

Preface

Image processing is used to process the images based on the requirement by using the signal processing techniques. The signal processing techniques is organized with mathematical operations, for which input is an image or video frame. The response of the processing unit may be either an image or set of parameters / characteristics related to the input image. Basically, image processing is dealing with two dimensional signals. In that, classifications of image parameters / characteristics are using the standard signal processing techniques. The three dimensional image processing has lot of applications in real time like computer vision, where the z-axis being time / frequency. Generally, image processing refers to digital, optical and analog input signal processing.

The digital image processing is dealing with computer simulations based on the mathematical algorithms. Based on the mathematical algorithms, the parameters / characteristics of the images can be studied / enhanced. The digital image processing techniques widely used to study the medical images and satellite images. By using the advanced digital image processing techniques, now researchers can predict the crop growth, cancer cells and material defects. The cancer cell detection in early stage is possible using optical microscopy imaging.

NEED FOR A BOOK ON THE PROPOSED TOPICS

The advanced image processing techniques are widely used in computer vision and control, by processing the two and three dimensional images as input. The three dimensional image processing is widely used to control the robotic movements and machine processing. The robot can move even non-planar surfaces by analyzing the two / three dimensional images. The fast responses with high accuracy of the robotic functions are achieved by using the advanced feedback processing units with digital image processing systems. Today, image processing and recognition has broad scope due to the requirement and gap in the scientific visualization. In materials science, generally X-ray and UV are used to evaluate the structure without disturbing it. In the bio-medical field, even today the working mechanism of the advanced imaging techniques are based on the ionizing radiation like X-rays, UV rays, etc. The ionizing radiations will affect the adjacent tissues as well as organs.

Now, researchers are interested to work with terahertz imaging techniques, because it has lot of merits and opportunities like non-ionizing radiation, unlicensed spectrum and high spatial resolution. In the electromagnetic spectrum, the terahertz waves lies from 0.1 THz - 10 THz (wavelengths of 3 mm to about 1 μm). The designs of THz transreceivers are under research, due to its system complexity and miniaturization. The THz imaging is playing interesting role in nano-biology, weapon and hazardous

materials detections. In 1995, Bell laboratories developed a first terahertz imaging systems based on the terahertz time domain spectroscopy. In which, the terahertz waveforms are down converted in to kilohertz frequency range. The short wavelength terahertz pulses enhanced the spatial resolution. The non-ionizing radiation opened the new research opportunities in the field of bio-medical imaging as well as radiology. The broadband terahertz pulses can be generated using photoconductive antennas. The terahertz time domain systems and coherent detectors are required to detect the terahertz pulses. The continuous wave terahertz systems are less expensive than terahertz time domain systems. Now, the terahertz imaging systems are used in airports to detect the hidden weapons / materials in the form of solids / powder. Even today, terahertz systems can differentiate the explosive materials, by studying the materials absorption.

ORGANIZATION OF THE BOOK

The book is organized into 17 chapters. A brief description of each chapter is given as follows:

- Chapter 1:** This chapter concerns the preliminaries of fuzzy, intuitionistic fuzzy, type-2 fuzzy and intuitionistic type-2 fuzzy set theory and its application in the fingerprint image; furthermore, the contrast enhancement and edge detection are carried out for that with the assistance of fuzzy set theory. It is useful to the students who want to self-study. This chapter composed just to address that issue.
- Chapter 2:** This chapter starts with an introduction to computer vision and its applications, which is followed by an introduction to text information extraction from images/video.
- Chapter 3:** This chapter deals with steganography algorithm which can embed multiple messages, each of which requires a separate key is proposed. The application can estimate the capacity used and capacity remains for the given cover image and texts
- Chapter 4:** This chapter presents an analysis on Zernike Moments from the class of orthogonal moments which are invariant to rotation, translation and scaling. The chapter initially focuses on the review of Zernike moments as 1D, 2D and 3D based on their dimension and later investigates on the construction, characteristics of Zernike Moments and their invariants, which can be used as a shape descriptor to capture global and detailed information from the data based on their order to provide outstanding performance in various applications of image processing
- Chapter 5:** This chapter deals distinct and discrete mapping function calculates the histogram values and improves the contrast of the image. The performance of IHE is based on noise removal ratio, reliability rate, false positive error measure, Max-Flow Computational Complexity Measure with NDRA and Variation HOD. As the outcome, the different levels of contrast have been significantly improved when evaluated against with the existing systems.
- Chapter 6:** In this chapter, authors have proposed sub-optimal key generation algorithm and this nature inspired optimization technique reveals complex keys, remains very useful for decision making in dynamic environment. Key generation is crafted as complex with this mathematical model that overcomes the predicament key problem exists in existing methods and upgrades quality of encryption. Results of the proposed algorithm show the efficiency and its resistance against various cryptanalytic attacks.

