Transactions on Computer Systems and Networks

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# Advance Concepts of Image Processing and Pattern Recognition

## Effective Solution for Global Challenges

Springer

# Transactions on Computer Systems and Networks

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# Preface

Image processing is one of the challenging fields of engineering. Various applications of image processing are being used in the field of medical imaging, cyberforensic, satellite imagery, smart agriculture, etc. Our aim is to explain the important concepts and principles of image processing so that readers can easily implement the algorithms and techniques and lead themselves to discover new problems and applications. This book will discuss numerous fundamental and advanced image processing algorithms and pattern recognition techniques to illustrate the framework.

The main strength of this book is it will present essential background theory, shape methods, texture about new methods, and techniques for image processing and pattern recognition. We have made a good balance between a mathematical background and practical implementation. This book also contains the comparison table and images that are used to show the results of enhanced techniques. This book consists of novel concepts and hybrid methods for providing effective solutions for society. It will also include a detailed and explanatory of algorithms in various programming languages like MATLAB, Python, etc.

This book is new and special for those people who are working in the field of image processing, pattern recognition, and security for digital images. The security features of image processing like image watermarking and image encryption, etc., are available in this book. This book is helpful for academicians and researchers to provide complete knowledge with the help of theoretical concepts, mathematical background and illustrated the procedure of image processing and pattern recognition.

## Readers

This book is helpful for researchers, academicians, and developers working in the areas of image processing, pattern recognition, medical imaging, and telemedicine.

*The main features of the book are:*

- It has covered all the latest developments and future aspects of image processing.

- This book is very useful for the new researchers working in the field to quickly know-how the best performing methods.
- The book is concisely written, lucid, comprehensive, application-based, graphical, schematics and covers wider aspects of image processing.

## Chapter Organization

Chapter 1: This chapter presents an overview of contrast enhancement techniques and has proposed one hybrid technique based on an evolutionary algorithm. The proposed technique has been applied to many low-contrast images, and the performance has been compared with the cuckoo search technique, artificial bee colony technique, and other similar techniques.

Chapter 2: In this chapter, the issues related to classification and identification of rice grains are of critical significance at the industrial level for the manufacturing and packaging foodstuffs has been discussed. This study focused on the development of the visual inception system for Sri Lankan rice grain quality based on features of the rice grains.

Chapter 3: Presented an image enhancement and noise reduction technique.

Chapter 4: Discussed the pattern recognition problem and its various stages in detail. In addition to that, the application of deep learning and machine learning in pattern recognition has also been explained.

Chapter 5: Discussed the brain tumor classification using a hybrid artificial neural network with chicken swarm optimization algorithm which consists of various pre-processing and thresholding to extract the lung parenchyma.

Chapter 6: Explained the design of a ConvNet model to extract features from the histological image of breast cancer based upon obtained relevant features by the same network contrary to the current model.

Chapter 7: In this chapter, a partial differential equation filter is introduced to restore noisy images based on anisotropic diffusion-based method in the L-2 framework.

Chapter 8: This chapter aims to discuss the state-of-the-art systems for detecting diabetic eye diseases with traditional and deep learning techniques. A statistical comparison is also made using various performance metrics.

Chapter 9: Proposed a hybrid method to reduce speckle noise from ultrasound images while maintaining a tradeoff between speckle reduction and edge preservation. Extensive work is carried out by taking four different types of images for research: synthetic images, simulated images, noise-free ultrasound images, and original ultrasound images.

Chapter 10: A diversity of approaches for de-noising mammogram pictures have been described, each with its own assumptions, advantages, and limitations. The efficacy of the filters has also been compared using criteria such as MSE and PSNR.

Chapter 11: This chapter, presented image enhancement technique by utilizing the morphological technique. The arrangement of elements determined the increase

of binary pixels in an image. When erosion is applied to the greyscale image, it enhances an image's intensity by enchanting the region extreme after fleeting the constructing part over the object. Outcomes of the technique carried out to several sides of an object indicate that abstract data of the reference object can be effortlessly obtained.

Chapter 12: In this chapter, a despairing depiction-based estimation is used to figure the affirmation cost and offers information to situate evaluation.

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