Chapter 8
Analysis of Medical Images Using Fractal Geometry

Soumya Ranjan Nayak
KL University, India

Jibitesh Mishra
College of Engineering and Technology, India

ABSTRACT

Fractal dimension is an emerging research area in order to characterize the complex or irritated objects found in nature. These complex objects are failed to analyze by classical Euclidian geometry. The concept of FD has extensively applied in many areas of application in image processing. The thought of the FD will work based upon the theory of self-similarity because it holds structures that are nested with one another. Over the last years, fractal geometry was applied extensively in medical image analysis in order to detect cancer cells in human body because our vascular system, nervous system, bones, and breast tissue are so complex and irregular in pattern, and also successfully applied in ECG signal, brain imaging for tumor detection, trabeculation analysis, etc. In order to analyze these complex structures, most of the researchers are adopting the concept of fractal geometry by means of box counting technique. This chapter presents an overview of box counting and its improved algorithms and how they work and their application in the field of medical image processing.

DOI: 10.4018/978-1-5225-6316-7.ch008

INTRODUCTION

The concept of fractal geometry originally initiated by (Mandelbrot, 1982) in order to characterized to complex objects. Mostly of the objects are surrounded in environment are so complicated and abnormal pattern, hence these types of abnormal structures are decline to analyzed by Euclidean geometry described by Chen et al. (2003), Asvestas et al. (1998), and Lopes and Betrouni (2009). The concept of fractal geometry will work based upon the concept of self similarity. Medical imaging system like human vascular system, nervous system, bones and breast tissue are so complex and irregular in pattern and most of the images carry self similar and statistical self similar content. In order to analysis of this complex medical images, most of the researchers are preferring the fractal concept; This is the region why fractal dimension are most popular research area now a days in the field of medical image analysis reported by Lopes and Betrouni (2009) because most of the human body organs such as tissues, brain and breast texture show complex and irritated geometric structural pattern. These types of irritated geometry structure can be characterized by means of shape properties through dissimilar scaled value. In this regard, Fractal concept shows the primary or key role when irregular surfaces comes in computation. The concept of fractal geometry was deals with self similarity objects, that means magnifying an object by means of deeper details with different scaling value and every distinct portion is look like as similar as the whole. As we discuss earlier those biomedical images generally complex and irritated in nature, that's way the fractal geometry, are widely techniques especially in medical image analysis field. In this context different researchers used different technique in medial image analysis but most of the researchers prefer box counting technique because of its simplicity and easiness. In recent literature survey of different applications of fractal geometry are progressed by means of box counting and its improved versions in both gray scale and color domain. In response to the gray scale domain many methods are presented by different researchers, but in this section we have reported some recent research topic which is related to this literature study like improved box counting at each box scale presented by Nayak et. al (2016), improved DBC by shifting box block gave by Nayak et. al (2016), Effect of error estimation by using box counting by same author (Nayak et. al (2016), Nayak et. al (2017)), comparative study was made in order to select appropriate algorithm for specific objects reported by Nayak et. al (2017), Fractal geometry the beauty of computer graphics presented by Das et. al (2017) and improved triangle box counting reported by Nayak et. al (2018). As concerned to color domain, there are very few technique are evolved like average box counting technique presented by Nayak et. al (2015), roughness subtraction technique by implementing improved differential box counting reported by Nayak et. al (2016), improved color box counting technique by Nayak et al

Related Content

Virtual Reality as Distraction Technique for Pain Management in Children and Adolescents

Barbara Atzori, Hunter G. Hoffman, Laura Vagnoli, Andrea Messeriand Rosapia Lauro Grotto (2019). *Advanced Methodologies and Technologies in Medicine and Healthcare (pp. 483-494).*

www.irma-international.org/chapter/virtual-reality-as-distraction-technique-for-pain-management-in-children-and-adolescents/213622

Education in Prosthetics and Orthotics: The Core of Active Teaching Methodologies

Adriana Isabel Rodrigues González Cavacoand João Miguel Quintino Guerreiro (2022). *Handbook of Research on Improving Allied Health Professions Education: Advancing Clinical Training and Interdisciplinary Translational Research (pp. 273-288).*

www.irma-international.org/chapter/education-in-prosthetics-and-orthotics/302529

Evidence-Based Practice in Osteopathy: Contribution to Develop Better Professionals

Andre Friasand Ana Cristina Ferreira da Costa (2022). *Handbook of Research on Improving Allied Health Professions Education: Advancing Clinical Training and Interdisciplinary Translational Research (pp. 289-310).*

www.irma-international.org/chapter/evidence-based-practice-in-osteopathy/302530

Increasing Health Literacy to Improve Clinical Trial Recruitment

Saliha Akhtar (2018). *Optimizing Health Literacy for Improved Clinical Practices (pp. 94-108).*

www.irma-international.org/chapter/increasing-health-literacy-to-improve-clinical-trial-recruitment/206345