

How can deep learning improve battery performance?

Deep learning algorithms have proven effective in accurately predicting key battery performance indicators, which facilitates faster and more informed material design decisions. Similarly, the use of generative adversarial networks has improved the reconstruction of detailed 3D electrode microstructures.

How can machine learning be used to optimize thermal energy storage systems?

The ML approaches are also applied in thermal energy storage systems containing phase-change-materials (PCM) widely used in buildings. For instance, a machine learning exergy-based optimization method is used to optimize the design of a hybrid renewable energy system integrating PCM for active cooling applications (Tang et al., 2020).

Can deep learning be used for HESS management?

For the application of deep learning for HESS management, DNNs are used to manage the hybrid energy system of electric vehicles (including battery modules, supercapacitor, motor, etc.) by controlling the flow of energy among the modules (Alaoui, 2019), to achieve the maximum module efficiency.

How to train a deep learning model?

The battery capacity decaying pattern obtained from virtual tests (based on a standard proposed by (Wang et al., 2011)) under various C-rates is used to train the deep learning model. The input features for the deep learning model are current, voltage, working temperature of the battery, and the battery capacity at the previous moment.

Can deep learning predict battery energy consumption in electric vehicles?

For the application of deep learning to the battery energy storage system (BESS), multi-layer perception neural networks and regression tree algorithms are applied to predict the battery energy consumption in electric vehicles (Foiadelli et al., 2018).

What are the advantages of deep learning?

The deep learning models also have the advantage of structural flexibility, which can easily suit various types of problem and can overcome the difficulties in kernel selection (such as the drawbacks existed in the GPR, SVM/SVR algorithms).

Energy storage systems play a crucial role in a variety of industrial applications such as Electric Vehicles (EVs), Uninterruptible Power Supply ... Recently, deep learning ...

Although deep learning methods have gained more and more attention and been widely used in the battery field lately, the interpretability of these methods still remains a big ...

Breakthroughs in energy storage devices are poised to usher in a new era of revolution in the energy landscape [15, 16]. Central to this transformation, battery units assume ...

Due to the inherent fluctuation, wind power integration into the large-scale grid brings instability and other safety risks. In this study by using a multi-agent deep reinforcement ...

Deep Reinforcement Learning (DRL) proved to be successful for solving complex control problems and has become a hot topic in the field of energy systems control, but for the particular case of thermal energy storage ...

Battery capacity loss is a widely accepted metric of battery life degradation, and it strongly affects the endurance of devices powered by batteries [6], such as the driving range ...

Deep learning optimization of a biomass and biofuel-driven energy system with energy storage option for electricity, cooling, and desalinated water. ... Therefore, electrical ...

In order to address the limitations of Q-learning, this paper proposes a distributed operation strategy using double deep Q-learning method. It is applied to managing the operation of a ...

This study focuses on optimizing shared energy storage (SES) and distribution networks (DNs) using deep reinforcement learning (DRL) techniques to enhance operation and decision-making capability.

Deep Reinforcement Learning (DRL) proved to be successful for solving complex control problems and has become a hot topic in the field of energy systems control, but for the ...

Hybrid energy storage techniques (such as H₂-NH₃ hybrid storage) ... Deep reinforcement learning for energy trading and load scheduling in residential peer-to-peer energy trading ...