Biometric system in homeland security context

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Abstract:
The mission of homeland security is ensuring the safety of living communities and protecting citizens from unforeseen events. In this research field, intelligent and advanced systems are extremely useful to prevent from tragic epilogues. Homeland security systems aim at supporting humans in those continuous and tiring activities of monitoring and detecting dangerous situations occurring in a surveilled area. Fatigue and distraction can reduce the human attention over time and be the cause of risks for safety and security. This thesis highlights the recent advances in this field and proposes some contributions on the state-of-the-art to deal with difficulties of the homeland security issues. The work focuses on a specific perspective view of the problem consisting in the use of biometrics to detect and recognize individuals. The biometric traits explored in this work are both hard biometrics, i.e. the face, and soft biometrics, i.e. the gait. Face is traditionally and widely used as a strong biometric trait for recognition and authentication. A reliable and robust face biometric recognizer is based on the assumption that facial features are good in quality and number. This is achieved when the face is detected in collaborative conditions and the pose is ideal to extract the features. The pose of the face is not always frontal therefore a preprocessing phase of facial recognition involves the estimation of the pose of an acquired face. As a contribution to the state-of-the-art of head pose estimation, three different methods have been proposed that encode the face thanks to the use of facial landmarks and extract the pose.
The features extracted from the face can be both static and dynamic. With static facial features we extract information from a face if its identity is not known. Dynamic facial features relate to lip movement and lip recognition.
The landmarks that define the skeleton have been extracted from a series of videos of people walking; this made it possible to study the gait and classify people on the basis of gender and on the basis of their "cooperativeness", that is the aptitude to support the camera or to try to escape it.
The results obtained and discussed in this thesis are strongly linked to the concepts of security, surveillance and trust and therefore may serve as insights to further explore the strengths and the limitations of software solutions applied to homeland security.