

INTRO TO ETHICS AND FAIRNESS

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Required reading: R. Caplan, J. Donovan, L. Hanson, J. Matthews. "Algorithmic Accountability: A Primer", Data & Society (2018).

LEARNING GOALS

- Review the importance of ethical considerations in designing AI-enabled systems
- Recall basic strategies to reason about ethical challenges
- Diagnose potential ethical issues in a given system
- Understand the types of harm that can be caused by ML
- Understand the sources of bias in ML

OVERVIEW

Many interrelated issues:

- Ethics
- Fairness
- Justice
- Discrimination
- Safety
- Privacy
- Security
- Transparency
- Accountability

Each is a deep and nuanced research topic. We focus on survey of some key issues.



In September 2015, Shkreli received widespread criticism when Turing obtained the manufacturing license for the antiparasitic drug Daraprim and raised its price by a factor of 56 (from USD 13.5 to 750 per pill), leading him to be referred to by the media as "the most hated man in America" and "Pharma Bro".

-- [Wikipedia](#)

"I could have raised it higher and made more profits for our shareholders. Which is my primary duty." -- Martin Shkreli

Speaker notes

Image source: https://en.wikipedia.org/wiki/Martin_Shkreli#/media/File:Martin_Shkreli_2016.jpg

TERMINOLOGY

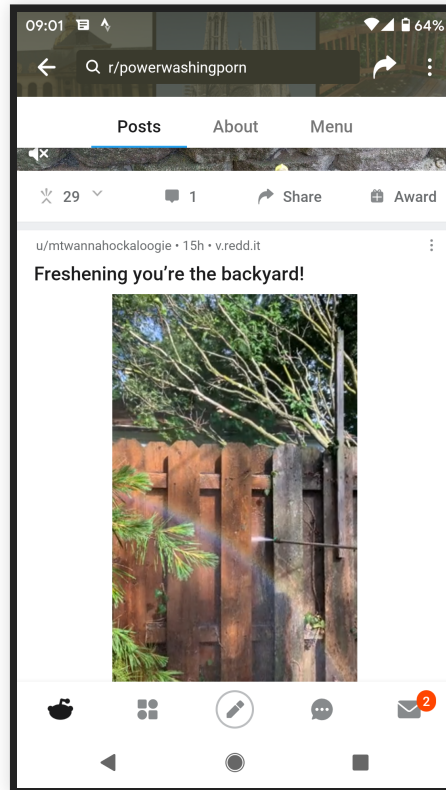
- Legal = in accordance to societal laws
 - systematic body of rules governing society; set through government
 - punishment for violation
- Ethical = following moral principles of tradition, group, or individual
 - branch of philosophy, science of a standard human conduct
 - professional ethics = rules codified by professional organization
 - no legal binding, no enforcement beyond "shame"
 - high ethical standards may yield long term benefits through image and staff loyalty

ANOTHER EXAMPLE: SOCIAL MEDIA



Q. What is the (real) organizational objective of the company?

OPTIMIZING FOR ORGANIZATIONAL OBJECTIVE



- How do we maximize the user engagement?
 - Infinite scroll: Encourage non-stop, continual use
 - Personal recommendations: Suggest news feed to increase engagement
 - Push notifications: Notify disengaged users to return to the app