- Chapter 7:** This chapter presents a technique which uses the sum of height square as a measure to define the deflection associated with a pseudo high curvature points on the digital planar curve. The proposed technique iteratively removes the pseudo high curvature points whose deflection is minimal, and recalculates the deflection associated with its neighboring pseudo high curvature points.
- Chapter 8:** This chapter presents Foreign body aspiration (FBA) is a common problem among pediatric population that requires early diagnosis and prompt successful management. Conventionally the radiography image inspection processes are carried out manually by the experts of medical field.
- Chapter 9:** The results of new experiments on the detection and description of images for an EKF-SLAM monocular application are employed in order to obtain a dispersed set of features without related data association problems.
- Chapter 10:** Hard mathematical problems having no polynomial time algorithms to determine a solution are seemly in design of secure cryptosystems. The proposed watermarking system used number theoretic concepts of the hard higher order Diophantine equations for image content authentication scheme.
- Chapter 11:** The design, construction and programming of a mobile robot controlled by means of artificial vision, capable of recognizing, grabbing and moving specific objects in a completely autonomous way is presented in this chapter, together with the conceptual and theoretical-practical grounds for the work.
- Chapter 12:** This chapter begins with the basic idea of Biometrics, Biometrics System with its components, working and proceeds with the need of Multimodal Biometrics with the emphasis on review of various multimodal systems based on fusion ways and fusion level of various features. The last section of this chapter describes various multimodal Biometric Systems.
- Chapter 13:** This chapter illustrates the Extensive experimental evaluations on a wide range of benchmark datasets validate the efficiency of RSDT compared to Center Symmetric Spatio Temporal Local Ternary Pattern (CS-STLTP) for unconstrained video analytics.
- Chapter 14:** These mechanisms and methods are integrated in two different distributed schemas so that it can be implemented in the same mean time without taking into the consideration of cluster size. Thus, the experimental evaluation shows that the proposed schemes and mechanisms drastically reduce the energy consumption and computational burden with respect to the existing methodology.
- Chapter 15:** This chapter elaborates the basics of Digital Image Steganography techniques from ancient era to digital edge, types of images used for the steganography, payload used for the steganography, various attacks and different algorithms that can provide the information security.
- Chapter 16:** This chapter describes the survey for finding vegetation, deforestation of earth images from various related papers from different authors. This survey deals with remote sensing and normalized difference vegetation index with various techniques.
- Chapter 17:** This chapter discussed with an Integrated Geographic Information System with Expert Systems using Cloud Computing.

AUDIENCE

The intended audiences of this book are scientists, professionals, researchers, and academicians, who deal with the new challenges and advances in the specific areas mentioned above. Designers and developers of applications in these fields can learn from other experts and colleagues through studying this book.

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Many universities have started to offer courses on Image Processing, Techniques and applications on the graduate/post graduate level in information technology and management disciplines. This book starts with an introduction to image Processing and applications, hence suitable for university level courses as well as research scholars. Major contributions of chapters are expected from leading researchers, industry practitioners, and implementers. Their insightful discussions and knowledge, based on references and research work, will lead to an excellent book and a great knowledge source.

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