SEMI-SUPERVISED INTERACTIVE UNMIXING FOR HYPERSPECTRAL IMAGE ANALYSIS

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ABSTRACT

Hyperspectral unmixing is the task of decomposing each pixel into a set of pure material signatures (called *endmembers*) with the corresponding proportions of each material found in each pixel. In this thesis, novel hyperspectral approaches are proposed that leverage interactive and semi-supervised approaches to improve unmixing results.

Fully supervised hyperspectral unmixing approaches are generally infeasible as the number of pixels in a hyperspectral image is often in the tens- or hundreds-of-thousands and obtaining accurate pixel-level labels is prohibitively expensive or simply impossible. Thus, many hyperspectral unmixing algorithms in literature only use the hyperspectral image. However, there are often other ancillary information regarding the image available that could be used to assist the unmixing process and do not add an infeasible amount of labeling tasks. Motivated by this, novel semi-supervised hyperspectral techniques (semi-supervised PM-LDA) are proposed. The proposed semi-supervised approaches allow supervision over hyperspectral unmixing to improve the unmixing performance but do not require complete pixel-level accurate labels for training data set. The ancillary information (e.g. Open Street Map) is incorporated to provide the spatial information and imprecise labels. In addition, in order to identify which pixels need to be (re-)labeled interactively during the unmixing process, an instance influence estimation approach is proposed, which simplifies the job of the analyst.

Results on real hyperspectral data sets indicate that the proposed instance influence estimation methods can effectively identify the most influential instances. Experiments on semi-supervised PM-LDA show that the overall hyperspectral unmixing accuracy is improved.