

A nonlinear singular value decomposition

Mariya Ishteva¹ and Philippe Dreesen²

¹ KU Leuven, Dept. Computer Science, ADVISE-NUMA, Belgium
`mariya.ishteva@kuleuven.be`

² KU Leuven, Dept. Electrical Engineering, ESAT-STADIUS, Belgium
`philippe.dreesen@kuleuven.be`

Abstract

While linear functions are widely used and well-understood, for nonlinear (multivariate vector) functions it is unclear how to

- define their complexity,
- reduce the complexity and
- increase their interpretability.

To solve these problems, we propose a decomposition of nonlinear functions, which can be viewed as a generalization of the singular value decomposition. In this decomposition, univariate nonlinear mappings replace the simpler scaling performed by the singular values. For example, the simplest such nonlinear functions would be pure powers, but more generally, we can use non-homogeneous polynomials. We discuss the computation of the decomposition, which is based on tensor techniques. We also mention an application in nonlinear system identification.

Keywords: singular value decomposition, nonlinear functions, tensors

References

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