SUPERVISOR MODULE

POLYNOMIAL METHODS FOR SPARSE MODELLING

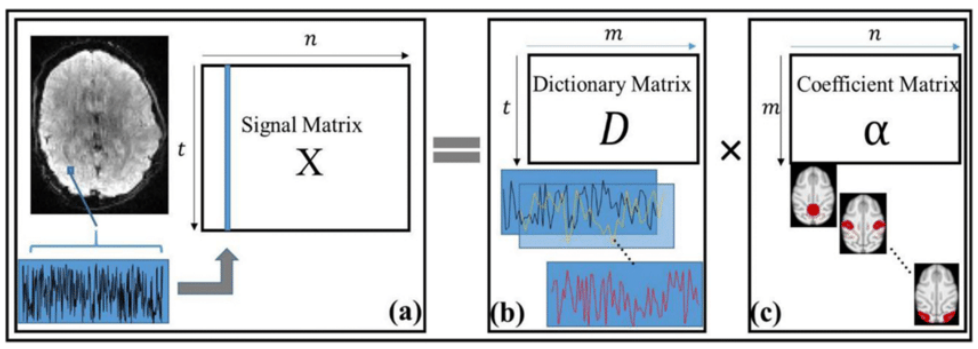
Details Studenten

Sparse approximation is about finding a sparse solution to an underdetermined set of linear equations, A x = b, where A is (mxn) with m < n. The vector b is a given signal that we wish to model as a linear combination of just a few columns of the given matrix A, which is therefore called the dictionary. This basic problem has countless applications in signal processing, machine learning, data analysis, and more.

Standard approaches such as basis pursuit rely on a relaxation of the problem formulation that allows one to find the unknown sparse vector x by convex optimization. For noisy data, which do not allow an exact sparse representation, one typically adjusts the sparsity level so that the data vector b is reconstructed within a certain tolerance.

An alternative approach would be to minimize the approximation error for a given fixed sparsity level. It turns out that this can be done by solving a set of polynomial equations with a highly structured coefficient matrix. Sets of polynomial equations are deeply connected to tensor decompositions. Rather than relying on convex optimization, the alternative approach is closer to numerical linear algebra, and in particular to (sets of) matrix eigenvalue decomposition(s).

The goal of this thesis is to explore the alternative approach and contrast it to the standard approaches. Depending on the interest, more or less emphasis can be put on numerical aspects, implementation, applications, or development of extensions and variants. As far as numerical aspects are concerned, one could for instance exploit the structure in the coefficient matrix of the set of polynomial equations for speed-up. Variants include structured sparsity (where the columns of A form (possibly overlapping) groups of dictionary vectors to choose from) and constrained sparse approximation (for instance, nonnegativity constraints on x would enforce a sum-of-parts interpretation in a nonnegative dictionary, greatly facilitating the interpretation in applications such as spectral analysis). As a possible extension, one can see that the alternative approach naturally allows for an estimation/fine-tuning of the dictionary itself. Indeed, if columns of A depend in a polynomial manner on some parameters, then the latter may be estimated along with the coefficients of x.



Sparse modelling of brain signals.

Bijlagen

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VOEG TOE

Promotoren	Co-promotoren	Mentors	Assessoren
Lieven De Lathauwer			

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. Contact moments are both possible on Campus Leuven (ESAT) and Campus Kortrijk (Kulak).

Artificiële Intelligentie

Status

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Laatst gewijzigd door

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Disciplines

(leeg)

Embargo

Aantal studenten

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‹ **OVERZICHT ONDERWERPEN**