

Policy Analysis in System Dynamics Models through Reinforcement Learning Exploration

Juan Sebastián Jaén-Posada, Juan C. España, Carlos E. Vasquez, Esteffany Peña

ALIADO - Analytics and Research for Decision Making, Department of Industrial Engineering, Universidad de Antioquia, Calle 67 No. 53-108, Antioquia, 50010, Medellin, Colombia

juan.jaen@udea.edu.co, juan.espana@udea.edu.co, carlos.vasquez3@udea.edu.co, esteffany.penap@udea.edu.co

Abstract

Reinforcement learning has emerged as a transformative paradigm in artificial intelligence, showcasing remarkable applications across diverse domains. Simultaneously, simulation has proven to be a crucial tool for constructing environments conducive to interactions with agents trained through reinforcement learning algorithms. This synergy opens avenues for refining policies within simulation models. While existing research has predominantly harnessed reinforcement learning in agent-based and discrete event simulation models, there is a noticeable gap in its application within the realm of system dynamics simulation. This simulation paradigm, widely employed in Industrial Engineering and Operations Management for decision-making processes, presents a unique set of challenges. This paper explores the integration of reinforcement learning techniques into system dynamics models, aiming to address the scarcity of applications in this context. By doing so, it seeks to extend the benefits of reinforcement learning to enhance decision-making processes in industrial and operational settings. The research delves into the nuances of policy exploration within the framework of system dynamics, providing insights into novel alternatives for optimizing and improving policies. Through this exploration, the paper contributes to the evolving landscape of reinforcement learning applications, particularly in the crucial domain of system dynamics simulation.

Keywords

System Dynamics, Reinforcement Learning, Policy Analysis, Optimization.