Special Issue

Generative AI Applications for Power Systems

Message from the Guest Editors

The digital transformation of power systems has enabled massive data collection via smart meters and sensors. This data explosion supports AI-driven analytics for grid observability, operation, and planning—vital with rising renewable energy. Generative AI enhances this by enabling synthetic data via GANs, probabilistic forecasting with VAEs, state estimation using input masking, rare event simulation through normalizing flows, and cross-domain awareness with multi-modal transformers. Generative AI also acts as an intelligent advisor—analyzing historical and live data to detect emerging patterns, predict anomalies, and propose mitigation strategies. This boosts operator awareness, supports informed decisions, and improves agility amid renewable and demand-side volatility. Together, AI and generative AI improve forecasting, optimize operations, and support renewables. The shift toward real-time control and market optimization highlights the need for continued collaboration across disciplines. We look forward to your contributions.

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