

STREET-LEVEL ALGORITHMS

USING INTELLECTUAL ARBITRAGE TO STUDY TECHNICAL SYSTEMS

Ali Alkhatib

@_alialkhatib || ali.alkhatib@cs.stanford.edu

August 21, 2019

UNINTENTIONAL PARALLELS

ANTHROPOLOGY

5 years studying Anthropology

- Archaeological digs up and down the Americas
- Ethnographic fieldwork of Quantified Self

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- “Nothing new under the sun”

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COMPUTER SCIENCE

5 years studying Computer Science

- People studying crowdsourcing and gig work
- People studying artificial intelligence

ANTHROPOLOGY

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- “Nothing new under the sun”

COMPUTER SCIENCE

5 years studying Computer Science

- People studying crowdsourcing and gig work
- People studying artificial intelligence
- Everything old is new again

NOTHING NEW UNDER THE SUN

EVERYTHING OLD IS NEW AGAIN

NATIONAL DOMESTIC WORKERS' ALLIANCE

ALIA

Allowing workers to book clients,
communicate with each other, and
make decisions about how the platform
should operate

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Worker-owned cooperative

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Worker-owned cooperative**VITAE**

Giving crowd workers the ability to stand behind collective reputations, and attract more skilled, lucrative work

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Worker-owned cooperative**VITAE**

Giving crowd workers the ability to stand behind collective reputations, and attract more skilled, lucrative work

Digital hiring hall

We design technical and social systems by **recognizable references**

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Digital hiring hall

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Allowing workers to book clients, communicate with each other, and make decisions about how the platform should operate

Worker-owned cooperative

Relief from precarity**VITAE**

Giving crowd workers the ability to stand behind collective reputations, and attract more skilled, lucrative work

Digital hiring hall

Solidarity

ALIA

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Worker-owned cooperative

Relief from precarity

VITAE

Giving crowd workers the ability to stand behind collective reputations, and attract more skilled, lucrative work

Digital hiring hall

Solidarity

Solutions to underlying social issues

ALIA

Allowing workers to book clients,
communicate with each other, and
make decisions about how the platform
should operate



Lourdes Dobarganes cleans the apartment of a client in San Francisco. She is the kind of domestic worker Alia is trying to serve by allowing individual clients to chip in on benefits. (Photo by Carlos Avila Gonzalez, San Francisco Chronicle/Polaris)

Mercedes Martinez scrubs other people's kitchen sinks and mops their floors every day of the week. At night she comes home to care for one of her sons. The money she makes covers their bills, but not benefits. When she catches the flu, she doesn't get paid. But one of her clients recently introduced her to [Alia](#), a website that helps her

We design technical and social systems by **recognizable references** and we can use this to understand systems, and to inform our actions.

We design technical and social systems by **recognizable references** and we can use this to understand systems, and to inform our actions.

We can draw from a much deeper well of scholarship than Computer Science to recognize the patterns we're recreating in **ostensibly** novel technical systems.

NEW TECHNOLOGIES, OLD METAPHORS

Artificial Intelligence

Street-level bureaucracies

CHI 2019 (Best Paper)

Crowd work systems

Piecework

CHI 2017 (Honorable Mention)

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STREET-LEVEL ALGORITHMS

ALKHATIB AND BERNSTEIN @ CHI 2019

FRUSTRATING ALGORITHMIC FAILURES

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YouTube is still restricting and demonetizing LGBT videos — and adding anti-LGBT ads to some

by Megan Farokhmanesh, [theverge.com](https://www.theverge.com)

June 4, 2018 01:46 PM



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**Google's Anti-Bullying AI Mistakes
Civility for Decency**

by Jillian York, [motherboard.vice.com](https://motherboard.vice.com/en_us/article/google-ai-mistakes)
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How Recommendation Algorithms Run the World

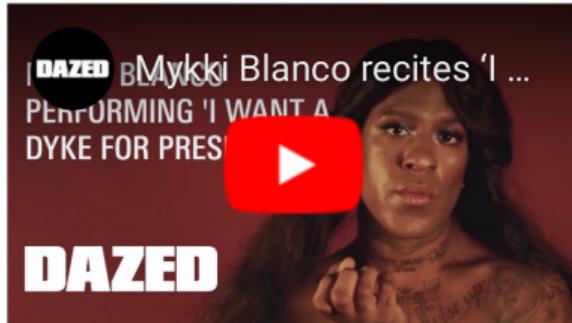
by Zeynep Tufekci, [wired.com](https://wired.com/article/recommendation-algorithms-run-world)
April 22, 2019 05:00 AM

FRUSTRATING ALGORITHMIC FAILURES

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Instagram Is Censoring Lesbian Content For Violating "Community Guidelines"

intomore.com | January 25, 2018



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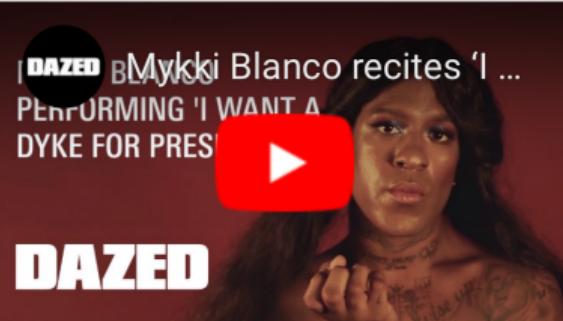
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The Algorithmic Copyright Cops: Streaming Video's Robotic Overlords ; Anti-Bullying AI Mistakes Civility for Decency

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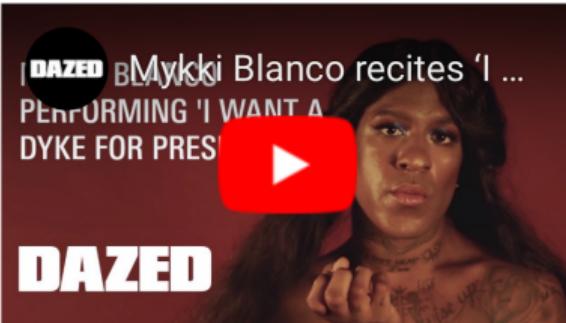
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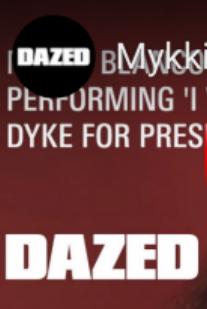
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by Mariella Moon, engadget.com

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When the Robot Doesn't See Dark Skin

by Joy Buolamwini, nytimes.com

June 21, 2018 10:06 AM

Ms. Buolamwini is the founder of the Algorithmic Justice League.

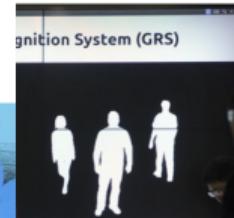


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April 1, 2019 07:50 PM

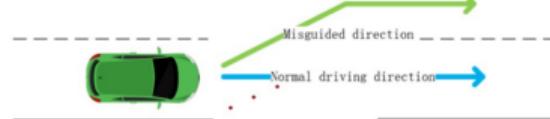


Photo by: Keen Security Lab

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Following

video surges in popularity. Right “bots” — automated AI that can match content against video files of copyrighted music — have been built to do just that.

@godblessamerica WE'RE GOING TO BUILD A

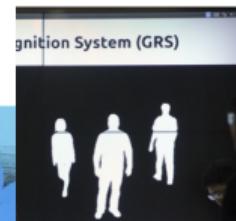
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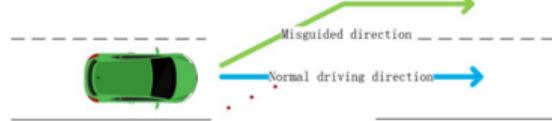


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Something is wrong on the internet

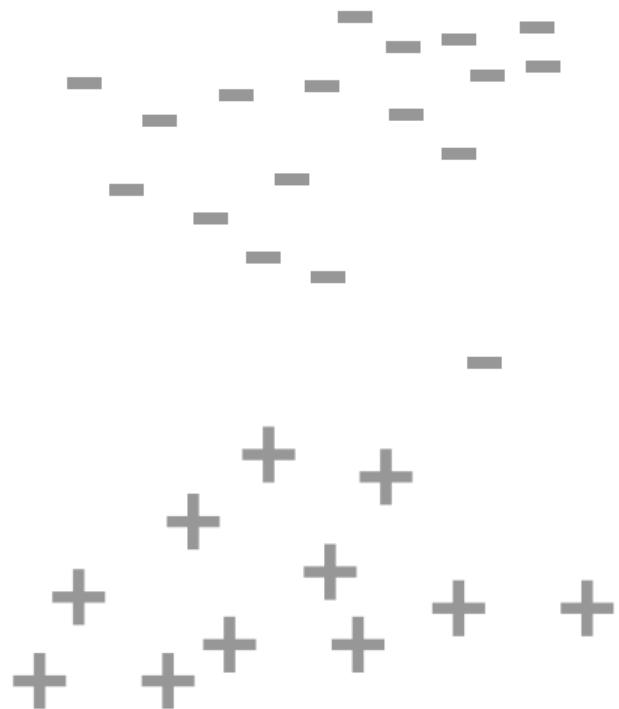
by James Bridle, medium.com
November 6, 2017 10:09 AM

I'm James Bridle. I'm a writer and artist concerned with technology and culture. I usually write on my own blog, but frankly I don't want what I'm talking about here anywhere near my own site. Please be advised: this essay describes disturbing things and links to disturbing graphic and video content. You don't have to read it, and are advised to take caution exploring further.

