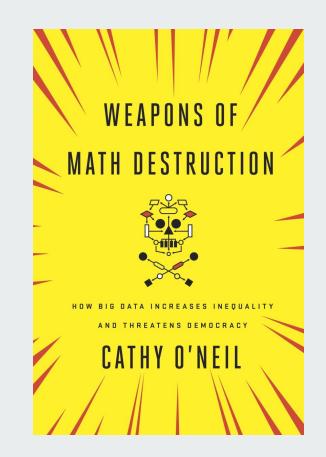# Weapons of Math Destruction

CIS 399 - Science of Data Ethics
Kevin Sim, Sam Holland, Joe Goodman, Sam Davis, Rounak Gokhale, Drew Boyette, Priyansh Sharma
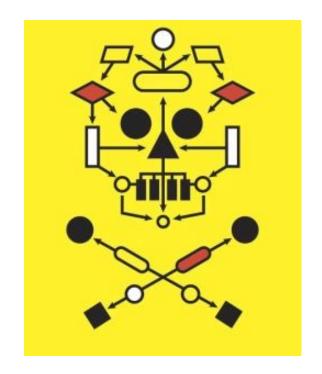

WEAPONS OF MATH DESTRUCTION

HOW BIG DATA INCREASES INEQUALITY AND THREATENS DEMOCRACY

CATHY O'NEIL

Overview / Themes

- "How big data increases **inequality** and threatens **democracy**
- The damage inflicted on society by these **weapons of math destruction**
- In what ways have algorithmic decisions affected our lives **for the worse**?

What is a 'weapon of math destruction?'

- A mathematical model that encodes "**prejudice**, **misunderstanding**, and **bias**"
- Often hurts individuals who are **the exception**
- No setup for **feedback**, it does not learn from its mistakes

Who is Cathy O'Neill?

- Academic-turned-data scientist
- Worked at a hedge fund in the height of the 2008 recession
- Saw the risk model attached to mortgages as a WMD
- Started 'Mathbabe' blog to write about WMDs

Arms Race: Going to College

- Premise: U.S. News & World Report college rankings
- 25% determined by president/provost questionnaires
- 75% of score determined by an algorithm with proxies like SAT scores, graduation rate, and percentage of alumni who contribute

Arms Race: Going to College

- Problems with scale: all schools, nationwide, are forced to the **exact same standards**
- A traditional "safety" school can reject more of it's top applicants because **statistically they won't enroll**, which will improve its acceptance rate metric and boost its rating
- **Financial aid** and **nonprofit status** are not proxies in the algorithm

Arms Race: Going to College

- Obama suggested creating a new rankings model that would take into account **affordability, percentage of minority students, and post-grad job placement**
- Heavy pushback from college presidents, who had spent time and effort "optimizing themselves" for the U.S. News rankings
- Education Dept. chooses to releases raw data online, aka **"the opposite of a WMD"**

Online Advertising

- For-profit colleges
- The targeted advertising pipeline
- Lead generation
- CALDER study
- Nefarious feedback loop
- Payday loans
- Strategic or predatory?

Civilian Casualties: Justice in the Age of Big Data

- Algorithms in criminal justice
- Predpol
- Feedback loop
- Fairness vs. Efficiency

Getting a Job

- Kronos test assesses job applicant's personalities
  - Those who did not pass this test were immediately denied
- It's actually Illegal to have intelligence tests be a basis for hiring (Griggs v. Duke Power Company)
- The conclusions drawn from certain questions are not intuitive
- Automatic resume screening programs tend to harm those not in a position to optimize resumes
  - Similar effects were observed in St. George's med school admission system
- Some companies use "churn" algorithms that target poorer regions

On the Job

- Scheduling software leads to people being totally unable to plan their lives in advanced
- Even companies vowing to remove these practices failed because of manager's pay structures
- The effects of this on people can be far reaching, especially for parents
- Models that attempt to measure worker's ideas and influence cost jobs of people who don't digitally share ideas.
- The teacher rating model from earlier was influenced by misleading data as well.
  - Regulations passed in 2015 allowed for more flexibility in assessing schools

