Applications of artificial intelligence in electrical power systems

What are the applications of artificial intelligence for power electronic systems?

Abstract: This article gives an overview of the artificial intelligence (AI) applications for power electronic systems. The three distinctive life-cycle phases,design,control,and maintenance are correlated with one or more tasks to be addressed by AI,including optimization,classification,regression,and data structure exploration.

Can artificial intelligence be used for distribution power system operation?

This paper provides a systematic overview of some of the most recent studies applying artificial intelligence methods to distribution power system operation published during the last 10 years. Based on that, a general guideline is developed to support the reader in finding a suitable AI technique for a specific operation task.

How can artificial intelligence help electric power operations?

Leveraging artificial intelligence (AI) tools to support operational personnel in monitoring and decision-making minimizes staff workload and enhances incident response efficiency. This convergence of electric power operations and AI represents a significant trend in recent years.

How does artificial intelligence affect power systems?

As different artificial intelligence (AI) techniques continue to evolve,power systems are undergoing significant technological changes with the primary goal of reducing computational time,decreasing utility and consumer costsand ensuring the reliable operation of an electrical power system.

What are the applications of AI in power electronics?

The applications of four categories of AI are discussed, which are expert system, fuzzy logic, metaheuristic method, and machine learning. More than 500 publications have been reviewed to identify the common understandings, practical implementation challenges, and research opportunities in the application of AI for power electronics.

How AI is used in power generation?

With regard to the planning of power generation,AI applications have been widely used in siting tasks,for example using genetic algorithms (AI domain "Planning") or Analytical Hierarchy Processes (AHP - AI domain "Reasoning") to site wind power plants [34,62]or to locate power-to-gas plants . 5.4.2. AI applications for distribution networks

This article gives an overview of the artificial intelligence (AI) applications for power electronic systems. The three distinctive life-cycle phases, design, control, and maintenance ...

Due to the energy transition and the distribution of electricity generation, distribution power systems gain a lot

of attention as their importance increases and new challenges in operation emerge. The integration of renewables and electric vehicles for instance leads to manifold changes in the system, e.g. participation in provision of ancillary services. To solve these ...

This paper offers a comprehensive summary of some of the most recent research on artificial intelligence techniques used to DC Micro grids and electrical power system networks.

As the smart grid advances, the current energy system moves toward a future in which people can purchase whatever they need, sell it when excessive and trade the buying rights for other proactive customers (prosumers) (Tushar et al., 2020).The worldwide power grids have to face a continually rising energy demand, and at the same time, provide a reliable electricity ...

This research provides a detailed review of AI applications in power systems, particularly in stability, control, and protection, identifying key challenges and research gaps ...

This systematic review paper examines the current integration of artificial intelligence into energy management systems for electric vehicles. Using the preferred reporting items for systematic reviews and meta-analyses (PRISMA) methodology, 46 highly relevant articles were systematically identified from extensive literature research. Recent ...

In the twenty-first century, Artificial Intelligence has become one of the most advanced technologies employed in various sectors [1,2,3,4,5,6,7,8,9,10,11,12,13].The United Arab Emirates was the first country to launch AI Strategy in the region and world; that shows the adoption of AI in the Federal government"s strategic plans is inevitable [14,15,16].

We consider six AI domains (reasoning, planning, learning, communication, perception, integration & interaction) and 19 use cases from the power supply chain (i.e., ...

In this paper, the application of heuristic and optimization algorithms based on artificial intelligence (AI) is investigated on electrical power systems. Three distinct areas have been categorized validating the application of AI methods in power systems. It involves classical problem of economic load dispatch in conventional power plant, continuing with optimal sizing issue of ...

He is an Associate Editor for IET Renewable Power Generation, a Guest Editor-in-Chief for Journal of Modern Power Systems and Clean Energy Special Issue on Applications of Artificial Intelligence in Modern Power Systems, a Guest Editor-in-Chief for Transactions of China Electrical Technology Special Issue on Planning and operation of multiple ...

Electrical power systems [1,10] provide the whole electricity supply across the country to ensure the basic needs of people"s livelihood. The application of automated monitoring and analysis on ...