ADDICTION

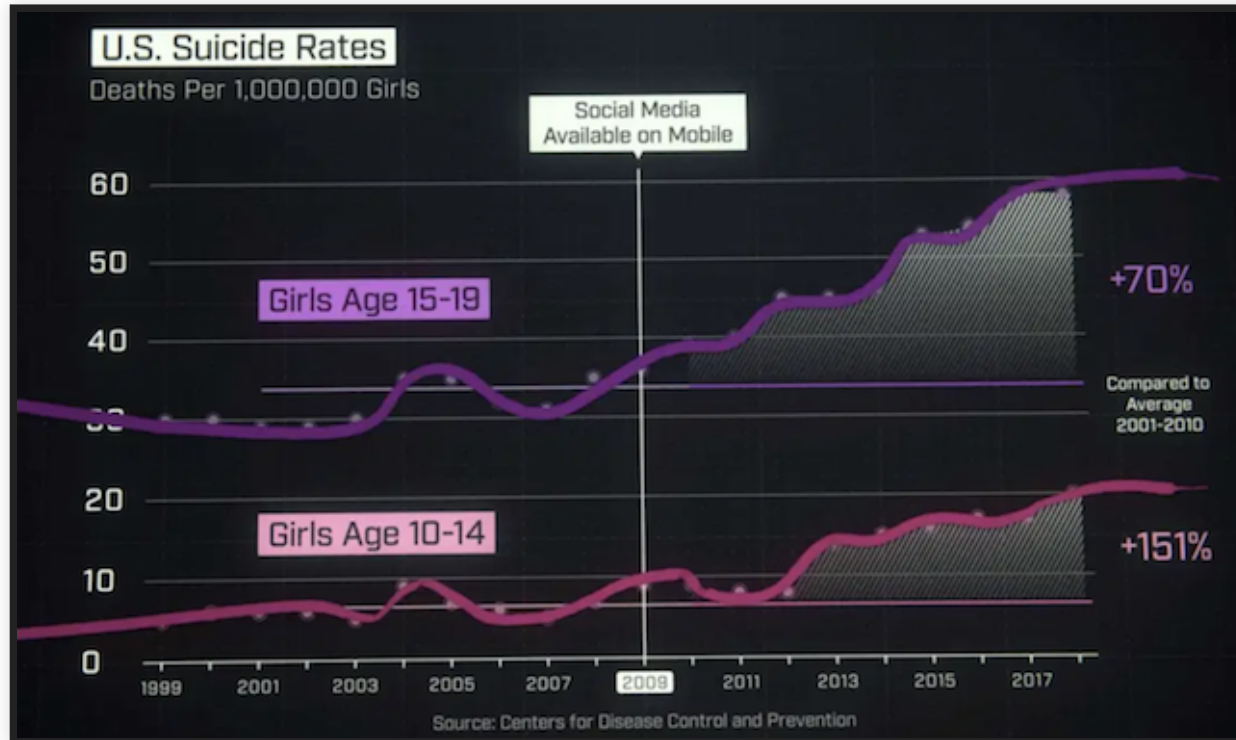


- 210M people worldwide addicted to social media
- 71% of Americans sleep next to a mobile device
- ~1000 people injured **per day** due to distracted driving (USA)

<https://www.flurry.com/blog/mobile-addicts-multiply-across-the-globe/>

https://www.cdc.gov/motorvehiclesafety/Distracted_Driving/index.html

MENTAL HEALTH



- 35% of US teenagers with low social-emotional well-being have been bullied on social media.
- 70% of teens feel excluded when using social media.

<https://lefronic.com/social-media-addiction-statistics>

DISINFORMATION & POLARIZATION

HILLARY ASKS "WHAT DIFFERENCE DOES IT MAKE"

BERNIE SANDERS: CLINTON FOUNDATION IS A "PROBLEM"

ANOTHER GRUESOME ATTACK ON POLICE BY A BLM MOVEMENT ACTIVIST

SUPPORT HILLARY & AMERICAN MUSLIMS

FOLLOW VETERANS - US IF YOU KNOW THE DIFFERENCE

OUR HEARTS ARE WITH THOSE 11 HEROES

HILLARY CLINTON HAS A 69 PERCENT DISAPPROVAL RATE AMONG ALL VETERANS

SATAN: IF I WIN CLINTON WINS! JESUS: NOT IF I CAN HELP IT!

PRESS 'LIKE' TO HELP JESUS WIN!

NO INVADERS ALLOWED

The collage features several images: a woman in a black dress pushing a casket on a tarmac; Bernie Sanders speaking; a police officer in uniform; a woman in a hijab and Hillary Clinton; a soldier in camouflage; a yellow diamond-shaped sign; and a religious illustration of Jesus and Satan.

DISCRIMINATION



<https://twitter.com/bascule/status/1307440596668182528>

WHO'S TO BLAME?

The image is a screenshot of a news article from the 'INDEPENDENT' website. The page has a dark background with white text. At the top left is the 'INDEPENDENT' logo. To the right are links for 'Support us', 'Contribute', and 'Subscribe'. Below the logo is a navigation menu with categories: NEWS, POLITICS, VOICES, SPORT, CULTURE, INDY/LIFE, INDYBEST, VIDEO, DAILY EDITION, and CONVERSATIONS. The main headline is 'GOOGLE QUIETLY REMOVES 'DON'T BE EVIL' PREFACE FROM CODE OF CONDUCT'. Below the headline is a sub-headline: 'Google employees resigned this month over the company's autonomous weapons project'. At the bottom left of the article is the author's name 'Anthony Cuthbertson' and his handle '@ADCuthbertson', along with the date and time 'Monday 21 May 2018 12:21'. At the bottom right are social media icons for a bookmark, Facebook, Twitter, and Email.

INDEPENDENT *Support us* [Contribute](#) [Subscribe](#)

NEWS POLITICS VOICES SPORT CULTURE **INDY/LIFE** INDYBEST VIDEO DAILY EDITION CONVERSATIONS

GOOGLE QUIETLY REMOVES 'DON'T BE EVIL' PREFACE FROM CODE OF CONDUCT

Google employees resigned this month over the company's autonomous weapons project

Anthony Cuthbertson | @ADCuthbertson | Monday 21 May 2018 12:21

[Bookmark](#) [Facebook](#) [Twitter](#) [Email](#)

- Q. Are these companies intentionally trying to cause harm? If not, what are the root causes of the problem?

CHALLENGES

- Misalignment between organizational goals & societal values
 - Financial incentives often dominate other goals ("grow or die")
- Insufficient amount of regulations
 - Little legal consequences for causing negative impact (with some exceptions)
 - Poor understanding of socio-technical systems by policy makers
- Engineering challenges, both at system- & ML-level
 - Difficult to clearly define or measure ethical values
 - Difficult to predict possible usage contexts
 - Difficult to predict impact of feedback loops
 - Difficult to prevent malicious actors from abusing the system
 - Difficult to interpret output of ML and make ethical decisions
 - ...

These problems have existed before, but they are being rapidly exacerbated by the widespread use of ML

FAIRNESS

LEGALLY PROTECTED CLASSES (US)

- Race (Civil Rights Act of 1964)
- Color (Civil Rights Act of 1964)
- Sex (Equal Pay Act of 1963; Civil Rights Act of 1964)
- Religion (Civil Rights Act of 1964)
- National origin (Civil Rights Act of 1964)
- Citizenship (Immigration Reform and Control Act)
- Age (Age Discrimination in Employment Act of 1967)
- Pregnancy (Pregnancy Discrimination Act)
- Familial status (Civil Rights Act of 1968)
- Disability status (Rehabilitation Act of 1973; Americans with Disabilities Act of 1990)
- Veteran status (Vietnam Era Veterans' Readjustment Assistance Act of 1974; Uniformed Services Employment and Reemployment Rights Act)
- Genetic information (Genetic Information Nondiscrimination Act)

Barocas, Solon and Moritz Hardt. "[Fairness in machine learning](#)." NIPS Tutorial 1 (2017).

