My Background

- PhD in Applied Math at Harvard (2014-2020)
  - Secondary field in Science, Technology, and Society (STS)
  - Fellow at Berkman Klein Center for Internet & Society, Harvard Law School
- Data scientist for the City of Boston (2016-2017)
- Postdoc at Michigan (2020-2023)
  - Society of Fellows
  - Gerald R. Ford School of Public Policy
- Assistant Professor at Michigan (2023-Present)
  - School of Information
The Promises and Perils of Government Algorithms

Promises: Accuracy, Fairness, Consistency

Perils: Errors, Biases, and Inflexibility

Given the many real-world harms associated with algorithms, how can data scientists help create a more just society?
Boston Emergency Medical Services (EMS)
Data scientists can’t promote justice simply by applying their existing practices to social and political challenges. Instead, they need to fundamentally transform data science epistemology and methodology.

My goal is to transform the field so that “doing good data science” becomes synonymous with “doing good with data science.”

Achieving this goal requires transforming data science from a formal methodology focused on mathematical models into a practical methodology focused on real-world social problems and impacts.
Talk Structure

1. Algorithmic Formalism

2. Algorithmic Realism

3. Implications and Examples
Algorithmic Formalism

- Algorithmic formalism is a data science methodology that focuses solely on the mathematical properties of algorithms.
- It assumes that mathematical formalisms provide a complete description of algorithms.
# Algorithmic Formalism

<table>
<thead>
<tr>
<th><strong>Orientation</strong></th>
<th><strong>Practice</strong></th>
<th><strong>Harm</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Mathematical internalism</td>
<td>Ignoring implementation</td>
<td>Unrealistic optimism</td>
</tr>
<tr>
<td>Abstract universalism</td>
<td>Oversimplying social contexts</td>
<td>Distort values and priorities</td>
</tr>
<tr>
<td>Political neutrality</td>
<td>Solving the wrong problem</td>
<td>Entrench injustice</td>
</tr>
</tbody>
</table>
An Impasse in Responses

Formalist Incorporation vs. Critical Deconstruction
Talk Structure

1. Algorithmic Formalism
2. Algorithmic Realism
3. Implications and Examples
Lessons from Pragmatist Philosophy

- Pragmatism is a philosophical tradition that developed in the United States in the late 1800s to early 1900s.
- Classical pragmatists: mathematician Charles Sanders Peirce, psychologist William James, and philosopher John Dewey.
- Most philosophy at the time aimed to develop formal systems of knowledge that perfectly represent abstract and objective truths.
- Pragmatist alternative: ideas are tools that should be wielded to improve society.
The Pragmatic Maxim

Pragmatic maxim: “The ultimate test for us of what a truth means is indeed the conduct it dictates or inspires.” -William James

Principle 1: Consequentialism
- Philosophers should evaluate ideas based on the real-world impacts of following them, not their internal logical structure.

Principle 2: Instrumentalism
- The goal of philosophy is to solve practical social problems, not to uncover abstract and immutable truths.

Principle 3: Sociality
- Philosophers should embrace the social interests that motivate and shape ideas.
Dewey: “Mistakes are no longer either mere unavoidable accidents to be mourned or moral sins to be expiated and forgiven. They are lessons in wrong methods of using intelligence and instructions as to a better course in the future. They are indications of the need of revision, development, readjustment.”

Impacts in law: “legal formalism” → “legal realism”
Algorithmic Realism

- Algorithmic realism is a data science methodology that designs and evaluates algorithms with a focus on real-world impacts.

- Pragmatic maxim for data science: "Algorithms are instrumental tools for improving society. The ultimate test of an algorithm’s quality is what impacts it generates in practice."
Conceptual Shifts

Formalist Orientation
- Mathematical internalism
- Abstract universalism
- Political neutrality

Realist Orientation
- Sociotechnical consequentialism
- Contextual instrumentalism
- Political agonism
### Expanding the Data Science Pipeline

