Simulation Galleries - Combining Experiment Design and Visual Analytics

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The complexity and size of simulation models is steadily increasing. As a consequence, input and output of simulations increase in complexity as well. This is particularly true for spatial, multi-level models where different structures might be of interest [1]. Therefore, new methods are required that support the experimentation process with these models.

We propose a novel, interactive method to explore the parameter space of simulation models. We adopt the idea of design galleries [2] to simultaneously present visualizations of simulation results from different model configurations to the user. The user then selects a number of desirable or interesting outcomes. This selection is transformed into constraints, based on which new parameter configurations to show to the user are sampled. Through this iterative interactive process, the user guides the sampling of interesting points in the parameter space. In doing so, our approach realizes the visual analytics paradigm of "bringing the users into the loop", so that their background knowledge on the model and the modeled domain can be taken into account when exploring large and complex parameter spaces.

We expect simulation galleries to provide valuable support to domain experts when calibrating and validating complex simulation models. Our approach combines well-established experiment design methods such as Latin Hypercube Sampling and visualization methods for individual simulation outcomes. Therefore, it naturally supports arbitrary numbers of model input parameters and arbitrary visualizations of model output. Currently, we foresee at least two concrete implementation variants: First, a "zoom-in"-style exploration, where the model is calibrated by iteratively pruning the parameter space based on an assessment of the displayed model output visualizations. Second, the application of an optimization algorithm that uses the user assessment as the target function. Based on the results of prototypical implementations, we will refine the method and evaluate it on a real-world modeling problem.

References

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