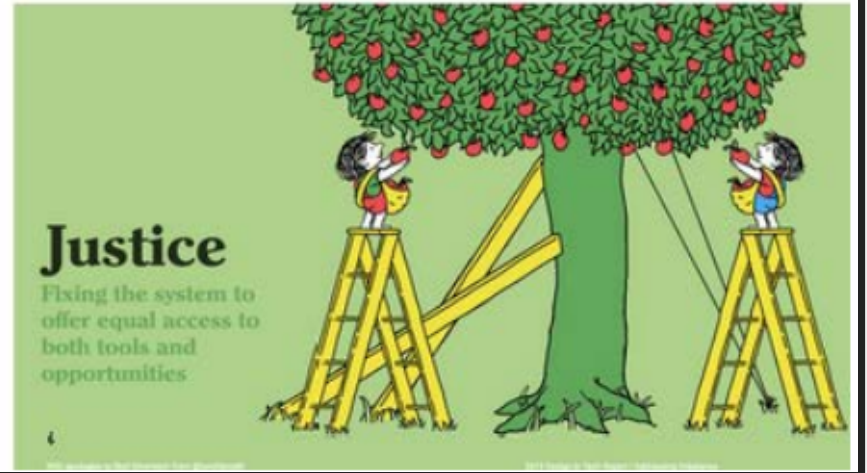
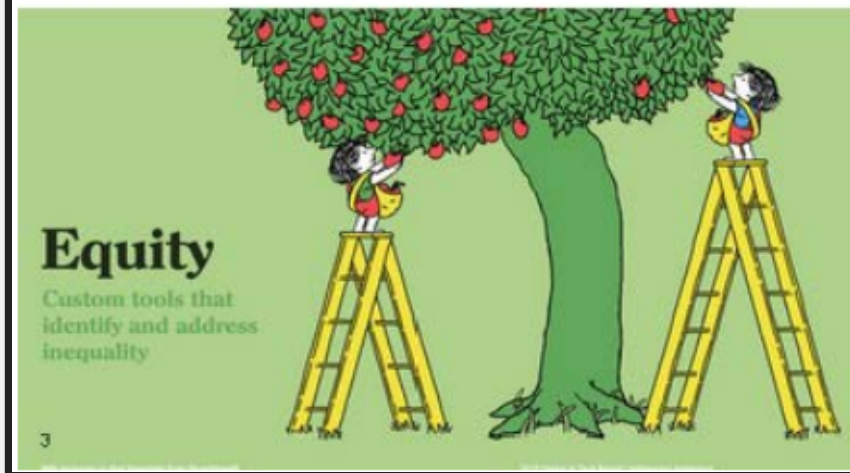
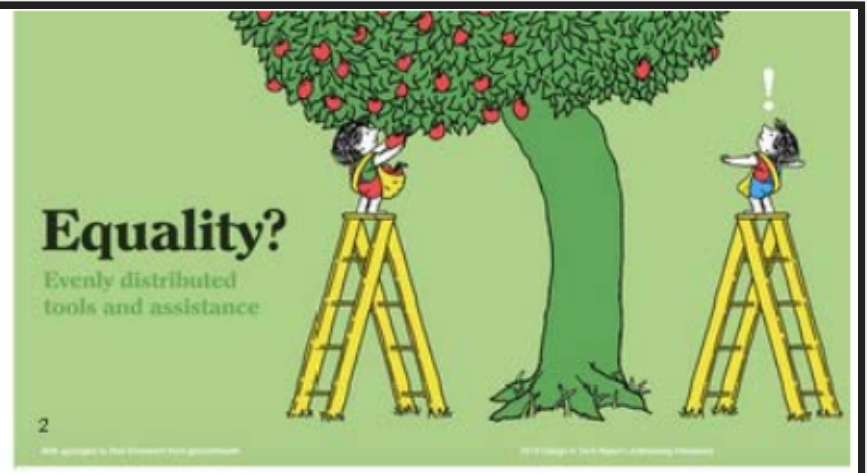
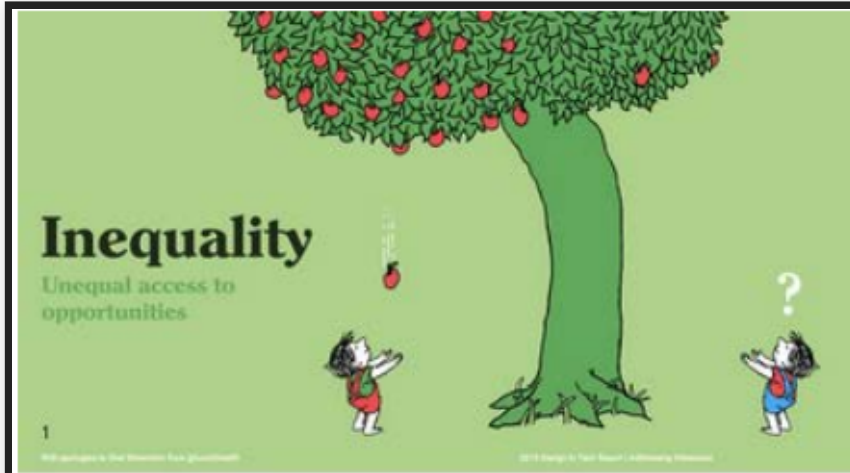
REGULATED DOMAINS (US)

- Credit (Equal Credit Opportunity Act)
- Education (Civil Rights Act of 1964; Education Amendments of 1972)
- Employment (Civil Rights Act of 1964)
- Housing (Fair Housing Act)
- 'Public Accommodation' (Civil Rights Act of 1964)

Extends to marketing and advertising; not limited to final decision

Barocas, Solon and Moritz Hardt. "[Fairness in machine learning](#)." NIPS Tutorial 1 (2017).

