to fingerprint your face and as such are entered into a table row-wise. Another table is also created which stores the user data related to the encodings. If the user uploads valid data and the backend is able to process the facial data and store it in the RDBMS a successful response is sent back.

Case 2: The user uses the scan route to take a picture of a target user. This image is then sent to the backend wherein the encodes are derived in a similar manner as that of the registration process. A query is created to find a specific neighborhood of faces that would return the least amount of cosine distance. Each face is compared against the target face and their cosine distances are then calculated. Generally, the neighborhood consists of 10 faces. From these faces, the face with the least cosine distance is selected and the corresponding user data is queried from the metadata table. This user data and the corresponding distance is sent back to the client as a response. The client can then check the cosine value against the threshold value and show and show the appropriate output.

Backend: Face identification and face verification are two subcategories of facial recognition (FR). In either case, the system enrolls a group of known subjects initially (the gallery), and during testing, a different subject is shown (the probe). Each of the test images is fed through the networks to produce a deep feature representation once the deep networks have been trained on huge amounts of data under the guidance of a suitable loss function.

Face identification computes one-to-many similarity to pinpoint the precise identity of a probe face, while face verification computes the one-to-one similarity between the gallery and probe to establish whether the two photos are of the same subject.

The proposed system takes the facial landmarks and facial encodings into consideration to compare and rank the top 10 facial encodings that match the encoding detected when a subject is fed to the probe.

The neighborhood of the closest 10 records having records that have the values of facial encodings the most similar or close to are compared and ranked. The record with the top most rank is identified as the result of the identification phase of the application.

The optimized comparison and storage would make it easier for getting the output quicker where the latency will be as low as possible provided the limitations of our resources. The face will be scanned, the image gets compared with the reference database clusters and the details connected to the particular face will be presented as the output.

4. CONCLUSIONS

Although you may be able to opt-out of or disable face recognition when it comes to a device or piece of software you own or use, it is becoming more and more difficult to do so in public due to the prevalence of cameras. Major firms, including Amazon, IBM, and Microsoft, have imposed a hold on selling their software to police enforcement because of worries about that prevalence, which have been exacerbated by evidence of racial profiling and protester identification. However, when moratoria end and facial recognition technology advances, society will need to decide how facial recognition should be controlled. It will also need to decide which services we are all willing to use and what privacy compromises we are all prepared to accept.

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