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A grid-connected photovoltaic power generation and energy storage system based on deep reinforcement learning

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ABSTRACT

With the widespread application of renewable energy, how to improve energy efficiency has become a focal issue. Grid-connected power generation and energy storage have always been key issues in photovoltaic(PV) power generation technology. This research uses deep reinforcement learning(DRL) methods to make grid connection and energy storage more efficient. Deep reinforcement learning (DRL) combines the characteristics of deep learning(DL) and reinforcement learning(RL). It has both the perception ability of deep learning and the decision-making ability of reinforcement learning. Maximum Power Point Tracking (MPPT) is a technical condition commonly used in photovoltaic (PV) power generation systems to maximize power extraction under all conditions. In this paper, Deep Q-Learning(DQN) algorithm and Deep Deterministic Policy Gradient(DDPG) algorithm in deep reinforcement learning(DRL) are used to obtain the maximum power(MPP) of photovoltaic power generation, use Markov Decision Process (MDP) to complete the distribution and dispatch control of electric energy. These methods are simulated and analyzed in MATLAB/Simulink. Experiments were conducted on various input and output conditions. Judging from the results, these methods are efficient and reliable. This study provides good technical conditions for the intelligentization of power grids in the future.

Keywords: grid-connected photovoltaic power generation, deep reinforcement learning(DRL), Maximum Power Point Tracking (MPPT), Deep Q-Learning(DQN), Deep Deterministic Policy Gradient(DDPG), Markov Decision Process (MDP)

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