Quick start guide for ANDURIL

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Preface

As its title suggests, this document was written with the purpose of increasing the "friendliness" of ANDURIL towards potential users. It is not the authors' intention to present a thorough step-by-step guide, rather than to clarify how the developed toolbox can be used. It is recommended to be read in combination with the supplementary information (SI) for *ANDURIL - A MATLAB Toolbox for ANalysis and Decisions with UnceRtaInty: Learning from expert judgments*.

Requirements

MATLAB with Statistics and Machine Learning Toolbox installed

Installation

Double click on the ANDURIL.mtlbx 

to install the toolbox. Please note that any previously installed versions of ANDURIL should be uninstalled in advance. This can be easily done by clicking on the *Add-Ons* -> *Manage Custom Toolboxes* in the *Home* tab of MATLAB and choose uninstall (see Figure 1). After the successful installation of the toolbox, the same window can be used to access all the functions by clicking on "Click to view toolbox files in MATLAB Current Folder window".

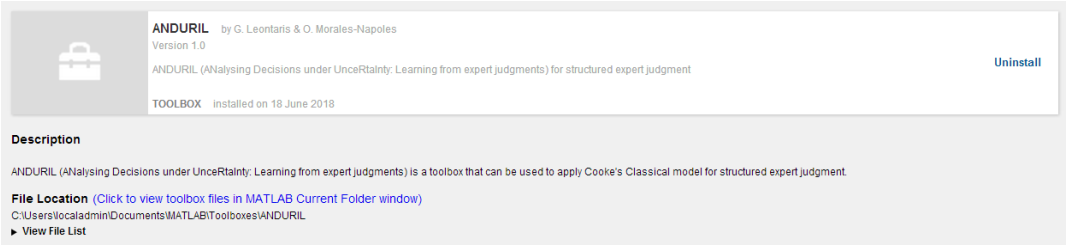

Figure 1: Manage Custom Toolboxes window.

ANDURIL Main Script

ANDURIL_main can be used for i) importing the values of expert judgments, ii) making the analysis and synthesis of expert judgments and iii) post-processing of the resulting synthetic decision makers (DMs).

i) Import data

The user has three options to import data in the format required by ANDURIL to perform the analysis applying Cooke's classical model. The first option is to enter the expert judgments

regarding seed and target variables as well as information regarding the background measure and the realizations of every variable, manually in the required format as described in the SI.

The second option is to import the expert judgments regarding the seed and target variables by using the import interface of MATLAB. It must be mentioned that these assessments could have been either exported from EXCALIBUR (by using the *Export as space delimited-> quantiles* functionality) or manually entered in a spreadsheet. In the latter case, attention should be payed to the format; this should be similar to that presented in Figure 2. Then, **only the values** should be imported to MATLAB and the *formulate_data.m* function can be used to formulate the assessments in the required format. Information regarding the number of experts, the number of elicited quantiles, the number of seed and target variables, the background measure of every variable as well as the realizations should be entered manually in the required format as described in the SI. Examples are presented in *ANRURIL_main.m* and *example_ANDURIL.m*.

The third option (and probably the favorite for EXCALIBUR users) is to use the .dtt and .rls files of EXCALIBUR. These should be saved as txt files **without any text** for the description of every variable. In case there is text this should be erased, otherwise the *import_ascii_files* function will not work properly. Finally, the *import_ascii_files.m* can be used to formulate the assessments of seed and target variables, as well as information regarding the background measure and the realization of every variable. An example is presented in *ANRURIL_main.m*.

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V
1		Expert1	Expert1	Expert1	Expert1	Expert1	Expert1	Expert1	Expert1	Expert1	Expert1	Expert1	Expert2	Expert2	Expert2	Expert2	Expert2	Expert2	Expert2	Expert2	Expert2	Expert2
2		seed_var1	seed_var2	seed_var3	seed_var4	seed_var5	seed_var6	seed_var7	seed_var8	target_var1	target_var2	target_var3	seed_var 1	seed_var 2	seed_var 3	seed_var 4	seed_var 5	seed_var 6	seed_var 7	seed_var 8	target_var1	target_var2
3	5%	3,1	3,5	4,5	3,5	2,5	30	6	6	3,1	1,9	2,8	10	5	10	2	2	10	2	3,2	1,2	1
4	50%	4,5	4	6,5	4,5	3,5	50	8	7	4,5	2,1	3,5	50	20	20	5	4,2	35	4,5	5,6	1,7	1,5
5	95%	6	4,5	7	6	4,5	70	10	8	5,5	3	4,2	80	30	30	7	6,5	50	10	6,5	2	1,9

