# Automated Algorithms and Risk: Two Sides of the Coin


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The use of **automated algorithms** for decision making has become increasingly ubiquitous across a wide variety of fields...

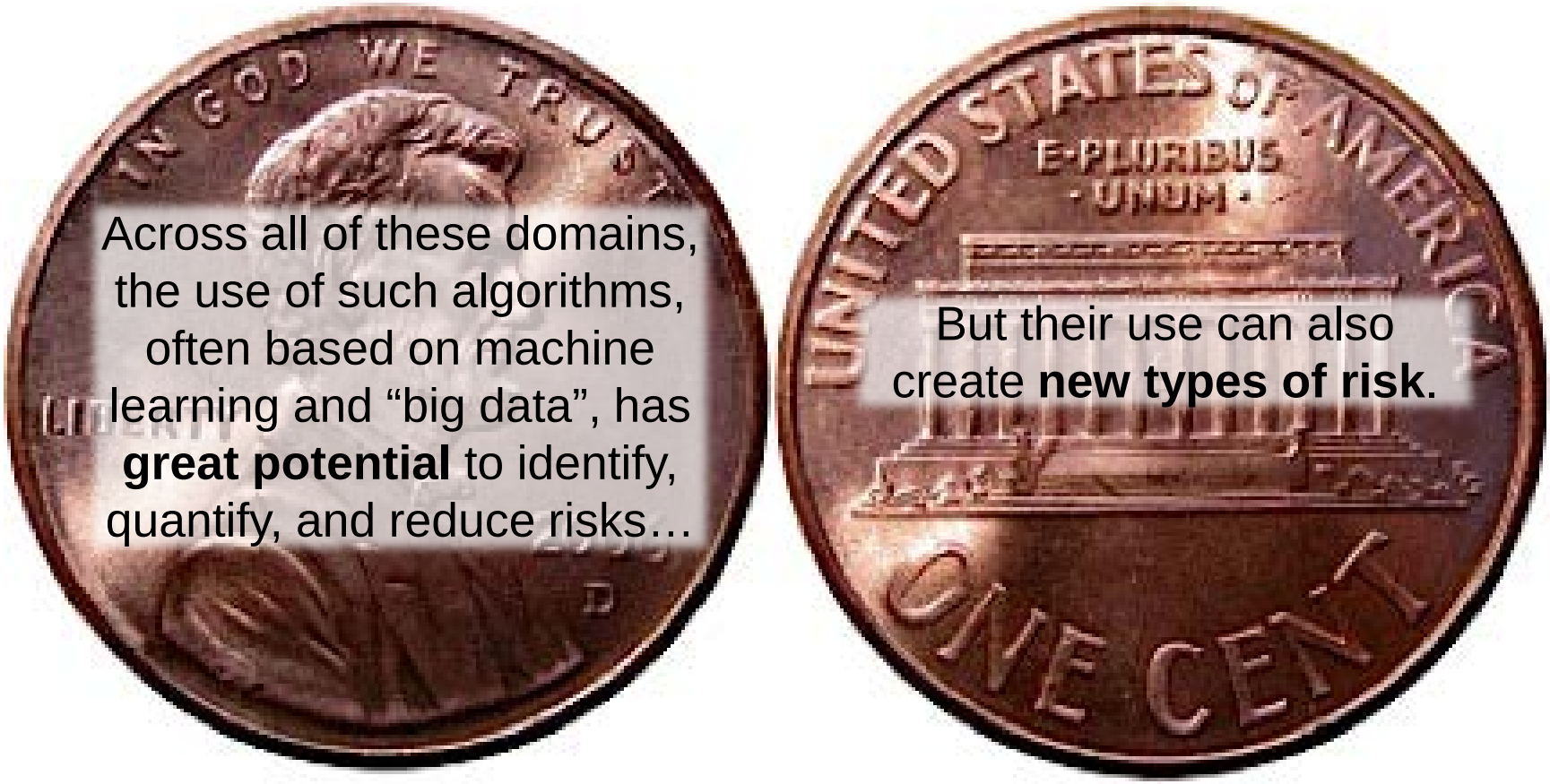
Online marketing

Lending Hiring

Health care diagnosis & treatment

Policing & criminal justice

Allocation of city services



# Automated Algorithms and Risk

# Part 1: The Promise

Better Models,
Better Decisions

Early Warning for
