

Cognitive Battery Digital Twin

Towards Intelligent Battery Management



About Us

CAP is an acronym for the “Cloud Application and Platform Lab” in the College of Computing and Data Science at NTU, led by Prof. Wen Yonggang. We are a leading research group conducting innovative and fundamental research across a broad range of applications and platforms.



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Project background:



Global EV battery demand exceeded 950 GWh in 2024



Over 40 GW of stationary battery energy storage capacity increase in 2023 - around twice the 2022 increase

Problem:

Complex and dynamic operating environments demand advanced battery health monitoring and management to maintain efficient and safe operation

Critical limitations in current BMS:

- Low accuracy in critical state estimation
- Low robustness in dynamic operation conditions
- Limited predictive maintenance capability
- Limited intelligent management to improve performance across lifecycle

Our solution: Five-tier cognitive battery digital twin

Leveraging advanced AI, the cognitive battery digital twin seamlessly integrates multi-physics with data-driven intelligence to achieve intelligent management, adaptive update, and autonomous decision-making for various applications across the lifespan.

