BAND SELECTION FOR HYPERSPECTRAL IMAGES BASED ON PARALLEL PARTICLE SWARM OPTIMIZATION SCHEMES

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Abstract

The advances of sensor technologies and the benefits of studying high dimensional spectral images make use of a growing number of spectral bands. High-dimensional remote sensing datasets obtained from multispectral, hyperspectral or even ultraspectral bands generally provide enormous spectral information for data analysis. It covers an abundance of applications from satellite remote sensing imaging and surveillance monitoring systems to industrial product inspections and medical imaging examinations. Researchers all describe the difficulties associated with the feasibility of distribution estimation. Accordingly, selecting the most valuable and meaningful information has become more important. In response, a technique known as g*reedy modular eigenspaces* (GME) has been developed [1] for the band selection of hyperspectral datasets. GME attempts to greedily select a near-optimal unique band (feature) set from hyperspectral images. Unfortunately, it is hard to find the most optimal set by greedy reordering operations of GME except by exhaustive iterations. The long execution time of these exhaustive iterations has been the major drawback in practice. Consequently, finding an optimal (or near-optimal) solution is very expensive. In this study we present a novel parallel mechanism, referred to as *parallel particle swarm optimization* (PPSO) *band selection*, to overcome this disadvantage. It makes use of a new *particle swarm optimization* scheme [2], which is a well-known method to solve the optimization problems, to develop the effective parallel feature extraction algorithm for hyperspectral imagery. The proposed PPSO can be expected to improve the computational speed by using parallel computing techniques which include the *compute unified device architecture* (CUDA) [3] of *graphics processor unit* (GPU) [4], the cluster-based library of *message passing interface* (MPI) and

the multicore-based application programming interface of *open multi-processing* (OpenMP). These parallel implementations can fully utilize the significant parallelism of proposed PPSO to create a set of near-optimal GME modules on each parallel node. In order to shorten the communication time and obtain the same computational loads on each parallel node, the loads of PPSO are balanced by using a load estimator to evenly distribute the hyperspectral datasets for a better computational performance.

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