Critical Events

Identifying Emerging
Trends and Patterns

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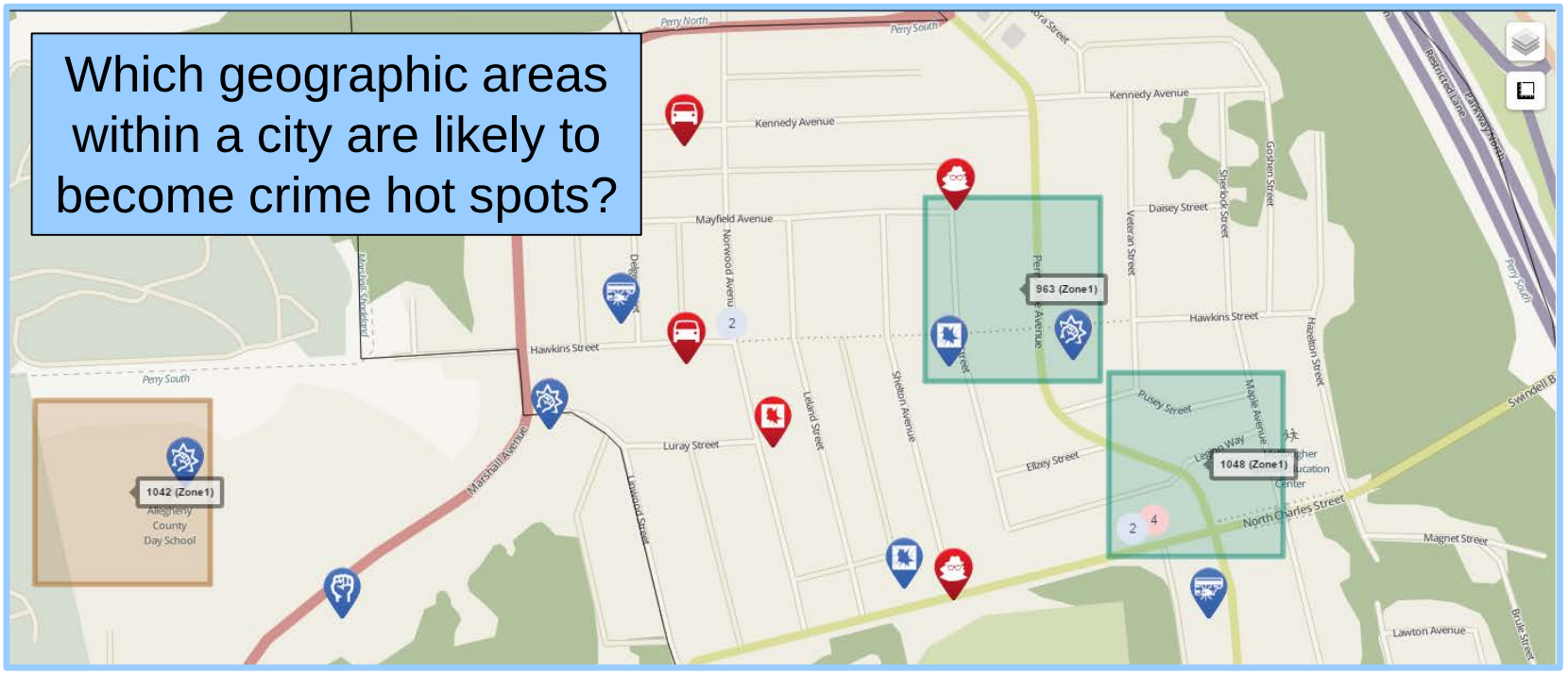
# Better Models, Better Decisions

Better **predictive models** can lead to improved organizational decisions, allocation of public resources, and quantification of risks.




<u>Short time horizon:</u>
Targeted police patrols in these areas reduce crime.

<u>Longer time horizon:</u>
Quantify risk of loss from theft, assault. Also informs city planning and policy.

