International Journal of Engineering and Technology Innovation, vol. 8, no. 3, 2018, pp. 200-216

Hardware Implementation of Road Network Extraction Using Simplified Gabor Wavelet in Field Programmable Gate Array

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Received 02 November 2017; received in revised form 26 January 2018; accepted 04 February 2018

Abstract

Automatic detection of road networks from the satellite and aerial images is the most demanded research area, and it is used for various remote sensing applications. The Simplified Gabor Wavelet based approaches are used to extract the road network automatically. In this paper, a field programmable gate array architecture designed for automatic extraction of road network using Simplified Gabor Wavelet is proposed. The hardware implementation results are compared with software implementation results. The performance measures such as completeness, correctness and quality are calculated. In the software implementation, the average value of completeness, correctness, and quality of various images are 91%, 98%, and 89% respectively. In the hardware implementation, the average value of completeness, correctness, and quality are 89%, 97%, and 87% respectively. The performance of the proposed algorithm is also proved in noisy images. These measures prove that the proposed work yields road network very resembling to reference road map.

Keywords: road network extraction, simplified Gabor wavelet, field programmable gate array, connected component

1. Introduction

Automatic detection of road networks from the satellite and aerial images is the most demanded research subject and it is used in many computer vision applications [1]. The updating of road network databases is essential to many GIS (Geographic Information System) applications like navigation, urban planning, route planning, health care accessibility planning, land cover classification and infrastructure management etc. The proposed work is boundary and centerline of road network extraction using Simplified Gabor Wavelet (SGW) and FPGA architecture is proposed for this road network extraction method.

The remaining part of this paper is organized as follows. In Section 2, a literature survey on road network extraction is given. Section 3 presents road network extraction using SGW. Section 4 provides the results and discussion of the proposed algorithm. In Section 5, FPGA Architecture for Road Network Extraction using SGW is proposed. Section 6 gives FPGA implementation and synthesis results of the proposed architecture, and Section 7 provides the conclusion of the paper.

2. Literature Survey

Many research works have been proposed for automatic road network extraction using wavelet transform for the past few years. Guan et al. have presented an approach for road centerlines extraction and width estimation [1]. Canny is used to detecting

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