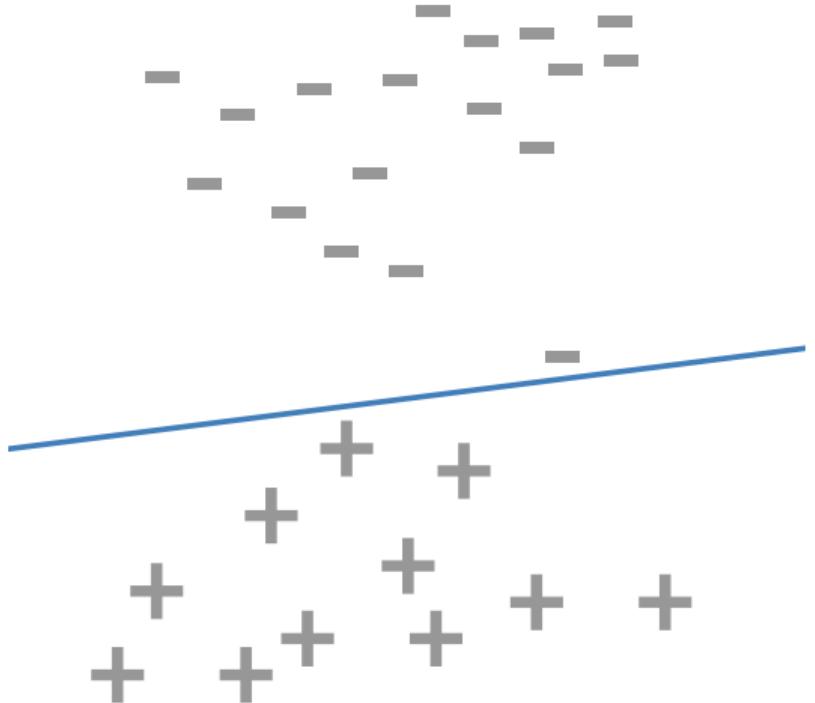
WHY IS THIS HAPPENING?

WHY IS THIS HAPPENING?

HOW CAN WE BUILD MORE PRO-SOCIAL SYSTEMS?



