Preface

Surveillance video has a wide range of applications in many fields, such as national economic construction, public security information construction, and widely adopted countries worldwide. The infrastructure of the video surveillance system has begun to take shape and is still rapid expansion. As thousands of surveillance cameras monitor and record round the clock, the amount of video data has been explosive growth. Finding the required information in a large number of surveillance videos is undoubtedly a needle in a haystack. Motion is a significant feature of video, and much meaningful visual information is contained in the movement. In many application scenarios, like road traffic monitoring, security for major events, guidance for military aircraft, and autonomous vehicle, people tend to pay more attention to the moving object. The analysis shows that the key frame extraction of surveillance video based on motion analysis has important practical significance. Hence, this book puts forward several key frame extraction methods of surveillance video around capturing the target motion state.

Video key frame extraction is an essential step in video analysis and content-based video retrieval. At the same time, it is also the basis and premise for generating video synopsis. Key frame extract from the video is to extract the meaningful parts of the video by analyzing their content and structure, thereby form the concise and capable of expressing semantics summary. To achieve the

purpose of removing redundancy, shortening the video time, and improving browsing and query efficiency. From the timeline, video is a collection of a series of consecutive image frames, but it is difficult for a single frame to express specific video semantics. Therefore, people usually synopsize the video by key frame extraction in video analysis. At present, many research results have been achieved in key frame extraction from the video. Nevertheless, apply existing effective video key frame extraction directly to surveillance video, and then the extracted key frames are not accurate enough. Surveillance videos are different from news, sports, and other videos with a specific structure and undergo manual editing. In surveillance, the video shot rarely appears. Therefore, many key frame extraction algorithms are not suitable for surveillance video.

Against this background, we are based on the realistic demand of surveillance video key frame extraction and draws on video summary related theoretical research results on the domestic and foreign. Based on the research foundation of the research group for many years, the research on the key frame extraction theory and algorithm based on analysis has been carried out. This book will be divided into six chapters to summarize and elaborate on the research work.

Chapter one explains the background and development status of surveillance video key frame extraction and points out the significance of video key frame extraction. On the basis, the current main key frame extraction techniques are listed. Finally, the main chapter arrangement of the book is given.

Chapter two mainly introduces the fundamental theories involved in the research, including image preprocessing, moving target detection, moving target tracking. It also lists the methods of current classic video key frame extraction and evaluation.

Chapter three presents a method for key frame extraction of surveillance video based on motion speed. First, two classic motion descriptors describing video motion characteristics are analyzed. On the basis, motion speed feature descriptors are proposed. Then, the basic framework and implementation steps of the method are given. Finally, experiments verify the correctness and effectiveness of the proposed method.

Chapter four proposes a video key frame extraction method based on center offset, which can capture the target's changes in the local motion state better than before. Firstly, the method defines the center offset, gives the basic framework and implementation process of the method, and finally validates the proposed method.

Chapter five proposes a video frame extraction method based on frequency domain analysis, which can more accurately capture the changes in the local motion state of the target. Firstly, the feasibility of frequency domain analysis is given, and then the basic framework and implementation process of the method is described. Finally, the correctness and effectiveness of the proposed method are verified.

Chapter six proposed a method for key frame extraction of surveillance video with an adaptive motion state. This method first established the STS-CS model based on the texture analysis of the target motion trajectory. The theoretical analysis of the possibility of model construction and validity verification. Then a key frame extraction method based on the STS-CS model for adaptive motion state is proposed. Finally, the proposed method's correctness is analyzed and compared with the current mainstream methods in terms of computational efficiency, MOS performance, and SRD performance.

This book involves multidisciplinary knowledge such as computer graphics, image processing, pattern recognition, video target detection, and specific applications in public security, railways, and other specific fields. The content is relatively new; the writing time is tight; some issues have not undergone more in-depth research and practical testing. Simultaneously, the author's level is limited, and omissions in the book's content are inevitable. Experts are welcome to advise and readers to provide valuable opinions.