Optimized Neural Networks Using Principal Component Analysis for Automatic Road Extraction from Remote Sensing

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Abstract
Remote sensing imagery has become an invaluable tool to observe and study the earth’s surface. With the increasingly availability of multi-spectral remote sensing images, color provides another important feature extracting road networks. From a scientific perspective, the extraction of roads in complex environments is one of the challenging issues in Photogrammetry and computer vision since many tasks related to automatic scene interpretation are involved. The aim of this paper is to show the ability of satellite imagery in road mapping by using Artificial Neural Networks (ANN) and Principal Component Analysis (PCA) of multi spectral SPOT imagery. The results demonstrate that the elimination of correlated information in the sample data by PCA improve the MLP estimation performance and reduce the required training time. We have obtained very accurate results (less than 0.03) for the MSE. This approach is distinguished from previous work by the choice of the structure of multilayer neural networks input based mainly on two PCA and the neighbors of the pixel influencing greatly the quality of output (extracted road network image). The system includes different modules: (1) data pre-processing and PCA transformation, (2) neural networks for road extraction (3) procedure of road centerline and vectorization. The results show that the proposed method for road extraction is very effective and demonstrate its performance.