Supplementary material for TFSAP book Section 12.5: "A General Approach to Time-Frequency Matched Filtering"[1]

The additional material[2] in this file is provided by Prof Boashash to assist the reader to better understand Section 12.5 of the TFSAP book. The material was collected from the original authors and then edited and standardized by Prof. Boashash. The MATLAB functions and scripts listed below are used to reproduce supporting figures for Section 12.5.

MATLAB Functions:

- *main_algorithm_function*: It computes the test statistics of a selected time-frequency distribution (TFD) based on the time-frequency matched filter (TFMF), for a neonatal EEG signal.
- *roc_analysis*: It computes the sensitivity and specificity of a classifier to form the receiver operating characteristics curve (ROC).
- *ckd*: It computes the compact kernel TFD (CKD) of a time domain signal.

MATLAB Scripts:

Call_functions_script.m

- Description: This script produces similar example results to the ones that are depicted in Table 12.5.2, on page 730 of the book.
- Process: It loads multichannel EEG data containing seizure and non-seizure events, stored in the MATLAB data files, *Seizure_20CH_BrainZ_ArtifactFree.mat* and *NonSeizure_20CH_BrainZ_ArtifactFree.mat*. After that, it computes the test statistics of the selected TFD based on two TFMF detectors. Finally, ROC curves are computed, and area under the curve (AUC) scores are calculated for the two detectors, as illustrated in Table 12.5.2.
- Note: Two groups of 7 *random* segments, each group picked out of: 89 for seizure and 199 for non-seizure segments, from the database, are used in this script. Therefore, results will vary from the ones reported in Table 12.5.2.
  Furthermore, TFSAP Toolbox[3] should be installed.

Fig_1.m

- Description: This script produces similar results to the ones depicted in Fig. 12.5.1, on page 728 of the book.
- Process: It loads multichannel EEG data containing seizure and non-seizure events, stored in the MATLAB data files *Seizure_20CH_BrainZ_ArtifactFree.mat* and

[1] B. Boashash and G. Azemi, "A General Approach to Time-Frequency Matched Filtering", Chapter 12.5; in B. Boashash (ed.), *Time-Frequency Signal Analysis and Processing*, 2nd Edition (London: Elsevier / Academic Press, pages 724-732, December 2015); ISBN 978-0-12-398499-9.
[2] All of the book supplementary materials can be found here.
[3] TFSAP Toolbox can be found here.

Non*Seizure_20CH_BrainZ_ArtifactFree.mat*, and then computes the extended modified B-distribution, as illustrated in Fig. 12.5.1.

- Note: TFSAP Toolbox should be installed.

MATLAB Data Files:

- *NonSeizure_20CH_BrainZ_ArtifactFree.mat*: It holds 26 minutes of multichannel EEG recordings of non-seizure events for five neonates, recorded at Royal Children's Hospital, Brisbane, Australia. Note that the provided database is only a portion of the full database used in Section 12.5.
- *Seizure_20CH_BrainZ_ArtifactFree.mat*: It holds 11 minutes of multichannel EEG recordings of seizure events for five neonates, recorded at Royal Children's Hospital, Brisbane, Australia. Note that, the provided database is only a portion of the full database used in Section 12.5.

Acknowledgments:

This Supplementary Material was made possible by NPRP grant #6-885-2-364 from QNRF.

Last version Date: 30-May-2017.

Copyright: Boualem Boashash.