Abstract

This thesis work is focused on two applicative fields of image processing research, which, for different reasons, have become particularly active in the last decade: Mixed Reality and Biometry. Though the image processing techniques involved in these two research areas are often different, they share the key objective of recognizing salient features typically captured through imaging devices.

Enabling technologies for augmented/mixed reality have been improved and refined throughout the last years and more recently they seems to have finally passed the demo stage to becoming ready for practical industrial and commercial applications. To this regard, a crucial role will likely be played by the new generation of smartphones and tablets, equipped with an arsenal of sensors connections and enough processing power for becoming the most portable and affordable AR platform ever. Within this context, techniques like gesture recognition by means of simple, light and robust capturing hardware and advanced computer vision techniques may play an important role in providing a natural and robust way to control software applications and to enhance on-the-field operational capabilities. The research described in this thesis is targeted toward advanced visualization and interaction strategies aimed to improve the operative range and robustness of mixed reality applications, particularly for demanding industrial environments.

Biometric recognition refers to the use of distinctive physiological and behavioural characteristics, called biometric identifiers, for automatically recognizing individuals. Being hard to misplace, forge, or share, biometric identifiers are considered more reliable for person recognition than traditional token or knowledge-based methods. Others typical objectives of biometric recognition are user convenience (e.g., service

access without a Personal Identification Number), better security (e.g., difficult to forge access). All these reasons make biometrics very suited for Ambient Intelligence applications, and this is especially true for the user's face that is one of the most common methods of recognition that humans use in their visual interactions. Moreover, face features allow to recognize the user in a non-intrusive way without any physical contact with the sensor. To this regard, the second part of this thesis, presents a face recognition method based on 3D features to verify the identity of subjects accessing the controlled Ambient Intelligence Environment and to customize all the services accordingly. In other words, the purpose is to add a social dimension to man-machine communication thus contributing to make such environments more attractive to the human user.