

Integrating Loops That Matter into Scenario Discovery for System Dynamics Models

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Abstract

Introduction: System Dynamics models are used to explain how feedback structure generates behavior in complex systems. Under deep uncertainty, future scenarios can be explored by analyzing large number of simulation runs, but this treats the model structure as a black box.

Approach: This paper addresses that limitation by integrating Loops That Matter into a core deep uncertainty method called scenario discovery. Using a small SIR epidemic model, two approaches are examined: an ex post interpretation of scenario classes through dominant loop patterns, and a clustering approach based on loop-score time series.

Results: The results show that dominant loop sequences can be used to offer explanation on model behavior within the context of deep uncertainty. Additionally, a loop score was found to be able to reproduce decision relevant clusters within a model variable.

Discussion: These findings suggest that Loops That Matter can help connect structure, behavior, and uncertainty in Scenario Discovery for small System Dynamics models, while further research is needed to test these approaches for larger models.

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