Multiset Canonical Correlations Analysis and Multispectral, Truly Multitemporal Remote Sensing Data - DTU Orbit (31/01/2019)

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This paper describes two- and multiset canonical correlations analysis (CCA) for data fusion, multi-source, multiset or multi-temporal exploratory data analysis. These techniques transform multivariate multiset data into new orthogonal variables called canonical variates (CVs) which when applied in remote sensing exhibit ever decreasing similarity (as expressed by correlation measures) over sets consisting of 1) spectral variables at fixed points in time (R-mode analysis), or 2) temporal variables with fixed wavelengths (T-mode analysis). The CVs are invariant to linear and affine transformations of the original variables within sets which means, for example, that the R-mode CVs are insensitive to changes over time in offset and gain in a measuring device. In a case study CVs are calculated from Landsat TM data with six spectral bands over six consecutive years. Both R- and T-mode CVs clearly exhibit the desired characteristic: they show maximum similarity for the low order canonical variates and minimum similarity for the high order canonical variates. These characteristics are seen both visually and in objective measures. The results from the multiset CCA R- and T-mode analyses are very different. This difference is ascribed to the noise structure in the data. The CCA methods are related to partial least squares (PLS) methods. The paper very briefly describes multiset CCA based multiset PLS. Also, the CCA methods can be applied as multivariate extensions to empirical orthogonal functions (EOF) techniques. (Multiset) CCA is well suited for inclusion in geographical information systems, GIS.

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