AI-Squad

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Nov-18, 2022

Business Problem

In cafeteria, a person with food in plate comes to camera and speaks:
=> charge them automatically

Steps for solving problem

1. Detect the food (amount and kind) in plate: Already Done
2. Identify the person
    a. Face
        i. Detect Face
        ii. Recognize the face (samples in data base)
    b. Voice: Key word (?)

Face Recognition Pipeline

1. Face Detection:
   - Detect the presence of human face(s)
2. Alignment
3. Normalization

Optional

4. Representation (encoding=>embedded in feature space)
   - Represent image as vectors
5. Face Recognition
   - “Whose face is that?”=>Classification in feature space (?)
   - “face verification” with available images in database

Additional work before pipeline: Finding out if it is a real person, photo or video

Face Detection

Difficulties/Challenges of Detecting a Face

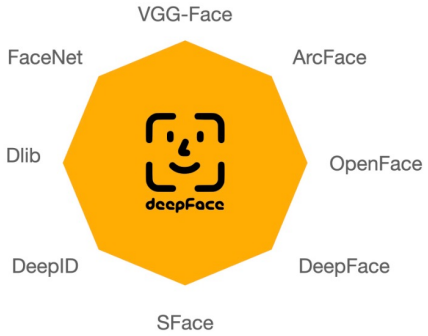
- Occlusion (only a part of face is visible)
- Lighting
- Skin Color
- Pose
- Facial Expression
- Accessories/Makeup/Facial Hair
- Scale of Face

Algorithms of Face Detection (OpenCV library)

- **Classical**
  - **Haar Cascades** (2001): Employing the line or edge-detection features
  - **DLib-HOG** (2005): **Dlib** uses the classical Histogram of Gradients (**HoG**) feature combined with a linear classifier, an image pyramid, and a sliding window detection scheme
- **Deep Learning based Face Detectors**
  - **SSD**: Single Shot Multibox Detector
  - **MTCNN**: Multi-Task Cascaded Convolutional Neural Network.
  - **Dual Shot Face Detector**
  - **RetinaFace**
  - **MediaPipe:** ***ultrafast***
  - **YuNet**
    - Even if frontal faces are not captured properly
    - With a model size of less than an MB, it can be loaded on almost any device.

Overall – Balanced speed and accuracy: YuNet and RetinaFace-Mobilenetv1 (google collab)

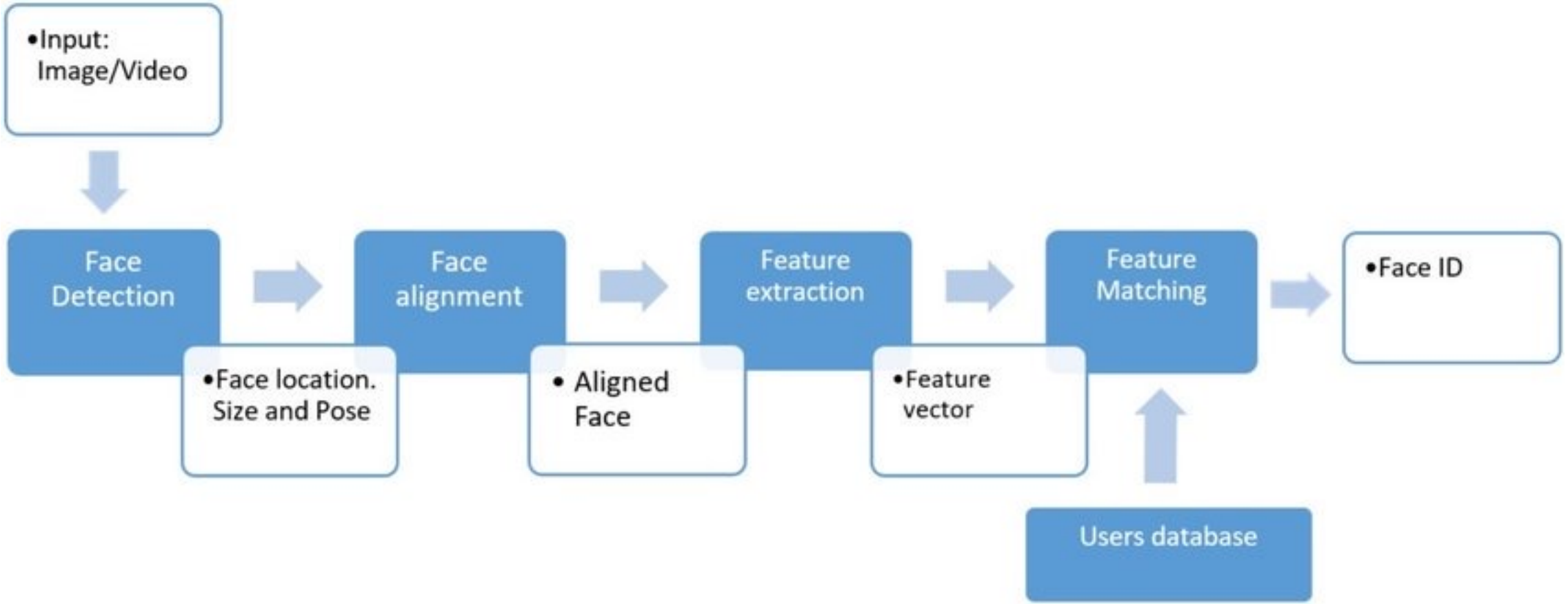
DeepFace



- Light weight face recognition and facial attribute analysis (age, gender, emotion and race) framework for python
  - deepface is mainly based on TensorFlow and Keras.
- Provides various face recognition models: VGG-Face, Google FaceNet, OpenFace, Facebook DeepFace, DeepID, ArcFace, Dlib and Sface
- Provides interface to use algorithms of OpenCV

References

- Face Detection:
  - https://learnopencv.com/what-is-face-detection-the-ultimate-guide/
- Face Recognition:
  - https://learnopencv.com/face-recognition-an-introduction-for-beginners/
- DeepFace:
  - https://github.com/serengil/deepface
  - https://viso.ai/computer-vision/deepface/


•Input:
Image/Video
Face Detection
•Face location. Size and Pose
Face alignment
• Aligned Face
Feature extraction
•Feature vector
Feature Matching
Users database
•Face ID