

Preface

Video segmentation has been a key technique for visual information extraction and plays an important role in digital video processing, pattern recognition, and computer vision. A wide range of video-based applications will benefit from advances in video segmentation including security and surveillance, bank transactions monitoring, video conferencing, and personal entertainment.

In the last four decades, this field has experienced significant growth and progress, resulting in a virtual explosion of published information. The field of image and video segmentation is still a very hot topic, with much advancement in recent years. As a consequence, there is a considerable need for books like this one, which attempts to bring together a selection of the latest results from researchers involved in state-of-the-art work in video segmentation and its applications.

The objective of this book is to present the latest advances in video segmentation and analysis techniques covering both theoretical approaches and real applications. This book provides an overview of emerging new approaches to video segmentation and promising methods being developed in the computer vision and video analysis community. It not only deals with the theoretical foundations and algorithms for image/video segmentation, which includes how to extract video features, and how to segment semantic video objects, this book also provides a comprehensive description of practical applications which I believe fills a hole in the video segmentation market.

This book is expected to provide researchers and practitioners a comprehensive understanding of the start-of-the-art of video segmentation techniques and a resource for potential applications and successful practice. The principal audience of this book will be mainly composed of researchers and engineers as well as graduate students working on video segmentation in various disciplines, e.g. video analysis, computer vision, pattern recognition, image and video processing, artificial intelligence, etc.

Chapter 1 introduces the current status of research activities including graph-based, density estimator-based and temporal-based segmentation algorithms. Recent developments are then discussed while providing a comprehensive introduction to the fields of image/video segmentation. More challenges ahead are identified whilst outlining perspectives for the years to come.

Chapter 2 presents object segmentation algorithms depending on the characteristics of eigen-structure. The eigen-subspaces are obtained from eigen-decomposition of the covariance matrix, which is computed from the selected color samples. By a joint consideration of signal and noise subspace projections of desired colors, the separate eigen-based fuzzy C-means and coupled eigen-based fuzzy C-means are used to achieve effective color object segmentation. With these proposed algorithms, the color objects can be successfully extracted by using eigen-subspace projections.

Chapter 3 addresses the issue of semantic object segmentation, which aims to label each pixel in a video frame to one of the object classes with semantic meanings. An overview of different technologies and major challenges of the semantic object are first discussed for each step. The frameworks of conditional random fields and topic models, which are the representative models of the generative and discriminative approaches respectively, are applied to achieve semantic object segmentation.

Chapter 4 presents a survey and tutorial on the research on the learning-based video-scene analysis. Two major tasks based on their application setup and learning targets are addressed, namely generic methods and genre-specific analysis techniques. Some research challenges in video content analysis and retrieval are reported for the video scene analysis.

Chapter 5 describes the representative and state-of-the-art approaches in multi-view image segmentation and video tracking. A depth-based segmentation in the initial frame and feature-based tracking algorithms from multiview video are proposed for both separated and overlapping human objects.

Chapter 6 discusses segmentation applications such as medical imaging, computer-guided surgery, machine vision, object recognition, surveillance, content-based browsing, and augmented reality applications. The expected segmentation quality for a given application depends on the level of granularity and the requirement that is related to shape precision and temporal coherence of the objects. Although, there exists still significant challenge to perform robust and fully automated segmentation that fits generic tasks, a reliable solution can be achieved using suitable attention and model-based information.

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