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Rajeev Srivastava, S.K. Singh, and K.K. Shukla

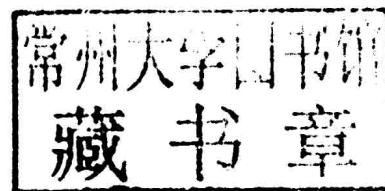


Research Developments in Biometrics and Video Processing Techniques

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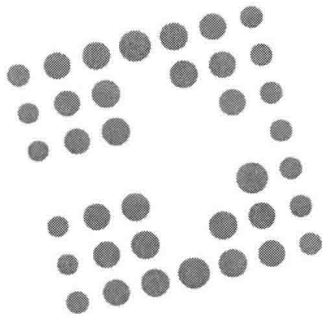
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Section 1

Biometrics and Security Techniques



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Preface

This book presents the recent research developments and applications in the areas of Biometrics and Video Processing. The book will serve as a research reference book in the areas of Biometrics and Security Techniques, and Video Processing.

Section 1 of the book presents chapters related to recent research developments in the area of biometrics and security techniques. Biometrics is the science of recognizing people by their physiological and behavioural characteristics. It holds a lot of promise in revolutionizing the way authentication works today. With a very security conscious society, biometrics-based authentication and identification have become the centre of attention for many important applications as it is believed that biometrics can provide the necessary accuracy and reliability. As the objective of biometric systems is to identify individuals based on their physiological or behavioural information, many types of biometric technologies have surfaced in recent years to provide a more secure and user-friendly methods of identification. Physiological characteristics such as face, retina, fingerprints, palm, veins, etc. have been widely researched, and many of these biometric-based products have been commercialized and used in a wide variety of applications. On the other hand, biometric products based on behavioural characteristics such as signature, voice, gait, etc. are less popular, and not as many are commercially available due to their higher rate of error when compared to physiologically based biometric products.

Section 2 of the book presents various chapters related to recent research developments in the field of video processing. The various topics presented in this section include a review on stereo vision-based object matching, detection, and tracking; feature-based affine motion estimation for super resolution of a region of interest; Daubechies complex wavelet-based computer vision applications to video processing; application of computer vision techniques for exploiting new video coding mechanisms; recognition of humans and their activities for video surveillance; and video authentication.

SCHOLARLY VALUE, POTENTIAL CONTRIBUTION/IMPACT, AND PURPOSE

At present most of the books available in the field of biometrics and video processing are tuned to very specific limited research fields. This book intend to serve the purposes of a large audience working in related or allied areas, including students, researchers, professors, practicing engineers, application developers, etc. In addition, this book will be helpful for new as well as experienced researchers to familiarise themselves with the new research areas and their possible applications in the said field. This book incorporates the methodologies to develop algorithms for the related problem in hand and new research trends. In addition, this book also incorporates the chapters related to new challenging

application areas. Emphasis has been given to develop each and every chapter incorporating a latest literature review, methods and models, implementation, experimental results, performance analysis, conclusion, future work, and the latest relevant references.

POTENTIAL USES/INTENDED AUDIENCE

Interdisciplinary engineering students at final year UG level, PG level, and doctoral research students, as well as faculty members/trainers/professors, research scientists, and practicing engineers and software application developers will find this book useful.

ORGANIZATION OF THE BOOK

Research Developments in Biometrics and Video Processing Techniques provides an overview, recent research developments in the field of computer vision and image processing, and related applications. This book contains 10 chapters divided in to two sections, namely Section 1: Biometrics and Security Techniques, and Section 2: Video Processing. Section 1 contains 4 chapters from Chapter 1 to Chapter 4, and Section 2 contains 6 chapters from Chapter 5 to Chapter 10.

Section 1: Biometrics and Security Techniques

Chapter 1: “Thermal Human Face Recognition for Biometric Security System”

This chapter presents an overview of some of the well-known techniques of face recognition using thermal infrared faces. This chapter talks about some of the most recent algorithms developed for this purpose and gives a brief idea of the state of the art of face recognition technology. An approach for evaluating the performance of face recognition algorithms using thermal infrared images is proposed. The results of several classifiers on benchmark dataset (Terravic Facial Infrared Database) are reported.

Chapter 2: “Multimodal Biometric Recognition for Newborns”

Identification of newborns at birth is a critical issue for hospitals, birthing centres, and other institutions where multiple births occur. Mixing, abduction, and illegal adoption of newborns is a global problem, and the research done to solve this problem is minimal. This chapter presents a multimodal biometric framework for the recognition of newborns.