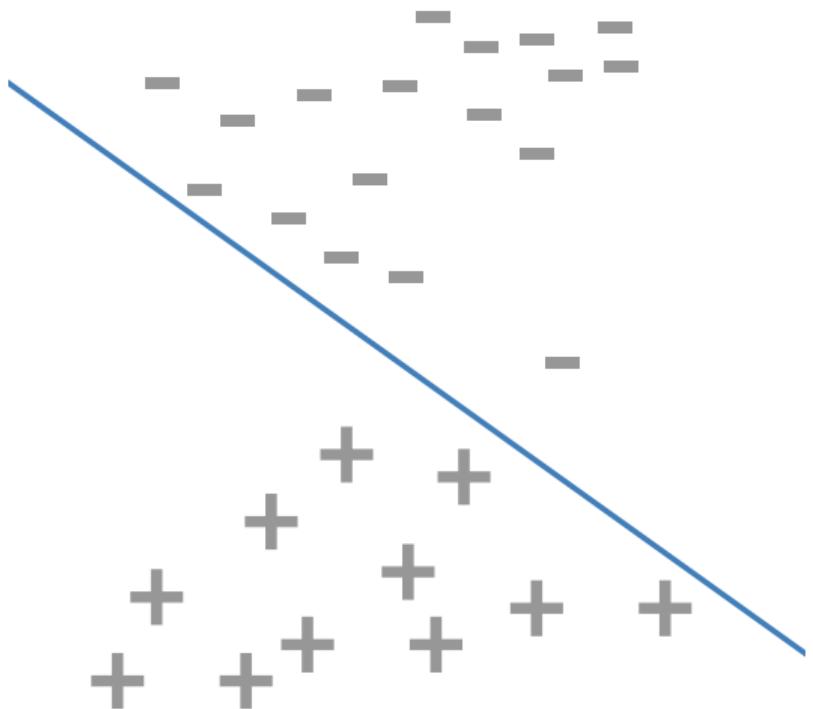




Code

Loss functions

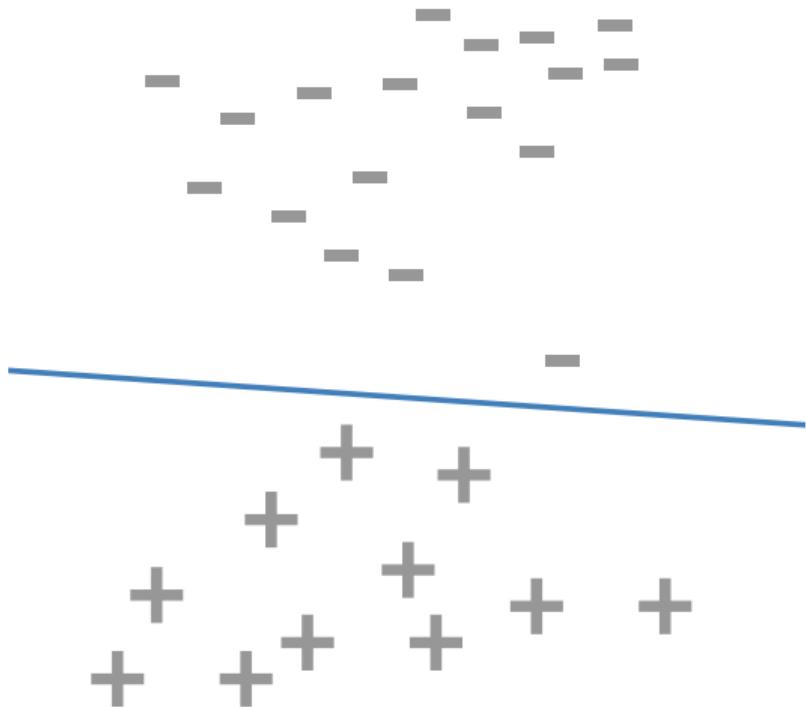
Training data



Code

Loss functions

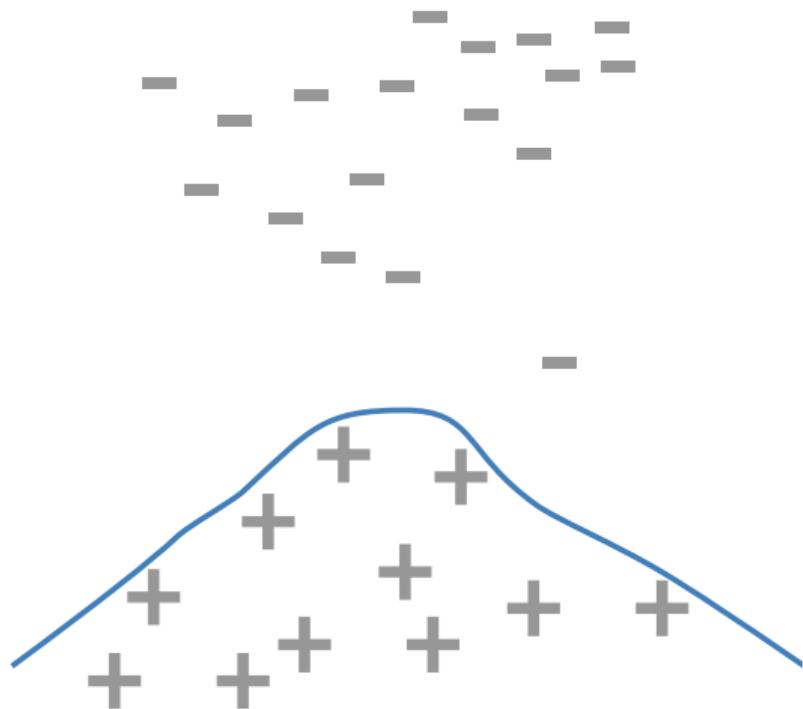
Training data



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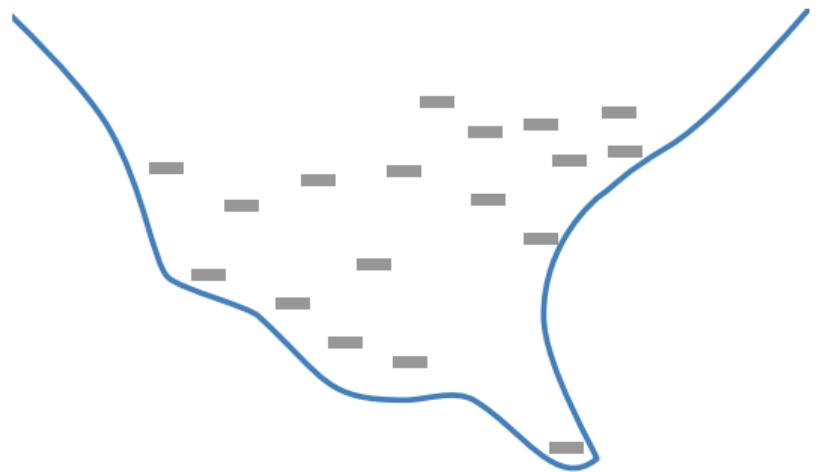
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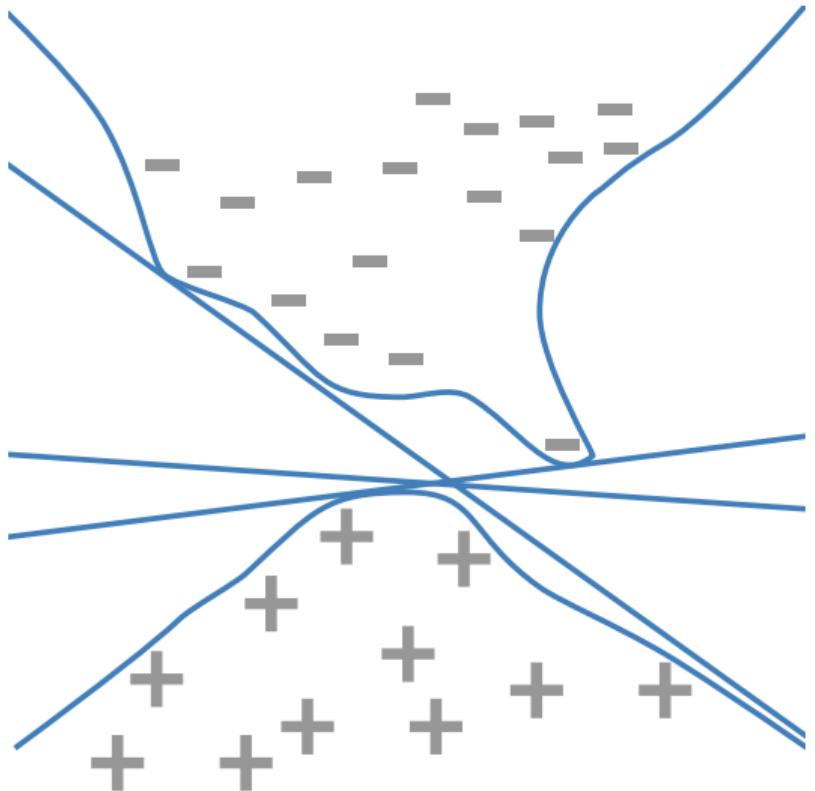
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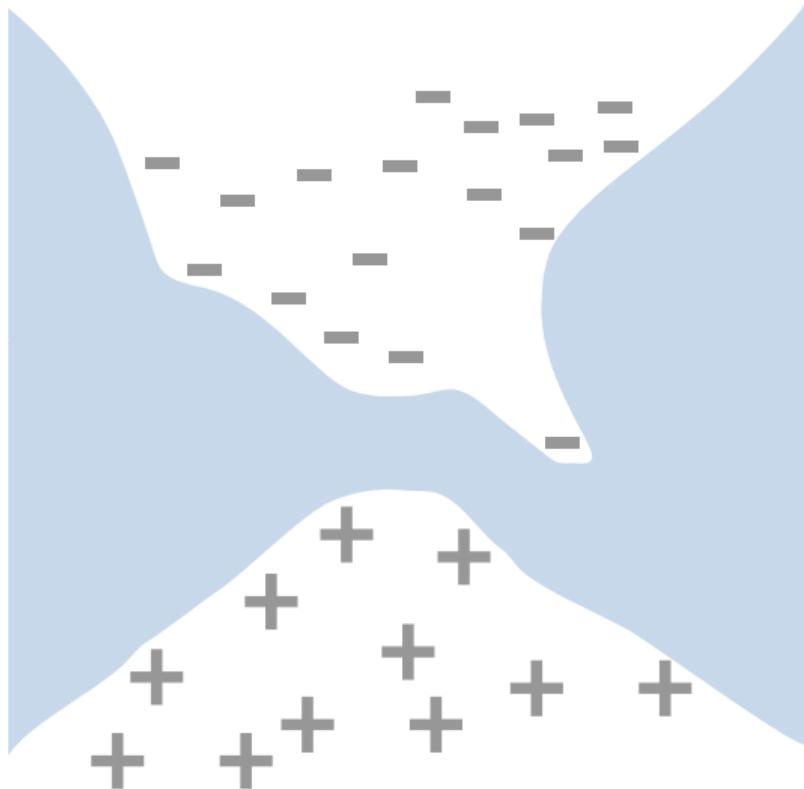
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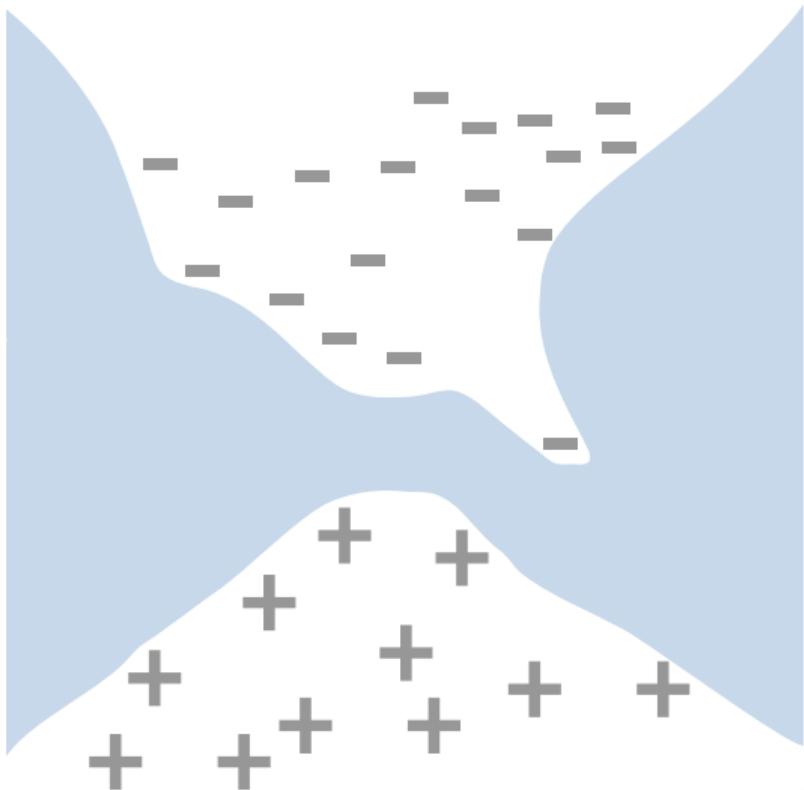
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Code

