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Abstract

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Doctor of Philosophy

Computer Vision Methods applied to Person Tracking and Identification

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Computer vision methods for tracking and identification of people in constrained and unconstrained environments have been widely explored in the last decades. Despite of the active research on these topics, they are still open problems for which standards and/or common guidelines have not been defined yet. Application fields of computer vision-based tracking systems are almost infinite. Nowadays, the Augmented Reality is a very active field of the research that can benefit from vision-based user's tracking to work. Being defined as the fusion of real with virtual worlds, the success of an augmented reality application is completely dependant on the efficiency of the exploited tracking method. This work of thesis covers the issues related to tracking systems in augmented reality applications proposing a comprehensive and adaptable framework for marker-based tracking and a deep formal analysis. The provided analysis makes possible to objectively assess and quantify the advantages of using augmented reality principles in heterogeneous operative contexts. Two case studies have been considered, that are the support to maintenance in an industrial environment and to electrocardiography in a typical telemedicine scenario. Advantages and drawback are provided as well as future directions of the proposed study. The second topic covered in this thesis relates to the vision-based tracking solution for unconstrained outdoor environments. In video surveillance domain, a tracker is asked to handle variations in illumination, cope with appearance changes of the tracked objects and, possibly, predict motion to better anticipate future positions.

An experimental vision-based tracker is proposed in this work. It is an hybrid software solution that fuses an Haar-like cascade classifier with an optical flow tracker to locate, track and predict the position of people in the scene. Preliminary results are also provided to highlight the performances and the problems to be addressed. The third and last subject faces with the recent (increasing) trend of adding biometric features to mobile devices. The sudden diffusion of mobile devices has led to a drastic improvement of their computing power. Nowadays, mobile phones are not only used for mere communication but they enable applications such as internetting, receiving and sending emails and storing (sensitive) documents. This opens to a wide range of potential risks for privacy. Based on this observation, an experimental proposal for ubiquitous iris recognition running on mobile devices is explored in this work of thesis. It exploits spatial histograms for iris matching offering a good trade-off between accuracy and computational demand. Preliminary results confirm the feasibility of such an approach to mobile platforms.