We set out in this book to address the problem of visual analysis of behaviours of objects, in particular of people. Understanding and interpreting behaviour is central to social interaction and communication between humans. To study computational models of behaviour by constructing automatic recognition systems and devices may help us with better understanding of how the human visual system bridges sensory mechanisms and semantic understanding. Automated visual analysis of behaviour also provides the key building blocks for an artificial intelligent vision system. Computational modelling and analysis of object behaviour through visual observation offers the potential for a wide range of applications including visual surveillance for crime prevention and detection, asset and facility management, video indexing and search, robotics and personalised healthcare, human computer interaction, animation and computer games.

Visual analysis of behaviour is a challenging problem. It requires to solve a host of difficult problems in computer vision including object detection, segmentation, tracking, motion trajectory analysis, pattern classification, and time series data modelling and prediction. An automated system for behaviour understanding and interpretation must address two challenging problems of computational complexity and uncertainty. Object behaviours in general exhibit complex spatio-temporal dynamics in a highly dynamical and uncertain environment. Visual analysis of behaviour is also subject to noise, incompleteness and uncertainty in sensory data. To further compound the problem, semantic meaning of a behaviour is highly context dependent, and behavioural context may not be measurable given visual information alone. To address these difficulties, statistical machine learning and the exploitation of human knowledge have become critical.

In this book, we study plausible computational models and tractable algorithms that are capable of automatic visual analysis of behaviour in complex and uncertain visual environments, ranging from well-controlled private spaces to highly crowded public scenes. In particular, we consider algorithms and methodologies capable of representing, learning, recognising, interpreting and predicting behaviours. The study of automatic visual analysis of behaviour is concerned with different types of behaviour ranging from facial expression and hand gesture to group behaviour observed from a network of distributed cameras. The book aims to reflect the current
trends, progress and challenges on visual analysis of behaviour and highlight some of the open questions.

Despite the best efforts of computer vision researchers in the past two decades, deploying automated visual analysis of behaviour to a realistic environment is still in its infancy. We hope that in the not too distance future, those techniques considered in this book will be matured enough to give birth to a host of practical computer vision applications that will have a profound impact on human life.
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