Algorithmic Realism:

Data Science Practices to Promote Social Justice

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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

The New York Times

PLAY THE CROSSWORD

Judges Replacing Conjecture With Formula for Bail

FEATURE The New York Times Magazine

Can an Algorithm Tell When Kids Are in Danger?

CITYLAB

Chicago Is Predicting Food Safety Violations. Why Aren't Other Cities?

Perils: Errors, Biases, and Inflexibility

Machine Bias

There's software used across the country to predict future criminals. And it's biased against blacks.

by Julia Angwin, Jeff Larson, Surya Mattu and Lauren Kirchner, ProPublica

May 23, 2016

Wrongfully Accused by an Algorithm

In what may be the first known case of its kind, a faulty facial recognition match led to a Michigan man's arrest for a crime he did not commit.

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By Kashmir Hill

Published June 24, 2020 Updated Aug. 3, 2020

Given the many real-world harms associated with algorithms, how can data scientists help create a more just society?

Boston Emergency Medical Services (EMS)

My argument in a slide

- 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

Orientation	Practice	Harm
Mathematical internalism	Ignoring implementation	Unrealistic optimism
Abstract universalism	Oversimplying social contexts	Distort values and priorities
Political neutrality	Solving the wrong problem	Entrench injustice

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.

Bridging Critique and Action

- 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	Realist Orientation
Mathematical internalism	Sociotechnical consequentialism
Abstract universalism	Contextual instrumentalism
Political neutrality	Political agonism

Expanding the Data Science Pipeline

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

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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? → Can an algorithm improve efforts to address X?

Is this algorithm fair? → 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

Duplicate vs. Supplement Decision-Makers

Shifting Concepts of Value

Designing Algorithmic Decision-Support Systems for Public Services

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Maximize Accuracy vs. Maximize Functionality

AJPH RESEARCH

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

Explain Advice vs. Guide Decision-Making

Explainable AI is Dead, Long Live Explainable AI!

Hypothesis-driven Decision Support using Evaluative AI

Tim Miller
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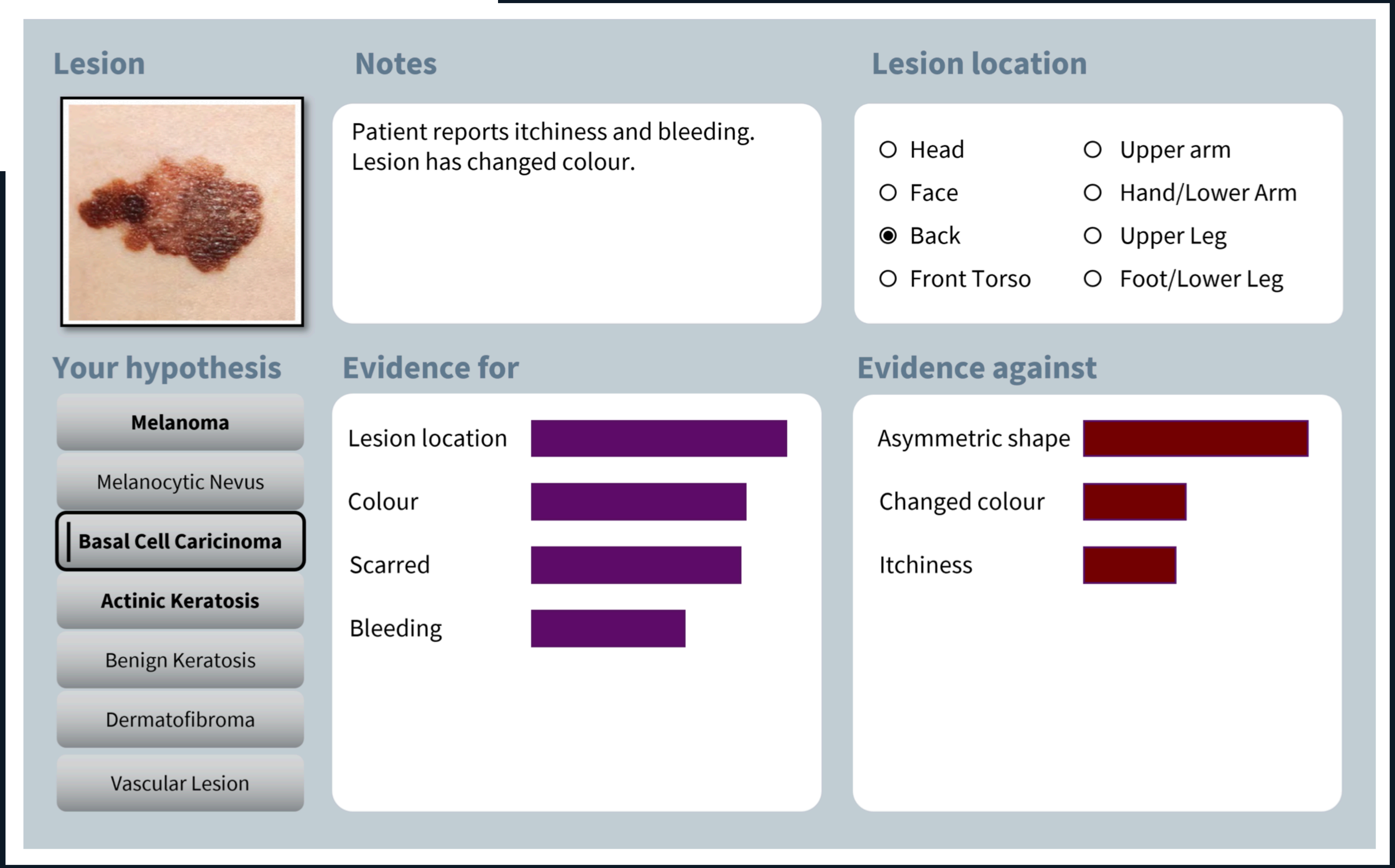
Melbourne, VIC, Australia



Evaluate Accuracy vs. Evaluate Moral Balancing

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
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