Loss functions

Training data



Code

Loss functions

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FILLING IN THE GAPS

“FILLING IN THE GAPS” ISN’T UNIQUE TO ALGORITHMS

**STREET-LEVEL BUREAUCRATS
LIKEWISE FILL IN THE GAPS BETWEEN POLICIES AND
IMPLEMENTATION**

STREET-LEVEL BUREAUCRATS

They're the
police



STREET-LEVEL BUREAUCRATS

They're the
police
teachers



STREET-LEVEL BUREAUCRATS

They're the
police
teachers
judges



STREET-LEVEL BUREAUCRATS

They're the
police
teachers
judges
clerks



STREET-LEVEL BUREAUCRATS

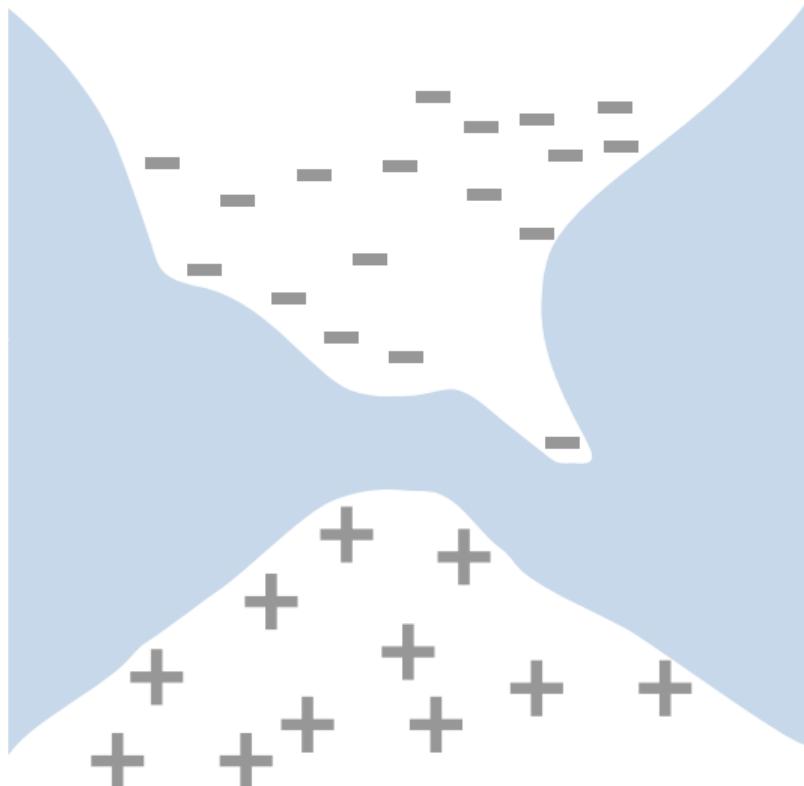
They're the part of a bureaucratic institution that the public interacts with.

police

teachers

judges

clerks



Code
Instructions

Loss functions
Incentives

Training data
Precedents

**STREET-LEVEL BUREAUCRATS FILL
IN THE GAPS**

A DEEP WELL TO DRAW FROM

Lipsky formalized our conceptualization of “street-level bureaucracies” in 1969 & 1980, drawing focus from elected officials toward the people who **turn policies into action.**

TOWARD A THEORY OF STREET-LEVEL BUREAUCRACY

Michael Lipsky

INSTITUTE FOR
RESEARCH ON
POVERTY DISCUSSION
PAPERS

WHERE POWER BECOMES MANIFEST

Street-level bureaucrats are enormously influential

- Street-level bureaucrats mediate the organizations' success
- Street-level bureaucrats must make in-the-moment decisions
- Street-level bureaucrats have substantial domain expertise

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STREET-LEVEL BUREAUCRATS

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STREET-LEVEL ALGORITHMS

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Street-level algorithms are algorithmic systems that directly interact with and make decisions about people in a sociotechnical system.

STREET-LEVEL ALGORITHMS

Street-level algorithms are algorithmic systems that directly interact with and make decisions about people in a sociotechnical system.

They classify and recommend:

- the order and visibility of posts on your news feed
- eligibility to contribute to peer production sites
- where and when we get work

STREET-LEVEL ALGORITHMS

Street-level algorithms are algorithmic systems that directly interact with and make decisions about people in a sociotechnical system.

They classify and recommend:

- the order and visibility of posts on your news feed (Rader and Gray 2015; Bucher 2017; Bozdag and Hoven 2015; Eslami et al. 2016; Eslami et al. 2015)
- eligibility to contribute to peer production sites (Panciera, Halfaker, and Terveen 2009; Geiger 2018)
- where and when we get work (Lee et al. 2015)

Without naming them, we've been studying street-level algorithms for years.

PROBLEMATIZING STREET-LEVEL ALGORITHMS?

PROBLEMATIZING STREET-LEVEL ALGORITHMS?

HOW DO STREET-LEVEL BUREAUCRATS FILL IN THE GAPS?

REFLEXIVITY

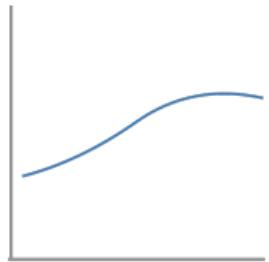
*Street-level bureaucrats ... at least [have] to be open to the possibility that each client presents special circumstances and opportunities that may require **fresh thinking** and **flexible action**.*

– Lipsky 1980

PROBLEMATIZING STREET-LEVEL ALGORITHMS?

PROBLEMATIZING STREET-LEVEL ALGORITHMS?

ALGORITHMS LACK REFLEXIVITY

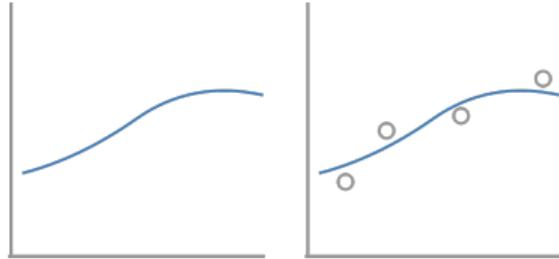


bureaucrats

algorithms

training

bureaucrats

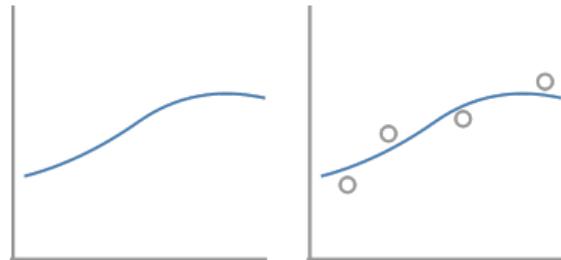


algorithms

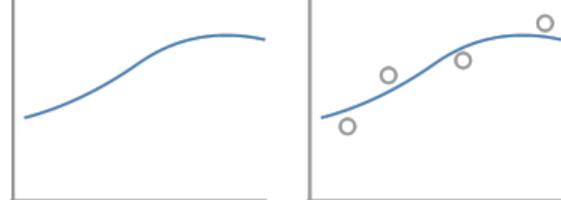
training

new data
appears

bureaucrats



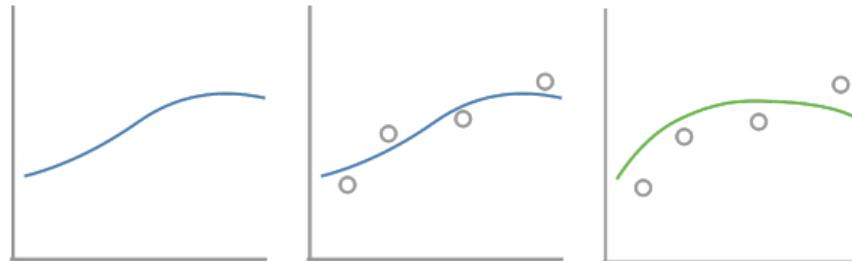
algorithms



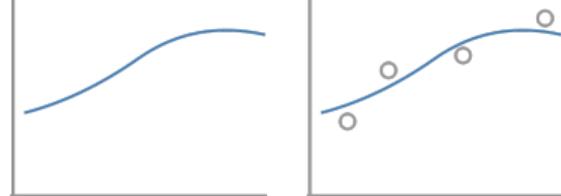
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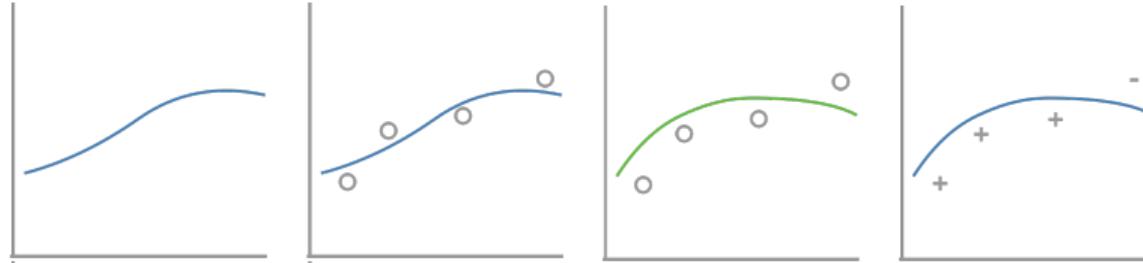


training

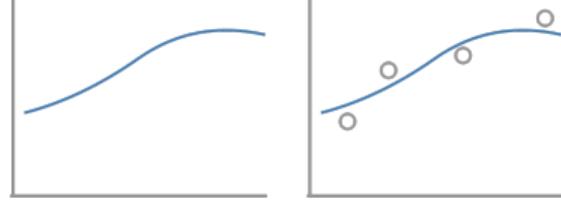
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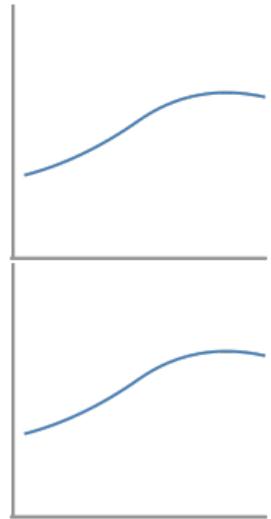
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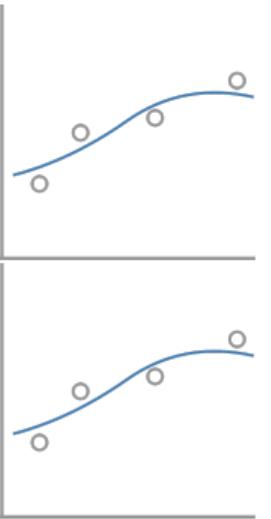
model
makes
prediction



