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Unsupervised Feature Selection Based on the Morisita Index for Hyperspectral Images

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Hyperspectral sensors are capable of acquiring images with hundreds of narrow and contiguous spectral bands. Compared with traditional multispectral imagery, the use of hyperspectral images allows better performance in discriminating between land-cover classes, but it also results in large redundancy and high computational data processing. To alleviate such issues, unsupervised feature selection techniques for redundancy minimization can be implemented. Their goal is to select the smallest subset of features (or bands) in such a way that all the information content of a data set is preserved as much as possible.

The present research deals with the application to hyperspectral images of a recently introduced technique of unsupervised feature selection: the Morisita-Based filter for Redundancy Minimization (MBRM). MBRM is based on the (multipoint) Morisita index of clustering and on the Morisita estimator of Intrinsic Dimension (ID). The fundamental idea of the technique is to retain only the bands which contribute to increasing the ID of an image. In this way, redundant bands are disregarded, since they have no impact on the ID. Besides, MBRM has several advantages over benchmark techniques: in addition to its ability to deal with large data sets, it can capture highly-nonlinear dependences and its implementation is straightforward in any programming environment.

Experimental results on freely available hyperspectral images show the good effectiveness of MBRM in remote sensing data processing. Comparisons with benchmark techniques are carried out and random forests are used to assess the performance of MBRM in reducing the data dimensionality without loss of relevant information.

References

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