Research Spotlight: Scaling AI Agents to Millions - From Research to Real-world Impact

I hope this email finds you well. I'm writing to share some exciting developments in our research at the Media Lab that bridges cutting-edge AI innovation with real-world policy impact.

Key Innovation: We've developed a breakthrough in AI agent simulation that scales from hundreds to millions of agents - a fundamental advance that allows us to model entire cities and their complex social dynamics. While current approaches (like Stanford's Smallville, Deepmind's Concordia, Altera's Project Sid [3]) are limited to 100-1000 agents, our framework successfully simulates 8.4 million agents, effectively recreating NYC's entire population with their interactions and behaviors. Our work has recently been accepted as an Oral paper at AAMAS 2025; and in collaboration with the govt of NZ: we used it to build a digital twin of their 5 million citizens that is being used to tackle the emerging H5N1 pandemic.

Technical Contribution: Our primary contribution is an agent architecture that enables the simultaneous simulation of millions of autonomous agents while maintaining computational efficiency. This represents a fundamental advance in how we model complex social systems - moving from small-scale simulations to population-level modeling that captures emergent behavioral patterns. We've implemented this architecture through AgentTorch, our open-source framework for large-scale agent modeling. While AgentTorch supports our agent architecture, it also provides a broader platform for developing and deploying population-scale AI systems. The framework allows policymakers to test interventions in a simulated environment before real-world implementation, bridging the critical gap between research innovation and practical deployment. This work is part of our broader research agenda on Large Population Models (LPMs), a new paradigm we've proposed for orchestrating beneficial collective behavior at unprecedented scales through sophisticated coordination protocols (published in AAMAS 2025 and detailed in our recent perspective paper).

Validation and Real-World Impact:

Our work's impact spans both experimental validation and real-world policy implementation.

Experimental: We conduct experimental validation by creating a digital version of New York City with 8.4 million autonomous agents - to recreate complex patterns of labor force participation and mobility. By validating these simulations against actual census data, we demonstrated two transformative capabilities. First, we showed that large-scale agent simulations can digitally recreate census-level insights for just a few hundred dollars - presenting an opportunity to move beyond traditional once-in-a-decade census taking toward real-time, passive population monitoring. Second, we show that evaluating policies at true population scale reveals insights that smaller simulations miss, particularly in understanding how behavioral patterns and disease transmission interact during public health crises. These results validate the potential of large-scale agent simulations for both data collection and policy evaluation. This work shows the potential for using AI simulations as a more efficient and privacy-preserving alternative to traditional data collection methods.

Real-world Policy: Our research has already translated into real-world impact through our AgentTorch framework. We have partnered with New Zealand's Environmental Science and Research (ESR) institute to create an agent-based twin of their society - simulating 5 million citizens and their interactions across health and economy. This system is actively supporting New Zealand's response to the emerging H5N1 bird flu threat, helping authorities understand and manage both public health implications and supply chain disruptions. This real-world deployment demonstrates how academic research in large-scale agent simulation can directly support critical government decision-making and improve public services.

This work represents a significant step forward in bridging AI research with practical policy needs. It demonstrates MIT's leadership in developing technologies that directly address societal challenges.

Best regards,

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Our work:

[1]: On the limits of agency in agent-based models. Accepted at AAMAS 2025 (Oral): https://arxiv.org/pdf/2409.10568

[2]: The future is now: revolutionising decision-making with AI-driven simulations - AgentTorch in New Zealand. https://www.esr.cri.nz/news-publications/the-future-is-now-revolutionising-decision-making-with-ai-driven-simulations/

Related work:

[3]: Article in TechReview on Altera: https://www.technologyreview.com/2024/11/27/1107377/a-minecraft-town-of-ai-characters-made-friends-invented-jobs-and-spread-religion/

[4]: MIT Tech Review article on Smallville: https://www.technologyreview.com/2024/06/20/1093428/generative-ai-reinventing-video-games-immersive-npcs/