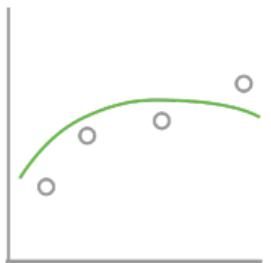
bureaucrats



algorithms



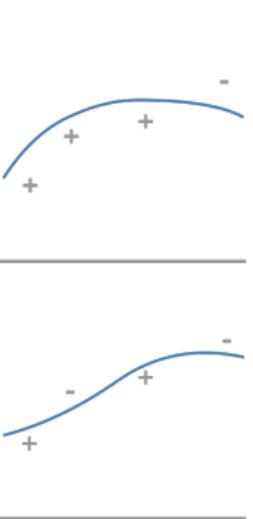
training



new data
appears

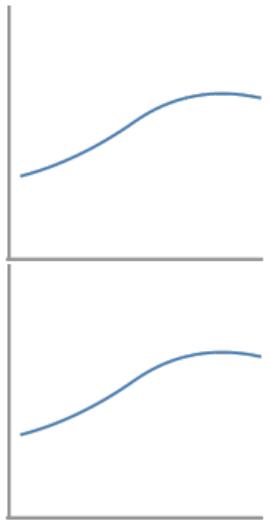


moment of
reflexivity

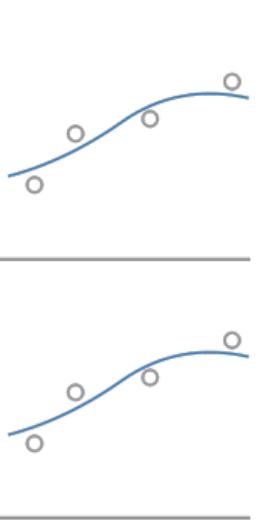


model
makes
prediction

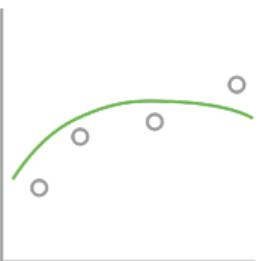
bureaucrats



algorithms



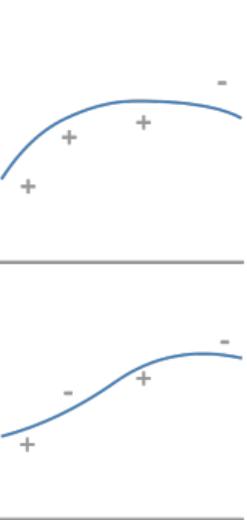
training



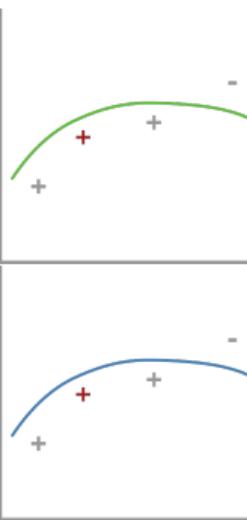
new data
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moment of
reflexivity

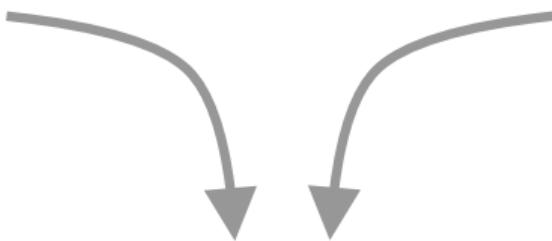


model
makes
prediction



Behavior

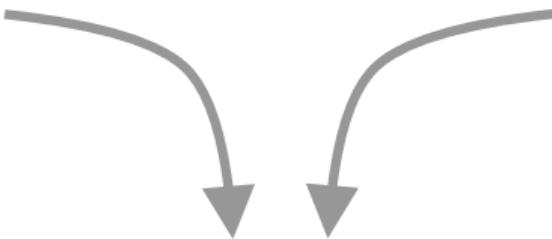
Algorithm



Judgment

Behavior

**Algorithm
Bureaucrat**



**Judgment
Application of
reflexivity**

YOUTUBE DEMONETIZATION

YOUTUBE DEMONETIZATION ALGORITHM

YouTube enforces many of its policies algorithmically:

- copyright
- advertiser guidelines
 - controversial issues
 - dangerous substances
 - harmful acts
 - inappropriate language
 - sexually suggestive content

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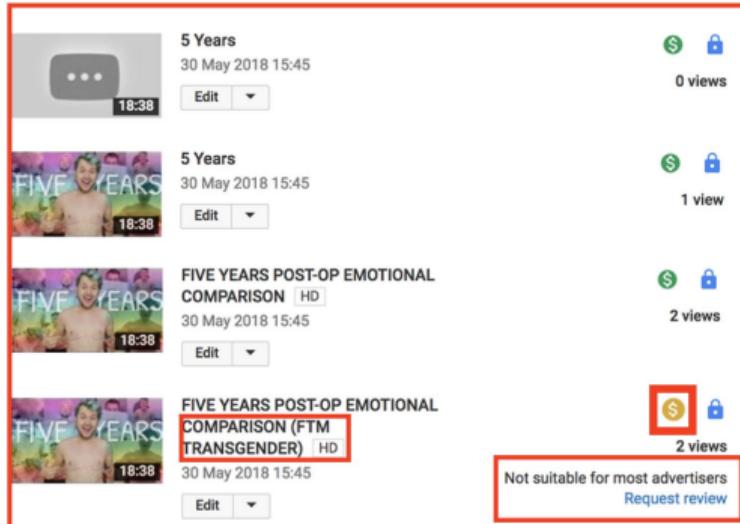
- copyright
- advertiser guidelines
 - controversial issues
 - dangerous substances
 - harmful acts
 - inappropriate language
 - sexually suggestive content

YouTubers can still upload, but **the algorithm** determines their eligibility to earn
Demonetized videos earn no money for the YouTuber

BUT THE DEMONETIZATION ALGORITHM MAKES MISTAKES

LGBTQ YOUTUBERS GETTING DEMONETIZED

TELL ME AGAIN HOW “TRANSGENDER”
DOESN’T TRIGGER THE ALGORITHM



Videos about **gender identity** are not necessarily about **sex** at all.

The algorithm learned to associate gendered terms with sex because the training data had that association.

In these videos, that association doesn't exist.

