ALGORITHMS AND MESSY DATA

LESSON PLAN
LESSON #2

LESSON RATIONALE:

Algorithms are informing and quickly replacing human judgement in many aspects of our lives. Service providers started out implementing algorithms to make predictions and decisions about our preferences for products and entertainment such as Amazon, Spotify, Google, Netflix, Facebook, etc. Today, however, algorithms are being used to make critical judgments on individual's criminal status, credit score, healthcare, and even eligibility as an employee or student.

This unit provides students with a quick and simple methodology to understand, analyze, and evaluate the costs and benefits of a particular algorithm. For instance, is the algorithm always reliable when it is used to predict human behavior?

This lesson introduces “messy data” which focuses on factual reliability as the first indicator of whether an algorithm is unreliable and possibly even unethical when it generates messy data. Students will learn a method that assesses factual reliability of algorithms and have a chance to evaluate the consequences of algorithmic messiness and unreliability.

INTRODUCTION (5 MINS)

Welcome students to class. As a warm-up, have the students reflect on what they learned about algorithms from the lesson.

- What is an Algorithm?
- What did they learn from the My Algorithmic Map activity?

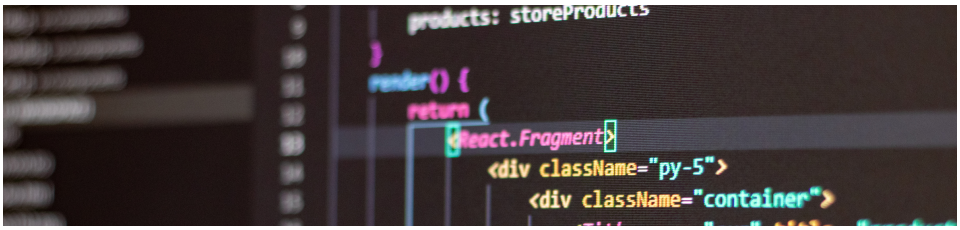
If students did not complete this activity, then have students reflect on what an algorithm is and how it impacts their lives.

MESSY DATA VIDEO (5 MINS)

Play the Messy Data Video for the students. While watching, have students write down any questions or surprises from the video.

After the video, display or distribute the Messy Data Definition graphic.
Ask students to reflect on the video as a whole group by asking these questions aloud:

- What surprised you about this video?
- What questions do you have about “messy” data?
- What questions do you have about algorithmic reliability?



GRADE LEVEL
High School
Grades 9-12

TIME
45-50 minutes (mins)

COMMON CORE STANDARDS
CCSS.ELA-LITERACY.RH.9-10.4

CCSS.ELA-LITERACY.SL.9-10.1

MATERIALS
Paper
Writing Utensil
Messy Data Video
Messy Data Definition Graphic

LESSON OBJECTIVE(S):

Explain the concept of messy data.

Explore using messy data to assess an algorithm’s factual reliability.

Evaluate the consequences of a factually unreliable algorithm.

ESSENTIAL QUESTIONS:

What is messy data?

How can algorithmic unreliability put people at risk?

KEY VOCABULARY
Algorithm

Messy Data

1. MAY THE ODDS BE IN YOUR FAVOR: SMALL GROUP ACTIVITY (10 MINS)

Explain to students that they are going to practice evaluating algorithms' reliability to determine if particular algorithms are too messy to use ethically.

Tell them they will do a small group activity to analyze a specific algorithm and then present their analysis to the class.

Each team will be assigned a specific algorithm and its factual error rate. Put the class into three teams (A, B, and C.)

Hand out the May the Odds Be in Your Favor worksheet to each team.

Have the teams review and complete their section (A, B, or C) of the worksheet.

2. MAY THE ODDS BE IN YOUR FAVOR: LARGE CLASS DISCUSSION (10 MINS)

Bring the students back together. Have each team present their answers to the May the Odds Be in Your Favor worksheet questions.

- **If this algorithm was wrong about someone, what would be the consequences?**
- **Why do you think your algorithm is wrong about certain types of people?**
- **Which race or gender do you think your algorithm is wrong about? Why?**
- **What are the consequences of an algorithm favoring a particular gender or race?**

WRAP UP: FORMATIVE ASSESSMENT (5 MINS)

Ask the students to reflect on the following questions. Students can turn in their responses for a formative assessment:

- Did seeing how many of your classmates would be affected by muddy data change your mind about whether the algorithm was too unreliable to use?
- What would happen if you were the type of individual that an algorithm is often wrong about?

