Quis-Campi: Extending *in the Wild* Biometric Recognition to Surveillance Environments

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Abstract. Efforts in biometrics are being held into extending robust recognition techniques to *in the wild* scenarios. Nonetheless, and despite being a very attractive goal, human identification in the surveillance context remains an open problem. In this paper, we introduce a novel biometric system – *Quis-Campi* – that effectively bridges the gap between surveillance and biometric recognition while having a minimum amount of operational restrictions. We propose a fully automated surveillance system for human recognition purposes, attained by combining human detection and tracking, further enhanced by a PTZ camera that delivers data with enough quality to perform biometric recognition. Along with the system concept, implementation details for both hardware and software modules are provided, as well as preliminary results over a real scenario.

1 Introduction

Biometrics is one of the most active fields in the area of computer vision, which is justified by our societies' increasing concern about security. Biometric systems significantly rely on the accurate extraction of individuals' distinctive features, which is conditioned by the acquisition environment and constraints. As such, the most reliable systems are deployed on controlled scenarios and count on subject cooperation. On the other hand, surveillance cameras are widely deployed and can constitute a good source of input for biometric systems. Filling the gap between biometrics and visual surveillance is quite a desirable goal, allowing to produce *automata* capable of recognizing human beings *in the wild*, without their cooperation and, possibly, even without their awareness.

When moving to *in the wild* scenarios the acquisition constraints are substantially lowered and, most of the time, subject cooperation is not even expectable. In order to deal with such challenging conditions, alternatives are sought over three axes [6]: 1) improve the existing algorithms so they can handle more degraded data; 2) resort to multi-modal biometric systems so that the usage of multiple traits can compensate for their lack of "quality"; 3) explore new

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biometric traits that could better cope with this new reality. Despite the recent efforts, no system yet exists capable of dealing effectively with all the issues introduced by *in the wild* biometrics, and even those systems able to cope with less constrained conditions (e.g. the Iris On The Move project [11]) still lack an ideal level of user abstraction. Most of existing surveillance systems are focused on activity recognition (e.g. W^4 project [5]), and not that many of them are prepared to handle surveillance scenarios by a watchlist approach (e.g. Kamgar-Parsi *et al.* [8]). In this paper, we present a novel biometric recognition system, designed to work covertly in a non-habituated and non-attended fashion, over non-standard environments. Our main goal is to conceive a system that links together both biometrics and visual surveillance, being able to conduct biometric recognition over typical surveillance scenarios, with the minimum possible amount of operational restrictions.

The remainder of this paper is organized as follows: in Sect. 2 we detail the three layers of the recognition system, its operation premises and devised modules; in Sect. 3 we present the exploited techniques for each module, along with preliminary results of our system over a real surveillance scenario and, finally, Sect. 4 states some final considerations.

2 The QUIS-CAMPI System

The optimal recognition system would operate in any environment, thus minimizing the amount of operational restrictions. Aiming at bridging biometrics with the visual surveillance, we have developed our system in a typical surveillance scenario – a parking lot (Fig. 3(a)) – particularly harsh for recognition purposes: 1) it is a non-standard environment with irregular lighting that changes during the day and accordingly to weather conditions, reflections, etc.; 2) complex background regions and the varying resolution of humans poses increasing challenges for both detection and recognition phases; 3) subjects can come from

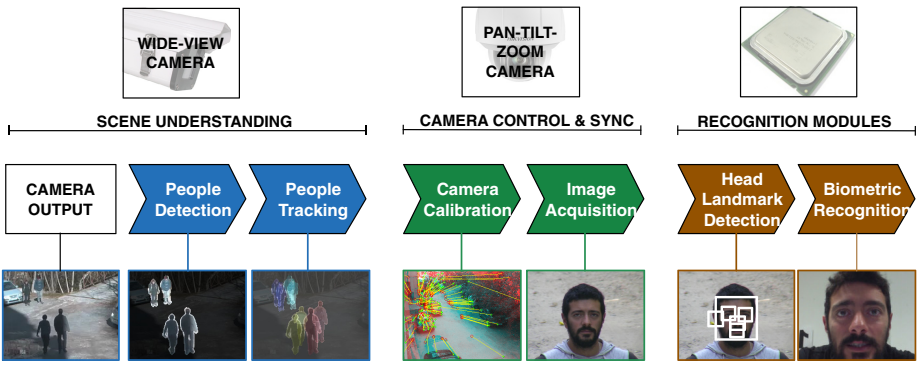

Fig. 1. Working diagram of the proposed system, and the three-layer architecture: scene understanding, camera control/synchronization and recognition modules.