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Software

CSMAA: A user-friendly software for SMAA-III/TRI/3

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Stochastic Multicriteria Acceptability Analysis (SMAA) is a family of decision support methods that allow to handle problems with partial or missing information about parameter values. Even though the different methods of the family have been used in real-life problems, a user-friendly software has never been available for wider audience. In order to allow the methodology to be used by analysts and academics less accustomed to the techniques of numerical computation, we have developed a software implementing some methods of the family. The methods of the software apply Monte Carlo simulation to calculate descriptive indices that characterize the decision making problem.

The software was done in conjunction to developing SMAA-TRI and SMAA-III, the two newest methods of the family. It implements these two as well as the SMAA-3 method. In future, other SMAA methods will be added to software. SMAA-TRI is for sorting problems, that is, for assigning alternatives into ordered categories. SMAA-III is for ranking the alternatives. SMAA-3 is similar to SMAA-III, but instead of the complete ELECTRE III procedure, it uses a less discriminative less-in-favor exploitation rule. Another approach to using the software is to use SMAA-TRI and SMAA-III as ELECTRE TRI and ELECTRE III with imprecise parameter values and missing preference information. In this case the SMAA-type indices can be used for parameter sensitivity analysis of the two ELECTRE methods.

The software allows imprecise criteria measurements to be defined with discrete or real values. With discrete values, each number in the imprecise range is considered equiprobable, while with real values they can be defined with uniform or Gaussian distribution. In the case of SMAA-III and SMAA-3, ordinal measurements are allowed as well. In this case, the alternatives are ranked with respect to the ordinal criterion. If SMAA-TRI is used, also the profile measurements as in ELECTRE TRI can be defined with imprecise values. The thresholds of ELECTRE model can be defined with absolute (+-) of percentage values. Both of these can be imprecise within some interval. The uncertainties of criteria and profile measurements can be automatically set to 5%, 10%, or 20% of the values. This way the methdods can be used for automatic robustness analysis. Therefore users accustomed to use ELECTRE III or ELECTRE TRI can apply the software to obtain robust conclusions with their model of exact values.

Various preference information can be incorporated into the model. Exact preferences (weights), lower and/or upper bounds for weights, or ordinal (ranking of the weights) information can be used. All other weight information except upper bounds for weights do not cause high computational burden. Upper bounds instead can slow down the computation, but usually this slowdown is of low factor and does not need to be taken into account.

The easy usability of the software allows the analysis to be performed iteratively in SMAA fashion. Usually obtaining more precise measurements means more costs, so the model can initially be defined with imprecise criteria measurements and technical parameter values, and partial or completely missing preference information. If the different indices allow sufficiently trustworthy conclusions to be drawn, the analysis can be ended. Otherwise more precise parameter values can be collected and the analysis repeated. This type of iterative process can stimulate discussion with the decision makers and facilitate obtaining more exact values for the model parameters, especially in the case of preference information.

The three attached figures illustrate some input and results screens of the software. The software can be obtained by contacting the author by email (tommi.tervonen@it.utu.fi). Full versions for Windows, Mac OS X, and Linux are available free of cost for academic use, and for a low cost for commercial purposes.

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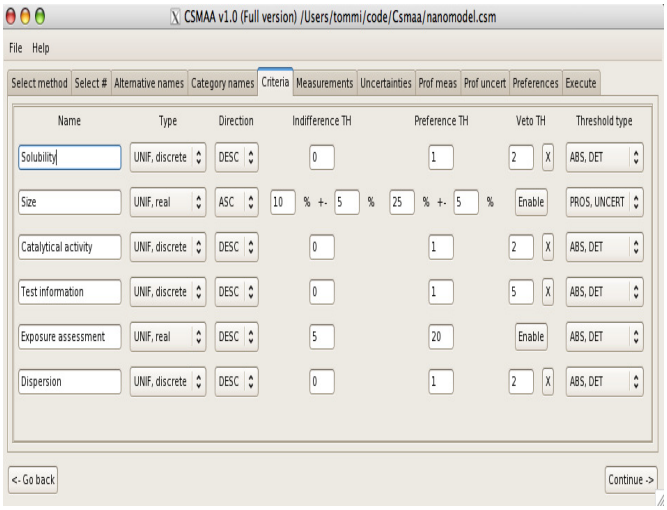

Figure: Criteria input screen.

Figure: SMAA-TRI results screen.

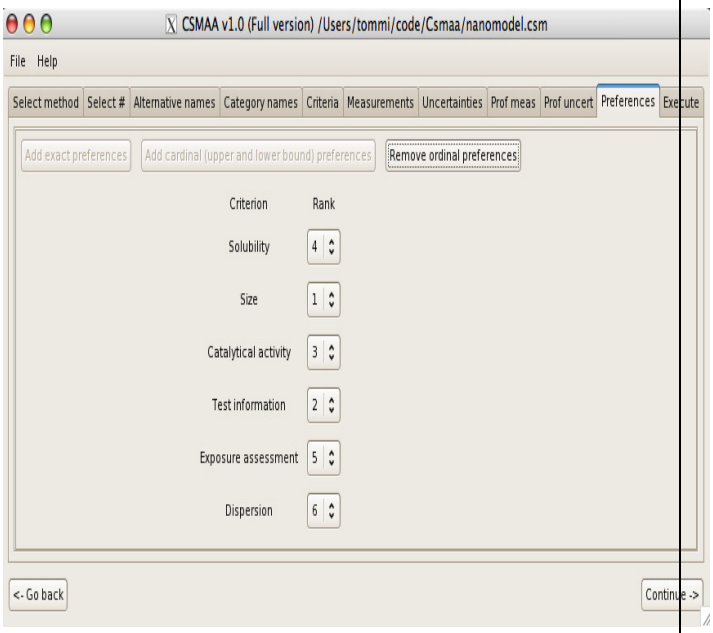

Figure: Input preference information screen.