Comparative Study of Deep Reinforcement Learning Algorithm Against Evolutionary Algorithms for Finding the Optimal Values in a Simulated Environment Space

Authors : Akshay Paranjape, Nils Plettenberg, Robert Schmitt

Abstract : Traditional optimization methods like evolutionary algorithms are widely used in production processes to find an optimal or near-optimal solution of control parameters based on the simulated environment space of a process. These algorithms are computationally intensive and therefore do not provide the opportunity for real-time optimization. This paper utilizes the Deep Reinforcement Learning (DRL) framework to find an optimal or near-optimal solution for control parameters. A model based on maximum a posteriori policy optimization (Hybrid-MPO) that can handle both numerical and categorical parameters is used as a benchmark for comparison. A comparative study shows that DRL can find optimal solutions of similar quality as compared to evolutionary algorithms while requiring significantly less time making them preferable for real-time optimization. The results are confirmed in a large-scale validation study on datasets from production and other fields. A trained XGBoost model is used as a surrogate for process simulation. Finally, multiple ways to improve the model are discussed. **Keywords :** reinforcement learning, evolutionary algorithms, production process optimization, real-time optimization, hybrid-

MPO

Conference Title : ICLR 2023 : International Conference on Learning and Reinforcement **Conference Location :** Singapore, Singapore **Conference Dates :** March 27-28, 2023

1