

A CONTEXT BASED TECHNIQUE FOR SMOOTHING OF DIGITAL THEMATIC MAPS

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ABSTRACT

This paper describes a context based technique for smoothing digital thematic maps produced by multispectral classification of Landsat Thematic Mapper data. The output of this technique is a "maplike" product which can be directly used as input to a geographic information system.

Keywords - classification, remote sensing, geographic information systems, image analysis.

INTRODUCTION

The work described here is the result of ongoing research at MacDonald, Dettwiler and Associates Ltd. into techniques for automated mapping utilizing remotely sensed data.

Multispectral classification techniques have been used on Landsat data to produce landcover maps. Traditional pixel-by-pixel multispectral classification techniques generally result in noisy or "speckly" images with a large number of small polygons which complicate the image and make the thematic image difficult to interpret. When classified imagery is used as an input to geographic information systems, the complexity of the classified image does not facilitate ease of map update or production. Thus there is a need for an effective technique to convert the classified image to a more cartographically acceptable product.

The role of a map is to effectively present information to users for their specific application at a given level of detail. In traditional mapping, a minimum mapping unit criteria is frequently used to simplify the map. In developing the final map, a cartographer takes into consideration contextual and esthetic factors.

Context plays an important role in cartography. It has been found that a large degree of the "errors" in automated computer classification is one of contextual interpretation. Even if an image could be classified with 100% accuracy, if it does not correspond to the interpretation desired by the mapper it would have "error". Interpretation frequently depends on the size, shape, and context. A small clearing

inside a forest may still be interpreted as "forest" whereas a similarly sized bog inside a forest may be interpreted as "bog".

In this paper we demonstrate a technique which incorporates context in smoothing the digital thematic map to produce a more "maplike" product.

REVIEW OF EXISTING TECHNIQUES FOR SMOOTHING DIGITAL THEMATIC MAPS

Several different techniques for smoothing classified images have been documented including majority and minimum area filtering techniques [DAV76,SCH83].

In the majority filtering approach, the center pixel of an N-by-N neighborhood is replaced by the majority class of the neighborhood so small isolated polygons will be eliminated. Although this technique significantly reduces the number of polygons, small polygons still remain as there is no explicit control over the minimum polygon size. With larger window sizes there is a tendency for the majority filter to erode smaller features and affect the integrity of the polygon boundary location. Smaller window sizes however, do not produce adequate smoothing.

In the minimum area filtering approach, the class of an undersized polygon is converted to the the class of the polygon with which it shares the largest common boundary. Since there is no explicit control of the class conversion of undersize polygons, there may be undesired class conversions when an undersized polygon is converted to a very dissimilar class rather than to a more similar neighbor.

INCORPORATING CONTEXT IN SMOOTHING OF DIGITAL THEMATIC MAPS

Recognizing the importance of context in mapping we conclude that an effective technique for smoothing thematic maps should attempt to incorporate context.

As an example of the importance of context, we cite criteria used by the B.C. Forest Service in their production of forest cover maps [FOR82]:

