

# 얼굴인식 기술을 이용한 출입 관리 시스템에 대한 연구

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## A study on access control system using face recognition

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### Abstract

Face recognition based person authentication system are having been popular among other biometrics recently. In this paper a method for access control system using facial recognition technology is presented. Face recognition technologies that has shown state of the art performance at their time and other biometric systems are discussed as well.

### 1. Introduction

Face recognition (FR) system has been active topic in computer vision and pattern recognition field in last decades [1-3]. Recently FR technology performance has increased thanks to deep convolutional networks. Face recognition is popular than other biometrics such as fingerprint and eye iris recognition. Widely used applications of FR are unlocking phone and door, verifying payment, and also face recognition access control system being used in the entrance of large-scale event [4] instead of ID card.

Table 1. Comparison of biometric system in term of technical and non-technical weaknesses

Biometric System	weakness of techniques	non-technical weakness
Fingerprint	low throughput	contactness
Iris	low throughput	high-cost
Face recognition	requires huge data to train the model that generalizes well a face image	contactless, user-friendly

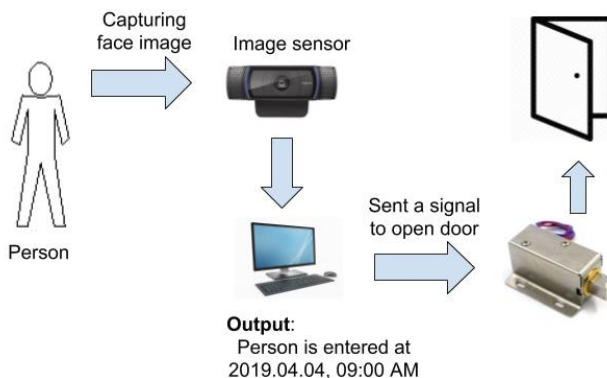


Figure 1. An illustration of access control system using face recognition

### 2. Related works

FR is more popular than other biometric system such as fingerprint, palm vein and eye iris recognition. A big reason of using FR is its contactless, non-invasiveness and secureness.

In FR there are several difficulties:

- illumination: low illumination and direct light effect on image acquiring;
- pose: persons do not directly look at the camera;
- occlusion: partial occlusion of face by other objects, e.g. hands;
- accessories: sunglasses, cap, etc.

In order to address these problems and achieve better recognition accuracy many approaches have been proposed [1-4]:

- Employing large-scale Deep CNN containing more than 1.6B parameters.
- training the model on very huge dataset, e.g. more than 200M image of 8M different identities [2];
- loss function that distinguish two face images (Contrastive loss, triplet loss, center

loss, large margin softmax, angular softmax, and large margin cosine loss, and cosine loss.

### 3. Face recognition system

FR is a technique that identifies a person by comparing facial image with images stored in database. In figure 2. depicted interface of the person authentication system using open-source face recognition model [1]. The system works automatic mode as default without need of any person. However, if it is necessary security person or manager can monitor it. The system also records enter and exit time of people, so this can be used as attendee management system as well. One advantages of FR to other object identification system is we do not need to train the model for registering a new person. The FR model well generalizes well a new dataset.

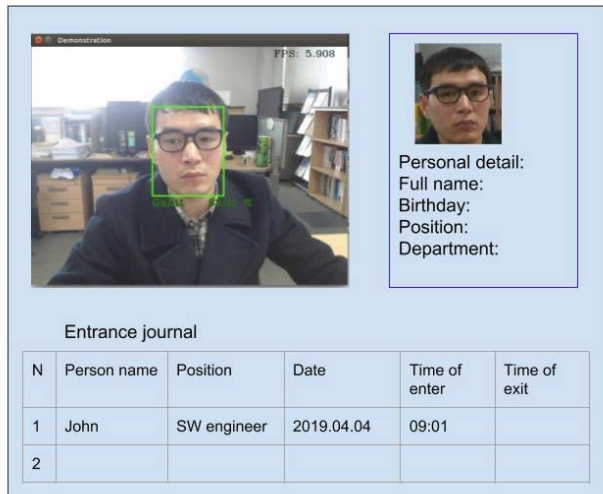


Figure 2. Interface of the system

In Figure 3. illustrated a method of face verification system based on FaceNet [2]. First of all, captured person's face image is cropped, aligned and resized to required size of the CNN and feeds to Deep CNN. It extracts face feature, i.e. transforms a face image to n-dimensional vector. After that in order to compare the image with image in database, distance between two vector of face image are measured. The system makes decision by thresholding distance value, if the distance less than or equal to the thresholding value (e.g. 0.3), the system predicts that the two images are face images of the same person, otherwise different person. Euclidean distance in n-dimensional space is measured by equation (1).

$$\text{dist}(x, y) = \sqrt{\sum_{i=1}^n (x^i - y^i)^2} \quad (1)$$

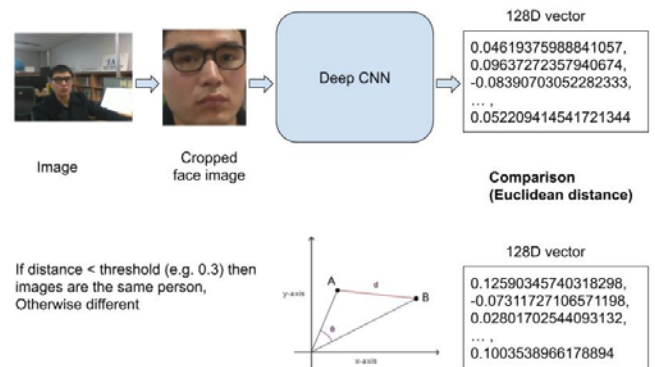


Figure 3. Face verification method based on FaceNet

### 4. Conclusion

This paper studied an access control system using facial recognition. The interface of the access control system based on publicly available open-source FaceNet and face verification method are presented. Face recognition system is considered a powerful, contactless, and secure system among other biometrics such as fingerprint and eye iris recognition. Future work will focus on improving the system to automatically register unseen person and recognize in the next appearance.

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