EQUALITY VS EQUITY VS JUSTICE



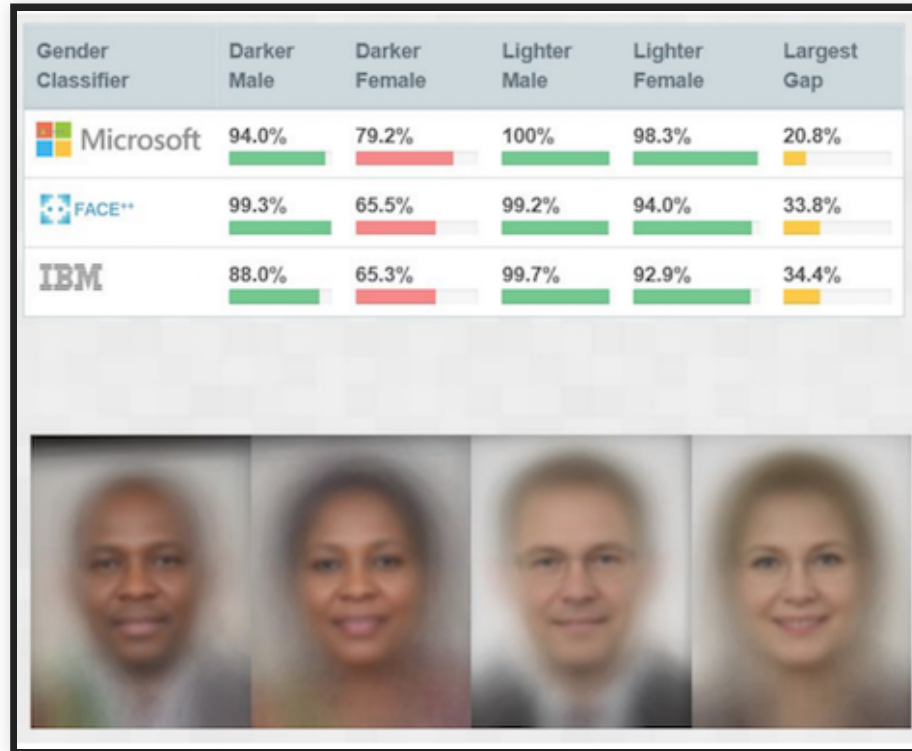
TYPES OF HARM ON SOCIETY

- **Harms of allocation:** Withhold opportunities or resources
- **Harms of representation:** Reinforce stereotypes, subordination along the lines of identity

“The Trouble With Bias”, Kate Crawford, Keynote@N(eur)IPS (2017).

HARMS OF ALLOCATION

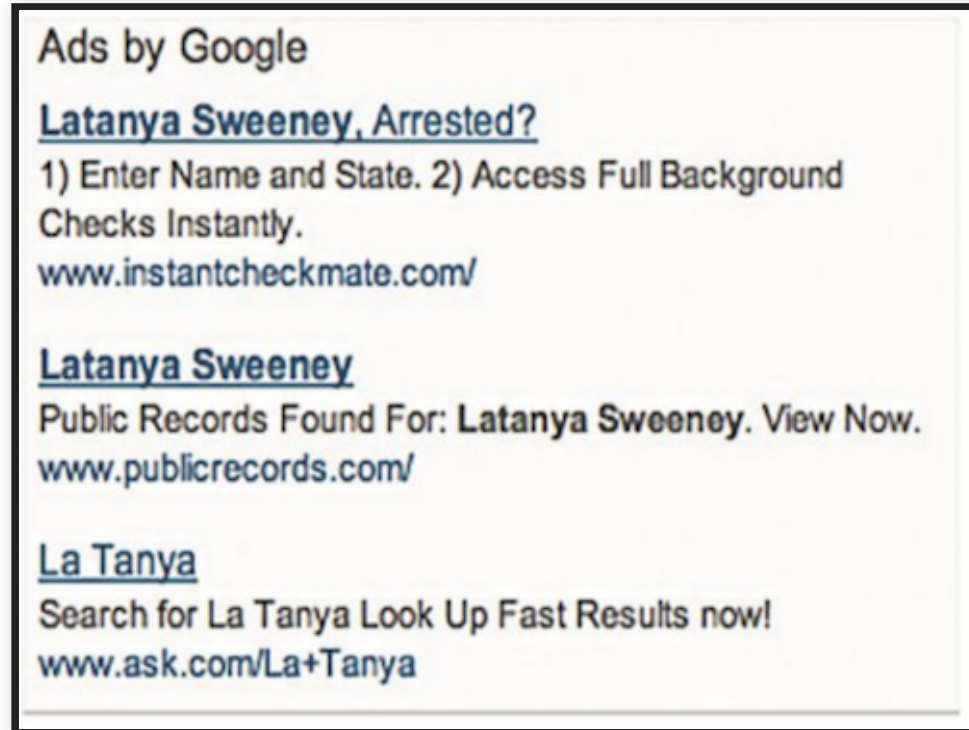
- Withhold opportunities or resources
- Poor quality of service, degraded user experience for certain groups