Landing Credit

- Loans originated from banker
  - Rated based off subjective characteristics
  - Church-going habits
  - Private family affairs
- Transition to algorithmic loans
  - FICO credit scores
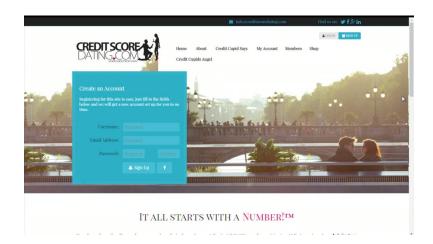 - eScore proxies

eScores Feedback Loop

- Borrowers from rougher neighborhoods receive lower scores
  - More defaults from that area
  - Leads to less credit and higher rates
- Used for payday loans and for-profit colleges ads
  - Illegal to use credit scores for marketing
  - Invisible to wealthier demographics
- Errors in data collection
  - 5%—ten million people—had at least one error on one of their credit reports
  - Abundance of data in unregulated consumer profiles
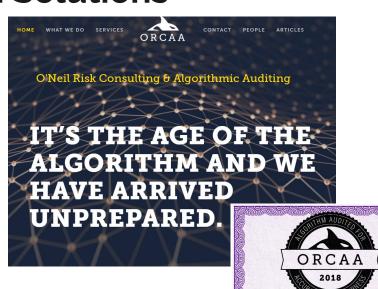 - More likely disregarded for privileged people

Credit Score Proxy

- Credit Score used as a metric
  - Applying to jobs
  - Online dating
- Allows missed credit to affect other areas
  - Leads back to feedback loops
  - Inability to get a job -> lowers ability to pay bills -> harder to get job
- Cyclical Unemployment lowers correlation
  - Trustworthiness, hardworking, responsibility
  - Credit Score
  - Affects those without savings

Potential Future Loan Solutions

- Regularization of data and data usage

- Data Science Hippocratic Oath

- Mandatory Certificate of Fairness

Getting Insurance

- **Insurance data**
  - Used to divide us into smaller tribes
  - Companies delineate neighborhoods where they would not invest
- **Auto-insurance**
  - Adults with clean driving records and poor credit scores paid $1,552 more than the same drivers with excellent credit and a drunk driving conviction
  - Win-win for auto insurers
- Insurance models are fine-tuned to draw as much money as possible from subgroups

Employee Data Usage

- Data companies are using cell phone data divide people into tribes based on their behavior
- Next step: developing health scores and wielding them to sift through job candidates
- CVS started requiring employees to report their health checkups or pay $600 a year
- Companies are overusing data to score us as potential employees and as workers

The Targeted Citizen - Civic Life

- **Role of Algorithms in swaying politics**
- **Social Media posts/updates influence political behavior**
  - information gathered by researchers to study this effect of updates on political results - i.e shared links, impact of different words
- **Political Microtargeting**
  - Allows politicians to manipulate voters, only caters to engaged voters
  - Extends to our civic life (ex: what news we are fed on TV)
- **Merging of politics and modern consumer marketing**
  - Use of big data/predictive analytics in determining where to target campaigns/speeches

Conclusion

- **Different WMDs intertwined together** - poor people often targeted, data about bad credit feeds into WMD's targeting people for incarceration
- **Importance of regulating and monitoring** these WMD's (Fairness vs. profit)
  - Individual companies vs general public
- **Accountability** of data scientists - establish "philosophical grounding"
  - Some cases we sacrifice accuracy for fairness (accuracy vs. fairness tradeoff) = "dumbing down algorithms"
- <u>**Takeaway: We are becoming increasingly reliant on predictive models and data. It is important that we take responsibility in regulating and integrating fairness into these models which dictate our data-driven society.**</u>