MGLUE User Manual

Code Information

Code: MGLUE

Programming language: MATLAB

Developed by: Ebrahim Ahmadisharaf

Last update: 5 Oct 2019

Contact: ebra@dhigroup.com

Overview

This code implements generalized likelihood uncertainty estimation (GLUE). It adjusts the prior distributions (or priori) and derives the posterior distributions (or posteriori). This could be done with either a cutoff threshold (limit of acceptability) or some top simulations (as a percentage) based on the likelihood function.

Inputs

The main input is a Microsoft Excel file. See the example spreadsheet ('MGLUE_Inputs.xlsx'). The example is for a problem with 5000 Monte Carlo simulations, 18 parameters and 4 likelihood functions. Place the spreadsheet in the same folder that the code is. Prior to using this code, you must have the results of your initial Monte Carlo simulations, including parameter values, corresponding probability of each parameter value and value of likelihood function for each simulation. The spreadsheet file consists of six worksheets:

i. parval: Parameter values in Monte Carlo simulations.
ii. parnam: Name of parameters.
iii. parpriorp: Prior probability of each parameter in Monte Carlo simulations. This will be equal to the inverse of number of Monte Carlo simulations, if you use uniform prior distribution.
iv. LFnam: Name of likelihood functions. You could include multiple likelihood functions. Every time the code will ask you which one you want to use for GLUE application.
v. LFval: Values of likelihood functions.
vi. LFcutoff: Cutoff threshold to select behavioral simulations.

Code Settings

Follow these steps to implement the GLUE code for your problem:

- Enter *N* (shaping factor).
- Select the approach to determine the behavioral simulations. Enter 1 for cutoff threshold (limit of acceptability) approach and 2 for top percentage approach.
- Enter the percentage of best simulations. For example, 0.1 means top 10% simulations. This is only needed when you use the top percentage approach (approach 2).
- The code ignores the 'LFcutoff' worksheet when you select the top percentage approach (approach 2).

<u>Caution:</u> The code assumes that the greater the value of likelihood function, the better the model performance. This is when you use a correlation measure (e.g., coefficient of determination) or others like Nash-Sutcliffe efficiency. If you use some error or bias measure as your likelihood functions, consider multiplying the values of likelihood function by (-1).

Post-Run Inputs

Once you run the code, you are asked to enter the column index of the likelihood function from the 'LFnam' worksheet of your Excel file, when you see this message: "Enter the index of the likelihood function (in the order of the input spreadsheet worksheet): ". For instance, in the example spreadsheet, you enter ‘1’ for ‘NSE’ (column A), ‘2’ for ‘R^2’ (column B), ‘3’ for ‘PBIAS’ (column B) and ‘4’ for ‘d’ (column D).

Outputs

The number of behavioral simulations is also reported. A figure is generated for each parameter. Each figure includes the cumulative prior and posterior distributions together. You could change the figure settings (e.g., fonts, labels, title, range, legend etc.) in the code.

Other outputs that are not visual but might be of interest include values of posterior probabilities ('postcump' variable) could be accessed from MATLAB Workspace.