

## Preface

Advancement in technology leads to wide spread use of mounting cameras to capture video imagery. Such surveillance cameras are predominant in commercial institutions through recording the cameras' output to tapes that stored in video archives. These recorded videos can be used for further monitoring and analysis to alert security officers in banks and institutes to avoid crime. Thus, automated video surveillance becomes a significant research area in several applications such as people/vehicles tracking and safety issues. Detected and tracked moving objects can be classified into several categories including human, vehicles and trucks using color and shape analysis as well as classifying the human activity into walking and running for example. This classification is applied to improve tracking using progressive reliable constraints. In order to achieve effective tracking and monitoring, advanced techniques for video analysis and processing are required.

In a digital video, the picture's information is digitized both spatially and temporally and the resultant pixel intensities are quantized. Generally, digital video and image processing are applied for improving the quality of the captured videos/images. Advancement in video technology leads to enormous amounts of data that accessible across the world in the form of images and video sequences through television and internet. Thus, there is a great potential for video-based applications in many areas. Moreover, the progression in multimedia acquirement and storage technology leads to a marvelous growth in multimedia databases.

The most essential 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. 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.

Typically, video processing has diverse applications, such as in astronomy, medicine, image compression to reduce the memory requirement, sports to capture the motion of an athlete, rehabilitation to assess the locomotion abilities, motion pictures, surveillance to detect and track individuals and vehicles), production industries, robot control, TV productions, educational programs biometrics, and photo editing. Numerous of these applications rely on the same video and image processing methods. Accordingly, these basic methods will the focus of this book.

## **OBJECTIVE OF THE BOOK**

This book deliberates the foremost techniques of video/image processing including noise elimination, segmentation, classification and encryption. It includes video steganography along with miscellaneous surveillance and monitoring systems for real-time applications. This book endeavors to endow with significant frameworks and the most recent empirical research findings in the area of video processing. It includes video processing fundamentals as well as advance topics to help readers building the initial concept and to carry out the research work on this particular field in appropriate manner. As well as it introduces variety of 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 OF THE BOOK**

The book consists of an introductory chapter followed by 12 chapters that are organized into three sections as shown below. The first section of the book encloses five chapters that introduced the segmentation, classification and registration based image/video processing. The second section contains two chapters concerning video steganography. From Chapter 8 till Chapter 12, the third section introduces several surveillance and monitoring systems applications.

The introduction reported the main concept of the video processing concept and its relation to the image processing. It elaborated the video processing various applications that can be improved in new research aspects in the future.

### **Section 1: Segmentation-, Classification-, and Registration-Based Image/Video Processing (Chapters 1-5)**

Segmentation, classification, and registration are significant image/video processes. Several metrics are used to evaluate and benchmark their performance. This section elaborated an overview of these techniques with an analysis of the evaluation metrics for Image and Video Segmentation methods. Moreover, a classification process was included to classify different types of crops, which can be applied for further video applications.

#### **Chapter 1**

This chapter presented a brief outline of the most common segmentation techniques such as thresholding based segmentation, model based segmentation, edge detection based segmentation, and clustering based segmentation. The Matlab simulated results for different image segmentation techniques were included for better understanding of image segmentation.

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### **Chapter 2**

Lack of evaluation metrics and benchmark datasets that covers the large variety of sub-problems appearing in image and video segmentation is a challenging issue. This chapter analyzed the evaluation metrics datasets for image and video segmentation methods. Furthermore, it discussed the traditional image and video segmentation methods and the required datasets to evaluate the segmentation algorithms.

### **Chapter 3**

This chapter proposed a recognition/classification system for fresh (healthy) crops and rotten ones. Image analysis was employed to extract statistical features for each crop using ImageJ software. These features were used for crops' recognition using the Least Mean Square Error (LMSE) algorithm and classification based on Bag of Features (BoF) technique. The experimental results were applied on databases for orange, mango, tomato and potatoes.

