Grades Unit | Using AI and Data Science to Predict Grades

Teachers' Guide

Preparation: • Display slide 2, with title for this unit and learning goals • Display the Core Learning Objectives on the virtual board/shared screen	
Learning Goals: • Evaluate the strengths and weaknesses of human vs. AI capabilities • Learn to calculate weighted average of a data set • Learn that data sets are imperfect and need handling • [Extension] Predict an outcome based on a data set	**Lesson Resources:** • Computer, internet connection, and projector • Slide deck Grades Unit - Introduction to AI and Data Science • Worksheet 1 Grades Unit - General Worksheet • Worksheet 2 Grades Unit - Determining Grades with Data Problem Sheet • Spreadsheet Exercise Grades Unit - Data Science Spreadsheet

Part 0: Opening Total Time: 5 Min

Activity	Time	Purpose and Notes
1. Class Greeting Greet students and complete introductions (e.g., introduce yourself as the facilitator and the topic	1 min	Students will learn the name of the facilitator, and will have an understanding of the overall purpose of the course and what will be covered.

of the course). Display the name(s) of the facilitator(s) on the virtual board.		
2. Ask students to introduce themselves (to give their name), and share why they are interested in the course or what they hope to learn. (Skip if done already)	1 min	Students will have an opportunity to share their names with the facilitator and the rest of the class. They will reflect on what they might personally get out of the course.
3. Explain the process of working in groups. ○ The class will be divided into groups of 4. ○ Within each group, each pair of students are elbow partners. ○ When responding in writing ('journaling'), as prompted by the instructor, students will (a) write silently, (b) share with their elbow partners, (c) share with their group, and (d) share with the class. (Skip if done already)	2 min	This process will be repeated throughout the curricula whenever there are discussion questions.
4. Introduce the day's topic Read the learning objectives for the day to the students.	1 min	You can also read through the learning objectives on the board to help students know what to expect from the lesson.

Part 1: A debate **Total Time: 25 Min**

Activity	Time	Purpose and Notes
1. Introduce the debate Let the students know that they will be exploring the question "should teachers use AI to grade your homework and exams?" Students might be very excited about this topic. Go through the objectives and the formats on the slide. Half of the class will be assigned to Team Yes and another half will be assigned Team No. Emphasize that as a good debater and an informed citizen, they should understand and consider both sides of the argument. Go over the tips and rules. Students can make a copy of the Grades Unit - General Worksheet. They will use the worksheet to take notes. Depending on the class dynamics, you can either let the teams choose three different representatives for the opening statement,	15 min	The debate fosters critical thinking skills in students. In discussing this topic, they will understand what are the strengths and weaknesses of AI vs human. Some points that might come up include: AI can grade and provide detailed feedback quickly, while teachers get tired and may omit feedback. AI can save teacher's time for valuable relationship building activities and more time for planning lessons. If a teacher doesn't read and grade students' answers, they may miss the opportunity to get to know the students and their voices. Students may feel that it's unfair when they are not allowed to use AI to do homework. AI may have errors / hallucinations. Students may write identifying information without knowing that the answer would be fed to an AI.

rebuttal and closing statement, or let the students speak as they wish.		
2. Demo how you use AI to mark students' answers to the Intro Unit Knowledge Check. If students have not done the Intro Unit Knowledge Check, they could do it now. But preferably before the class. The knowledge check short link is: https://aif.to/unit0knowledgecheck. Copy the following prompt into your LLM of choice. Replace the square bracketed text with students' responses for the final question in the Unit 0 Knowledge Check. === I asked my students this question: A facial recognition door lock system uses your face to unlock the doors. Please describe what's the data and intelligent output of the system? I got this list of answers: [Copy and paste students' answers]	5 min	It is fun for students to see this process in action. They might find out that AI is actually doing a very good job grading and giving feedback most of the time. It could also serve as a prompt engineering exercise in which the class can practice writing better prompts.

Please turn the answers into a column in a table, each answer is the first cell of a row. Please give the answers a score each, in the next column, and give the reasons in a third column. ==== Read AI's marking with the students. If they have suggestions for better prompts, you can try a few more times.		
3. Ask the students did AI do a good job grading their answers? Can ask students to raise their hands. If students think otherwise, let them express their reasons. Ask students if their opinions about teachers grading their answers change? Ask what they think the school policy should be.	5 min	Students can consider all sides of the debate and keep an open mind. They can consider the ethical issues that arise. For policy, let students share their ideas. One compromise might be that AI can provide feedback, but its feedback need to be explicitly labeled. Teachers can be transparent about the process and teachers need to be the ultimate judge.

Part 2: A curse or a blessing? Total Time: 20 min

Activity	Time	Purpose

1. Introduce the scenario of AI-predicted grades Tell students the scenario that in 2022, exams were cancelled due to covid. Instead, AI was used to determine school leavers' final grades. Without giving any more information or discussions, ask students to show whether they are for or against. Ask one or two students from each side their reasons.	5 min	We bring a use case of AI that is very close to students' lives and future. Students might feel very differently at first glance compared to after they have read and thought more thoroughly about using AI to predict grades. The activity hopefully motivates students to think and discuss the significance of AI technologies throughout the course.
2. Think-Pair-Share: scenario of AI-predicted grades Students can make a copy of the Grades Unit - General Worksheet. They will use the worksheet to take notes. Students should work in pairs. Instruct the pairs to read the below articles, one each, in silence: • What Happens When AI is Used to Set Grades? • A-levels: Anger over 'unfair' results this year	15 min	We encourage students to always think about both sides when thinking about AI. We encourage students to dig deeper in thinking about the issues and advantages with using AI to predict grades. Motivate students as one day, they will have to make informed decisions about AI usage.

