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Special Session 25: AI-Driven Energy Management and Security in Power Systems: Challenges, Solutions, and Future Directions

Session Organizer：

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Brief Description of the Session Thematic:

The growing complexity of energy management in power systems poses significant challenges, primarily due to the non-convex and nonlinear nature of these problems. Traditional numerical methods often struggle to find effective solutions in such complex environments. While recent advancements in Artificial Intelligence (AI) offer promising nonlinear representation capabilities, AI-based approaches, particularly those using multi-layer neural networks, can exacerbate uncertainties in the physical systems and lead to suboptimal or degraded performance. These degraded outcomes are difficult to detect due to the limited interpretability of AI systems, making them vulnerable to cyberattacks. Malicious actors can exploit this by injecting falsified data that closely resembles real data, causing AI agents to generate incorrect solutions, potentially leading to severe consequences such as power grid failures. To address these critical concerns, this conference seeks contributions on the application of AI in power systems, with a focus on both optimization and security.

Topics and Keywords:

Topics of interest include, but are not limited to:

1. Challenges in interpretability for AI-driven optimization control.
2. Security risks and vulnerabilities in AI-powered power and energy systems.
3. Attack strategies against AI-based dispatching centers.
4. AI-powered detection, identification, and recovery from cyber-attacks and data injection.
5. Knowledge-based and data-driven approaches to enhancing smart grid security.
6. Privacy-preserving AI methods in power and energy applications.
7. Efficient and reliable AI-driven optimization, scheduling, and control for large-scale, complex systems.

We welcome original research articles, review papers and case studies exploring innovative solutions at the intersection of AI, power systems, and security.

Keywords

Artificial intelligence; Security; Attack and defense; Interpretability challenge for AI; Machine learning; Energy management; Smart grids; Knowledge-based & data-driven strategy; Dispatching framework; Integrating renewable energy