### **Chapter 4**

Typically, video analysis including object detection, classification and tracking require the entire video scanning, which in turn requires objects detection and classification. This chapter elaborated moving object classification based on the features extracted from the objects in the video sequence. Techniques such as edge detection using various filters, edge detection operators, CBIR (Content Based Image Retrieval) and Bag-of visual words (BoV) were used to classify videos into broad classes to assist searching and indexing using semantic keywords.

### **Chapter 5**

Image registration refers to transforming one image with reference to other images from different viewpoints at variant time. This current chapter highlights the cogitation effect of four different registration techniques, namely the affine transformation based registration, rigid transformation based registration, B-splines registration, and Demons registration. It provided a comparative study among all of these registration techniques as well as different frameworks involved in registration process.

## **Section 2: Video Steganography (Chapters 6-7)**

Recently, due to technology errorless with secured data transmission become a must during large multimedia transfer. Video Steganography known as the process of hiding secret information inside a video sequence without changing the pixel color is involved. In this section, steganography was introduced along with its system requirements, categories, and classifications with focus on image and video files. Furthermore, steganography system evaluation, attacks, and applications were explained.

### **Chapter 6**

This chapter elaborated an overview of the steganography model including the components and the embedding and extraction processes with the evaluation process. Furthermore, the steganography system

requirements were discussed as well as a comparison has been conducted among three categories of steganography.

## Chapter 7

This chapter addressed the computation delay reduction and increase in the throughput for the LSB/multi-bit based image steganography. This was achieved by implementing the embedding and extraction schemes of LSB/multi-bit steganography in the reconfigurable device such as FPGA. Novel architectures were developed for real-time applications. The algorithm presented in this chapter was validated before the hardware implementation. The hardware simulation and synthesis established that the proposed technique achieved high speed compared to its software counterpart. Further, this scheme can be extended to complex steganography techniques and higher performance can be obtained.

## **Section 3: Surveillance and Monitoring Systems (Chapters 8-12)**

Surveillance and monitoring systems are essential with the extensive dissemination of the human activities. In real time applications, each moving object is denoted as a space-time activity tube in the video. Automated recognition of human activities is a crucial topic that can be applied in several real time applications, including human computer interaction, and smart automated surveillance. Moreover, monitoring allows the detection of any interference that may occur during an action. Therefore, this section outlined and provided several applications and examples for surveillance and monitoring systems.

## Chapter 8

Researchers are interested with the perception and recognition of human activities that involved in the automated visual surveillance. This chapter discussed different studies that devoted to human action recognition. Moreover, it addressed several public datasets that used to validate the automated activity recognition techniques.

## Chapter 9

Video synopsis afforded long surveillance video representation, while preserving the essential activities of the original video. Since, activities should be displayed in different time segments than original video. Thus, the process begins with extracting moving objects. In this chapter, temporal median algorithm was used to model the background and foreground objects using background subtraction method for detection. The genetic algorithm was used to optimize the temporal shifting of the activity tubes. Finally, the activity tubes were stitched on the time-lapse background video using Poisson image editing.

## Chapter 10

In this chapter, the development and implementation of a remote monitoring system for an electric golf cart was presented. The proposed monitoring system consisted of two phases: teleoperation and vehicle complete autonomy. The acquired video images on the vehicle were sent wirelessly to the monitoring station. Afterward, several significant teleoperation variables of a land vehicle, such as voltage level, current and speed were sensed.

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### **Chapter 11**

Traffic congestion in cities is a major problem mainly in the developing countries that led to develop several models for the traffic system. This chapter proposed a developed Intelligent Traffic Monitoring System using infrared proximity sensors and a centrally placed microcontroller. Vehicular length along a lane is used to implement auto controlling of the traffic. The proposed model provided a mean to control the traffic manually through PC software and an android application.

### **Chapter 12**

Fire detection and warning are challenging problems as the fire color has a wide range from red yellow to almost white. Early warning and instantaneous responses are the preventing ideas to avoid losses affecting environment as well as human casualties. In order to reduce false alarms of conventional fire detection systems, vision systems were developed. This chapter was briefly described the fundamentals of videos, various issues in processing video signals, various algorithms for video processing using vision techniques.

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