Defense Announcement

Superpixel based Active Learning and Online Feature Importance Estimation for Hyperspectral Image Analysis

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The rapid development of multi-channel optical imaging sensors has led to increased utilization of hyperspectral data for remote sensing. For a classification of hyperspectral data, an informative training set is necessary for ensuring robust performance. However, in remote sensing applications, labeled samples are often difficult, expensive and time-consuming to obtain. This makes active learning (AL) an important piece of an image analysis framework --- AL aims to efficiently build a representative and efficient library of training samples that are most informative for the underlying classification task. This thesis proposes an AL framework that leverages from superpixels. First, a semi-supervised AL method is proposed that leverages the label homogeneity of pixels in a superpixel, leading to a faster convergence using few training samples. Secondly, a spatial-spectral AL is proposed that integrates spatial and spectral features extracted from superpixels in an AL framework. The experiments with an urban land cover classification and a wetland vegetation mapping task show that the proposed methods have faster convergence and superior performance compared to baselines. Importantly, our proposed framework has a key additional benefit in that it is able to identify and quantify feature importance --- the resulting insights can be highly valuable to various remote sensing image analysis tasks.