

ROAD IDENTIFICATION IN LANDSAT THEMATIC MAPPER IMAGERY USING PULSE-COUPLED NEURAL NETWORKS: AN INITIAL ASSESSMENT

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ABSTRACT

Classifying roads in remotely sensed imagery has been addressed by a number of research efforts. Detecting these features is important for a variety of endeavors such as agricultural assessment and urban planning. This study investigates the viability of using a pulse-coupled neural network to recognize roads in Landsat-4 Thematic Mapper multispectral imagery.

KEY WORDS

Computer Vision, Remote Sensing, Neural Networks, Environmental Assessment, AI

1 Description

The Landsat-4 Thematic Mapper images the earth in seven spectral bands ranging from visible to infrared. The analysis TM-4 imagery is important for assessing changes over time in areas such as climate and land use. It also provides an appropriate challenge for road detection algorithms since the 30m ground resolution for a pixel exceeds the width of a typical road. This study represents the first step toward a comparison of the pulse coupled approach with other studies[1].

Pulse Coupled Neural Networks (PCNN) attempt to model neuron interactions in time. Based upon physiological models, when stimulated the PCNN produces a succession of binary output pulses[2]. In image processing, an individual neuron receives input from a single, scaled, gray level pixel in the original image along with a receptive field consisting of a weighted neighborhood. This results in a series of binary images highlighting salient features, in this case potential road pixels from band 3 (Figure 1) as shown in Figure 2.

The preliminary results illustrated here suggest that the pulse-coupled neural network has potential for satellite road discrimination. The ongoing work will include a quantitative assessment of its performance, a comparison with other approaches, and an exploration of its potential for integration into hybrid classifiers.

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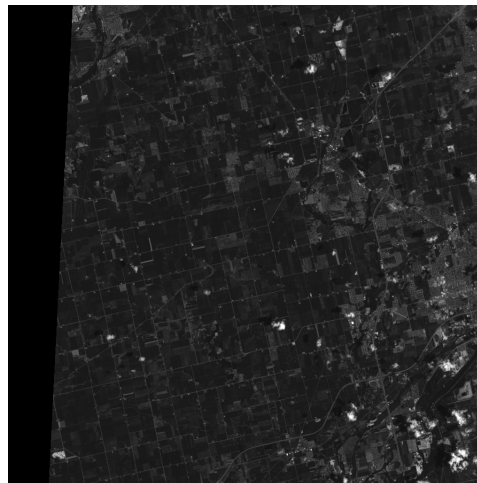


Figure 1: Landsat Band 3



Figure 2: Landsat Band 3 Roads

References

- [1] James Wolfer James Robergé Thom Grace. Learning vector quantization vs multilayered perceptrons for classifying landsat thematic mapper imagery. *World Congress on Neural Networks Proceedings*, 1995.
- [2] Thomas Lindblad and Jason M. Kinser. *Image Processing using Pulse-Coupled Neural Networks*. Springer Verlag, 1998.