Chapter 1
An Edge Detection Approach for Fractal Image Processing

Kalyan Kumar Jena
Parala Maharaja Engineering College, India

Sasmita Mishra
Indira Gandhi Institute of Technology, India

Sarojananda Mishra
Indira Gandhi Institute of Technology, India

ABSTRACT
Research in the field of fractal image processing (FIP) has increased in the current era. Edge detection of fractal images can be considered as an important domain of research in FIP. Detecting edges in different fractal images accurate manner is a challenging problem in FIP. Several methods have introduced by different researchers to detect the edges of images. However, no method works suitably under all conditions. In this chapter, an edge detection method is proposed to detect the edges of gray scale and color fractal images. This method focuses on the quantitative combination of Canny, LoG, and Sobel (CLS) edge detection operators. The output of the proposed method is produced using matrix laboratory (MATLAB) R2015b and compared with the edge detection operators such as Sobel, Prewitt, Roberts, LoG, Canny, and mathematical morphological operator. The experimental outputs show that the proposed method performs better as compared to other traditional methods.
INTRODUCTION

A fractal is a geometric shape (non regular) which has the equal degree of non regularity on every scale. It is considered as a fragmented or rough geometric structure which can be split into parts each of which is recognized as a reduced size replication of the whole. Several concepts and techniques of FIP are provided by Krantz et al. (1989), Uemura et al. (2000), Falconer (2004), Bassingthwaighte et al. (2013), Russ (2013), Nayak et al. (2015), Nayak et al. (2016), Nayak et al. (2018a), Nayak et al. (2018b), Nayak et al. (2018c), Nayak et al. (2018d), Nayak et al. (2018e), Nayak et al. (2018f), Nayak et al. (2018g), Nayak et al. (2019), Bhatnagar et al. (2019), Joardar et al. (2019), Kadam et al. (2019), Yin et al. (2019), Joshi et al. (2019), Li et al. (2019) and Padmavati et al. (2019). Fractals are considered as never ending patterns. These are referred to as infinitely complex patterns which are self similar across several scales. It is required to repeat a simple process again and again in an ongoing feedback loop in order to create the fractals. From mathematics point of view, a fractal is considered as a subset of Euclidean space for which the hausdorff dimension exceeds (strictly) the topological dimension. Fractals have the tendency to appear nearly equal at several levels. These provide identical patterns at increasingly small scales which are considered as unfolding symmetry or expanding symmetry. When the replication is same (exactly) at every scale, then it is referred to as affine self similar. On the basis of mathematical equations, these are normally nowhere differentiable. Generally, these are not limited to geometric patterns and also describe processes in time. Different techniques such as iterated function systems, L-systems, finite subdivision rules, etc. can be used to generate fractals. Fractal generating programs can be used to create fractal images. These can be used for modelling natural structures, image compression, analysis of medical diagnostic images, study of chaotic phenomenon, study of convergence of iterative processes, etc. Fractal geometry can be used to approximate several natural objects to a certain degree including mountain ranges, clouds, vegetables, coastlines, etc. These geometry concepts can be used to simulate as well as understand several objects in nature. Different methods or operators such as Sobel, Prewitt, Roberts, LoG, Canny, mathematical morphological operator, etc. can be used to detect the edges of fractal images. Several approaches, concepts as well as techniques are provided by Gonzalez et al. (2004), Gonzalez et al. (2007), Wang et al. (2016), Xin et al. (2012), Lahani et al. (2018), Othman et al. (2017), Podder et al. (2018), Shanmugavadivu et al. (2014), Wan et al. (2007), Wang (2007), Patel et al. (2011), Coleman et al. (2004), Huertas et al. (1986), Gupta et al. (2013), Chaple et al. (2014), Alshorman
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