LGBTQ YOUTUBERS GETTING DEMONETIZED

TELL ME AGAIN HOW “TRANSGENDER”
DOESN’T TRIGGER THE ALGORITHM

5 Years
30 May 2018 15:45
Edit

5 Years
30 May 2018 15:45
Edit

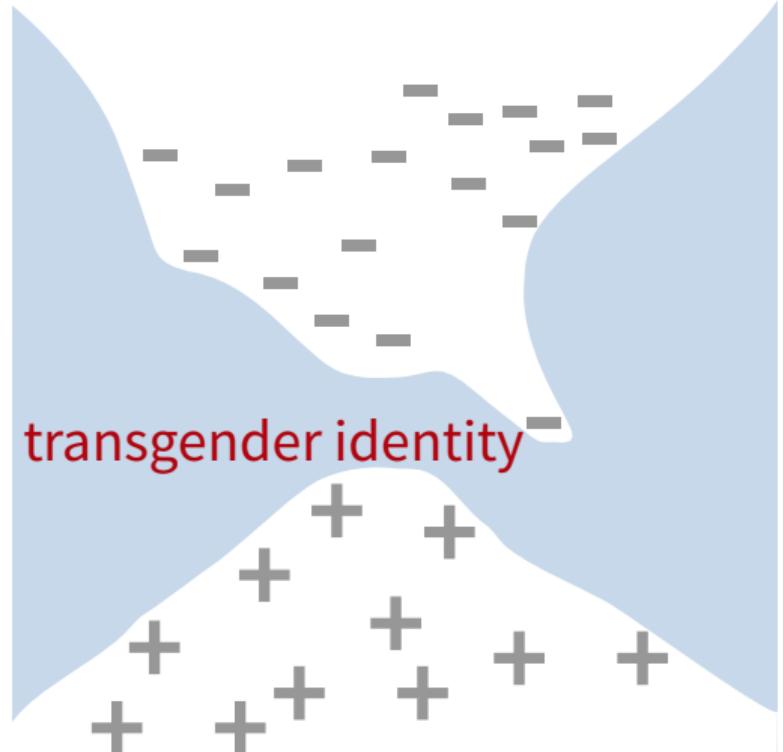
FIVE YEARS POST-OP EMOTIONAL COMPARISON HD
30 May 2018 15:45
Edit

FIVE YEARS POST-OP EMOTIONAL COMPARISON (FTM TRANSGENDER) HD
30 May 2018 15:45
Edit

Not suitable for most advertisers
Request review

@CHASEROSS

/UPPERCASECHASE1



FALSE NEGATIVES



Videos of children's character Peppa Pig being tortured in the dentist's office were, by all appearances, monetized normally

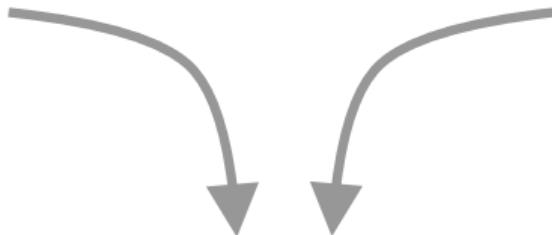
In some cases they were included in YouTube Kids

Behavior

User-created videos

Algorithm

YouTube demonetization

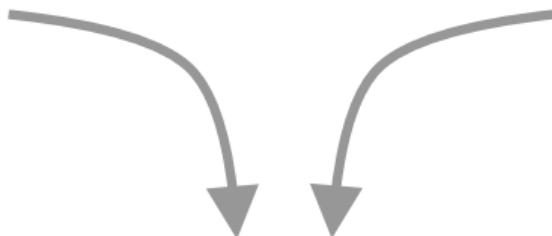


Judgment

Does this video look similar
to previous videos that were
demonetized?

Behavior

Street performances
("buskers")



Bureaucrat

Police tasked with
enforcing busking
ordinances in cities

Judgment

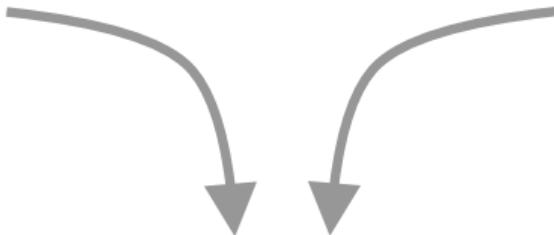
Is this performance pushing
the envelope, or does it
cross a line?

Behavior

Millions of street performances

Algorithm

Quasi-police force tasked with making street performance judgments at massive scale



Judgment

Ideally

Recognize new situations and navigate them culturally and contextually appropriately

In reality

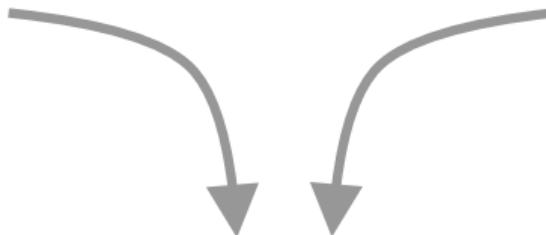
Trained on yesterday's data, before today's cultural movements began

Behavior

Millions of street performances

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Quasi-police force tasked with making street performance judgments at massive scale



Judgment

Ideally

Recognize new situations and navigate them culturally and contextually appropriately

In reality

Trained on yesterday's data, before today's cultural movements began

TAKEAWAYS

It's unlikely we can avoid these problems algorithmically

- Having **more training data** would not have helped us avoid this problem
- Experimentation and provocation is often the **point** of performance and art
- Street-level algorithms can only adapt **after** they make the wrong call

ON-DEMAND WORKER WAGE THEFT

ON-DEMAND WORK

Algorithmic systems determine the quality of on-demand workers' work and whether workers get paid.

ON-DEMAND WORK

Algorithmic systems determine the quality of on-demand workers' work and whether workers get paid.

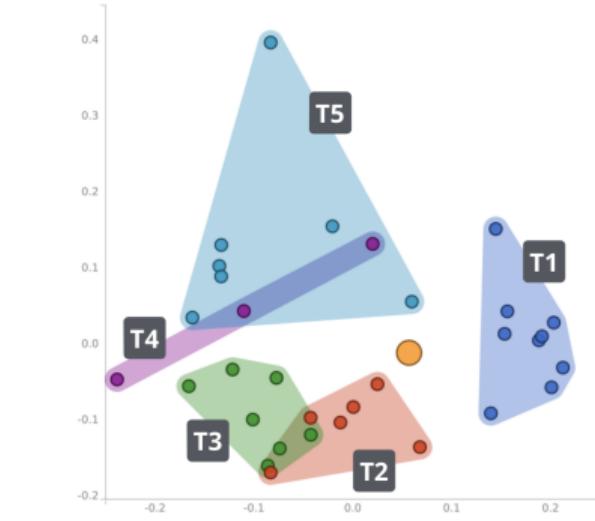
These systems have been accused of wage theft (Dombrowski, Alvarado Garcia, and Despard 2017; McInnis et al. 2016).

ON-DEMAND WORK

Algorithmic systems determine the quality of on-demand workers' work and whether workers get paid.

These systems have been accused of wage theft (Dombrowski, Alvarado Garcia, and Despard 2017; McInnis et al. 2016).

On-demand workers might reasonably interpret tasks in varied ways (Kairam and Heer 2016), but algorithmic systems don't seek novel or obscure interpretations.



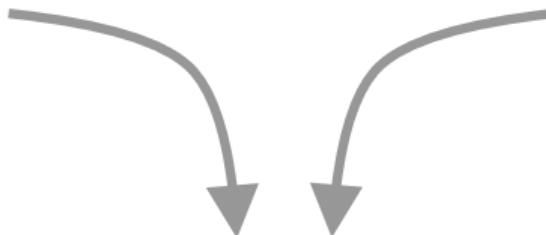
*Clusters of legitimate workers' differing interpretations of the same task
(Kairam and Heer 2016)*

Behavior

On-demand tasks

Algorithm

Crowdwork quality control systems



Judgment

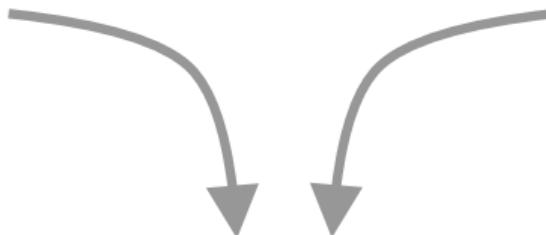
Is this crowdworker's output
correct, or should their work
be rejected?

Behavior

Factory workers

Bureaucrat

Factory foremen



Judgment

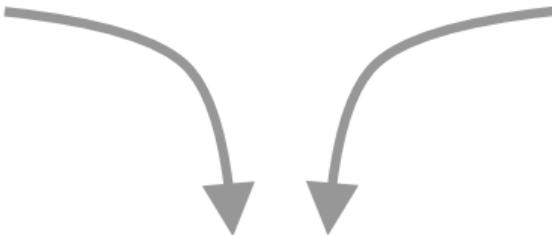
Is the factory worker doing
the work correctly, or do
they need assistance?

