Supplementary Material for Chapter 16: "Time-Frequency Methodologies in Neurosciences" [1]

Prof. Boualem Boashash, Editor.

The zip files contained in this directory contain the supplementary materials[2] (SM) for each Section of the Chapter separately. The user is advised to review the read-me file for each Section to get a good overview of the contents of its SM. Below is a brief overview of the Chapter in the book. Part 2, next page, is the actual inventory of the SM provided for this chapter.

1. Book Chapter SM Overview:

This chapter presents a number of time-frequency ((t,f)) techniques that can provide advanced solutions to several problems in neuro-sciences with focus on the monitoring of brain abnormalities using EEG and other physiological modalities (t,f) characteristics as a diagnosis and prognosis tool. The methods presented illustrate the improved performance obtained by using a time-frequency approach to process EEG data, including a focus on detecting abnormalities in sick newborns in a Neonatal Intensive Care Unit (NICU) as well as mental health issues in elderlies.

The chapter starts by presenting methods for the assessment of Newborn EEG and ECG abnormalities using a Time-Frequency identification approach (16.1: see page 2). Next, the important question of (t,f) modelling of nonstationary signals is discussed with illustration on newborn EEGs (16.2: see page 2); Then, the use of (t,f) features for Nonstationary Signal Classification is illustrated on an application to newborn EEG burst-suppression detection (16.3: see page 2); An application relevant to the elderly is described where a time-varying analysis of brain networks uses the EEG for the detection of Alzheimer disease (16.4: see page 2). Another method of time-frequency analysis is described that involves EEG noise reduction using the empirical mode decomposition (16.5: see page 2). Finally, the chapter concludes with a discussion on other perspectives of using advanced (t,f) methods for medical diagnosis and prognosis in other areas of neurosciences (16.6: see page 2).

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[1] B. Boashash (ed.), Time-Frequency Signal Analysis and Processing, 2nd Edition (London: Elsevier / Academic Press, December 2015); ISBN 978-0-12-398499-9.

[2] All of the book supplementary materials can be found here.

2. Book Chapter SM Main Script Inventory:

Supplementary material	Brief Description
16.1: Time-Frequency Diagnosis of Abnormalities in Newborn Physiological Signals	
Figure_16_1_1..m	This script produces results that are similar to the ones depicted in Fig. 16.1.1, on page 919 of the book.
eeg_analysis_example.m	This script reproduces the results that are depicted in Fig. 16.1.2, on page 921 of the book.
ecg_analysis_example.m	This script reproduces the results that are depicted in Fig. 16.1.3, on page 922 of the book.
Section 16.2: Time-Frequency Modelling of Nonstationary Signals for Newborn EEGs	
nonstationary_component_parameter_estimation.m	This script reproduces the results that are depicted in Fig. 16.2.1, on page 927 of the book.
Fig_16_2_2.m	This script reproduces the results that are depicted in Fig. 16.2.2, on page 929 of the book.
Neonate_EEG.m	This script produces similar results to the ones that are depicted in Fig. 16.2.2, on page 929 of the book.
Section 16.3: Time-Frequency Features for Nonstationary Signal Classification with Illustration on Newborn EEG Burst-Suppression Detection	
Call_functions_script.m	This script produces similar results to the ones that are depicted in Table 16.3.1, on page 935 of the book.
Section 16.4: Time-Varying Analysis of Brain Networks	
Causality_Analysis.m	This script produces results that demonstrates the concepts presented in Section 16.4.
Section 16.5: Time-Frequency Analysis and EEG Noise Reduction Using Empirical Mode Decomposition	
TFSAP_SUP_MAT_CHAP_16_5_1_fig2.m	This script produces similar results to the ones that are depicted in Fig. 16.5.2, on page 946 of the book.
TFSAP_SUP_MAT_CHAP_16_5_2_fig3.m	This script produces similar results to the ones that are depicted in Fig. 16.5.3, on page 947 of the book.
TFSAP_SUP_MAT_CHAP_16_5_3_1.m	This script produces similar results to the ones that are depicted in Fig. 16.5.4, on page 949 of the book.
TFSAP_SUP_MAT_CHAP_16_5_3_2.m	This script produces the results that are depicted in Figs. 16.5.5 (b) and 16.5.6, on pages 950 and 951 of the book.
TFSAP_SUP_MAT_CHAP_16_5_4.m	This script produces the results that are depicted in Figs. 16.5.7 and 16.5.8, on page 952 of the book.
Section 16.6: Time-Frequency Methodologies for Assessment of Biosignals in Neurosciences	
plots.m	This script produces the results that are depicted in Fig. 16.6.2, on page 956 of the book.