Generative AI-Powered Inference
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Abstract:

We introduce Generative AI-Powered Inference (GPI), a statistical framework for both causal and predictive inference using unstructured data, including text and images. GPI leverages open-source generative AI models---such as large language models and diffusion models---not only to generate unstructured data at scale but also to extract low-dimensional representations that capture their underlying structure. Applying machine learning to these representations, GPI enables estimation of causal and predictive effects while quantifying associated estimation uncertainty. Unlike existing approaches to representation learning, GPI does not require fine-tuning of generative models, making it computationally efficient and broadly accessible. We illustrate the versatility of the GPI framework through three applications: (1) analyzing Chinese social media censorship, (2) predicting electoral outcomes from candidates' facial appearance, and (3) assessing the persuasiveness of political rhetoric. An open-source software package is available for implementing GPI.

Kosuke Imai (pronounced K$\overline{o}'\cdot$ sk $\overline{a}$) is Professor in the __Department of Government__ and the __Department of Statistics__ at __Harvard University__. He is also an affiliate of the __Institute for Quantitative Social Science__. Before moving to Harvard in 2018, Imai taught at __Princeton University__ for 15 years where he was the founding director of the __Program in Statistics and Machine Learning__. Imai specializes in the development of statistical methods and machine learning algorithms and their applications to social science research. His areas of expertise include causal inference, computational social science, and survey methodology. Imai leads the __Algorithm-Assisted Redistricting Methodology Project (ALARM)__ and served as an expert witness for several high-profile legislative redistricting cases. In addition, he is the author of __Quantitative Social Science: An Introduction__ (Princeton University Press, 2017). Outside of Harvard, Imai served as the President of the __Society for Political Methodology__ from 2017 to 2019.