Behavior

Massive amounts of creative information work

Algorithm

Foremen tasked with accepting or rejecting work



Judgment

Ideally

Acknowledge when workers need to deviate from script, provide necessary resources, and give feedback

In reality

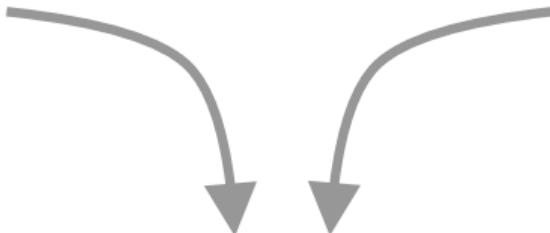
Frustratingly inflexible quality control algorithms deter creative effort and encourage gaming

Behavior

Massive amounts of creative information work

Algorithm

Foremen tasked with accepting or rejecting work



Judgment

Ideally

Acknowledge when workers need to deviate from script, provide necessary resources, and give feedback

In reality

Frustratingly inflexible quality control algorithms deter creative effort and encourage gaming

TAKEAWAYS

Algorithms can't cope with novelty, which is what we want from increasingly complex and creative on-demand work

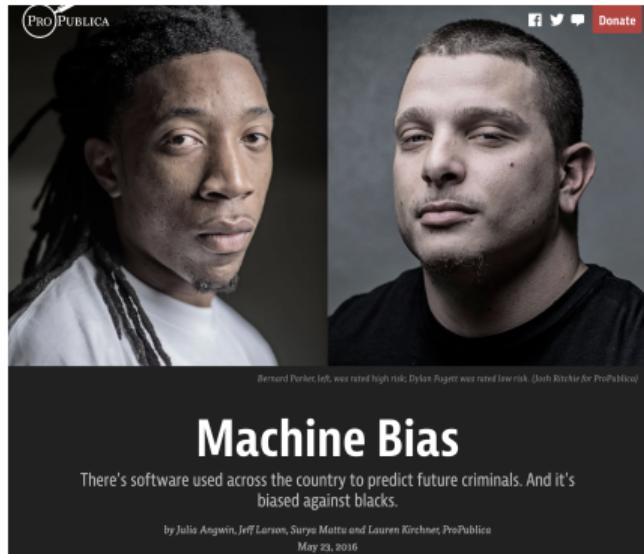
- Algorithmic foremen can't distinguish novel answers from wrong answers
- There's a catch-22 of training data
- Street-level algorithms here never have the data they need to distinguish between bad and novel

ALGORITHMIC BIAS IN JUSTICE

ALGORITHMIC BIAS IN JUSTICE

Algorithmic systems predict whether defendants are likely to appear at their court date, recommending the level at which to set bail.

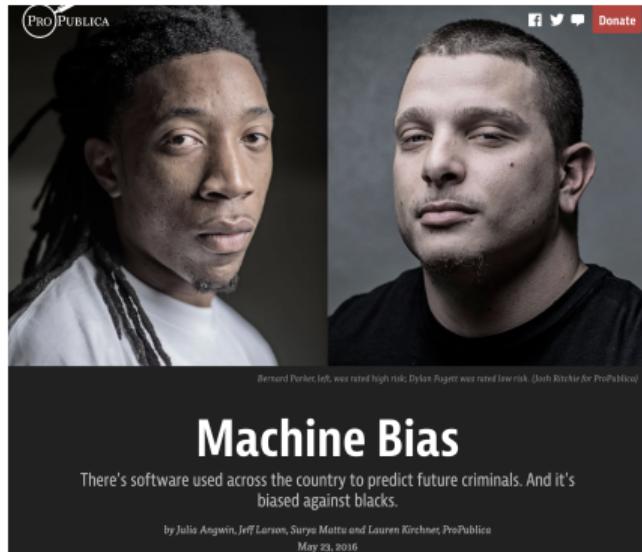
These algorithms reflect and amplify racial biases in society (Buolamwini and Gebru 2018; Lambrecht and Tucker 2018; Thebault-Spieker, Terveen, and Hecht 2015).



ALGORITHMIC BIAS IN JUSTICE

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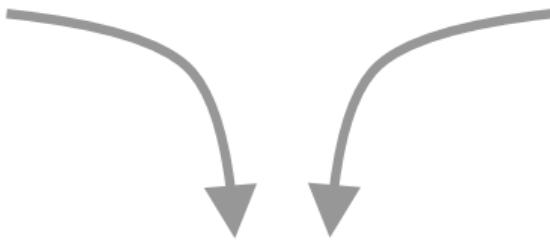


Behavior

Defendant's situation
and behavior

Bureaucrats

Judges



Judgment

Should this defendant be
eligible to go free on bail?

Behavior

Defendants from many different jurisdictions, environments, backgrounds

Algorithm

Algorithmic judges tasked with predicting whether defendants will return for trial

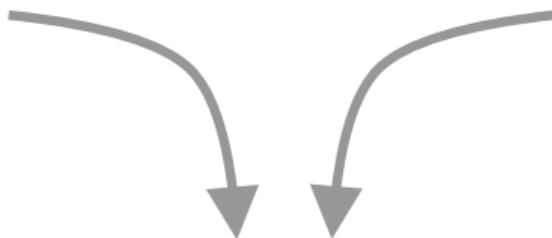
Judgment

Ideally

Account for the circumstances of defendants' environments

In reality

Re-enact old cases, even if new intersectional ones arise



Behavior

Defendants from many different jurisdictions, environments, backgrounds

Algorithm

Algorithmic judges tasked with predicting whether defendants will return for trial

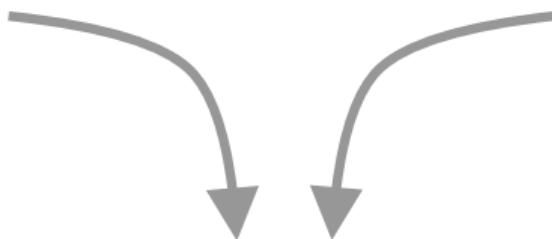
Judgment

Ideally

Account for the circumstances of defendants' environments

In reality

Re-enact old cases, even if new intersectional ones arise



TAKEAWAYS

Here we have something new: a street-level bureaucrat interacting with a street-level algorithm. Bureaucrats can resist or buffer the algorithm's recommendations when needed (Christin 2017; Veale, Van Kleek, and Binns 2018).

Even a perfectly fair, transparent, and accountable algorithm will make errors of generalization in cases at the margin. Bureaucrats reason by extension from precedent and case law. How should an algorithm reason?

Conceptualization is directed toward the task of generating interpretations of matters already in hand [...] But that does not mean that theory has only to fit (or, more carefully, to generate cogent interpretations of) realities past; it also has to survive – intellectually survive – realities to come.

– Geertz 1973

Conceptualization is directed toward the task of generating interpretations of matters already in hand [...] But that does not mean that theory has only to fit (or, more carefully, to generate cogent interpretations of) realities past; it also has to survive – intellectually survive – realities to come.

– Geertz 1973

Good theories give us analytical power

for the past

for the present

for realities to come

IMPLICATIONS

A theory of street-level algorithms suggests that, when faced with algorithmic failure, we should reflect on the mechanisms and processes at play with street-level bureaucrats.

- Ensuring that the person or system reviewing the appeal does not overlap with the person or system who made the initial judgment
- Predefined rules for recourse, (e.g. compensating lost income)
- Requirements to publish plain-language descriptions of complex systems

CONCERNS

Street-level bureaucrats reflect and exercise discretion to support the goals of the institution, but that's resulted in **historically, systematically, marginalized groups**, by way of:

- Systematic brutality committed against people of color, trans people, and other marginalized communities
- Criminalization of disempowered groups.

CONCERNS

Street-level bureaucrats reflect and exercise discretion to support the goals of the institution, but that's resulted in historically, systematically, marginalized groups

Street-level algorithms are replicating **the same old patterns**

LGBTQ
YouTubers

Financially precarious
crowd workers

People of color in the
criminal justice system

CONCERNS

LGBTQ
YouTubers

Financially precarious
crowd workers

People of color in the
criminal justice system

CONCERNS

LGBTQ YouTubers

LGBTQ YouTubers are suing YouTube over alleged discrimination

Including suppressing video recommendations and demonetization

By Julia Alexander | Aug 14, 2019, 9:16am EDT

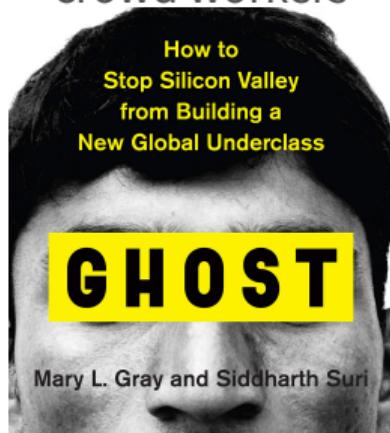
f t SHARE



The Verge

A group of YouTube creators is suing YouTube for allegedly discriminating against their LGBTQ-focused videos by suppressing recommendations and

Financially precarious crowd workers



People of color in the criminal justice system



STREET-LEVEL ALGORITHMS

Street-level algorithms can create and act on decision boundaries like street-level bureaucrats.

But they can't reflect on new circumstances, and update their decision boundaries, like people can.

STREET-LEVEL ALGORITHMS

Street-level algorithms can create and act on decision boundaries like street-level bureaucrats.

Let's pause

But they can't reflect on new circumstances, and update their decision boundaries, like people can.

Any questions to clarify at this point?

