

Toward Trustworthy AI for Decision Making in Population Health

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AI and population health are becoming increasingly intertwined, driven by the growing availability of multimodal data and rapid advances in AI (Rodríguez et al. 2024). At the AAAI-26 New Faculty Highlights, I present our efforts to harness these trends to enhance our capacity to model, simulate, and adapt to complex dynamical processes. I first introduce our robust deep learning architectures for real-time outbreak response (Rodríguez et al. 2021b,a), highlighting how our frameworks capture uncertainty and dynamics across shifting distributions, multimodal data, hierarchical structures, and relational dependencies (Li and Rodríguez 2025; Li, Menacho, and Rodríguez 2025; Kamarthi et al. 2023; Zhao et al. 2025). I will then introduce our hybrid approaches that integrate machine learning with science-based mechanistic epidemiological models, including physics-informed neural networks, expert-guided generative models for causal inference, and differentiable agent-based models (Rodríguez et al. 2023; Mu et al. 2025; Chopra et al. 2023b,a). Together, these advances illustrate how combining data-driven AI with domain knowledge can enable more reliable, adaptive, and actionable solutions to inform decision making in population health.

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