

Développement en Intelligence Artificielle

Cas pratique 2 (ref. E3)

Reconnaissance Facial

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In the past decade, Facial recognition technology has reached an incredibly high standard and has gained an important role among the most frequently used image processing applications and the availability of viable technologies in this field has also contributed significantly to this. Face recognition has become an enabler in healthcare, security monitoring , surveillance, photo cataloging, attendance, airport security systems, banking, online purchases and much more. Face recognition can be applied to both still images and videos.

Face recognition can be categorized into three groups :

* The global approach uses the whole face as input for the face recognition system.
* The local approach uses measurements between important landmarks of a face and certain face region selection for training.
* The hybrid approach blends global and local approaches in which the hybrid approach uses the best global and local approach methods. Hybrid face recognition has gained much interest in recent years due to its similarity to the human’s capability to recognize a person.

Despite rapid progress in face-recognition technology, various challenges

affect the performance of the system still need to be addressed. These challenges are;

* automated face detection where difficulties lies on detecting a person's face,
* pose variations cause by rotation of people’s head,
* face occlusion,

- facial expression changes,

- ageing of the face,

- varying illumination conditions,

- low image resolution,

- identity look-alike or twin, and

- other technical difficulties.

Finally, the solutions to each of the highlighted challenges were described.

The face detection problem can be solved by applying a skin colour detection followed by a face detection algorithm. Pose variations, facial expression changes, and varying illumination condition problems can be solved by training multiple images with different image condition. Occlusion problem can be solved by using a

combination of global and local approaches. 3D face model-based face recognition can be used to solve occlusion and ageing of the face problems. Low image resolution can be solved by implementing the Super-Resolution method. A combination of face recognition with another biometric method can be used to solve identity look-alike problem.

Although extensive work has been carried out in this field for over 40 years, there are still unresolved work issues and the current algorithm performance is still far from that of human perception ; and it was one of the fields of pattern recognition and computer vision that was most researched.

# Face detection tools (synthesis)

There are dozens of face detection solutions, both proprietary and open-source, that offer various features, from simple face detection to emotion detection and face recognition.

[OpenCV](https://opencv.org/) isn’t an API, but it is a valuable tool with over 3,000 optimized computer vision algorithms. It offers many options for developers, including Eigenfacerecognizer, LBPHFacerecognizer, or lpbhfacerecognition face recognition modules.

[FaceNet](https://github.com/davidsandberg/facenet) developed by Google uses the Python library for implementation. The repository boasts of 11,8k starts. Meanwhile, the last significant updates were in 2018. The accuracy of recognition is 99,65%, and it does not have REST API.

[OpenFace](https://cmusatyalab.github.io/openface/) is a Python and Torch implementation of face recognition with deep neural networks. It rests on the CVPR 2015 paper [FaceNet: A Unified Embedding for Face Recognition and Clustering](http://www.cv-foundation.org/openaccess/content_cvpr_2015/app/1A_089.pdf).

Les source :

Microsoft Azure Cognitive Services Face API :

allows you to make Features include age estimation, gender and emotion recognition, landmark detection.

[Paravision](https://www.paravision.ai/) is a face recognition company for enterprises providing self-hosted solutions. Face and activity recognition and COVID-19 solutions (face recognition with masks, integration with thermal detection, etc.) are among their services.

[Amazon Rekognition](https://aws.amazon.com/rekognition/) is based on deep learning and is fully integrated into the Amazon Web Service ecosystem. It is a robust solution both for face detection and recognition, and it is applicable to detect eight basic emotions like “happy”, “sad”, “angry”, etc. Meanwhile, you can determine up to 100 faces in a single image with this tool. There is an [option for video](https://aws.amazon.com/rekognition/video-features/?nc=sn&loc=3&dn=1), and the pricing is different for different kinds of usage.

[Face++](https://www.faceplusplus.com/) is a face analysis cloud service that also has an offline SDK for iOS and Android. You can perform an unlimited amount of requests, but just three per second. It also supports Python, PHP, Java, Javascript, C++, Ruby, iOS, Matlab, providing services like gender and emotion recognition, age estimation, and landmark detection.

