Preface

Video data analysis has become an increasingly important research area with widespread applications in automatic surveillance of transportation infrastructure including roads, rail and airports. As the amount of video data collected grows, so does the opportunity for further processing with new artificial intelligence methods. One type of useful video data that has seen little research is the roadside video data that is collected using video-mounted vehicles. These video data may augment or replace road-based surveys of the conditions of roadside objects such as trees, grasses, roads and traffic signs and can be potentially used in many real-world applications such as roadside vegetation growth condition monitoring, effective roadside management to reduce the possible hazards to drivers and vehicles, and developing automatic vehicles that are able to automatically sense roadside objects and traffic signs.

Most existing studies on video data analysis are primarily focused on analyzing generic object categories in the data content in public benchmark datasets. Very limited research has focused on the analysis of roadside video data, although the significance of developing smart techniques for roadside video data analysis has been widely recognized. One of the main reasons is probably because there is a lack of a comprehensive public dataset that was specifically created for roadside objects. Another reason is the various types of variations and environmental conditions encountered along road sides, which are still challenging issues in the computer vision field. The great variability in the appearance and structure of objects as well as the various types of environmental effects such as underexposure, overexposure, shadows, and sunlight reflectance make accurate segmentation and recognition of objects difficult. The current literature lacks a comprehensive review of existing machine learning algorithms, particularly deep learning techniques, on roadside data analysis.

This book highlights the methods and applications for roadside video data analysis. It describes various system architectures and methodologies that are specifically built upon different types of learning algorithms for roadside video data processing, with detailed analysis of the segmentation, feature extraction and classification. The use of deep learning to solve the roadside video data segmentation and classification problems is one of the major highlights of this book. Deep neural net learning has become popular in machine learning and data mining areas. However, the benefits of a deep feature free approach must be balanced against the considerations of accuracy and robustness, and most real-world learning systems require some hand engineering of features and architectures. This book examines via empirical testing the types of features and architectures that contribute to the performance of multi-layer neural nets on real-world scene analysis. We then demonstrate novel architectures that perform scene classification with equal or better accuracy to previous methods and investigate the feature engineering into convolutional neural networks. Further, we provide an industrial perspective to help align theoretical concerns with real-world results. Finally, as a case study of roadside video data analysis, we demonstrate an application of vegetation biomass estimation techniques for roadside fire risk assessment. Overall, this book compiles the most useful strategies in the field of scene analysis to help researchers identify the most appropriate features and architectures for their applications.

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