<table>
<thead>
<tr>
<th>Problem Scoping</th>
<th>Problem Formulation</th>
<th>Model Development</th>
<th>Implementation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Identify a Problematic Situation</td>
<td>Specify Concrete Goals</td>
<td>Curate Data</td>
<td>Anticipate Impacts and Mitigate Harms</td>
</tr>
<tr>
<td>Diagnose the Problem</td>
<td>Identify Roles for Data Science</td>
<td>Train a Model</td>
<td>Implement the Algorithm</td>
</tr>
<tr>
<td>Develop Reform Strategies</td>
<td>Formulate a Prediction Problem</td>
<td>Make Predictions and Evaluate Model</td>
<td>Measure Impacts and Mitigate Harms</td>
</tr>
</tbody>
</table>
Talk Structure

1. Algorithmic Formalism
2. Algorithmic Realism
3. Implications and Examples
New Questions, New Algorithms

John Dewey: “Intellectual advance occurs in two ways. At times increase of knowledge is organized about old conceptions, while these are expanded, elaborated and refined, but not seriously revised, much less abandoned. At other times, the increase of knowledge demands qualitative rather than quantitative change; alteration, not addition. … Former problems may not have been solved, but they no longer press for solution.”

- Can an algorithm accurately predict X?
- Is this algorithm fair?
- Can an algorithm improve efforts to address X?
- Does this algorithm reduce social and material inequality?
Efficiency vs. Efficacy

A Slow Algorithm Improves Users’ Assessments of the Algorithm’s Accuracy

JOON SUNG PARK, University of Illinois at Urbana-Champaign, USA
RICK BARBER, University of Illinois at Urbana-Champaign, USA
ALEX KIRLIK, University of Illinois at Urbana-Champaign, USA
KARRIE KARAHALIOS, University of Illinois at Urbana-Champaign, USA
Shifting Concepts of Value
Designing Algorithmic Decision-Support Systems for Public Services

Naja Holten Møller
Department of Computer Science, University of Copenhagen, Copenhagen, Denmark
naja@di.ku.dk

Irina Shklovski
Department of Computer Science and Department of Communication, University of Copenhagen, Copenhagen, Denmark
ias@di.ku.dk

Thomas T. Hildebrandt
Department of Computer Science, University of Copenhagen, Copenhagen, Denmark
hilde@di.ku.dk
Machine Learning for Social Services: A Study of Prenatal Case Management in Illinois

Ian Pan, MA, Laura B. Nolan, PhD, Rashida R. Brown, MPH, Romana Khan, PhD, Paul van der Boor, PhD, Daniel G. Harris, MA, and Rayid Ghani, MS
Explainable AI is Dead, Long Live Explainable AI!

Hypothesis-driven Decision Support using Evaluative AI

Tim Miller
tmiller@unimelb.edu.au
The University of Melbourne
Melbourne, VIC, Australia

Lesion
Patient reports itchiness and bleeding. Lesion has changed colour.

Notes

Evidence for
Lesion location
○ Head ○ Upper arm
○ Face ○ Hand/Lower Arm
○ Back ○ Upper Leg
○ Front Torso ○ Foot/Lower Leg

Evidence against
Asymmetric shape
Changed colour
Itchiness
Algorithmic Risk Assessments Can Alter Human Decision-Making Processes in High-Stakes Government Contexts

BEN GREEN, University of Michigan, USA
YILING CHEN, Harvard University, USA
Institutionalizing Algorithmic Realism

Pedagogy Reforms
- Provide Training Across the Algorithmic Realism Pipeline
- Introduce Clinical Courses
- Expand Institutional Support for Public Interest Technology Careers

Research Reforms
- Enforce Higher Standards for Realist Considerations in Peer Review
- Expand Opportunities to Publish Realist Research
- Universities Should Expand Jobs and Support for Realist Scholars
- Make Ethics and Social Impacts Central Priorities in Grantmaking
Algorithmic Realism and Undone Science

**Problem Scoping**
- Identify a Problematic Situation
- Diagnose the Problem
- Develop Reform Strategies

**Problem Formulation**
- Specify Concrete Goals
- Identify Roles for Data Science
- Formulate a Prediction Problem

**Model Development**
- Curate Data
- Train a Model
- Make Predictions and Evaluate Model

**Implementation**
- Anticipate Impacts and Mitigate Harms
- Implement the Algorithm
- Measure Impacts and Mitigate Harms