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Acceleration of ISOMAP for Hyperspectral Image Classification on Multicore Processors and GPUs

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The isometric mapping (Isomap) is a nonlinear dimensionality reduction method that is often used for analyzing hyperspectral images. To achieve such objective, Isomap involves the construction of a neighbourhood graph and the computation of the shortest paths between the nodes. Moreover, it uses the state-of-the-art MultiDimensional Scaling method (MDS) for dimensionality reduction. In this work, two efficient parallel versions of ISOMAP using OpenMP and CUDA have been developed and evaluated on multicore and GPU. On the one hand, we propose to use Isomap with SMACOF, the most accurate MDS method. On the other hand, we propose to use an insertion sort instead of the k-nearest neighbours' algorithm (KNN) for the construction of the neighbourhood graph. Since the number of managed neighbours by ISOMAP is low, the insertion sort is proved to be more efficient than KNN.