Artificial Intelligence Can Make the U.S Electric Grid Smarter and More Reliable

Argonne National Laboratory in partnership with the Office of Science, Office of Electricity, and the Midcontinent Independent System Operator

Using artificial intelligence, researchers at Argonne National Laboratory are developing new ways to extract insights about the electric grid from vast quantities of data, with the goal of ensuring reliability and efficiency.

Innovation

How much electricity will you need tomorrow? Answering that question is like looking ahead to your morning commute—somewhat predictable, but by no means ironclad. To manage the uncertainty in predicting power needs, grid operators rely on computer models that help estimate everything from power demand to traffic patterns.

This challenge of factoring in both the certain and the unknown to deliver electricity under different scenarios involves a series of incredibly complex math problems. With the assistance of artificial intelligence (AI), researchers at Argonne National Laboratory are developing new ways to extract insights from vast quantities of data on the electric grid, with the goal of ensuring greater reliability, resilience, and efficiency.

Outcomes

Technology Advancement

Argonne researchers are working on optimization models that use machine learning, a form of AI, to simulate the electric system and the severity of various problems much more quickly than is possible with current widely used models.

Other work at Argonne involves applying AI to speed up the daily calculations that go into regional electric system planning. One such calculation is the security constrained unit commitment (SCUC), which helps grid operators set a schedule for daily and hourly power generation.

Impact

Argonne researchers developed AI that can solve SCUC 12 times faster, on average, then conventional methods[1]. An early version of the method was used successfully in tests at Midcontinent Independent System Operator[2], which oversees electricity delivery across 15 U.S. states and one Canadian province.

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"In power systems, this SCUC problem is solved multiple times a day. Since this problem is solved repeatedly, we can accumulate a lot of data and discover patterns that could be used to solve the next round."

Feng Qiu, Principal Computational Scientist
Argonne National Laboratory

Timeline

2018: Machine learning methods to solve SCUC calculations were tested at the Midcontinent Independent System Operator.

[1]Xavier A., et al. "Learning to Solve Large-Scale Security-Constrained Unit Commitment Problems" arXiv. Feb. 2019

[2]Xavier A., et al. "Transmission Constraint Filtering in Large-Scale Security-Constrained Unit Commitment" IEEE Xplore. May 2019