Abstract

In this paper, unsupervised segmentation methods are investigated for surficial materials mapping in Nunavut, Canada. Different satellite data sources including RADARSAT-2 polarimetric image, LANDSAT-7 image, and DEM data are combined and three unsupervised segmentation methods are compared. Results show that IRGS has better performance than the other two methods.

Introduction

The Canadian Arctic is important to the Geological Survey of Canada (GSC) because better understanding of the Arctic’s land cover is required to support decision making on northern resource development. This study focuses on the performance of unsupervised segmentation methods in the Umiujaq Lake area in Nunavut. Multisource remote sensing data including RADARSAT-2 polarimetric, LANDSAT-7 images, and digital elevation model (DEM) are used.

Experimental results

Methods for comparison include k-means, Gaussian mixture model (GMM) [3], and IRGS [4]. K-means and GMM are baseline methods for image segmentation. After each pixel is assigned a clustering label, a confusion matrix is calculated in which each class label corresponds to each cluster label. Only pixels in training areas are considered in the confusion matrices. Table 1 and Table 2 show that “Classes with little vegetation” and “Classes with vegetation” cannot be separated into two clusters by either k-means or GMM. Table 3 shows that they can be approximately separated into two classes by IRGS after spatial context and edge strength are taken into consideration.

Finally the best accuracy is calculated considering all the permutations. The result is shown in Table 4. IRGS outperforms both k-means and GMM, and achieves highest overall accuracy.

Conclusions

A comparison of unsupervised segmentation methods is made for surficial materials mapping in Nunavut, Canada. RADARSAT-2 polarimetric magnitude, LANDSAT-7 intensity, and DEM height information are combined into a feature set. K-means, GMM, and IRGS are used for unsupervised segmentation. Experimental results show that IRGS outperforms k-means and GMM. Future direction is to use limited number of labeled samples to build the unsupervised segmentation.

Reference


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