Q. Other examples?

HARMS OF REPRESENTATION

- Over/under-representation, reinforcement of stereotypes



Ads by Google

[Latanya Sweeney, Arrested?](#)
1) Enter Name and State. 2) Access Full Background Checks Instantly.
www.instantcheckmate.com/

[Latanya Sweeney](#)
Public Records Found For: **Latanya Sweeney**. View Now.
www.publicrecords.com/

[La Tanya](#)
Search for La Tanya Look Up Fast Results now!
www.ask.com/La+Tanya

Q. Other examples?

Discrimination in Online Ad Delivery, Latanya Sweeney, SSRN (2013).

IDENTIFYING HARMS

	Allocation of resources	Quality of Service	Stereotyping	Denigration	Over- / Under-Representation
Hiring system does not rank women as highly as men for technical jobs	x	x	x		x
Photo management program labels image of black people as “gorillas”		x		x	
Image searches for “CEO” yield only photos of white men on first page			x		x

- Multiple types of harms can be caused by a product!
- Think about your system objectives & identify potential harms.

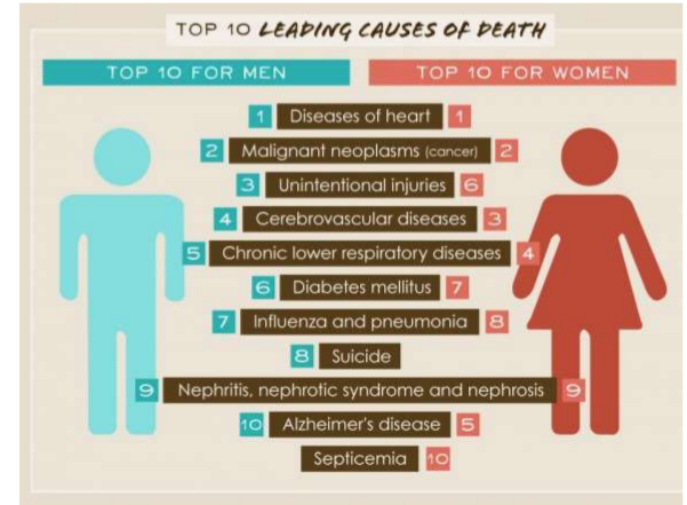
Challenges of incorporating algorithmic fairness into practice, FAT Tutorial (2019).*

NOT ALL DISCRIMINATION IS HARMFUL



FEDERAL TRADE COMMISSION

Mortgage discrimination is against the law.



- Loan lending: Gender discrimination is illegal.
- Medical diagnosis: Gender-specific diagnosis may be desirable.
- The problem is *unjustified* differentiation; i.e., discriminating on factors that should not matter
- Discrimination is a **domain-specific** concept, and must be understood in the context of the problem domain (i.e., world vs machine)

Q. Other examples?

ROLE OF REQUIREMENTS ENGINEERING

- Identify system goals
- Identify legal constraints
- Identify stakeholders and fairness concerns
- Analyze risks with regard to discrimination and fairness
- Analyze possible feedback loops (world vs machine)
- Negotiate tradeoffs with stakeholders
- Set requirements/constraints for data and model
- Plan mitigations in the system (beyond the model)
- Design incident response plan
- Set expectations for offline and online assurance and monitoring

SOURCES OF BIAS

WHERE DOES THE BIAS COME FROM?

The image displays two screenshots of the Google Translate interface, illustrating a gender bias in the Turkish translation of English sentences.

Top Screenshot: The source text is "He is a nurse" and "She is a doctor". The detected source language is English. The target language is set to Turkish. The translation output is "O bir hemşire" (She is a nurse) and "O bir doktor" (He is a doctor). The word "hemşire" (nurse) is associated with the female pronoun "O", and "doktor" (doctor) is associated with the male pronoun "O".

Bottom Screenshot: The source text is "O bir hemşire" and "O bir doktor". The detected source language is Turkish. The target language is set to English. The translation output is "She is a nurse" and "He is a doctor". The female pronoun "O" is associated with "hemşire" (nurse), and the male pronoun "O" is associated with "doktor" (doctor).

Semantics derived automatically from language corpora contain human-like biases, Caliskan et al., Science (2017).

WHERE DOES THE BIAS COME FROM?

The screenshot displays the Microsoft Translator interface with four text boxes arranged in a 2x2 grid, illustrating a bidirectional translation loop. The top-left box shows English text: "He is a nurse. She is a doctor." with a character count of 31/5000. The top-right box shows the Turkish translation: "O bir hemşire. O bir doktor." with a "Suggest an edit" button and share icons. The bottom-left box shows the Turkish text: "O bir hemşire. O bir doktor." with a character count of 28/5000. The bottom-right box shows the English translation: "She's a nurse. He's a doctor." with a "Suggest an edit" button and share icons. The interface includes a Microsoft logo, a search bar, and navigation tabs for Text, Conversation, Apps, For business, and Help.

