

# A review of machine learning applications in power system resilience

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Duchesne et al. (2020) review recent research works that adopt machine learning techniques in the context of reliability assessment and control in bulk power systems, aiming to foster wide practical machine learning applications in other systems including distribution power systems, multi-energy systems, and microgrids.

Several natural hazards have caused unexpected problems to power systems due to climate change, emphasising the position that power systems are not prepared for extremely large-scale events. As a result, the need to study resilience in the context of power systems has been increased. A comprehensive review of the literature on power system resilience (PSR) ...

A review of the literature and evaluation of studies conducted in recent years shows that many solutions have been introduced to cyberattacks detection in the power systems so that machine learning and deep learning methods have found a special place in this field [79,80,81,82,83].

This comprehensive improvement in situational awareness promotes economic growth in the energy sector and supports sustainable, climate-resilient transformation. AI and ML not only improve energy distribution and efficiency but also promote conservation efforts and ensure reliable energy amidst a changing climate.

Citation: Porawagamage G, Dharmapala K, Chaves JS, Villegas D and Rajapakse A (2024) A review of machine learning applications in power system protection and emergency control: opportunities, challenges, and ...

Drawing insights from resilience theory, the paper presents a state-of-the-art review of the literature on power system resilience, highlighting the escalating vulnerabilities of energy systems to ...

This paper aims to systematically review the existing application of machine learning methods on power system resilience enhancement, to expand the interest of researchers and scholars in this topic, and to jointly promote the application of artificial intelligence in the field of power systems. Expand

Recently, due to the increase of the frequency of high impact low probability (HILP) events (manmade and natural events), assessment and enhancement of resilience has become very important in the operation and planning procedures of future power systems.

It emphasizes the significance of resilience and the principles of machine learning application in power systems. Predictive models for climate-related disruptions are among the most recent ...

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DOI: 10.1016/j.egy.2021.08.133 Corpus ID: 239641463; A comprehensive review: Machine learning and its application in integrated power system @article{Kumbhar2021ACR, title={A comprehensive review: Machine learning and its application in integrated power system}, author={Aanand Kumbhar and Pravin G. Dhawale and Shobha Kumbhar and Uday K. Patil ...

The review papers [5,26] explored a variety of topics, from conventional power system resilience methods to the metrics and assessment techniques for power system resilience. The review paper [ 27 ] comprehensively discussed ...

Power systems are generally designed to be reliable when faced with low-impact, high-probability, and expected power outages. By contrast, the probability of extreme event (extreme weather or natural disasters) occurrence is low, but may seriously affect the power system, from long outage times to damage to major equipment such as substations, ...

This paper explores how advanced technologies, including smart grids, artificial intelligence (AI), and machine learning, (ML), enhance the resilience of power systems against ...

It further illustrates how AI and ML optimize smart grids to support these strategies. Proactive integration of smart grids with advanced technologies could significantly reduce climate-related costs compared to non-adaptive methods.

The need to integrate climate science and machine learning technologies to address climate change concerns and improve power system resilience is emphasized in this analysis. This study focuses on how climate science and machine learning techniques may be used to improve power system resilience in the face of climate change. It emphasizes the ...

To this end, structural risk and resilience assessment has been an ongoing research topic in the past 20 years. Recently, machine learning (ML) techniques have been shown as promising tools for advancing the risk and resilience assessment of structure and infrastructure systems.

Although the utilization of ML for outage prediction and power system resilience has been reviewed in [105], [114], respectively, to the best of the authors' knowledge, there is no review of data-driven and ML applications in predictive analytics related to cascade attributes in power systems to date. This section is focused on reviewing such ...

The resilience of interdependent critical infrastructure systems (ICISs) is critical for the functioning of society and the economy. ICISs such as power grids and telecommunication networks are complex systems characterized by a wide range of interconnections, and disruptions to such systems can cause significant socioeconomic losses.

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Review of Machine Learning Techniques for Power Electronics Control and Optimization. ... aspects of power system resilience, such as ... learning applications in power system resilience, in: ...

Recognizing the need to address these issues, this paper explores data-driven solutions, focusing on the potential of machine learning (ML) in power system protection and control. It presents a comprehensive review highlighting ...

Resilience curves could date back to the work of Bruneau et al. [7] on seismic community resilience. This study developed a measure  $Q(t)$ , the service quality of the infrastructure over time, to quantify resilience. The function plot of  $Q(t)$  is a resilience curve. Since its birth, the resilience curve has been a powerful tool for researchers to illustrate key ...

A systematic review on power system resilience from the perspective of generation, network, and load: Impact analysis and quantification in power system resilience: ... A review of machine learning applications in power system resilience. IEEE power and energy society general meeting, IEEE Computer Society (2020), 10.1109/PESGM41954.2020. ...

Then, the paper delves into the concept of resilience and the role of microgrids in maintaining power stability. The paper reviews various AI techniques and methods, and their application in power ...

This paper presents an in-depth exploration of the application of Artificial Intelligence (AI) in enhancing the resilience of microgrids. It begins with an overview of the impact of natural events on power systems and provides data and insights related to power outages and blackouts caused by natural events in Estonia, setting the context for the need for resilient ...

The review papers [5,26] explored a variety of topics, from conventional power system resilience methods to the metrics and assessment techniques for power system resilience. The review paper [ 27 ] comprehensively discussed machine learning strategies and their applications in conserving energy and managing it effectively, emphasizing their ...

A comprehensive review about machine learning application in power system especially in smart grid, renewable energy sector etc. is summarized in this paper. In the power sector, the power consumption is increased day by day very tremendously.

and opportunities of applying machine learning for various aspects of power system resilience, such as situational awareness, contingency analysis, restoration planning, and adaptive protection. The paper also describes machine learning techniques and their applications in power system resilience. A picture containing text, clipart

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For this reason, this study conducted a comprehensive review on ML for risk and resilience assessment in four main branches of structural engineering (buildings, bridges, pipelines, and electric power systems).

An extensive literature review shows that machine learning and deep learning approaches are gaining significant traction in addressing various asset management challenges within power systems. Considering the surge in development and interest across diverse ML applications, the electric power industry benefits substantially from integrating ML ...

This study seeks to review machine learning applications to power system studies. This paper reviewed applications of ML tools in power systems studies. Keywords: Machine Learning; Big Data; Data Analytic; Power systems. 1. Introduction The electric power system is one of the most complex systems ever built by mankind. Economy and security of ...

It is an urgent challenge to integrate the advanced machine learning technology and large amount of real-time data from wide area measurement systems and intelligent electronic devices, in order to effectively enhance power system resilience and ensure the reliable and secure operation of power systems.

Natural disasters pose significant threats to power distribution systems, intensified by the increasing impacts of climate changes. Resilience-enhancement strategies are crucial in mitigating the resulting social and economic damages. Hence, this review paper presents a comprehensive exploration of weather management strategies, augmented by recent ...

The applications of machine learning (ML) algorithms are identified by Olowononi et al. in the field of security and resiliency of the power grid. Their target is to effectively survey ...

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