Mini-Lecture: Brief outline of the math behind MCIA

Max Mattessich Joaquin Reyna Anna Konstorum

9/1/2022

Introduction

Multiple Co-Inertia Analysis (MCIA) is a joint dimensionality reduction method which takes as input multiple datasets from the same sample but different different experimental sources. This method then calculates factors that find relationships across all data sources and the resulting matrix compositions can be used for a variety of downstream analyses.

Theory

Table of abbreviations

Abbreviation	Description
X	Dataset matrix or global data matrix (MCIA) typically in $\mathbb{R}^{n\times p}$
p	The number of columns/variables/features of the global data matrix
n	The number of rows/samples/observations of the global and block data matrices
X_k	k^{th} Data block matrix in the multi-block stucture (MCIA)
p_k	The number of columns/variables/features f the h^{th} block data matrix
N	The number of blocks in the multi-block structure of X
$f^{(j)}$	PC score of order j (PCA) or global score of order j (MCIA)
$a^{(j)}$	PC loading of order j (PCA) or global loading of order j (MCIA)
$f_k^{(j)}$	Block score for block k of order j
$a_k^{(j)}$	Block loading for block k of order j
S or S_X	Covariance matrix of dataset X
$T^{(j)}$	the $n \times N$ matrix with columns consisting of the order-j block scores

. . . (tbd)