Topic for Thesis
Identification of a Person based on the Geometry and Characteristics of their Palms

Hintergrund

Helicoph is a system that was developed in collaboration with Helios Klinikum in Stralsund, Germany, that has improved overall hygiene in hospitals by creating incentives for hand disinfection. A digital name tag allows the hand disinfections performed by individuals to be tracked, which enables self-monitoring as well as subsequent analysis at the hospital level. (Explanatory video from Helios: https://youtu.be/K3RcfRq9xdg – only available in german)

The smart name tag and the disinfectant dispensers are each equipped with a Bluetooth transmitter module. When a dispenser is activated, it searches for the name tag that is closest to the dispenser in order to record a disinfection process. The name tags regularly transmit information about themselves in the form of a Bluetooth beacon, which is collected by the dispenser. The distance between the dispenser and the name tag is derived from the reception strength of the received data packet. However, if there are several people in the immediate vicinity of the dispenser, the determination is prone to errors. The signal strength of the beacons can be affected by possible reflections or sources of interference, which can lead to incorrect results when determining the distance.

For this reason, it shall now be investigated whether it is possible to identify a person by recognizing their hand palm when it is held under the dispenser. Similar to fingerprints, people's hands are not identical in structure, so that the size of the hand and the length and width of the individual fingers differ. Furthermore, human hands have characteristic ridges that can also be used for unique identification. Since it is essential to move the hand under the dispenser to collect the disinfectant, this offers an opportunity for data collection. Another advantage is that no additional step is necessary when using the dispenser.

Task description

The aim of this thesis is to develop a method for identifying individuals on a disinfectant dispenser via their palm. For this it is necessary to examine and evaluate existing methods with regard to their potential use in regards to disinfectant dispensers and to identify any shortcomings. Subsequently, a method should be selected and implemented as a prototype in order to conduct experiments with it and determine its reliability. Good knowledge of the Python programming language and initial experience with machine learning are desirable, but not essential.

The following steps can be considered:

- Analysis of existing methods for recognizing and identifying hands
- Familiarization with image processing (using machine learning)
- Listing and evaluation of identification features of the human hand
- Development of a method for extracting hand characteristics in an image
- Development of a prototype application in the disinfectant dispenser environment
- Conducting experiments

Possible research questions

The practical usability of the developed methodology shall be tested using various experiments. The following questions can be used as a basis for possible experiments. A sensible selection should be made – not all questions need to be answered. If further interesting questions arise during the course of the work, these can also be addressed in more detail.

- What characteristics can be used to identify a person based on their hand?
- How effective are current methods for extracting hand characteristics from an image? Are there specific requirements for brightness and image background?
- How error-prone is the method? How reliable is the assignment of hand characteristics to a person? How often is a hand not assigned to the correct person?
- How precisely must the hand be held over the camera (or under the dispenser) to enable feature extraction and successful identification of the person?

References

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