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Through condition monitoring, early fault detection, and predictive maintenance, AI ensures that electrical systems operate at peak performance, offering a glimpse of the transformative potential of artificial intelligence in electrical engineering. Read This Article on Artificial Intelligence in Electrical Predictive Maintenance. 3.

Artificial Intelligence Technologies for Electric Power Systems . Submission Deadline: 31 December 2019 IEEE Access invites manuscript submissions in the area of Artificial Intelligence Technologies for Electric Power Systems.. As the main energy supply system and the most complicated artificial system, the electric power system is undergoing revolutionary changes, ...

Advances in machine learning and artificial intelligence (AI) techniques bring new opportunities to numerous intractable tasks for operation and control in modern electric distribution systems. Nevertheless, AI applications for such grids as cyber-physical systems encounter multifaceted challenges, e.g., high requirements for the quality and quantity of ...

The application of artificial intelligence (AI) has emerged as a potential strategy to improve the control, fault detection, energy management, and design optimisation of power electronics and ...

This paper presents a comprehensive overview of diverse AI techniques that can be applied in power system operation, control and planning, aiming to facilitate their various ...

Power systems are becoming vastly more complex as demand for electricity grows and decarbonisation efforts ramp up. In the past, grids directed energy from centralised power stations. ... This need arrives just as the capabilities of artificial intelligence (AI) applications are rapidly progressing. As machine learning models have become more ...

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Regarding the application of artificial intelligence (AI) in power systems as case studies, real-world applications demonstrate the practicality of AI technologies and highlight their successes and limitations. For instance, a case study involving a major power utility"s use of machine learning algorithms to predict and manage load ...

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B.Kasztenny, vol.5,No.4,December 1997, pp.185-93.

He is an Associate Editor for IET Renewable Power Generation, a Guest Editor-in-Chief for Journal of Modern Power Systems and Clean Energy Special Issue on Applications of Artificial Intelligence in Modern Power ...

This paper lists the literature related to artificial intelligence applications to power systems and notes the artificial intelligence technologies that are becoming important in conjunction with expert systems. ... Application of Artificial Intelligence in Electrical Automation Control. Procedia Computer Science, Volume 166, 2020, pp. 292-295 ...

This article first analyzes the artificial intelligence technology, introduces the two mainstream artificial intelligence technologies in the current situation, and analyzes the power system, and ...

The primary purpose of this report is to provide an overview of the advancement in artificial intelligence and machine learning (AI/ML) technologies and their applications in power systems. It offers a foundation for understanding the transformative role of AI/ML in power systems and aims to stimulate further research and development in this area.

Due to the energy transition and the distribution of electricity generation, distribution power systems gain a lot of attention as their importance increases and new challenges in operation emerge.

Many of the most promising achievements at the intersection of AI and electrical engineering have focused on power systems. For example, the Electric Power Research Institute reported on its efforts to create algorithms capable of identifying malfunctions in transmission and distribution infrastructure based on images collected by drones ...

IET Electric Power Applications; IET Electrical Systems in Transportation; IET Energy Systems Integration ... Application of Statistical Relational Artificial Intelligence in New Electric Power Systems. Submission deadline: Wednesday, 30 April 2025 ... This special issue seeks to explore and showcase innovative applications and methodologies of ...

Here, using a feature selection technique based on principle component analysis (PCA) decreases the number of important components. Figure 2 shows the typical model of the ML framework used in the power system applications. The electric power system is being updated to support a sustainable energy system . As an integrated energy system ...

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Applications of Artificial Intelligence Models in Power System Analysis. Syed Ammar Shah. Electrical Engineering Department. King Fahd University of Petroleum & Minerals Dhahran, Saudi Arabia. I. O. Habiballah. Department of Electrical Engineering King Fahd University of Petroleum & Minerals. Dhahran, Saudi Arabia

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In short, the application of artificial intelligence technology has made the electric automation control unprecedented development, and the future potential is incalculable. 5. Reference 1. Shi Xiaoming. A Brief Analysis of the Application of Artificial Intelligence in Electrical Automation Control [J]. Electronic Production, 2015 (14). 2. Hu ...

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This Special Issue, "Application of Artificial Intelligence in Power System Monitoring and Fault Diagnosis", aims to introduce the latest advances in this field and discusses the application of AI technology in power system modeling and control, state estimation, performance diagnosis, and prognosis, among other fields.

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