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Maximum auto-mutual-information factor analysis

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ABSTRACT

Based on the information theoretical measure mutual information derived from entropy and Kullback-Leibler divergence, an alternative to maximum autocorrelation factor analysis is sketched.

1. INTRODUCTION

In signal and image processing principal component analysis¹ (PCA) is often used for dimensionality reduction and feature extraction in pre-processing steps to for example classification.

In remote sensing image analysis PCA is often replaced by maximum autocorrelation factor² (MAF) or minimum noise fraction³ (MNF) analysis. This is done because MAF and MNF analyses incorporate spatial information in the orthogonalization of the multivariate data which is conceptually more satisfactory and which typically gives better results.

In this contribution, autocorrelation between the multivariate data and a spatially shifted version of the same data in the MAF analysis is replaced by the information theoretical, entropy and Kullback-Leibler divergence based measure mutual information.^{4–8} This potentially gives a more detailed decomposition of the data. Also, the orthogonality between already found components and components of higher order requested in the MAF analysis is replaced by a requirement of minimum mutual information between components. These ideas resulting in maximum auto-mutual-information factor analysis are in turn based on.^{9–11}

The sketched methods are used on the well-known AVIRIS*¹² Indian Pines data.

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*<https://aviris.jpl.nasa.gov/>

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