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

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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
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