SUPERVISOR MODULE

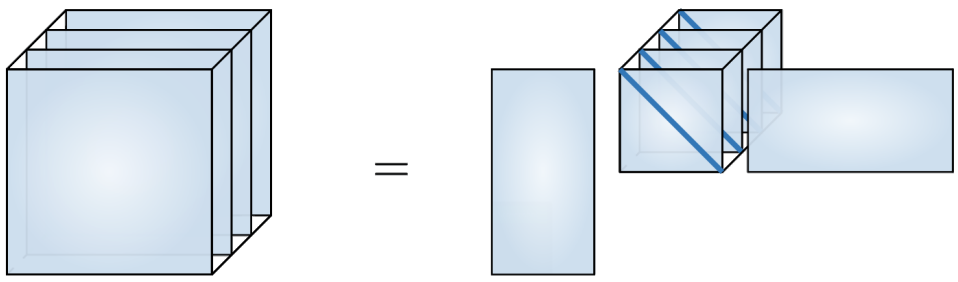
ALGEBRAIC ALGORITHMS FOR TENSOR-BASED SIGNAL SEPARATION

Details Studenten

Higher-order tensors are ``matrices in more than two dimensions''. Tensor methods are intensively studied in many disciplines nowadays. One of the core problems in signal processing consists of splitting data into meaningful components. The most well-known instance of this is probably the cocktail party problem: at a party we succeed in understanding the words spoken to us, while actually several people are speaking at the same time. Signal separation is of importance in application areas as audio, image processing, telecommunications (OFDM, CDMA, ...), array processing, biomedical problems (EEG, ECG, fMRI, ...), data mining, chemometrics, econometrics, bioinformatics, astrophysics, and so on.

The Canonical Polyadic Decomposition (CPD), or “rank decomposition”, writes a higher-order tensor in a minimal sum of rank-1 terms and is as such a very fundamental concept. Contrary to conventional matrix decompositions, CPD is unique under mild conditions. The uniqueness of the underlying components makes that they can in principle be recovered. In other words, CPD is a basic tool for finding the components that are present in a data set. This feature of the CPD explains to a large extent the importance of the tensor framework for data analysis and signal separation and why it is better suited than conventional matrix techniques.

The goal of this thesis is to develop superior algebraic methods for the computation of the CPD, along with their application in signal separation. We expect that the new algorithms will extend the range of settings in which recovery of underlying data components is possible. Two tracks will be explored. A first track is founded on an interpretation of CPD as an extension of the generalized eigenvalue decomposition (GEVD) of a matrix pencil, involving only two matrices, to a multi-matrix setting. The other way around, with a CPD multiple matrix GEVDs may be associated. This opens up an avenue of new computational strategies in the style of numerical linear algebra, of which the application range exceeds the tensor setting. In a second track, we will explore connections with sets of linear equations with low-rank-structured solution.



Bijlagen

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VOEG TOE

Promotoren	Co-promotoren	Mentors	Assessoren
Lieven De Lathauwer		Andreas Devogel	

Project URL

(leeg)

Naam organisatie / URL

(leeg)

Opmerkingen

The required know-how w.r.t. tensor methods is acquired through discussions, attending a few lectures and a limited, guided study of the literature. A concise course text is available. New algorithms are developed with attention for numerical aspects. The algorithms are validated on synthetic examples and real-life data.
Depending on the interest, the emphasis can be put less or more on algebraic aspects, numerical aspects, implementation or applications. The algorithms are implemented in Matlab and may eventually become part of Tensorlab (www.tensorlab.net).

Wiskundige ingenieurstechnieken

Mathematical Engineering

Status

ontwerp

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Laatst gewijzigd door

Lieven De Lathauwer

Disciplines

NUMA

STADIUS

Plasma-astrofysica

Embargo

Aantal studenten

1 - 2

‹ **OVERZICHT ONDERWERPEN**