B24 Face Recognition on CCTV Materia Using a Biometric System: Limitations and Opportunities

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After attending this presentation, attendees will have a better insight in the limitations and possibilities of automated biometric systems for facial identification using CCTV material.

This presentation will impact the forensic community by qualifying some of the claims made by facial recognition systems.

Biometric face recognition is still advocated as a good option for person identification and detection of people on watch lists. However, the current state of the art in face recognition is mostly not sufficient for forensic applications. Although some of the techniques reach reasonably high levels of recognition under controlled circumstances with frontal face images, of course, surveillance images hardly ever capture a suspect frontal face, with good lighting conditions, and a neutral facial expression. Also sharpness and resolution are, in general, far from optimal. Of interest to the forensic use of biometric systems is knowledge about the reliability of the matching results, even under imperfect conditions.

The performance of face recognition software was studied using surveillance images from six different analog cameras and camera- positions. The surveillance material was recorded at 4CIF (704x576 pixels) at 12 frames per second. Volunteers were asked to walk along a predefined path and stop walking and look left and right at 4 positions. The frontal-most images at each position were selected for the analysis. Verification match results were used to construct receiver-operator curves (ROC), and the Equal Error Rate (EER), error rate at the setting resulting in equal rates of false accepts and false rejects was used as performance criteria.

When using good quality controlled lighting and frontal pose images, an EER of 1.5% can be reached using automated face recognition software. However, when using passport-type but less controlled entrance-card images, the EER increased to 9%. Even with cameras at eye-height and fully zoomed-in the EER increased to 24-30% at distances of 1.5-3.5 m. When the subjects were wearing a baseball cap, EER increased 4-10% compared to bare-headed images. Images from a teller-machine like camera position performed relatively well. These images resulted in an EER of 16% with people looking into the camera, but performance dropped to an EER of 37% when people looked straight ahead, when a database of high quality controlled frontal images was used. However, when a database with images from a similar low position camera was used, the EER improved to 19% for the teller- machine images with people looking straight ahead and to 9% when people looked straight into the camera. At almost all camera positions the use of a reference database with images from the same camera position outperformed the use of full frontal images as reference database. This indicates that full frontal images are not always the best reference set for automated face recognition. Preferably images from the same camera and position should be used.

The absolute match-values generated by the recognition software should be viewed with care, as low quality images compared to a low quality database resulted in high match-values for matching as well as mismatching images, with high EER values as consequence. The data even suggests that the mismatch-values of an image with a database of images of a similar quality may be predictive of the EER of the system. This means that the evidential value of an image may be predicted by the mismatch value with images of similar quality, providing the opportunity to establish the evidential value of the CCTV image without suspect information.

Facial Recognition, CCTV Images, Biometrics

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