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Classification of Hyperspectral Image Using Mathematical Morphological Operator-Based Distance Metric

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Abstract : In this article, we proposed a pixel-wise classification of hyperspectral images using a mathematical morphology operator-based distance metric called “dilation distance” and “erosion distance”. This method involves measuring the spatial distance between the spectral features of a hyperspectral image across the bands. The key concept of the proposed approach is that the “dilation distance” is the maximum distance a pixel can be moved without changing its classification, whereas the “erosion distance” is the maximum distance that a pixel can be moved before changing its classification. The spectral signature of the hyperspectral image carries unique class information and shape for each class. This article demonstrates how easily the dilation and erosion distance can measure spatial distance compared to other approaches. This property is used to calculate the spatial distance between hyperspectral image feature vectors across the bands. The dissimilarity matrix is then constructed using both measures extracted from the feature spaces. The measured distance metric is used to distinguish between the spectral features of various classes and precisely distinguish between each class. This is illustrated using both toy data and real datasets. Furthermore, we investigated the role of flat vs. non-flat structuring elements in capturing the spatial features of each class in the hyperspectral image. In order to validate, we compared the proposed approach to other existing methods and demonstrated empirically that mathematical operator-based distance metric classification provided competitive results and outperformed some of them.

Keywords : dilation distance, erosion distance, hyperspectral image classification, mathematical morphology
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