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Jan Kwakkel
Delft University of Technology, j.h.kwakkel@tudelft.nl

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Jan H. Kwakkel
j.h.kwakkel@tudelft.nl
Delft University of Technology
Faculty of Technology, Policy and Management
Delft, The Netherlands

Abstract: Scenario discovery is a model-based approach for scenario development. Scenario discovery aims at finding one or more subspaces within the uncertainty space that are decision relevant. As such scenario discovery is the multi-dimensional generalization of vulnerability analysis techniques such as adaptation tipping points and decision scaling, and forms the analytical core of robust decision making. Scenario discovery involves solving a three objective optimization problem: maximize coverage, density, and interpretability. The dominant algorithm for scenario discovery, the Patient Rule Induction Method (PRIM), however, is a lenient single objective optimization approach. PRIM maximizes density, while coverage and the number of restricted dimensions, a proxy for interpretability, are calculated afterwards. Adopting a single objective optimization algorithm for a many objective optimization problem implies that the full trade-off space is not identified. In this presentation, we introduce an explicit many-objective optimization approach for scenario discovery. We compare this with an improved usage of PRIM for identifying the multidimensional trade-offs amongst coverage, density, and interpretability. We find that the many objective optimization approach produces results that dominate those of the improved version of PRIM on all three objectives. Qualitatively, however, both approaches identify essentially the same subspace. The prime benefits of the many objective optimization approach is its potential in bringing additional scenario relevant concerns such as consistency into the scenario discovery framework, as well as its ability to avoid over fitting. It also paves the way for future work on using more sophisticated many-objective genetic algorithms, or genetic programming for scenario discovery.

***Keywords**:* Scenario Discovery, (Many Objective) Robust Decision Making, Deep Uncertainty, Many Objective Evolutionary Algorithms