Chapter 3: “Biometric Authentication Based on Hand Vein Pattern”

This chapter discusses vein pattern authentication, which uses the vascular patterns of the back of the hand as personal authentication data. A dynamic ROI extraction algorithm is presented through which more features can be extracted when compared to the fixed ROI. Further, the extracted ROI is enhanced and de-noised. The two key features, bifurcation and ending points, which represent the geometric information of the vein pattern are extracted. A new vein pattern recognition system is introduced by assigning

different weights to bifurcation and ending points. The approach is tested on a vein pattern database of 60 different hands. Experimental results show the approach achieves 2.5% of Equal Error Rate (EER) and recognition accuracy of 98.24%.

Chapter 4: “Securing Biometrics Using Watermarking”

This chapter focuses on the role of watermarking techniques in biometric systems. This work finds application in a number of security implementations based on multimodal biometric authentication. Computationally intelligent techniques can be employed to develop efficient watermarking algorithms in terms of watermarked image quality and distortion tolerance-ability.

Section 2: Video Processing

Chapter 5: “Stereo Vision-Based Object Matching, Detection, and Tracking: A Review”

Stereo vision has turned out to be an important research component in the subdivision of computer vision and image processing that deals with the extraction of information from images for the purpose of video surveillance systems, mimicking the human vision for the visually impaired, for robotics to control unmanned vehicles, for security purposes, virtual reality, and 3-Dimensional (3D) televisions, etc. This chapter presents a comprehensive review of recent algorithms for stereo matching, object detection, and tracking techniques for stereo vision.

Chapter 6: “Feature-Based Affine Motion Estimation for Super Resolution of a Region of Interest”

This chapter presents an interpolation method of low-computation for a Region Of Interest (ROI) using multiple low-resolution images of the same scene. The proposed Super Resolution (SR) method employs a simple global motion model only to the ROI that contains important information of the scene. The ROIs extracted from multiple images are assumed to have simple global motions. Experimental results show that the feature-based Motion Estimation (ME) is accurate, and reducing the computational load of the ME step is efficient in terms of the computational complexity. It is also shown that the SR results using the proposed method are remarkable even when input images contain complex motions and a large amount of noise. The proposed POCS-based SR algorithm can be applied to digital cameras, portable camcorders, and so on.

Chapter 7: “Daubechies Complex Wavelet-Based Computer Vision Applications”

In this chapter, the basic concepts of Daubechies complex wavelet transforms, their properties, and capabilities are discussed. Further, two computer vision applications, namely moving object segmentation and moving shadow detection and removal using Daubechies complex wavelet transform, are proposed and discussed. Results obtained show that the Daubechies complex wavelet transform provides better results than other real-valued wavelet transform-based methods for the applications in consideration and have good potential for other applications as well.

Chapter 8: “Application of Computer Vision Techniques for Exploiting New Video Coding Mechanisms”

This chapter discusses the concerns related to current multimedia platforms for provisioning of content to end-users that provides them a good quality of experience, which can be achieved through new interactive, personalized content applications, as well by improving the image quality delivered. These issues are addressed by describing mechanisms for changing content consumption. The aim is to give Application Service Providers (ASPs) new ways to allow users to configure contents according to their personal tastes while also improving their quality of experience, and to possibly charge users for such functionalities. The author proposes to employ computer vision techniques to produce extra object information, which further expands the range of video personalization possibilities on the presence of new video coding mechanisms.

Chapter 9: “Recognition of Humans and Their Activities for Video Surveillance”

This chapter gives a detailed overview and survey of methods for recognition of humans and their activities for video surveillance. Image representations and the subsequent classification process are discussed to focus on the novelties of recent research. The limitations of the state of the art are discussed, and promising directions of research are outlined. Comprehensive comparative analyses of standard existing methods are also presented.

Chapter 10: “Video Authentication: An Intelligent Approach”

This chapter presents an intelligent video authentication technique for raw videos using a support vector machine-based classifier and its applications. The method discussed covers both types of tampering attacks, spatial and temporal. It uses a database of more than 2000 tampered and non-tampered videos and gives excellent results with 98.38% classification accuracy. A vast diversity of tampering attacks, which are possible for video sequences are also discussed. The proposed method gives good results for almost all kinds of tampering attacks.

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