3. MAY THE ODDS BE IN YOUR FAVOR: (10 MINS) LARGE GROUP ACTIVITY

Using the script below, randomly assign students to the "messy" group and have them move to a different corner of the room. Then bring them all back together and repeat this process for all three groups

Messy Group One: Health Algorithm

Remind the class that one health algorithm misidentified chronic health conditions in African-Americans 26.3% of the time. Instruct ¼ of the class to move to one side of the room.

Messy Group Two: Facial Recognition Algorithm

Remind the students that one facial recognition algorithm misidentified the gender of women of color 34% of the time. Instruct ⅓ of the class to move to one side of the room.

Messy Group Three: Employment Algorithm

Remind the students that one employment algorithm was shown to favor white applicants over African-American applicants 50% of the time. Instruct half of the class to move to one side of the room.

OPTIONAL CURATION:

For face-to-face instruction, take a picture of the "separated" class and submit it to the IDH for presentation on our social media. For virtual instruction, have the "muddy" students use the Messy Data Definition Graphic as their zoom background and then submit a screenshot.)

Name: Date:

MAY THE ODDS BE IN YOUR FAVOR

Axis of Facts: Small Group Activity.

INSTRUCTIONS:
EACH TEAM SHOULD REVIEW THEIR ASSIGNED SECTION AND THEN ANSWER THEIR AXIS OF FACTS QUESTIONS.

Team A: Facial Recognition

Facial recognition algorithms are used to detect your location, whether you would be a good job applicant, and even whether you are lying. But facial recognition algorithms are well known to be factually unreliable a significant percentage of the time. Depending on your age, facial recognition can be as much as 10 times more incorrect. A widely used facial recognition program actually misidentified one gender 19% of the time. (If you factor in facial complexion, that same program was wrong about gender 31% of the time.) A federal study showed that certain races were up to 100 times more likely to be misidentified than other races. Combining race and gender, facial recognition algorithms show a range of error rates, from 0.8 percent for some race and gender combinations and 34.7 percent for others.

AXIS OF FACTS QUESTIONS:

Why do you think your algorithm is wrong this percentage of the time?

If this algorithm was wrong about you, what would be the consequences?

Which race or gender do you think this algorithm is wrong about? Why?

Team Two: Employment

Employment algorithms are used as a faster alternative to sorting through job applications or marketing job applications to certain groups of people on the internet. But known factual errors exist with these algorithms. Even with job applicants who have identical CVs, one employment algorithm was 50% more likely to hire a particular race over another particular race. Another employment algorithm -- for an executive job paying $200,000 a year -- was programmed to show its advertisement to 1,800 members of one gender but only 300 of another. Another algorithm showed one gender ion CEO job searches 85% of the time.

Why do you think your algorithm is wrong this percentage of the time?

If this algorithm was wrong about you, what would be the consequences?

Which race or gender do you think this algorithm is wrong about? Why?

AXIS OF FACTS QUESTIONS:

Team Three: Health

In the healthcare industry, there is an algorithm that is designed to determine the likelihood of a patient needing additional care after visiting the doctor. It's been shown that this particular algorithm ranks one race as having more chronic illnesses compared to another race, despite one of the races having 26.3% more chronic health conditions. (If the algorithm was to be altered to fix this disparity, the number of people of this race who receive additional care after healthcare services would be increased from 17.7% to 46.5%.)

AXIS OF FACTS QUESTIONS:

Why do you think your algorithm is wrong this percentage of the time?

If this algorithm was wrong about you, what would be the consequences?

Which race or gender do you think this algorithm is wrong about? Why?

1 Natasha Singer, Amazon Is Pushing Facial Technology That a Study Says Could Be Biased, New York Times, Jan 24, 2019
2 Singer, supra.
3 Singer, supra.
4 Drew Harwell, "Federal Study Confirms Racial Bias of Many Facial Recognition Systems, Casts Doubt on Their Expanding Use," The Washington Post, Dec 19, 2019.
5 Singer, supra.
6 Hannah Devlin, AI programs exhibit racial and gender biases, research reveals, The Guardian, Apr 13, 2017.
7 Byron Spice, Questioning the Fairness of Targeting Ads Online,citing Amit Datta, Michael Carl Tschantz and Anupam Datta, Automated Experiments on Ad Privacy Data Settings, Carnegie Mellon University, Proceedings on Privacy Enhancing Technologies, Volume 2015, Issue 1, April 18, 2015 https://doi.org/10.1515/popets-2015-0007
8 Krista Bradford, Google Shows [One Gender] Ads for Better Jobs, theGoodSearch, Dec 1, 2019.
9 Quinn Gawronski, Racial bias found in widely used health care algorithm, NBC News, Nov. 6, 2019.
10 Gawronski, supra.

"Margin of error," a statistic that represents how often the algorithm fails in its purpose

Messiness

THE IDH