NEW TECHNOLOGIES, OLD METAPHORS

Artificial Intelligence

Street-level bureaucracies

CHI 2019 (Best Paper)

Crowd work systems

Piecework

CHI 2017 (Honorable Mention)

NEW TECHNOLOGIES, OLD METAPHORS

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PIECEWORK

ALKHATIB, BERNSTEIN, AND LEVI @ CHI 2017

**ON-DEMAND WORK IS A MODERN INSTANTIATION OF A
MUCH OLDER PHENOMENON — PIECEWORK.**

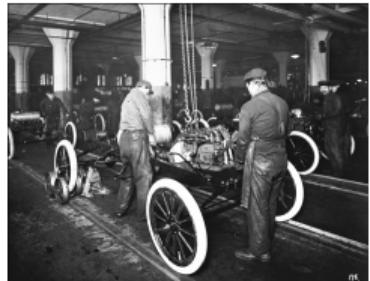
**THE HISTORICAL ARC OF PIECEWORK CAN SHED LIGHT ON PERSISTENT QUESTIONS
IN THIS ONGOING PHENOMENON OF ON-DEMAND WORK.**

PAYMENT FOR OUTPUT RATHER THAN FOR TIME

Textiles



Automobiles



Metalwork

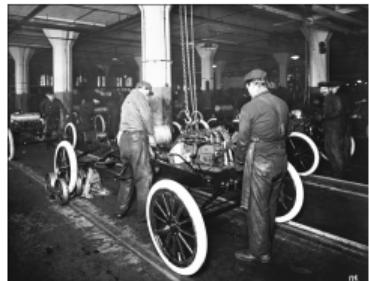


PAYMENT FOR OUTPUT RATHER THAN FOR TIME

Textiles



Automobiles



Metalwork



Crowd work



Upwork

UBER

Gig Work

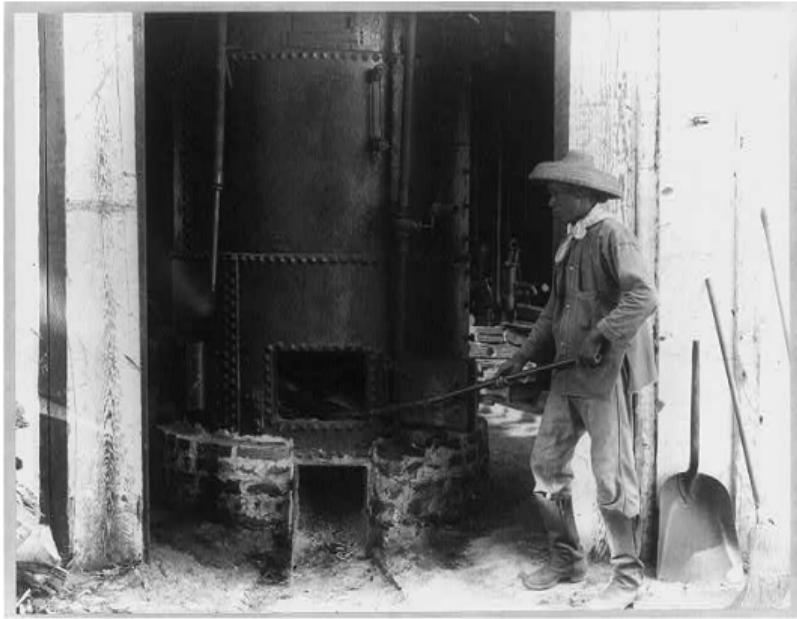


How will technology affect the complexity of on-demand work?

How will technology affect the complexity of on-demand work?

What are the **limits** of complexity in on-demand work?

Farms



- Formalization of piecework:
payment for results
Chadwick 1865
- Dynamic piece rates

Textiles

- Distributed workers



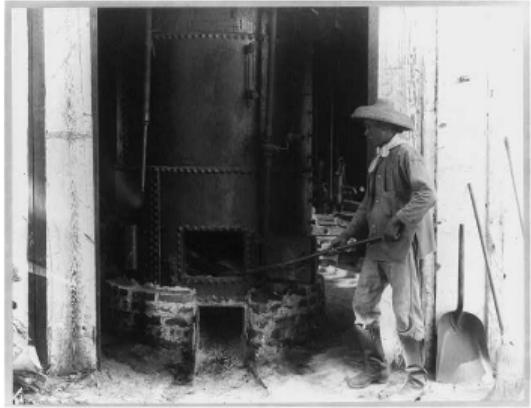
- Assuming common skills

Matchstick Girls

- Strict management
- Formalizing work methods



Farms



Textiles



Matchstick Girls



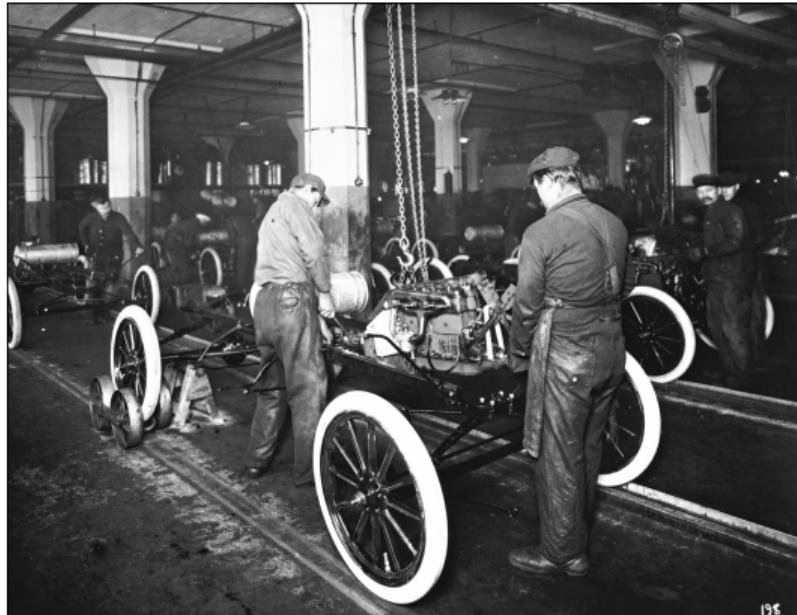
Trains



- “Efficiency experts” measured how long it would take to do various jobs
(Cunningham 1911)
- These measurements would be used to assign pay rates for each specific task
(Jewell 1921)

Automobiles

- Consolidating and training workers
(*Fordism*)
(Schoenberger 1988; Tolliday and Zeitlin 1986)



- Measuring and evaluating workers by very carefully defined instructions
(*Taylorism*)
(Taylor 1911)

Planes

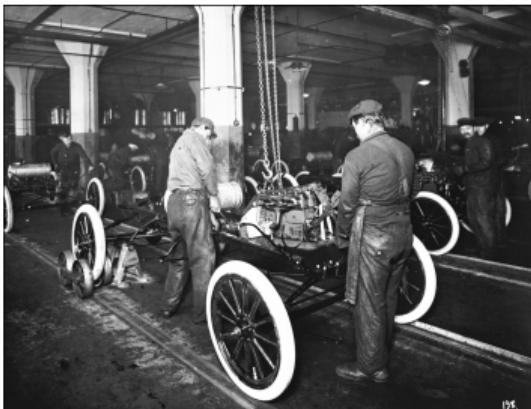
- Men drafted during World War II
- Factories turned to a new workforce who had neither conventional training nor experience
- **Specialized training and assignment**



Trains



Automobiles



Planes



Good theories give us analytical power

for the past

for the present

for realities to come

ON-DEMAND WORK'S LIMITS

We'll be able to make stronger assumptions of what people know



ON-DEMAND WORK'S LIMITS

We'll be able to make stronger assumptions of what people know



ON-DEMAND WORK'S LIMITS

We'll be able to make stronger assumptions of what people know

...but we probably won't be able to get much further than piecework did.



CONCLUDING

STREET-LEVEL ALGORITHMS

Street-level algorithms can create and act on decision boundaries like street-level bureaucrats.

But they can't reflect on new circumstances, and update their decision boundaries, like people can.

PIECEWORK

Technology can help enhance cognition; but AIs are poor evaluators, let alone producers, of creative work.

People may deploy AI in these ways anyway. Piecework should inform our critiques of these efforts.

We design technical and social systems by recognizable references and we can use this to understand systems, and to inform our actions.

We can draw from a much deeper well of scholarship than Computer Science to recognize the patterns we're recreating in ostensibly novel technical systems.

NOTHING NEW UNDER THE SUN

EVERYTHING OLD IS NEW AGAIN

STREET-LEVEL ALGORITHMS

USING INTELLECTUAL ARBITRAGE TO STUDY TECHNICAL SYSTEMS

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