# Preface

Person re-identification is the problem of recognising and associating a person at different physical locations over time after the person had been previously observed visually elsewhere. Solving the re-identification problem has gained a rapid increase in attention in both academic research communities and industrial laboratories in recent years. The problem has many manifestations from different application domains. For instance, the problem is known as "re-acquisition" when the aim is to associate a target (person) when it is temporarily occluded during the tracking in a single camera view. On the other hand, in domotics applications or personalised healthcare environments, the primary aim is to retain the identity of a person whilst one is moving about in a private home of distributed spaces, e.g. crossing multiple rooms. Re-identification can provide a useful tool for validating the identity of impaired or elderly people in a seamless way without the need for more invasive biometric verification procedures, e.g. controlled face or fingerprint recognition. Moreover, in a human–robot interaction scenario, solving the re-identification problem can be considered as "non-cooperative target recognition", where the identity of the interlocutor is maintained, allowing the robot to be continuously aware of the surrounding people. In larger distributed spaces such as airport terminals and shopping malls, re-identification is mostly considered as the task of "object association" in a distributed multi-camera network, where the goal is to keep track of an individual across different cameras with non-overlapping field of views. For instance, in a multi-camera surveillance system, re-identification is needed to trace the inter-camera whereabouts of individuals of interest (a watch-list), or simply to understand how people move in complex environments such as an airport and a train station for better crowd traffic management and crowding control. In a retail environment, re-identification can provide useful information for improving customer service and shopping space management. In a more general setting of online shopping, re-identification of visual objects of different categories, e.g. clothing, can help in tagging automatically huge volumes of visual samples of consumer goods in Internet image indexing, search and retrieval.

Solving the person re-identification problem poses a considerable challenge that requires visually detecting and recognising a person (subject) at different space time locations observed under substantially different, and often unknown, viewing conditions without subject collaboration. Early published work on re-identification can date back a decade ago to 2003, but most contemporary techniques have been

developed since 2008, and in particular in the last 2–3 years. In the past 5 years, there has been a tremendous increase in computer vision research on solving the re-identification problem, evident from a large number of academic papers published in all the major conferences (ICCV, CVPR, ECCV, BMVC, ICIP) and journals (TPAMI, IJCV, Pattern Recognition). This trend will increase further in the coming years, given that many open problems remain unsolved.

Inspired by the First International Workshop on Re-Identification held at Florence in Italy in October 2012, this book is a collection of invited chapters from some of the world′s leading researchers working on solving the re-identification problem. It aims to provide a comprehensive and in-depth presentation of recent progress and the current state-of-the-art approaches to solving some of the fundamental challenges in person re-identification, benefiting from wider research in the computer vision, pattern recognition and machine learning communities, and drawing insights from video analytics system design considerations for engineering practical solutions. Due to its diverse nature, the development of person re-identification methods by visual matching has been reported in a wide range of fields, from multimedia to robotics, from domotics to visual surveillance, but all with an underlying computer vision theme. Re-identification exploits extensively many core computer vision techniques that aim at extracting and representing an individual's visual appearance in a scene, e.g. pedestrian detection and tracking, and object representation; and machine learning techniques for discriminative matching, e.g. distance metric learning and transfer learning. Moreover, solving the person re-identification problem can benefit from exploiting heterogeneous information by learning more effective semantic attributes, exploiting spatio-temporal statistics, estimating feature transformation across different cameras, taking into account soft-biometric cues (e.g. height, gender) and considering contextual cues (e.g. baggage, other people nearby).

This book is the first dedicated treatment on the subject of *Person Re-Identification* that aims to address a highly focused problem with a strong multidisciplinary appeal to practitioners in both fundamental research and practical applications. In the context of video content analysis, visual surveillance and human recognition, there are a number of other books published recently that aim to address a wider range of topics, e.g. *Video Analytics for Business Intelligence,* by Caifeng Shan, Fatih Porikli, Tao Xiang and Shaogang Gong (2012); *Visual Analysis of Behaviour: From Pixels to Semantics,* by Shaogang Gong and Tao Xiang (2011); and *Visual Analysis of Humans: Looking at People*, by Thomas Moeslund, Adrian Hilton, Volker Kruger and Leonid Sigal (2011). In contrast to those other books, this book provides a more in-depth analysis and a more comprehensive presentation of techniques required specifically for solving the problem of person re-identification. Despite aiming to address a highly focused problem, the techniques presented in this book, e.g. feature representation, attribute learning, ranking, active learning and transfer learning, are highly applicable to other more general problems in computer vision, pattern recognition and machine learning. Therefore, the book should also be of considerable interest to a wider audience.

We anticipate that this book will be of special interest to academics, postgraduates and industrial researchers specialised in computer vision and machine learning, database (including internet) image retrieval, big data mining and search engines. It should also be of interest to commercial developers and managers keen to exploit this emerging technology for a host of applications including security and surveillance, personalised healthcare, commercial information profiling, business intelligence gathering, smart city, public space infrastructure management, consumer electronics and retails. Finally, this book will also be of use to postgraduate students of computer science, engineering, applied mathematics and statistics, cognitive and social studies.

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