Block/Canonical PDC/DC Module

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Abstract

Main documentation for the Blocks/Canonical Module for use that was developed for use with [1]. It requires the AsympPDC package:

(http://www.lcs.poli.usp.br/∼baccala/pdc/CRCBrainConnectivity/AsympPDC/)

1 Introduction

The present module was developed to support the research described in [1] . Its functionality presumes the same data structure used in the AsympPDC package to whose future versions it will be incorporated.

This document contains installation, data and software structure information together with a short description of the routines used to compute examples from [1].

The core data structure is represented by **Block_set** which describes the channel grouping used in defining channel subsets.

Further implementation details are available by reading function descriptions in the respective ***.m**. files.

1.1 Installation

The module is written in MATLAB (tested under version) and must be installed in the same path as the AsympPDC package with full access to its subdirectories: .

2 Data Structures

The data structures are the same as in the AsympPDC package except for **Block_set** and is common to all core routines:

```
% input: A - model matrix
%          pf - residue covariance matrix
%          nf - number of frequencies in [0,.5]
%        Block_set  - Matrix containg indices for each blocks
%                     rows - number the blocks (=<n) - nb blocks
%                     columns - number provide the indices per block
%                               (=n - filled with zeros above the number of
%                               valid indices)
```

where **Block_set**'s rows stand for the number of blocks while the columns contain the channel indices for each block (row). Rows with fewer channels have their unused positions filled wth zeros.

Block PDC/DC_{ij} outputs are numbered according to $j \rightarrow i$ they relate as function of frequency index from 1 to nf. The variables are denoted **pdc_b/dc_b** respectively.

Canonical PDC/DC_{ij} have a fourth index to point to the component of interest. The number of valid components is denoted by **len_c**. The variables are denoted **pdc_c/dc_c** respectively.

3 Routines

3.1 Main

The routines presume model availability as generated by the AsympPdc package.

The main routines are comprised of:

1. Block Computations
   - **pdc_b_alg_A.m**
   - **dc_b_alg_A.m**
2. Canonical Computations
   - **pdc_c_alg_A.m**
   - **dc_c_alg_A.m**

in the **main_routines** directory.

3.2 Support

The main computational support routines are (**support_routines** directory):

1. **grab_block.m** - used to select channels from the model.
2. **ss_alg.m** - used to compute the spectral density matrix.
3. **ssi_alg.m** - used to compute the inverse of the spectral density matrix.
4. **A_to_f.m** - A matrix frequency representation.
5. **H_to_f.m** - H matrix frequency representation.

3.3 Graphic Display

1. **plot_block2.m**
2. **plot_block4.m**
3. **plot_canon1.m**
4. **plot_canon3.m**
5. **plot_canon4.m**

in the **support_routines** directory which also contains other auxiliary plot routine internals not listed here.

4 Examples

The figures used in the examples in [1] have been edited for publication purposes. Their raw generation was provided by the following routines in **PaperExamples** directory. They should be considered as templates for further study.

4.1 Example 1

Example_1_Fig_2ab.m

4.2 Example 2

1. **Example_2_Figs_4_5.m**

2. **Example_2_Figs_4_6.m**

4.3 Real Data Example

Computations were performed using **Regions_ictus_Fig_7** with the model parameters in **results_ictus.mat** which was obtained from data used in [2] whose raw data may be downloaded from the [3] website or from its CD.

5 Disclaimer and Copyright

References

[1] Daniel Y. Takahashi, Luiz A. Baccala and Koichi Sameshima (2014) "Canonical Information Flow Decomposition Among Neural Structure Subsets", *Frontiers in Neuroinformatics*, doi:10.3389/fninf.2014.00049.

[2] Sameshima, K., Takahashi, D. Y., and Baccala, L. A. (2014). "Asymptotic PDC Properties",(Chap. 7) in *Methods in Brain Connectivity Inference through Multivariate Time Series Analysis* (Boca Raton: CRC Press), 113-131. doi: 10.1201/b16550-9.

[3] Sameshima, K. and Baccala, L. A. (2014) "Methods in Brain Connectivity Inference through Multivariate Time Series Analysis" (Boca Raton: CRC Press),

http://www.lcs.poli.usp.br/~baccala/pdc/CRCBrainConnectivity/