ITERATIVE AREA SEEDED REGION GROWING FOR MULTICHANNEL IMAGE SIMPLIFICATION

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Abstract Motivated by the unsuitability of the image extrema paradigm for processing multiphase or multichannel images, we propose a solution in the context of image simplification based on a combination of the flat zone and seeded region growing paradigms. Concepts and results are illustrated on satellite images.

Keywords: lambda flat zone, mathematical morphology, area filter.

Introduction

While the image extrema paradigm is a valid assumption for numerous applications, it does not apply to images containing more than two phases such as satellite images with various crop fields. In this situation, objects correspond to regions of homogeneous grey tone rather than simply maxima and minima. It follows that filters acting solely on the image extrema may not produce the desired filtering effect. For example, Fig. 1 displays the flat zones of a satellite image processed by the self-dual alternating filter based on 8-connected area opening and closing up to an area of 25 pixels. Although this filter ensures that all extrema of the filtered image are larger or equal to the size of the filter, flat zones belonging to non-extrema regions can be arbitrarily small in the filtered image. Indeed, transition regions and non-extrema plateaus may be preserved by this filter even if their extent is smaller than the selected area parameter [8]. Likewise, the extrema paradigm does not apply to multichannel images owing to the lack of total ordering between vectors of more than one dimension. It

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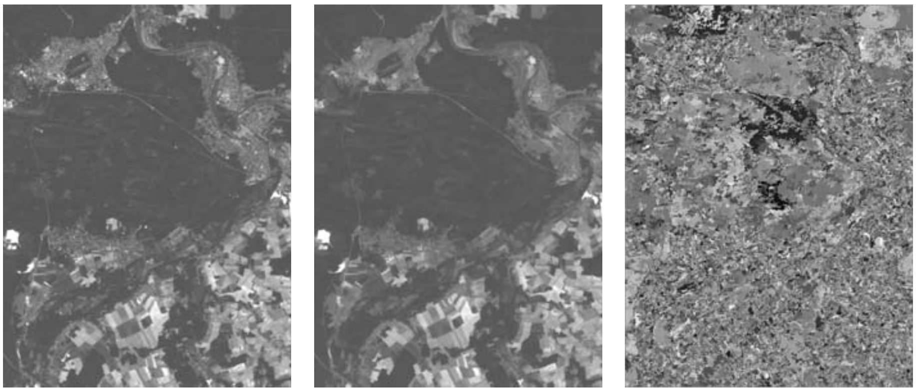

Figure 1. *Left:* Subset of the 3rd channel of a Landsat image with Fontainebleau at the upper left, 481 × 641 pixels (25 m resolution). *Middle:* Self-dual alternating sequential 8-connected area opening and closing up to 25 pixels applied to the left image. *Right:* Partition of the middle image (labelled 8-connected flat zones). Note the presence of many flat zones with an area less than 25 pixels. In this example, the number of 8-connected flat regions drops from 151,715 to 83,808.

follows that objects of multichannel images are often considered as regions whose pixels have similar vector values.

In this paper, we propose to tackle these problems in the context of multichannel images by combining the flat zone [7] with the seeded region growing [1] paradigms while considering an iterative scheme. The proposed methodology is developed in Sec. 1. Related works are briefly discussed in Sec. 2. We then conclude and present some ideas for future research in Sec. 3.

1. Methodology

The proposed methodology proceeds iteratively until a given area threshold value is reached. Denoting the current area value by i, which is initialised to 2 pixels, it can be summarised as follows: (i) select all flat zones whose area is greater than or equal to i, (ii) grow the selected flat zones so as to obtain a new partition of the image definition domain into flat zones, and (iii) stop if i has reached the threshold value, otherwise increment i by 1 and go to (i). The two main steps of our procedure are detailed hereafter as well as post processing steps to further improve the simplification results with the aim to vectorise the output image.

Quasi-flat zone filtering

We extend the definition of quasi-flat zones [5] to multichannel images as follows. Two pixels $\mathbf{x}$ and $\mathbf{y}$ belong to the same quasi-flat zone of