Figure 2: Example of assessments regarding 8 seed and 2 target variables of 2 experts in a spreadsheet.

ii) Analysis and Synthesis of expert judgments

ANDURIL supports the synthesis of expert judgments based on four different weighting schemes, i.e. four different types of DMs. Namely, the a) *equal*, b) *user-defined*, c) *global* and d) *item* weights. However for the performance-based weighting schemes (i.e. *global* and *item* weights) the option of optimization is available (for more information about this see the SI). This results in two more possible DMs, the e) global weights with optimization and f) item weights with optimization. The functions that should be called and the values of the required parameters for the synthesis of each different DM are presented below (with the same notation as these are presented in the *ANRURIL_main.m*). For more information regarding the arguments of each function, see the SI.

a) Equal weights DM

Parameters:

- k = 0.1; (this is the default value)
- cal_power = 1; (this is the default value)
- optimization = 'no';
- weight_type = 'equal';
- alpha_eq = 0;

Function(s): calculate_DM_global.m

b) User defined weights DM

Parameters:

- k = 0.1; (this is the default value)
- cal_power = 1; (this is the default value)
- optimization = 'no';
- weight_type = 'user';
- user_w = [0 0 0 0 0.4 0.6 0 0 0]; (in this example expert 5 and expert 6 were given weights equal to 0.4 and 0.6 respectively)
- alpha_ud = 0;

Function(s): calculate_DM_global.m

c) Global weights DM

Parameters:

- k = 0.1; (this is the default value)
- cal_power = 1; (this is the default value)
- optimization = 'no';
- weight_type = 'global';
- alpha = 0.05; (value used in the example presented)

Function(s): global_weights.m; calculate_DM_global.m

d) Item weights DM

Parameters:

- k = 0.1; (this is the default value)
- cal_power = 1; (this is the default value)
- optimization = 'no';
- weight_type = 'global';
- alpha = 0.05; (value used in the example presented)

Function(s): item_weights; calculate_DM_item

e) Global weights with optimization DM

Parameters:

- k = 0.1; (this is the default value)
- cal_power = 1; (this is the default value)
- optimization = 'yes';
- weight_type = 'global';

Funtion(s): DM_Optimization

f) Item weights with optimization DM

Parameters:

- k = 0.1; (this is the default value)
- cal_power = 1; (this is the default value)

- optimization = ‘yes’;
- weight_type = ‘global’;

Funtion(s): DM_Optimization

iii) Post-processing

ANDURIL supports the following post-processing functionalities:

a) Plotting assessments (itemwise). The user can plot the assessments (i.e. 5^{th}, 50^{th} and 95^{th} %tiles) of every individual expert and DM for a particular item in one plot. The function that should be used for this purpose is the *plotting_itemwise.m*. Illustrative examples are presented in *ANDURIL_main.m*, *example_ANDURIL.m* and the SI.

b) Checking robustness (itemwise). The user can investigate the robustness of the obtained DM (i.e. the values of the statistical accuracy and informativeness) when up to k items are excluded at the time. The option of including the calibration power is also provided. The function that should be used for this purpose is the *Checking_robustness_items.m*. Illustrative examples are presented in *ANDURIL_main.m*, *example_ANDURIL.m* and the SI.

c) Checking robustness (expertwise). The user can investigate the robustness of the obtained DM (i.e. the values of the statistical accuracy and informativeness) when up to k experts are excluded at the time. The function that should be used for this purpose is the *Checking_robustness_experts.m*. Illustrative examples are presented in *ANDURIL_main.m*, *example_ANDURIL.m* and the SI.

d) Plotting box-plots of the performance measures (statistical accuracy and informativeness). The user can produce box-plots of the statistical accuracy and informativeness of the DM under investigation. Illustrative examples are presented in *ANDURIL_main.m*, *example_ANDURIL.m* and the SI.