

# HDR<sup>2</sup> From Harnessing the Data Revolution to Harvesting the Data Revolution

Contribution ID: 59

Type: **not specified**

## HDR IDEAL - The Institute for Data, Econometrics, Algorithms, and Learning

*Wednesday 26 October 2022 16:30 (1 hour)*

This IDEAL (Phase I) project involves the development of a multi-discipline and multi-institution collaborative institute in the Chicago area that focuses on key aspects of the theoretical foundations of data science. The institute leverages existing strengths across computer science, statistics, economics, electrical engineering and operations research across Northwestern University, Toyota Technological Institute at Chicago (TTIC) and University of Chicago to bear upon foundational problems related to machine learning, high-dimensional data analysis and optimization in both strategic and non-strategic environments.

The research thrusts center around three broad themes:

1. High dimensional data analysis: This theme addresses both algorithmic and statistical challenges in dealing with high dimensional data, and investigate topics like dimension reduction, metric embeddings, sketching, inference on networks and problems in unsupervised learning like clustering and probabilistic modeling.
2. Data Science in Strategic Environments: This addresses computational and information theoretic challenges in econometric models of strategic behavior. Complexity arises, for example, from high-dimensional parameter spaces, unobserved heterogeneity, and multiplicity of equilibria in games. Specific topics of interest include inference on structural parameters, algorithms to characterize boundary of sets, partial identification, and machine learning in econometrics.
3. Machine learning and optimization: This theme addresses foundational questions in both continuous and discrete optimization and its use in machine learning; topics include representation learning, robustness in learning, and provable bounds for non-convex optimization and deep learning.

There have been 5 special quarters (fall and spring of each year) so far where the institute has brought together investigators, postdocs and Ph.D. students to focus on the topic of the special quarter. We are currently in the middle of our special quarter on Data Economics (Fall 2022). In addition to the interdisciplinary foundational research and education through coordinated graduate courses, there have been several hybrid and virtual workshops, seminars (which are all recorded and posted on our public webpage) and other events that have allowed us to engage with the broader community.

### Research

### Education and Outreach

### Data & Cyberinfrastructure

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**Session Classification:** Poster session I