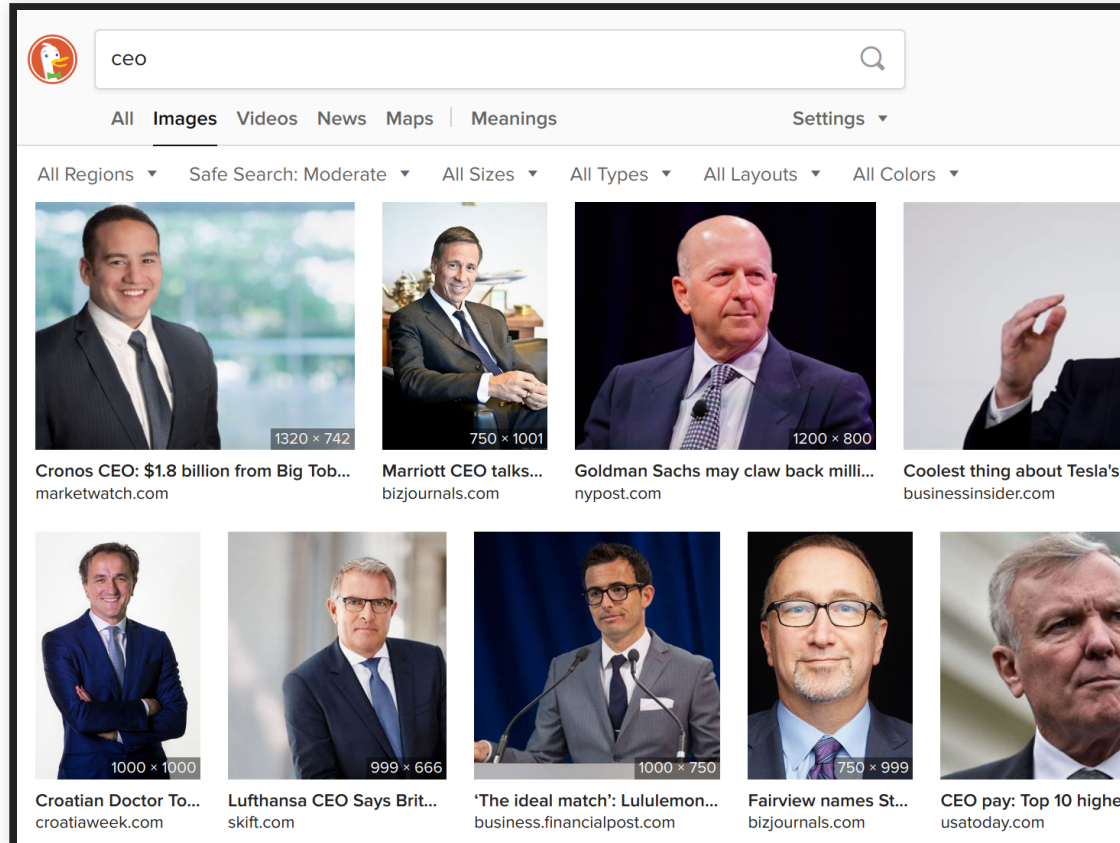
SOURCES OF BIAS

- Historial bias
- Tainted examples
- Skewed sample
- Limited features
- Sample size disparity
- Proxies

Big Data's Disparate Impact, Barocas & Selbst California Law Review (2016).

HISTORICAL BIAS

Data reflects past biases, not intended outcomes



Q. Should the algorithm reflect the reality?

Speaker notes

"An example of this type of bias can be found in a 2018 image search result where searching for women CEOs ultimately resulted in fewer female CEO images due to the fact that only 5% of Fortune 500 CEOs were woman—which would cause the search results to be biased towards male CEOs. These search results were of course reflecting the reality, but whether or not the search algorithms should reflect this reality is an issue worth considering."

TAINTED EXAMPLES

Bias in the dataset caused by humans

TECH \ AMAZON \ ARTIFICIAL INTELLIGENCE \

Amazon reportedly scraps internal AI recruiting tool that was biased against women

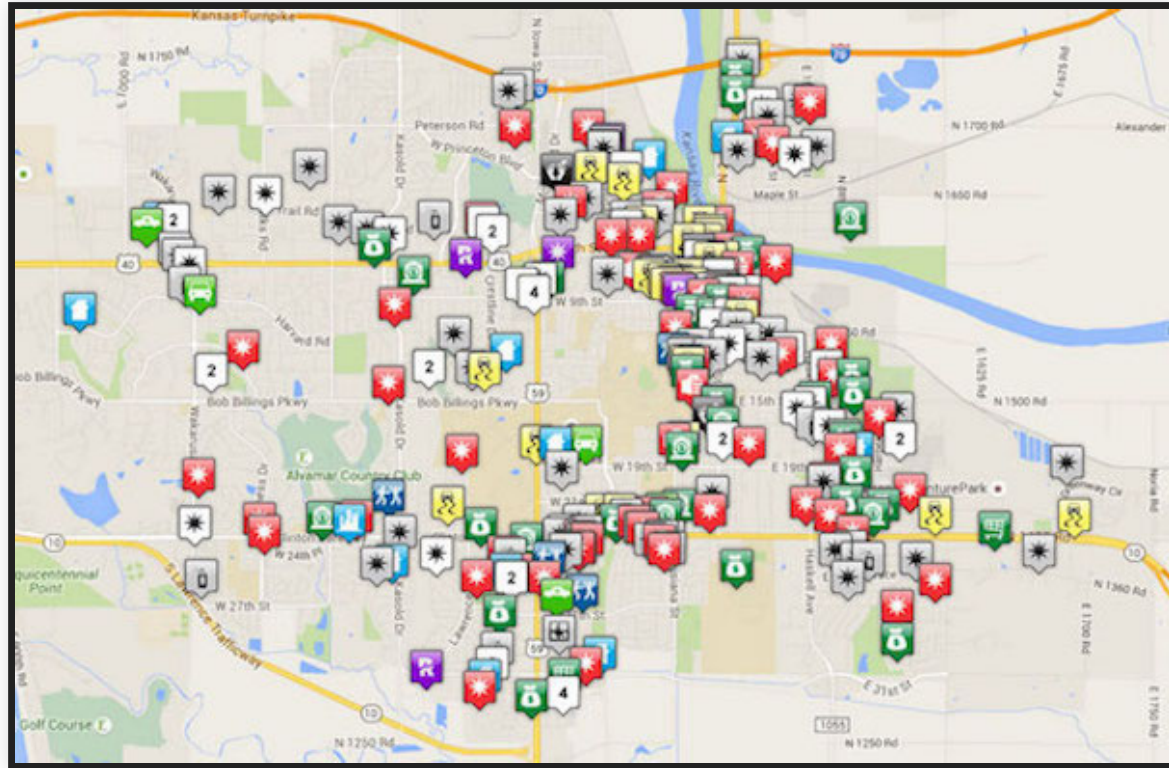
The secret program penalized applications that contained the word "women's"

