Abstract

Biometrics are popular nowadays, as we cannot lose them and they are secure. A very significant problem with biometric solutions is their lack of performance, as the matching accuracy of biometric recognition systems can be affected by various social factors. This thesis reports on our new findings regarding the influences of certain social factors on biometric recognition. Three methods were chosen and related questions were answered: a- Iris: this part looks at the reliability test of the iris recognition system under the influence of diabetes. A new database has been collected. We have used various matchers in order to obtain similarity scores between the captured samples. We found that, while there is no obvious impairment on non-healthy irides, the accuracy of the recognition system is higher when dealing with healthy people. In other words, it is harder to recognize people who suffer from diabetes due to certain non-obvious disorders in their iris textures. Gender and age dependency studies are also available. b- Voice: this part looks at the effect of “Morning Voice” on text-independent speaker recognition. It presents an investigation on the effect of the time of day on the matching accuracy of the voice recognition system. A new database has been collected and offered. The database contains a dataset of thirty people. We have collected 1780 voice samples. There were two different data collection sessions: a. participants were asked to record their voice after getting up, using their own smartphone devices (nine hundred and sixteen morning voice samples were recorded), and b. participants were asked to record their voice samples during the day (more than eight hundred and eighty-four samples were collected from the same users). Each sample lasts for six seconds, at a bit rate of 705 kbps. All the participants are native Persian speakers. In order to conduct numerical experiments, a pre-trained VGG-Speaker is used. An All-versus-All comparison scenario is carried out. The intrasession comparison scores are better than the intersession comparisons. For the evening versus evening comparison scenario, an equal error rate (EER) of 1.46% was achieved. For the morning versus evening comparison scenario, the EER is increased to 10.2%. c- Face: this part explores the joint influence of makeup and facial expressions on the matching accuracy of the facial recognition system. We consider the question of whether or not the effect of makeup and facial expression are correlated. In fact, while a single effect of each is not significant, the joint effect is. We implemented three state of the art approaches, namely python face recognition dlib, Verilook and VGGFace. While the application of “light makeup” on angry faces showed no statistically significant differences, for fearful or happy faces the comparison score differs significantly. For each of the mentioned cases, we have built a classifier to make the system more reliable. For instance, building a makeup detection algorithm can improve facial recognition. c Therefore, the central aim of this thesis is testing the performance of a biometric recognition system under the influence of social problems that have the potential to degrade a system’s matching accuracy (the effects of diabetes on the iris, the morning effect on the voice and a combination of mood variation and makeup influences on facial appearance were considered). The next goal was to make mobile contactless biometric systems robust against the impacts of the predetermined influential parameters. The final goal of this work was to achieve an EER in all the mentioned cases. In this thesis: a- From a database of more than 1900 iris images from 509 eyes (723 diabetic iris images from 161 eyes and 1183 healthy iris images from 348 ones), we used three different matchers (open source) and found that accuracy was consistently higher in those images of eyes from people who do not have diabetes. b- We present an investigation on the effect of time of day on the matching accuracy of a speaker recognition system. We have collected 1780 voice samples donated by 30 people. The intrasession comparison scores are better in than the intersession comparisons. For the evening versus evening comparison scenario an EER of 1.46% was achieved. For the morning versus evening comparison scenario, the EER increases to 10.2%. c- An EER of 4.68% was achieved when identifying faces under the joint influences of full makeup and mood variation, while the EER under the effect of each of these factors separately is less than 1%. In a nutshell, the study highlights the limits of unimodal biometrics and cautions against the widespread use of methods that only perform well under optimal circumstances, without taking into account certain relatively common conditions. Improving the robustness of biometric systems can enhance the popularity of contactless mobile biometric systems. Robustness, which is defined as survivability under failure or attack, is one of the most important properties of a system. A biometric system should perform well under any circumstances. In this thesis, we have detected several issues and fixed them by using the same methodology. To tackle the detected problems in all three cases, we have tried to build sophisticated diabetes, makeup and morning voice detection algorithms that can improve iris, face and speaker recognition. While the accuracy of the makeup detector and morning voice detector was up to 95%, it was not possible for us to diagnose diabetes using the iris texture.