AI Sovereignty Just Got a Mathematical Guarantee

New proof ensures self-hosted AI can converge in finite time—no cloud required.

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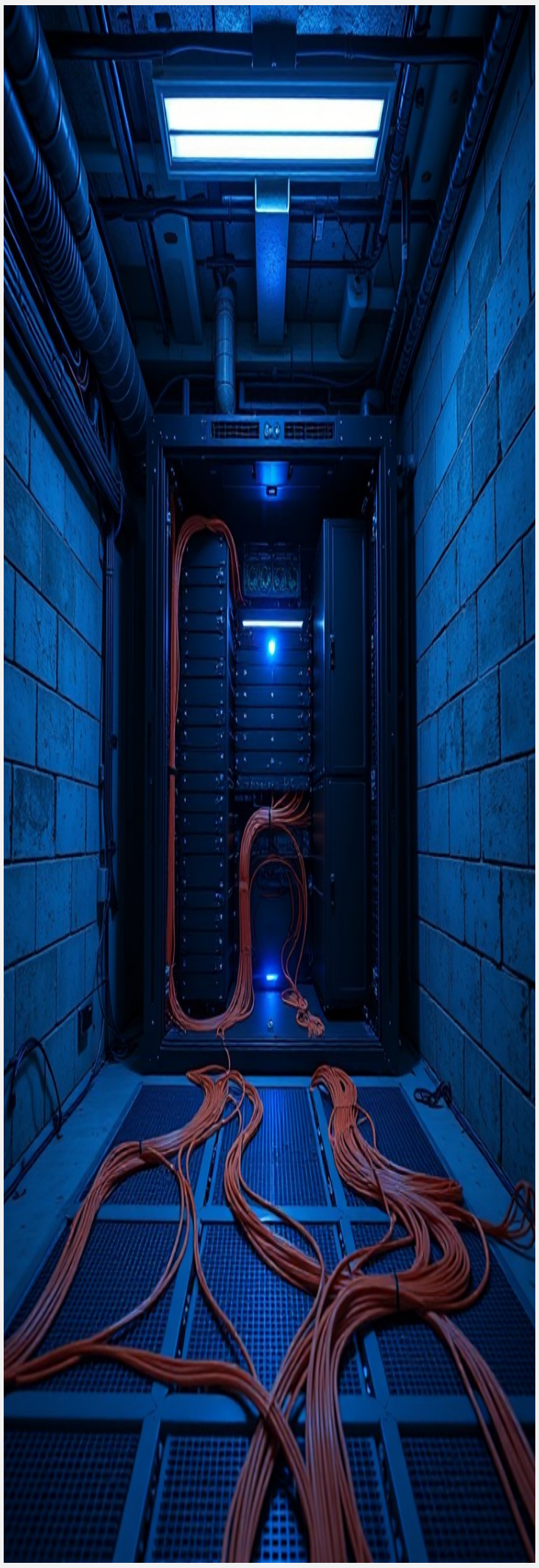
THE DATA

finite-time sublinear regret

Regret Bound

The paper establishes the first finite-time sublinear regret guarantee for neural reinforcement learning in POMDPs using finite-memory approximations.

This means AI systems trained locally—on private data, in home labs, or on-prem—can now be mathematically guaranteed to improve over time without drifting into poor decisions. The result is not just theoretical: it enables real-time, self-correcting agents that don’t rely on cloud-based supervision or external validation.



Source: arXiv · Published November 04, 2026
https://arxiv.org/abs/2611.07069

01

Trust in Code, Not Cloud

For AI Sovereignty Council members building local stacks, this is the first formal proof that decentralized AI isn’t just possible—it’s provably efficient. The convergence guarantee means your private RAG system or local LLM can autonomously refine its behavior within a bounded time, even with incomplete or noisy data. This eliminates the need for constant reliance on centralized training pipelines.

02

The End of the ‘Black Box’ in Private AI

By proving regret bounds for neural function approximators in POMDPs with finite memory, the work dismantles the myth that local AI must be unreliable. Now, teams can deploy autonomous agents—like home security systems or personal assistants—knowing they will converge to near-optimal performance without external oversight. This is the foundation for truly sovereign AI: autonomous, verifiable, and locally accountable.

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