By James Vincent | Oct 10, 2018, 7:09am EDT

- Example: Hiring decision dataset
 - Some labels created manually by employers
 - Dataset "tainted" by biased human judgement

SKEWED SAMPLE

Bias compounds over time & skews sampling towards certain parts of population



- Example: Crime prediction for policing strategy

LIMITED FEATURES

Features that are less informative or reliable for certain parts of the population



- Features that support accurate prediction for the majority may not do so for a minority group
- Example: Employee performance review
 - "Leave of absence" as a feature (an indicator of poor performance)
 - Unfair bias against employees on parental leave

SAMPLE SIZE DISPARITY

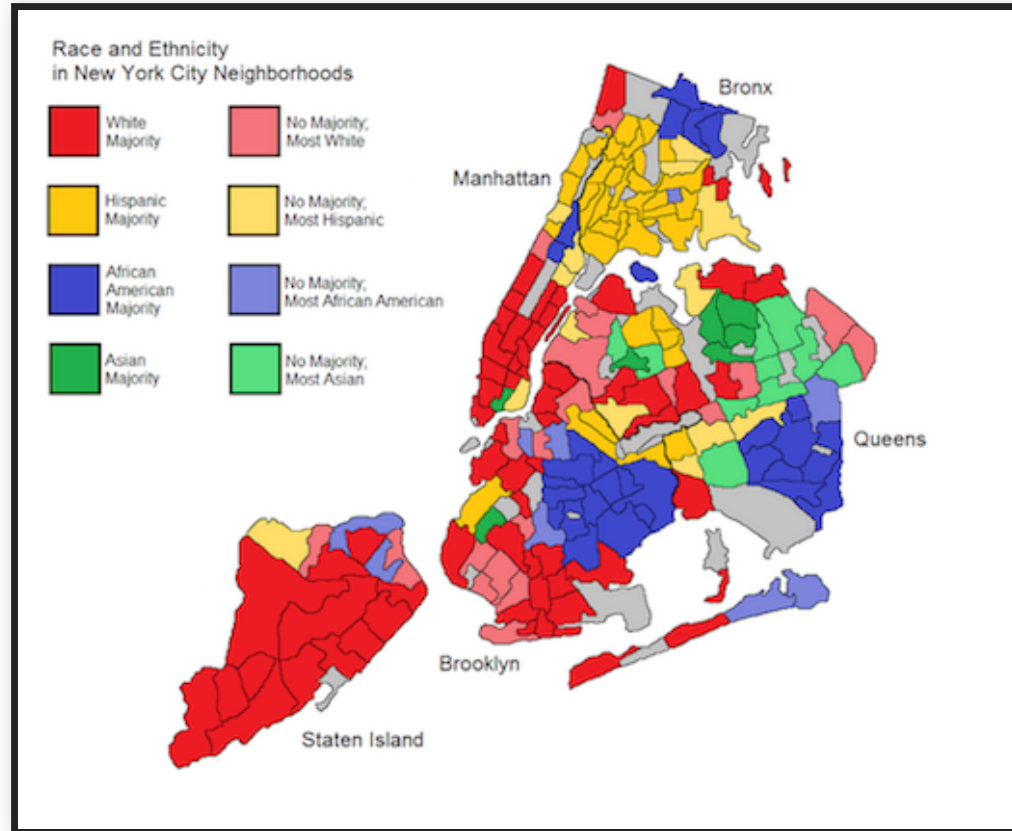
Less data available for certain parts of the population



- Example: "Shirley Card"
 - Used by Kodak for color calibration in photo films
 - Most "Shirley Cards" used Caucasian models
 - Poor color quality for other skin tones

PROXIES

Certain features are correlated with class membership



- Example: Neighborhood as a proxy for race
- Even when sensitive attributes (e.g., race) are erased, bias may still occur

CASE STUDY: COLLEGE ADMISSION



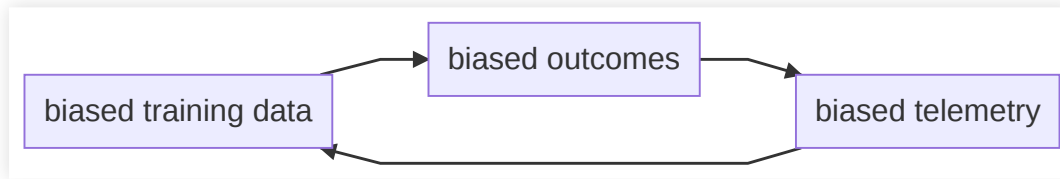
- Evaluate applications & identify students who are likely to succeed
- Features: GPA, GRE/SAT, gender, race, undergrad institute, alumni connections, household income, hometown, etc.,

CASE STUDY: COLLEGE ADMISSION



- Possible harms: Allocation of resources? Quality of service? Stereotyping? Denigration? Over-/Under-representation?
- Sources of bias: Skewed sample? Tainted examples? Historical bias? Limited features? Sample size disparity? Proxies?

