Computational Procedures for Analysis of Rhythms (CPAR)

This project includes a MATLAB implementation of CPAR, and the scripts for simulations, analyses, and plotting Figures reported in the article titled “Extracting evidence for neural rhythms from behavioral measurements.” To ensure the reproducibility of the simulation results, some scripts are provided with a random seed used for simulations reported in the article. You will need MATLAB R2016b or later with Optimization Toolbox to run the scripts.

For a quick tutorial on how to use CPAR with your own data, please refer to the tutorial scripts.

Few scripts rely on bayesFactor Toolbox (https://klabhub.github.io/bayesFactor/, see the “lib/bayesFactor-2.2.0/LICENSE” file for license information) which requires Statistics and Machine Learning Toolbox.

# Directories and Files

data-fitted/ directory – stores simulation results and analyzed data.

data-step4/ directory – stores open data published by Ruzzoli et al. (2019). A zip file containing the data will be downloaded and unpacked to this directory (Step4A).

fig-images/ directory – stores image files for Figures 2-6.

lib/ directory – contains simple functions used to implement CPAR and simulations. Please refer to the help text in the beginning of each function file.

lib/bayesFactor-2.2.0/ directory – contains bayesFactor Toolbox version 2.2.0.

fitRhythms() function – implements CPAR. Please refer to the help text in the beginning of the file.

fftRhythms() function –implements of the spectral analysis employed in Cha & Blake (2019). Please refer to the help text in the beginning of the file.

simRndWalk() function – generates reaction times using a modified random walk model simulation. Please refer to the help text in the beginning of the file.

CommonVars\_CDF.m and CommonVars\_Figure.m scripts – define common variables (initial guesses for CDF parameters and rhythmic transformation parameters, font size and line thickness for Figures, etc.).

# Tutorial Scripts

Tutorial\_FitRhythms\_LognormCDF.m script – shows a simple example of how to analyze a single set of duration data with CPAR.

Tutorial\_FitRhythms\_GammaCDF.m script – shows an example of how to analyze a single set of duration data with CPAR using a gamma CDF (or any other CDF of one’s choice).

# Scripts Whose Name Starts with “Step”

Step1 – script plots example rCDFs varying in rhythmic transformation parameters (Figure 2).

Step2 – script [2A] generates response time data using a modified random walk model simulation, analyzes the data with CPAR; script [2B] generates another set of response time data, analyzes the data with spectral analysis; script [2C] plots CPAR and spectral analysis results (Figure 3).

Step3 – script [3A] generates lots of data sets using a modified random walk model simulation, analyze all data sets with both CPAR and spectral analysis; script [3B] plots CPAR and spectral analysis results against the ground-truth values (Figure 4); script [3C] performs statistical tests for correlations and partial correlations shown in Figure 4.

Step4 – script [4A] fetches open data from an OSF repository; script [4B] analyzes the data with CPAR; script [4C] analyzes the same data with spectral analysis; script [4D] plots CPAR and spectral analysis results (Figure 5); script [4E] performs statistical tests for Figure 5.

Step5 – script [5A] repeats a set of modified random walk model simulations six times, each time generating different numbers of data points per condition, and analyzes all data sets with CPAR; script [5B] plots CPAR results per varying numbers of data points; script [5C] performs statistical tests for Figure 6.

Step6 – script calculates the goodness of fit measures (adjusted *R*2) of lognormal CDF fits estimated in Examples 1 and 3 (reported in Footnote 4).