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Robust multiway PCA for casewise and cellwise outliers

Tuesday, 17 September 2024 12:30 (30 minutes)

Multi-way data extend two-way matrices to a higher-dimensional tensor. In many fields, it is relevant to pursue the analysis of such data by keeping it in its initial form without unfolding it into a matrix. Often, multi-way data are explored by means of dimensional reduction techniques. Here, we study the Multilinear Principal Component Analysis (MPCA) model, which expresses the multi-way data in a more compact format by determining a multilinear projection that captures most of the original multi-way data variation. The most common algorithm to fit this model is an Alternating Singular Value Decomposition algorithm, which, despite its popularity, suffers from outliers. To address this issue, robust alternative methods were introduced to withstand casewise and cellwise outliers, respectively, where two different loss functions are tailored based on the type of outliers. However, such methods break when confronted with datasets contaminated by both types of outliers. To address this discrepancy, we propose a method by constructing a new loss function using M-estimators for multi-way data, offering robustness against both kinds of anomalies simultaneously. Extensive simulations show the efficacy of this Robust MPCA method against outliers, demonstrating its potential in robust multi-way data analysis.

Type of presentation

Talk

Classification

Both methodology and application

Keywords

Robust statistics; Multiway data analysis; Tensor decomposition

Primary authors: CENTOFANTI, Fabio (University of Naples Federico II); HIRARI, Mehdi (KU Leuven); HUBERT, Mia (KU Leuven); Prof. VAN AELST, Stefan (KU Leuven)

Presenter: HIRARI, Mehdi (KU Leuven)

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