

Article

Tensor Modeling and Analysis for Vehicle Traffic

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Abstract: A single paragraph of about 200 words maximum. For research articles, abstracts should give a pertinent overview of the work. We strongly encourage authors to use the following style of structured abstracts, but without headings: (1) Background: Place the question addressed in a broad context and highlight the purpose of the study; (2) Methods: Describe briefly the main methods or treatments applied; (3) Results: Summarize the article's main findings; and (4) Conclusion: Indicate the main conclusions or interpretations. The abstract should be an objective representation of the article, it must not contain results which are not presented and substantiated in the main text and should not exaggerate the main conclusions.

Keywords: keyword 1; keyword 2; keyword 3 (list three to ten pertinent keywords specific to the article, yet reasonably common within the subject discipline.)

1. Introduction

Content

1. Related work.
2. Contribution.
3. Content.

2. Tensor Algebra

Table 1. Tensor Algebra Notation Summary.

$\mathcal{X}, \mathbf{X}, \mathbf{x}, x$	Tensor, matrix, vector scalar.
$\mathcal{X} \in \mathbb{R}^{I_1 \times \dots \times I_N}$	A $I_1 \times \dots \times I_N$ tensor.
$x_{i_1 \dots i_N}$	The $(i_1 \dots i_N)$ entry of an N^{th} -order tensor.
$\mathbf{X}^{(n)}$	The n^{th} matrix element from a sequence of matrices.
$\mathbf{X}_{(n)}$	The n-mode matricization of a tensor.
\otimes_{outer}	Outer product of two vectors.
\otimes_{kron}	Kronecker product of two matrices.
\odot	Khatri Rao product of two matrices.
$\langle \mathcal{X}, \mathcal{Y} \rangle$	Inner product of two tensors.
$\mathcal{Y} = \mathcal{X} \times_n \mathbf{U}$	The n-mode product of a tensor \mathcal{X} times a matrix \mathbf{U} along the n dimension.
$[[\lambda/\mathcal{G}, \mathbf{U}^{(1)}, \dots, \mathbf{U}^{(N)}]]$	Simplified form of N^{th} -order tensor decomposition models as factor matrices.
$rank_t(\mathcal{X})$	Decomposition/CP rank.
$rank_{tc}(\mathcal{X})$	Multilinear/Tucker rank.
$\mathcal{X} * \mathcal{Y}$	t-product of two tensors.
$\mathcal{X} *_{\Phi} \mathcal{Y}$	Φ -product of two tensors.
$\mathcal{H}(\cdot)/\mathcal{H}^{-1}(\cdot)$	Hankelization direct/inverse transformation.
$\mathcal{L}(\cdot)/\mathcal{L}^{-1}(\cdot)$	Löwnerization direct/inverse transformation.
\mathcal{V}	Video of duration τ , represented as a tensor.
\mathcal{B}	Background tensor.
\mathcal{F}	Foreground tensor.
\mathcal{Z}	Vehicle traffic features tensor.

Content

1. Notation.
2. Basic tensor concepts.
3. Tensor decompositions (E.G.)
 - (a) CANDECOM/PARAFAC Decomposition
 - (b) Tucker Decomposition
 - (c) Tensor Robust PCA
 - (d) Non-negative Tensor Decomposition

3. Problem Statement and Mathematical Definition

Content

1. Problem Statement.
2. Mathematical Definition.

4. Vehicle Traffic Model

Content

1. Traffic surveillance video modeling.
2. Representing vehicle traffic data as an n-way tensor.
3. Tensor Factorization for vehicle traffic analysis.

5. Experiments

6. Discussion

Authors should discuss the results and how they can be interpreted in perspective of previous studies and of the working hypotheses. The findings and their implications should be discussed in the broadest context possible. Future research directions may also be highlighted.

7. Conclusions

This section is not mandatory, but can be added to the manuscript if the discussion is unusually long or complex.

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Abbreviations

The following abbreviations are used in this manuscript:

MDPI	Multidisciplinary Digital Publishing Institute
DOAJ	Directory of open access journals
TLA	Three letter acronym
LD	linear dichroism

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Sample Availability: Samples of the compounds are available from the authors.

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