Internship

Sensitivity Analysis, contribution to the R-package « sensitivity »

Responsables du stage :

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Modeling is increasingly used in many scientific fields, considered as a simplified view of the complex reality. Indeed, models are developed to approximate observed phenomena, of course their accuracy must be as best as possible.

However, inputs of a model are subject to many sources of uncertainty including errors of measurement or absence of information.

As a consequence, a modeller has to evaluate the confidence of a model and he should distinguish between uncertainties on the inputs and uncertainties due to the natural variability of the model. Sensitivity analysis aims to identify the sensitive parameters, that is, parameters for which a small variation implies a large variation of the model output. In global sensitivity analysis, one makes use of the probability distribution of the outputs to define (amongst other sensitivity measures) sensitivity indices (also known as Sobol indices). The sensitivity index of an output with respect to an input variable is the fraction of output variance which can be "explained" by the variation of the input variable, either alone (one then speaks about main effect), or in conjunction with other input variables (total effect). This way, input variables can be sorted by the order of importance they have on the output.

The R software is currently used by practitioners interested in uncertainies quantification. The aim of this internship is to understand recent methods developed to estimate Sobol indices. We refer to Tissot (2012) for an overview on the various estimates. Then, the aim is to contribute to the

existing package « sensitivity » to code new functions related to these very recent methodologies.

The R sytem includes somme support for objects-oriented programming (OOP), the preferred paradigm for organizing computer software, faster to write, easier to maintain and less likely to contain errors.

R includes two differents mechanisms for OOP, a first based on S version 3 (S3) which introduced class attributes that allowed single-argument methods and a second based on S version 4 (S4) for which formal classes and method were introduced that allowed multiple arguments, more abstract type and more sophisticated inheritance.

Objects-oriented programming is not the same thing as programming with objects and attributes, a reflexion should be conducted in consultation with the experts in sensitivity analysis, for a consistent installation of the various methods implemented.

Some skills in object-oriented programming and/or in the software R are desirable. It is also recommended to have interest in applied mathematics and applications.

Links

Package sensitivity http://sensitivity.r-forge.r-project.org/

Tissot, J.Y. (2012)http://www.gdr-mascotnum.fr/documents.html#phd_theses