Preface

Multimedia is a media and content uses an arrangement of diverse content forms including sound, audio, graphics, animation, and video. The most significant form of multimedia is video as it has various relevance in different aspects. Motion detection is the main module for several video applications including security, visual localization and mapping (SLAM), visual tracking of vehicles ahead for safety/auto-driving, and Augmented Reality (AR). However, motion detection systems/algorithms have specific requirements based on the application to achieve accurate, robust, and fast detection in real time problems.

In a digital video, the information/features extracted form a picture is digitized both spatially and temporally. Digital image and video processing are applied for improving the captured videos/images quality. The most crucial task in video processing is to divide the long video sequences into a number of shots. Afterward, discover a key frame of each shot for supplementary video information retrieval tasks, where a frame is known as an electronically coded still image. Background subtraction principle is mainly applied in motion detection systems to extract the objects from the background. The extracted features from the video are constantly tracked. Features are known as the points of interest for image description, such as lines, edges, and corners. The temporal features' information and their motion behaviors are used for identification, image alignment, 3D reconstruction, object recognition, motion tracking and robot navigation. Local invariant features provide good representation that allows efficient matching for local structures between images. The first phase for the local feature extraction pipeline is finding a set of reliable localized key points under varying viewpoint, changes imaging conditions, and in the presence of noise. Moreover, the extraction approach should realize the same feature locations even if translation or rotation has occurred. Hessian detector, Harris detector, Laplacian-of-Gaussian (LoG) detector, Harris-Affine and Hessian-Affine detectors are all examples for efficient detectors. Once a set of the interest regions are extracted from an image, their corresponding content are encoded in a descriptor, which is suitable for discriminative matching. Such descriptors include the Scale Invariant Feature Transform (SIFT), Speeded-Up Robust Features (SURF).

Segmentation of the video track into smaller items facilitates the succeeding processing procedures on video shots, for instance semantic representation/ tracking of the selected video information, video indexing and recognizing the frames where a transition occurred from one shot to another. The low level features can be extracted from the segmented video. The video data must be manipulated appropriately for efficient information retrieval. The main challenging task is the retrieval of information from the video data. The majority task is to transform the unstructured data into structured one for video data processing. Prior to processing the video frames noise elimination and illumination changes should be removed. Video processing has several applications including:

- Motion capturing of an athlete,
- Motion pictures' analysis,
- Rehabilitation to assess the locomotion abilities,
- Robot control, and
- Educational programs biometrics.

Consequently, this book focuses on exploring different applications for the feature detectors and descriptors as well as motion detection in video processing applications.

OBJECTIVE

This book thoughtful the foremost feature detectors and descriptors algorithms for video/image processing. It deals chiefly with methods and approaches that involve video analysis and retrieval, automatic shot detection, etc. This book grants significant frameworks and the most contemporary empirical research outcomes in the feature detectors and descriptors algorithms. As well as it introduces variety of motion detection in video processing applications in a wide range. It is written for professionals and researchers working in the field of video and imaging in various disciplines, e.g. Software/Hardware video security monitoring, medical devices engineering, researchers, academicians, advanced-level students, and technology developers.

ORGANIZATION

The book consists of an introduction followed by twelve chapters that organized in three sections as shown in Table 1. The first two chapters focus on the concept and applications for the image/video processing as well as the mining concept. The second section consists of Chapters 3 through 6 that extensively deploy feature detectors and descriptors. The last six chapters are included in section 3, which focuses on different motion detection in video applications and miscellaneous related topics.

INTRODUCTION

Object tracking is an estimating problem for the positions and other relevant information of moving objects within an image sequences (video). This chapter deployed concept of motion detection. Additionally, it includes the motion detection and tracking in different video processing applications that can be improved in new research aspects in the future.

Table 1.

Section 1: Introduction to Video Processing and Mining					
Chapter 1 Medical Video Processing: Concept and Applications			**Chapter 2** Educational Data Mining and Indian Technical Education System: A Review		
Section 2: Feature Detectors and Descriptors					
Chapter 3 Feature Detectors and Descriptors Generations with Numerous Images and Video Applications: A Recap	**Chapter 4** Analysis of Different Feature Description Algorithm in Object Recognition		**Chapter 5** A Study on Different Edge Detection Techniques in Digital Image Processing	**Chapter 6** A Nearest Opposite Contour Pixel Based Thinning Strategy for Character Images	
Section 3: Motion Detection in Video Applications and Miscellaneous Related Topics					
Chapter 7 Multi-view RGB-D Synchronized Video Acquisition and Temporally Coherent 3D Animation Reconstruction Using Multiple Kinects	**Chapter 8** On the Use of Motion Vectors for 2D and 3D Error Concealment in H.264/AVC Video	**Chapter 9** Vision-Based Protective Devices	**Chapter 10** A Study on Various Image Processing Techniques and Hardware Implementation using Xilinx System Generator	**Chapter 11** New Redundant Manipulator Robot with Six Degrees of Freedom Controlled with Visual Feedback	**Chapter 12** Insilico Approach for Epitope Prediction Toward Novel Vaccine Delivery System Design

SECTION 1: INTRODUCTION TO VIDEO PROCESSING AND MINING (CHAPTERS 1-2)

This section elaborated the fundamental concepts and algorithms of video processing in the medical domain. Another context is introduced related to data mining that has great benefit in data extraction various applications including educational and medical domains.

Chapter 1

This chapter included an overview on the medical video processing. Recently, various medical modalities are supported by cameras to provide videos for the human body internal for surgical purposes. In addition, more information is acquired from such medical videos for accurate diagnosis. In this current chapter, it was convinced that video processing and real time frame will have outstanding value in the clinical environments.