They primarily operate in China, are exceptionally well funded, and are known for their inclusion in Lenovo products. However, bear in mind that its parent company, Megvii has been sanctioned by the US government in late 2019.

[Face Recognition and Face Detection API (Lambda Labs](https://lambdalabs.com/face-recognition-api)) provides face recognition, facial detection, eye position, nose position, mouth position, and gender classification. It offers 1000 free requests per month.

[Kairos](https://www.kairos.com/)offers a variety of image recognition solutions. Their API endpoints include identifying gender, age, facial recognition, and emotional depth in photos and videos. They offer 14 days free trial with a maximum limit of 10000 requests, providing SDKs for PHP, JS, .Net, and Python.

Many organizations during their onboarding procedures, to have adequate amount of information about their customers, requires customers to submit some documents that they could use to verify their identity and get relevant details about them. A few examples include banks and insurance companies. This process is usually time consuming and prone to errors since it is done manually at a lot of places. The customer is expected to submit a digital copy of the documents which a manual reviewer will review, identify if it is fake, extract information like name, address, etc. and enter it into a data entry software.

As deep learning approaches and OCR technologies have progressed, semi or fully automated solutions relating to physical document information extraction are seeing a wider adoption. Here are a few reasons why digitization of information is becoming prevalent -

1. **Information extraction** - We can capture all the information provided on the ID card and push that data as a unique source for further use. All the information pulled from the captured ID card will be in a simple text/numerical format. This helps to maintain data in an organized fashion and facilitates any sort of verification or registration process.
2. **Greater speed and efficiency** - Digitizing ID cards can save a lot of time and money for businesses and organizations. It takes a couple of seconds to simply scan an ID card and retrieve all the data from it.  This shift towards fast digital processes instead of manual entry and review is enabled by deep learning based approaches (discussed later).
3. **Records data without error** - With the advancement in technologies and computational power, machines are now capable of capturing the data without many errors. The chances of human error can be reduced by automating repetitive tasks and allowing humans to review document information on the final stages of the information extraction pipeline.
4. **Integrates easily into any system** - Digitized solutions can be easily integrated into any system. For example, the model that is trained to identify information from a particular ID card can be deployed on a website where users upload the images in bulk, or it can be used in mobile phones where users click on images and thereby, the information is extracted.

Automated document processing with [**OCR**](https://www.klippa.com/en/blog/information/what-is-ocr/) saves companies time and money, while reducing mistakes and frustrations.

La dématérialisation consiste à transformer un objet physique tel qu’un document

papier en une image numérique. Les entreprises de dématérialisation souhaitent produire

une valeur ajoutée à cette dématérialisation. La problématique globale est donc d’extraire

des informations sur le contenu des documents dématérialisés afin d’en faciliter la recherche

et l’accès au contenu. Par exemple, en plus de créer l’image d’un document, il est possible

d’extraire le texte, les illustrations, les photos ou encore les tableaux qui le composent. De

manière générale, face à la diversité des images de documents à traiter, il reste complexe

d’extraire une information précise d’un document si l’on ne sait pas quel est le type de

document que l’on est en train d’analyser. Par exemple, l’extraction du nom d’une personne

sur une carte d’identité ne sera pas réalisée de la même manière que l’extraction du nom

d’une personne sur une facture. Les travaux de recherche relatifs à cette thèse tendent à

explorer de nouvelles techniques permettant de regrouper des documents par similarité de

contenu. Notre ambition est donc de mettre en place, selon différents cas de figures, un

ensemble de méthodes permettant de reconnaitre en amont les images des documents afin

que chaque classe soit traitée de manière adéquate.

En sécurité l'identification est un objectif de tout systèmes de surveillance. L'identification par moyen de caméras de sécurité est un outil très puissant qui connais un essor majeur à cause de l'évolution do domaine de l'AI.

https://microblink.com/