

AI Paradoxes: Between Model Scalability and Energy Efficiency Limits

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Abstract:

The expansion of large-scale language models has introduced challenges that go beyond algorithmic innovation, directly impacting global energy infrastructure. This lecture analyzes the correlation between the operational costs of current models—reflected in token pricing and processing architectures—and the actual physical demand for electricity. Drawing on updated data from official sources, the presentation discusses how increasing computational capacity necessitates a revision of sustainability strategies and the responsible use of resources in data centers. From a physics education perspective, it proposes a technical analysis of energy conversion and dissipation processes, turning technological consumption into a scientific and pedagogical object of study. The goal is to provide a critical view on how optimizing available technologies can coexist with environmental preservation, fostering a deeper

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understanding of artificial intelligence's impact on the contemporary energy landscape.

Keywords: Dual-rotor, Axial momentum theory, Hydrokinetics Turbines.