Chapter 2

Educational Data Mining (EDM) is emerged as a powerful tool to explore the unique types of data in educational settings for better understand students. Clustering, classification, association rule mining and decision trees are employed to improve teaching and learning systems. This chapter is carried out to explore the most relevant studies in the data mining domain in higher and technical education sectors to probably portray a pathway towards the improvement of the quality education in technical institutions.

SECTION 2: FEATURE DETECTORS AND DESCRIPTORS (CHAPTERS 3-6)

Feature detectors and descriptors are the milestone in numerous applications including video camera calibrations, object recognition, biometrics, medical applications and image/video retrieval. Extract the points of interest between two similar scenes, objects, images/video shots are the main task of the feature detectors and descriptors. This section highlighted the different feature detectors and descriptors types that involved in various applications.

Chapter 3

This current chapter introduced a synopsis about the feature detectors, such as Moravec, Hessian, Harris and Features from Accelerated Segment Test. It addressed their generation over time, their concept, and their applications in image/video processes. Additionally, some recent feature detectors are addressed with comparison to illustrate their respective strengths and weaknesses. The advanced feature detectors indicated that combining a novel heuristic for feature detection with machine learning methods provided a robust, high-speed corner detection algorithm that can be use in real-time image processing applications.

Chapter 4

Local feature description and global feature description algorithms have a vital role in the object recognition process. This chapter analyzed the foremost feature detector/descriptor algorithm and evaluated their performance in different circumstances including rotational, scaling, illumination, and blurring effects. Moreover, the speed of each algorithm in different situations was measured.

Chapter 5

Edge detection is one of the fundamental techniques for image segmentation. The image edges include a good number of rich information that is very significant for obtaining the image characteristic image analysis. Thus, edge detection techniques transform the original images into edge images using the changes of grey tones in the image. This chapter studied the theory of edge detection for image segmentation using various computing approaches. It was stated that edge detection techniques are a combination of image smoothing and differentiation plus a post-processing for edge labeling.

Chapter 6

Removal of strokes or deformities in thinning of character images is a big challenge. This chapter proposed a nearest opposite contour pixel based thinning strategy used for performing skeletonization of printed and handwritten character images. Shape characteristics of text were used to get a skeleton of nearly same as the true character shape. This method assists to preserve the local features and true shape of the character images. The proposed algorithm produces one pixel-width thin skeleton. The results were conducted on printed English and Bengali characters and compared to other thinning methods without any post-processing.

SECTION 3: MOTION DETECTION IN VIDEO APPLICATIONS AND MISCELLANEOUS RELATED TOPICS (CHAPTERS 7-12)

Real time dynamic scene has been employed in a number of applications, such as the three- dimensional (3D) animation videos in electronic games, 3D television, motion analysis, and gesture recognition. This process was proposed and discussed in this section. In addition, the developed artificial vision system allows allocating the position of objects located on the robot's Cartesian work plane. The frame by frame acquisition of images allows positioning in real time the links of a manipulator robot. However, cameras speed of frame acquisition restricts such operation, which was discussed in this section. Finally, the section included other related topics.

Chapter 7

This chapter proposed a system for acquiring synchronized multi-view color and depth (RGB-D) video data using multiple off-the-shelf Microsoft Kinect and reconstructing methods for coherent 3D animation from the multi-view RGB-D video data. The data acquired by this framework can be registered in a global coordinate system and then can be used to reconstruct the 360-degree 3D animation of a dynamic scene.

Chapter 8

Motion estimation and motion compensation (MC) have a significant role in the coding/decoding H.264/ AVC standard for error concealment. The H.264/AVC has selective intra-prediction and optimized inter-prediction methods to reduce temporal and spatial redundancy more efficiently. This chapter depicted that motion compensation/prediction using variable block sizes and directional intra-prediction assisted the decision for the best coding. Unfortunately, motion treatment is a computationally-demanding component of a video codec. The H.264/AVC standard has solved problems its predecessors faced when it comes to image quality and coding efficiency, but many of its advantages require an increase in computing complexity.

Chapter 9

Machine Safety is a technical discipline with a strong basis in the development of electrical and electronic devices. Recently, real-time digital video processing is involved in machine safety. This chapter intended to explore the standardized features of the vision-based protective devices (VBPDs), their technical development and principal applications in the machine safety domain with a stress on prominent vision-related implementation issues.

Chapter 10

This chapter was extensively discussed the various image processing techniques in MATLAB and the hardware implementation in FPGA using Xilinx system generator. The Xilinx system generator tool is a new application in image processing and offers a friendly environment design for the processing. This tool supports software simulation as well as synthesizes in FPGAs hardware with the parallelism, robust and speed.

Chapter 11

This chapter depicted the design and implementation stages of a redundant robotized manipulator with six degrees of freedom (DOF) controlled with visual feedback by means of computational software. The artificial vision system/interface programming are designed and implemented. Finally, functional mechanical and electric tests to validate the correct operation of each of the systems of the manipulator robot and the whole robotized system were carried out.

Chapter 12

Vaccines through mimicking disease agents and stimulating the immune system builds a defense mechanism against the disease causing agents. The present chapter proposed an Insilico technique in epitope prediction and analysis of antigenecity and Immunogenecity of Haemophilus influenzae strains. The conducted insilico approaches selected the best strain target proteins, m strain selection, epitope prediction, antigenicity and immunogenicity prediction of target proteins to find out the best targets.

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