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Multimodal Recognition System for Cloud Robots

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Abstract. With the advancement of Cloud Robotics technology, smart robots are required to be small but powerful. The easily acquirable face and voice biometric information have been widely used for person identification. Also, to support various personal services, the smart robots need to precisely identify people. The MBRS is deployed as a cloud server and provides person recognition service for smart robots. Face image processing and voice processing are intensive tasks for an embedded robot. In our approach, the implementation of a multimodal biometric recognition system based on face recognition system and voice recognition system is proposed.

Keywords: Face recognition, Voice recognition, Multimodal biometric recognition system, Cloud robotics.

1 Introduction

It is to identify a certain person by understanding his physiological and/or behavioural characteristics. It has been employed in many fields, such as: security systems [Lai et al. 08], surveillance systems [Garibotto, 09], computer interface [Gips et al., 02], and service robot [Kim et al., 05]. In these systems, various biometric traits are used for identification. Such are fingerprint [Hong et al., 97], palm print [Zhang et al., 03], face [Harmon et al., 81], iris, voice, hand geometry, gait, gesture, and so on. However, most of these systems are unimodal

Particularly, in our approach, face and voice recognition systems were integrated into a multimodal biometric recognition system (MBRS), and deployed in a high performance computer as a cloud service. The cloud server provides cloud recognition service for the smart robots. Using MBRS for a robot is a good implementation of the cloud robotics system.

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2 Implementation of Recognition System

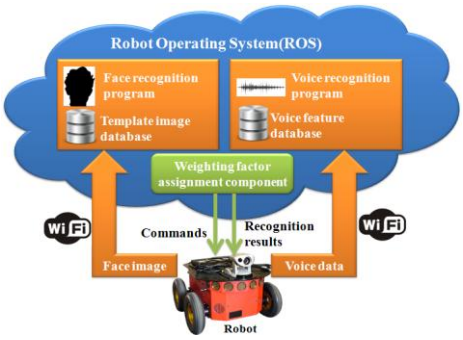

Fig. 1: Architecture of multimodal biometric recognition system

Particularly, the proposed MBRS is based on face and voice recognition. However, more biometric recognition systems (finger print, iris and so on) will be integrated into it in the future. Therefore, the portability of the system is an important issue. Component-based software engineering (CBSE) is a suitable or even best solution for this requirement. In the MBRS, each biometric recognition system is an individual component. It is convenient for a unimodal biometric recognition system to integrate into or disassemble from the MBRS. In addition, the MBRS can be also used as a unimodal biometric recognition system when the other subsystems are set disabled.

The processes of face recognition consist of two main steps, face detection and face recognition. The purpose of face detection is finding a face in the acquired images or videos. Then face recognition algorithm will be applied to match detected face with known faces in the database.

In our approach, the OpenCV library is used to do the face recognition. The Haar-like features was employed for face detection. The principal component analysis (PCA) was applied for face recognition. The Face Recognition Subsystem (FRS) workflow is shown in Fig. 2.

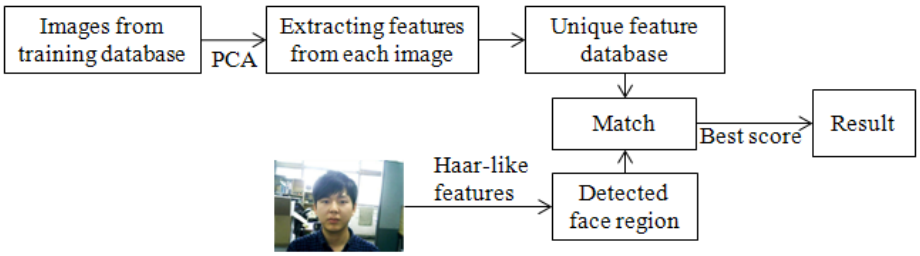

Fig 2: The workflow of face recognition subsystem

The performance of the subsystem can be tuned by increasing or lowering the threshold value. There is a function named “threshold” in the OpenCV library.

There are two types of voice recognition systems: text-independent voice recognition system and text-dependent voice recognition system. The average

approximation method was employed as the voice recognition algorithm. The workflow of voice recognition is shown in Fig. 3.

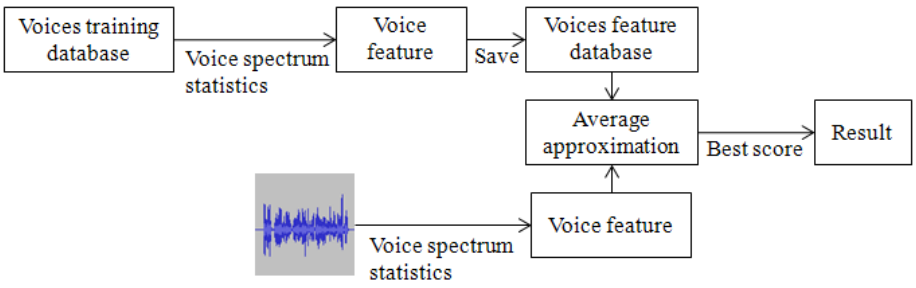

Fig. 3: The workflow of voice recognition subsystem

3 Conclusions

This paper describes an enhanced multimodal biometric recognition system(MBRS) by integrating two biometric features. The MBRS is deployed a cloud service and provides person recognition service for the robots. For face recognition, the lighting intensity could affect the recognition rate. The recognition rate by voice recognition system will be affected by environmental noise. In order to overcome these problems, we imitated human physiology that added an eye and an ear to robot. The face recognition system can overcome the problems caused by environmental noise and the voice recognition system can overcome the problems by lighting intensity.

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