# Early Warning for Critical Events

Disease pandemic

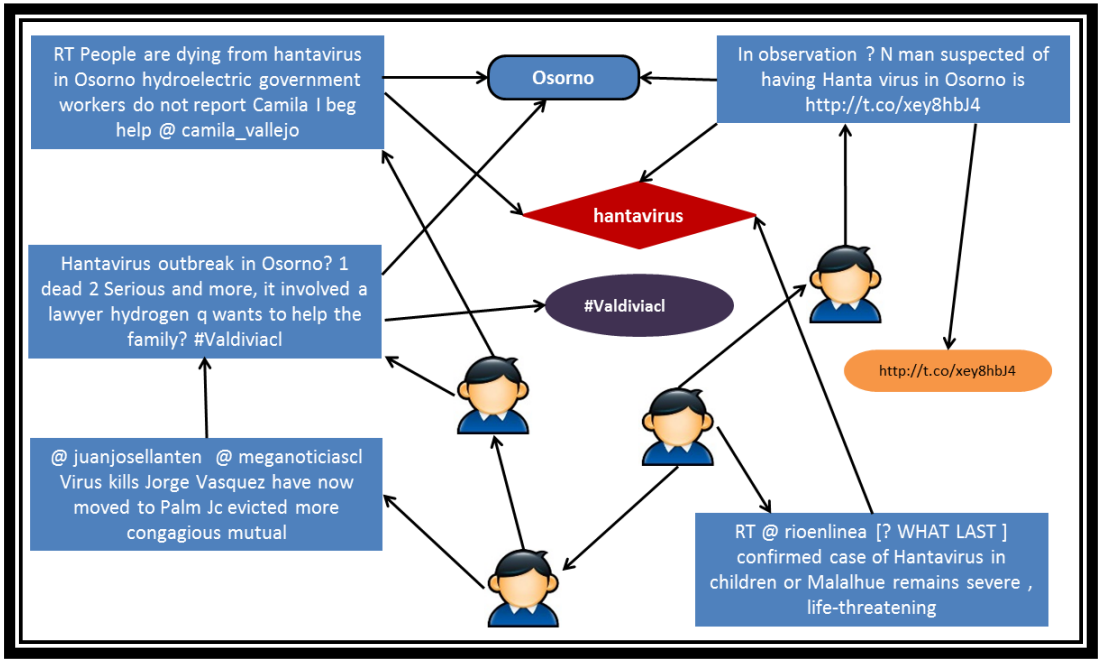
Natural disaster

Terrorist attack

Civil unrest

**Early detection** can reduce costs to society by enabling a targeted and effective response.

**Advance prediction** can both quantify and reduce risk.




(Chen and Neill, KDD 2014)

Twitter Event Surveillance

Can accurately predict civil unrest up to 1 wk. in advance

Enables earlier detection of emerging disease outbreaks

Can identify emerging human rights issues

# Identifying Emerging Trends and Patterns

Trends of opioid use, abuse, addiction, and overdose

Patterns of patient care that impact health outcomes


Line-of-duty injuries among uniformed service workers

Building/neighborhood issues and chronic health conditions

# Automated Algorithms and Risk

# Part 2: The Perils

Who is responsible when these algorithms fail, particularly when they fail **systematically**?

One major risk area: **fairness**, **bias**, and **discrimination** in algorithmic decision-making

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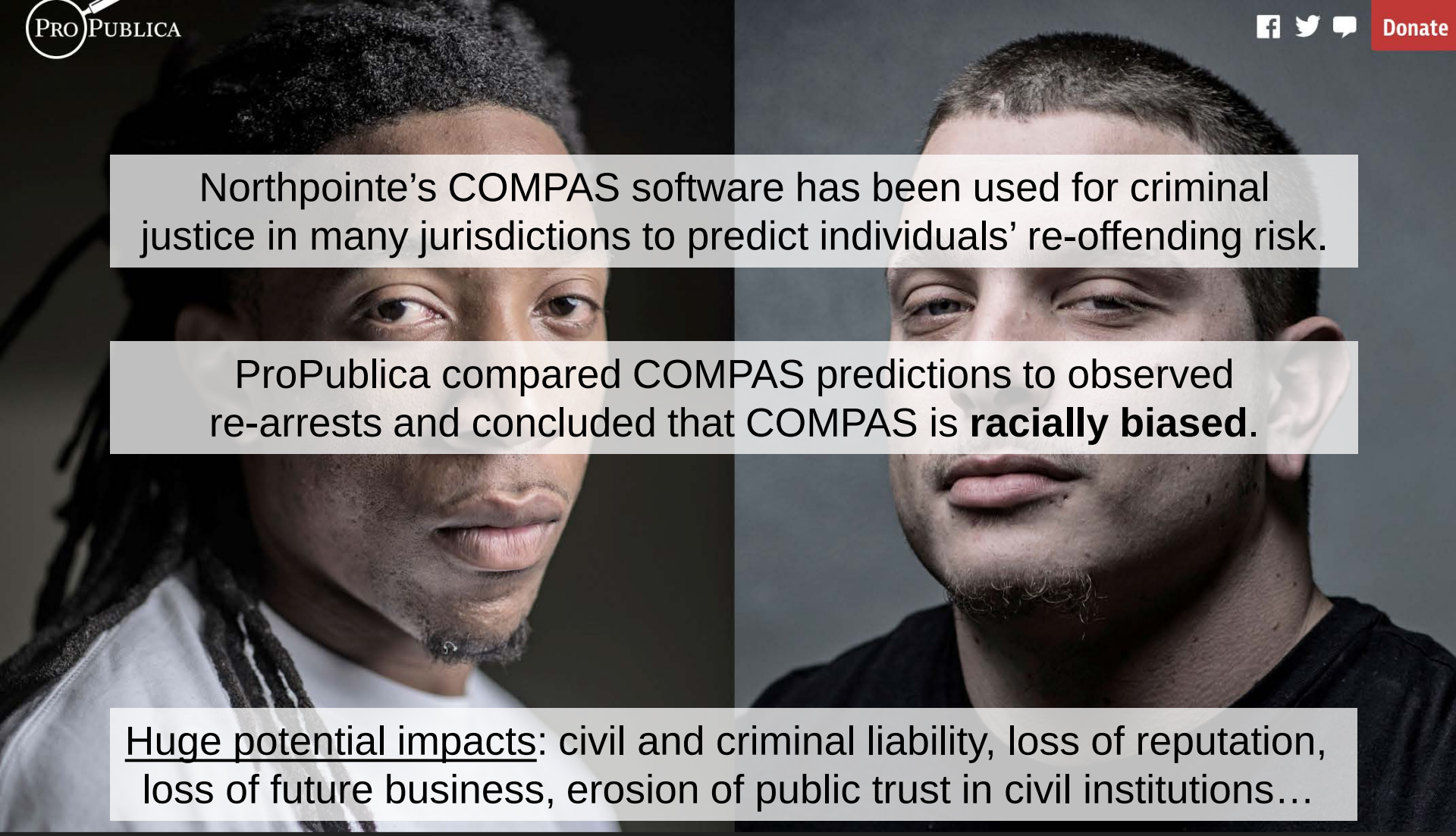



