Sensitivity Analysis in the Model Web

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The Model Web, and in particular the Uncertainty enabled Model Web being developed in the UncertWeb project aims to allow model developers and model users to deploy and discover models exposed as services on the Web. In particular model users will be able to compose model and data resources to construct and evaluate complex workflows. When discovering such workflows and models on the Web it is likely that the users might not have prior experience of the model behaviour in detail. It would be particularly beneficial if users could undertake a sensitivity analysis of the models and workflows they have discovered and constructed to allow them to assess the sensitivity to their assumptions and parameters.

This work presents a Web-based sensitivity analysis tool which provides computationally efficient sensitivity analysis methods for models exposed on the Web. In particular the tool is tailored to the UncertWeb profiles for both information models (NetCDF and Observations and Measurements) and service specifications (WPS and SOAP/WSDL). The tool employs emulation technology where this is found to be possible, constructing statistical surrogate models for the models or workflows, to allow very fast variance based sensitivity analysis. Where models are too complex for emulation to be possible, or evaluate too fast for this to be necessary the original models are used with a carefully designed sampling strategy. A particular benefit of constructing emulators of the models or workflow components is that within the framework these can be communicated and evaluated at any physical location.

The Web-based tool and backend API provide several functions to facilitate the process of creating an emulator and performing sensitivity analysis. A user can select a model exposed on the Web and specify the input ranges. Once this process is complete, they are able to perform screening to discover important inputs, train an emulator, and validate the accuracy of the trained emulator. In cases where an emulator is not appropriate, the sensitivity analysis tool can be used directly with the model. The user is presented with a visual and tabular summary of the sensitivity analysis results.

We will demonstrate the sensitivity analysis system on a range of models, and show the steps and assumptions necessary to employ the tool. We will describe the future developments we anticipate and explain how we hope to address the current limitations in future work.