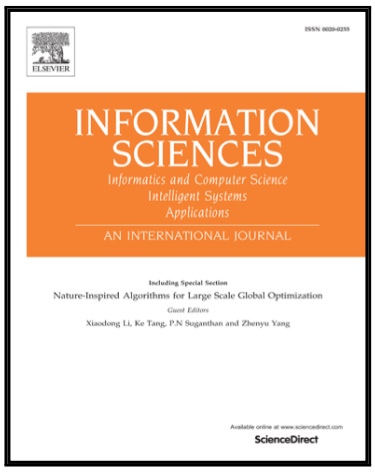

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A Deep Heterogeneous Feature Fusion Approach For Automatic Land-Use Classification

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Abstract

In remote sensing, images have assorted appearances due to fused boundaries, making it difficult to generate discriminative feature representation for the purpose of conducting classification tasks. Therefore, an effective feature representation can boost the classification accuracy in the field of satellite imaging. In this paper, we propose a novel hybrid system for satellite image classification that combines the distinct information of ~~different~~ deep features, and generate a discriminative representation by preserving the essential information of original feature space. We use pre-trained convolutional neural networks for extracting our features via transfer learning. For this purpose, we first propose a single strategy where fully connected layers are effectively used to represent different levels of ~~representation of the~~ [per] image features. Secondly, a robust approach, called entropy controlled neighborhood component analysis, is then proposed to optimize ~~the~~ [per] fusion of multiple layers of different architectures in a unified hierarchical manner ~~with entropy controlled neighborhood component analysis~~[per]. To validate the effectiveness of the proposed approach, we perform experiments on three benchmark satellite datasets; UC MERCED, RS19 and AID. We statistically analyze our results ~~by~~[per] with analysis of variance and post-hoc Bonferroni test, and compare our proposed methodology with state-of-the-art methods. Experimental results show that the proposed methodology can accurately classify satellite images with 99.7%, 99.1% and 92.2% accuracy with selected classifier and by utilizing less than 5% features.

Keywords: `Convolutional neural network, Transfer learning, Entropy information Neighborhood component analysis, Satellite imaging.`

1. Introduction

Remote sensing, in general, is a procedure to collect information without making direct physical contact with the object, material, or phenomenon under investigation. The complete process involves detection, by means of sensor technologies, followed by measurement of radiation at different wavelengths, either reflected or emitted from distant objects or materials. Remote sensing proffers local, regional and global observations, which ratifies its significance for many applications including land cover/land use [1], agriculture monitoring [49], ~~soil mapping,~~[per] forestry management [22], ~~city planning, archaeological~~

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