

A 2-D Edge Detection using Hilbert-Huang Transform

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Abstract:

Edge detection has been studied substantially in image processing for the past few decades. Most of the proposed algorithms for edge detection use the differential geometric technique. As discussed in these issues, edges are formed from pixels with derivative values that exceed a preset threshold. The main disadvantage of these forms of edge detectors lies in their inherent low pass filtering of the signal, so that fine detail in image cannot be detected. Most methods of edge detection are focused on determining the locations of edges. In this study, we propose an approach to edge detection based on the empirical mode decomposition (EMD). Using this information about the object size, we may recognize the linear shaped objects, such as rivers.

The algorithm proposed here is based on the EMD method. In order to develop a suitable edge detection scheme we attack the problem in two stages. In the first stage the objective is to calculate the instantaneous frequency of the signal such that most possible edge boundaries are converted into extrema. The Hilbert Huang Transform (HHT) method fulfils this requirement since the bases for expansion of the data are the local characteristics of the data. At the second stage, the extrema that do not correspond edges are removed. We have found that high instantaneous frequencies occur at the edges of objects coincidentally. This finding gives us a guideline for edge detection.

In our method, there are different widths of edge of object detected from various IMFs. A user can choose how wide of edge of object is wanted by themselves. And various length of a signal will lead to the details in different IMFs. The proposed approach is applied to real multispectral images. Our preliminary results show that the proposed approach can successfully detect edges of river in real images.