Multi-way Shape Measurements for Classification Tasks in a Dissimilarity Representation Space.

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Representation of objects by multidimensional data arrays has become very common for many research areas, as image analysis, signal processing and chemometrics.
Multiway data analysis is the extension of multivariate analysis when data is arranged in the multiway structure. Nevertheless, this type of data will not be analyzed optimally by the traditional multivariate methods, which do not take into account the multiway structure.
A number of methods for multiway analysis have been proposed. Most of these methods are for exploratory and regressions purposes. Classification has been less studied.
This work introduces the dissimilarity representation approach as a new tool for the classification of multiway data and also in this context a new 2D measure (2D Shape) for classification tasks in three ways spectral data is presented. This measure is based on the combination of ID measures taking into account the information of both measurements directions.
Even the good performance obtained comparing it with the 1D traditional approach and the 2D existing measures, this measure still has some limitations because does not take into account the simultaneous shape changes in both directions of the surfaces of 2D continuous data. To solve this problem a continuous multiway shape measurement (CMS) is presented, which is based on the differences between the gradients of objects. The new measure allows taking into account the complex multidimensional structure, such that the shape information of the surfaces (objects) can be considered in the dissimilarity representation of the objects. The way the measure has been defined, allows to use different gradient convolution kernels, according to the problem at hand. .
Results have corroborated the presented argument that considering the continuous multiway nature of these type of data in their analysis can lead to better results. Moreover , it is shown that by taking into account the information in more directions, results can be improved. This measure has also the advantage that is easily extended to high dimensions multiway data.