*Bernard Parker, left, was rated high risk; Dylan Fugett was rated low risk. (Josh Ritchie for ProPublica)*

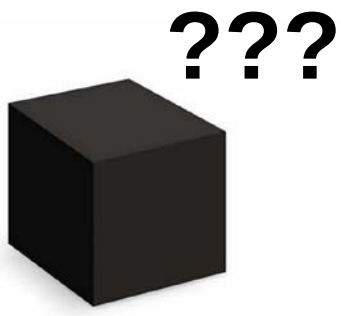
# Machine Bias

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

# Mitigating risks of algorithmic bias

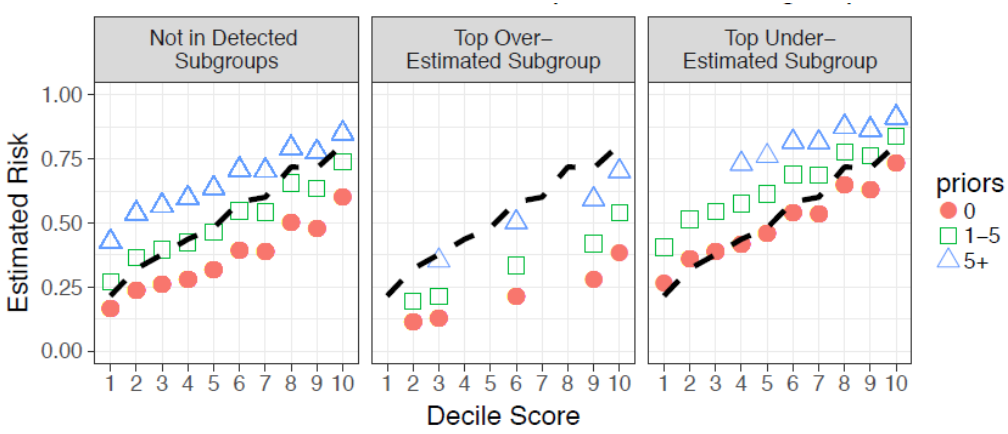
Need for increased transparency:

- Is the model specification reasonable?
- Is the training dataset representative?
- Is the target variable biased?
- Possible unintended consequences?




Should assess by **multiple approaches**, both human and automated.

We have developed a novel approach ("bias scan") to **audit** black-box risk prediction algorithms for fairness, and to **correct** systematic biases.




(Zhang and Neill, FATML 2017)

When applied to COMPAS, our system revealed 3 biases:

- Number of prior offenses
- Males under age 25
- Females w/ misdemeanors

(Not racial biases, but...)

# Conclusions

Automated machine learning algorithms have great, mostly untapped potential to benefit the insurance and reinsurance fields:

**Underwriting** – advance prediction of crisis events, risk estimation

**Risk mapping/surveillance** – early detection of events, trends, patterns

**Loss mitigation** – reducing impact through early and targeted response

But they also create **new risks** of systematic failures and unforeseen consequences, including the potential for algorithmic bias and discrimination.

These new risks should be carefully considered and mitigated, ideally through a combination of human expert oversight and algorithmic auditing approaches.

# Thanks for listening!

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