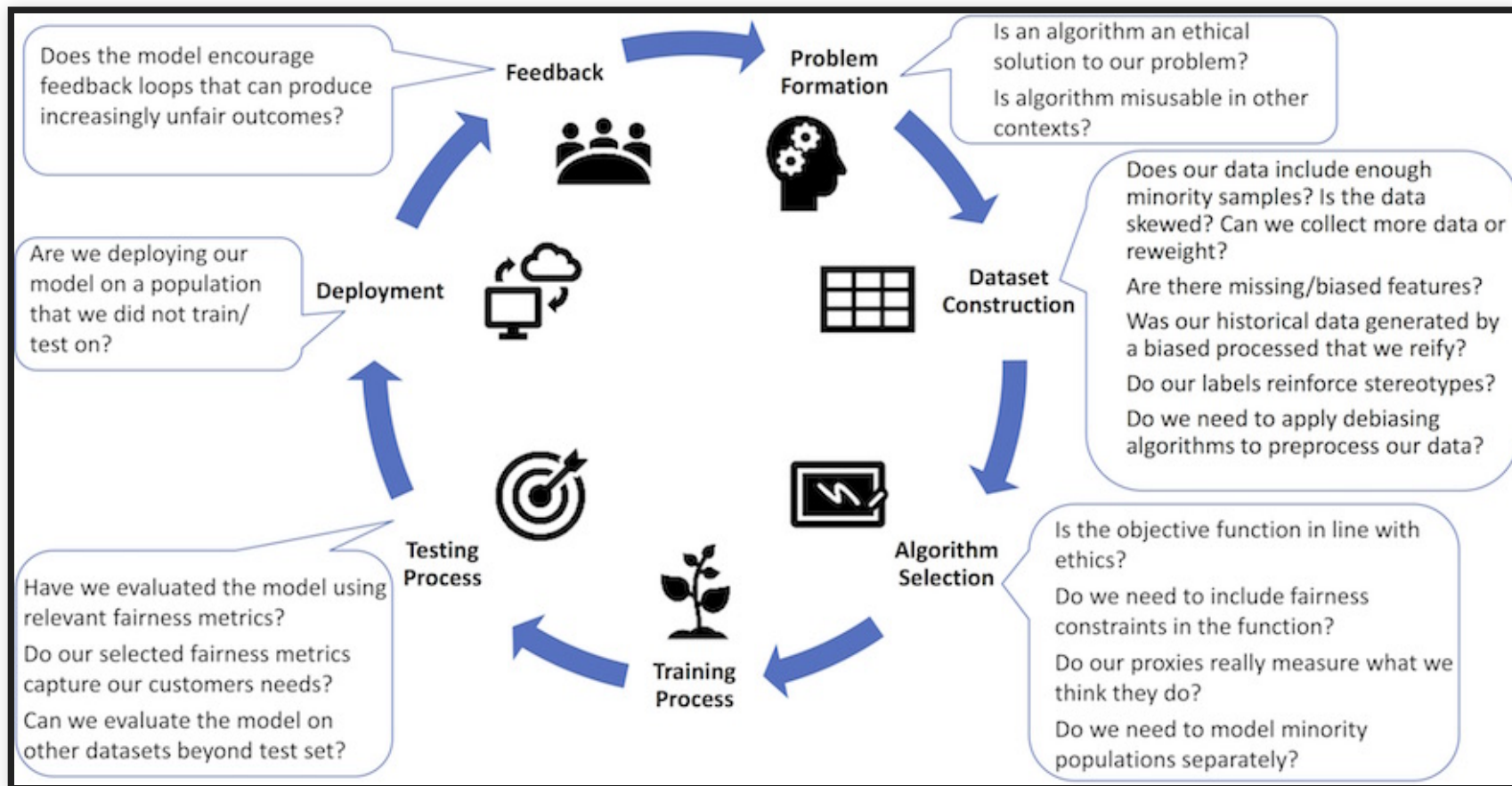
FEEDBACK LOOPS



"Big Data processes codify the past. They do not invent the future. Doing that requires moral imagination, and that's something only humans can provide. " -- Cathy O'Neil in [Weapons of Math Destruction](#)

BUILDING FAIR ML SYSTEMS

FAIRNESS MUST BE CONSIDERED THROUGHOUT THE ML LIFECYCLE!



SUMMARY

- Many interrelated issues: ethics, fairness, justice, safety, security, ...
- Both legal & ethical dimensions
- Challenges with developing ethical systems
- Large potential for damage: Harm of allocation & harm of representation
- Sources of bias in ML
 - Skewed sample, tainted examples, limited features, sample size, disparity, proxies
- Addressing fairness throughout the ML pipeline
- Data bias & data collection for fairness
- **Next class:** Definitions of fairness, measurement, testing for fairness

