Preface

INTRODUCTION

In image analysis, the computational improvement increases dramatically through the few last decades. New algorithms have endorsed the powerful computer-assisted analytical approaches development to radiological data. Digital scanners facilities the digitization and the storage of the tissue histopathology slide in the form of digital images. Therefore, digitized tissue histopathology become amenable to the computerized image analysis application as well as machine learning systems. Medical imaging leads to the development of the computer-assisted diagnosis (CAD) algorithms to counterpart the radiologist's opinion. The developed CAD algorithms assist the diagnosis, prognosis and the detection of disease, where the manual analysis of the microscopic digital images (MIRA) by the physicians is a very tedious process. Several factors directly to the importance of the CAD based microscopic image processing. Such limitations and challenges include the impractical examination of all regions of the tissue slide under the microscope at high magnifications (e.g., 40×). In addition, the resulting diagnosis varies considerably between different readers (oncologists) i.e. subjectivity issue. Moreover, uneven staining, occlusion, in homogeneity, multiple area of interest makes prognosis process a major impediment.

Consequently, the present proposed book includes the recent state of the art related to the CAD technology for digitized histopathology. A brief description of the improvement and application of innovative image analysis techniques for specific histopathology related problems are addressed. It provides interesting chapters related to the area of disease, preventive and corrective opinion to classify the particular grades of the lymphoma foe example. Furthermore, a complete prototype for extracting and for processing the information from images is provided. This book addresses the major techniques of segmentation, features extraction and classification and pattern recognition for the Histopathological images as well as their use to support the CAD.

OBJECTIVE OF THE BOOK

Medical image technologies have attracted much attention with the advancement of the medical equipment that devoted to use medical imaging. Microscopic imaging is one of the most significant visualization and interpretation methods in biology and medicine for cells and tissues. It solves real-world problems in decision making, pattern classification, diagnosis and learning will be achieved. In order to achieve all these necessities, feature extraction procedures are developed, which can be considered as a problem-oriented processing techniques in which an algorithm is used to be designed for a specific application. Progressions of this field will assist to intensify interdisciplinary discovery in microscopic image processing and CAD systems to aid physicians in diagnosis and early detection of diseases. The Computer aided system (CAD) can provide superior representation in the form of 3D and quantitative values to assist physicians to correctly diagnose the diseased tissue for further treatment planning. According to the pathology classification, cancer patients are classified into favourable and unfavourable histology based on the tissue morphology and to identify unfavourable histology at initial phase leads to increase the chance to recover the cancer quickly. In this book, an image analysis system that operates on digital Histopathological images is involved. Classification of the Histopathological images in terms of their extracted features such as the brightness, contrast, entropy, hue, saturation and value, size, texture, shape is also studied. Analysis of the histopathological images using artificial neural network and other machine learning techniques are also introduced.

ORGANIZATION OF THE BOOK

To achieve the objectives, this book contains 12 chapters contributed by promising authors that are organized as shown below.

Chapter 1

This chapter focuses on segmentation of Leukocyte Image with Shannon's Entropy. In this chapter a semi-automated approach is proposed by integrating the Shannon's Entropy and DRLS based segmentation procedure. It is used to extract the stained blood cell from digital PBC pictures. This chapter provides Cuckoo Search, SE based pre-processing and DRLS based post-processing procedure to examine the PBC pictures.

Chapter 2

This chapter focuses on microscopic image analysis for Nosema disease. This work develops new technologies in order to solve the bottleneck found on the analysis bee population. This chapter focuses on the detection and study of Nosema cells, extraction of characteristics, and compare the other objects with Nosema.

Chapter 3

This chapter introduces the lossy compression technique with LSTM networks for medical images. Generally medical images have larger in size which leads to a problem in the storage as well as in the transmission of such images. Hence, it is essential to compress these images to reduce the size and also to maintain a better quality. This chapter provides a method for lossy image compression of medical images based on recurrent neural network (RNN).

Chapter 4

This chapter focuses on identification of early cancer by using digital image analysis. To extract characteristic features from the digital images different techniques are used. In this chapter authors discusses some characteristics features of image processing techniques along with the different advanced analytical methods used in oncology.

Chapter 5

This chapter presents multi criteria decision making techniques for histopathological image classification. In this chapter different machine learning algorithms such as K-Nearest Neighbor, Random Forest, Support Vector Machine, Ensemble Learning, Multilayer Perceptron, Convolutional Neural Network are used for analysis. Further, Multi Criteria Decision Making (MCDM) methods such as SAW, WPM and TOPSIS are used to improve the efficiency of the decision making process.

Chapter 6

This chapter introduces the concept of histopathological image analysis for classification using deep learning method. It also introduces the digital pathology and significance of digital pathology techniques in cancer diagnosis. This chapter also provides the method of classification of histopathological images using deep learning for different datasets.

Chapter 7

This chapter describes the concept of K-SVD based algorithm for image denoising. This method is good in performance on the quality improvement of medical image. In addition, authors utilize the technology of improved dictionary learning of the image patches using heap sort mechanism followed by dictionary updation process.

Chapter 8

This chapter focuses on the analysis of medical images using fractal geometry concepts. It is generally applied extensively in medical image analysis in order to detect cancer cell, in human body because our vascular system, nervous system, and bones. It is also successfully applied in ECG signal, brain imaging for tumour detection, and trabeculation analysis.

Chapter 9

The chapter provides detailed analysis of color image encryption using multidimensional Bogdanov map. This chapter concerned with enhancement of dimension of image encryption which deals with pixels shuffling of an image using Bogdanov chaotic map for both gray and color image, where encryption and decryption process are associated with the key. This chapter also analyses the security of image encryption techniques with two parameters called NPCR and UACI.

Chapter 10

This chapter focuses on automatic diagnostic tool for down syndrome detection in Fetus. Down syndrome is a genetic disorder and the chromosome abnormality observed in humans that can cause physical and mental abnormalities. This chapter deals with the creation of automatic and computerised diagnostic tool for Down syndrome detection based on EIF.

Chapter 11

This chapter focuses on adaptive prediction methods for medical image or video compression in telemedicine. Due to rapid development of multimedia communication and advancement of Image acquisition process, there is a crucial requirement of high storage and compression techniques to mitigate high data rate with limited bandwidth

scenario for Telemedicine application. Apart from achieving high compression ratio, there is a need to maintain the original imaging quality along with fast and adequate processing. To overcome these inherent challenges, this chapter reviewed various adaptive prediction techniques for medical images.

Chapter 12

This chapter discusses the concept of HE stain image segmentation concept using type-2 fuzzy set. Generally, most of the cells are colourless and transparent. So, it is difficult to analyse it. So, HE stain methodology is essential in histological section to make the cells distinct and visible which involves the usage of hematoxylin and eosin. Through segmentation, HE Stain image is divided into different segments and from those segments, it will be easy to analyse the particular ROI for which diagnosis will be conducted.

Topics presented in each chapter of this book are unique to this book and are based on unpublished work of contributed authors. In editing this book, we attempted to bring into the discussion all the new trends, experiments, and products that have made image processing in medical decision making as such a dynamic area. We believe the book is ready to serve as a reference for larger audience such as system architects, practitioners, developers, and researchers.

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