Option 1: Students can scan the QR codes on Google Slides to access the articles. Option 2: Students can type short links to access the articles. Option 3: Teachers can print out the articles. Links here (What Happens When AI is Used to Set Grades?, A-levels: Anger over 'unfair' results this year) After reading, they should discuss with their partners and write down reasons for and against using AI to predict grades in Grades Unit - General Worksheet. Pick two or three people to share their reasons. Try to get a mix of both sides. We can touch upon: • AI-predicted grades deviated substantially from teacher predicted grades in unexplainable ways • The appeal process was not clear or non-existent		

• Having some students take the exam at home while others take the exam in school would also be unfair • Having students congregate to take exams would also have been risky • There could be a big portion of students sick from Covid and therefore make the exam-taking unfair Emphasize that AI can be very powerful in helping us to solve problems, but at the same time, we have to be very cautious about using AI. Emphasize that assigning grades during covid was a difficult problem. Throughout the course, students will encounter a lot of hard problems. If you were the system designer, how would you do it? We want to make informed decisions. We can start by learning more about AI. Lead to the next part during which we will talk about what AI is.		

Part 3:Calculating and predicting grades Total Time: 56 min

Activity	Time	Purpose
Introduce the materials Tell students that they will be using the following resources for the data science activities and that they will be using statistics and critical thinking skills to stimulate the case for predicting grades: • Grades Unit - Determining Grades with Data Problem Sheet • Grades Unit - Data Science Spreadsheet	3 min	Introduce the task and let students know and prepare the documents which they will work on.
1.1 Calculating weighted average Introduce the problem to students. To calculate weighted averages, students will need to multiply scores by their percentage weights and sum them. 80 * 40% + 100 * 60% = 92	5 min	This is a warm-up exercise that prepares students. If a student cannot calculate weighted average, the subsequent activities will be difficult.
1.2 Final scores for Class A Make sure the spreadsheet is on the “Class A” tab. Introduce the problem to students. Students can		Students will experience handling a sizable amount of data in one go. They will understand

choose to either calculate the Final Scores for the first two students by hand and/or calculate the Final Scores using the spreadsheet. Students should use the score for each assignment and multiply by its weight. The formula for the first student is: =B4*B2+C4*C2+D4*D2+E4*E2+F4*F2+G4*G2 Students can copy the formula and paste for subsequent students.		that digital tools such as the spreadsheet can help make calculations at scale.
2.1 Looking for stories in data (Think-Pair-Share) Introduce the scenario to students. They will discuss in pairs and look for interesting hypotheses they could make from looking at the data and whether the data can inform us about students' performances or areas of improvement? If students need prompting, you can ask: - Who has made the most progress? - Is there a particular quiz that is very hard? - Is there a person who performs well in quizzes but not so well in assignments?	8 min	Students learn to use data to make arguments. Students compare the advantages of visualization choices.

（Answers in the examples below） Encourage students to use the vocabulary of statistics to present their reasoning. The tasks can be expanded to make calculations if more elements of statistics are suitable. Examples include: • Jessica has made the biggest progress. • The mean and median for Quiz 2 is lower than those of the other quizzes. • Ethan works well in quizzes but does not do well in assignments. Ask 2 to 3 groups to share their hypotheses and their rationale. Ask students to compare presenting data in a table versus in a chart. Advantages of charts: • Easier to show trends and patterns • Easier to spot relationship (e.g. score vs time)		

• Can use colors and visual cues to highlight key points Advantages of tables: • Provides exact values • Can handle a wide variety of data types		
3.1 Issues with the data (Think-Pair-Share) Introduce the scenario to students. They will discuss in pairs and look for issues with the data and potential solutions. • Jayden has been absent, so three out of five data points are shown as N/A. • There is a typo in Diego's first assignment. How confident are we that it is a typo? What's our rationale? (Because there is an outlier. The range of his other scores is 70 to 90. The mean for his other scores is 83.75. 3 is 3.58% of the mean, which is unusual). • There is a formatting issue with Aiden's Quiz 2 score. There are spaces.	10 min	Students will understand that data is never perfect. They will need to clean the data before doing any analytics. Students will realize the choice we make in algorithm design will have an unbalanced impact on results. Students can experiment with interpolating data.

In terms of solutions to the missing data, students can share many ideas and we can evaluate as a class the merits of each idea. For instance: • You could potentially use scores for other quizzes to replace the missing scores. But as we have seen in the previous exercises, not all quizzes have the same level of difficulty. • You could work out the person's rank in other quizzes or how the person usually fares compared to the mean, and use this to interpolate for the missing data. However, we have seen in the previous example that a person's rank might change. There is no right or wrong answer.		
3.2 Clean the data (Extension) This is an Extension. Students can decide to change and re-calculate for the "N/A" missing data, Diego 's Assignment 1 score and reformat for Aiden's Quiz 2 score.	10 min	Students will experiment and practice using digital tools to clean the data.

For example, students can ignore the N/A for Jayden and only use 90 and 94. But this may bring questions on fairness. Or students can see how Jayden fares compared to the average of Quiz 2 and 3, and use this information to interpolate for the missing data. Similar methods could be applied to Diego's erroneous datum.		
3.3 Predicting the Final Score (Extension) Students can think about their methods for determining the final score and evaluating the advantages and disadvantages of the methods. They could decide to skip the Final Exam completely and just use the scores from the quizzes and assignments. They could copy the scores for Quiz 3 and use it as the Final Exam since Quiz 3 is closest to the Final Exam.	5min	Students will learn to design and evaluate different algorithms.
3.3 Predicting the Final Score and Bias (Extension)	10 min	Students will practice critical thinking skills and write a coherent argument.

Introduce the scenario to the students. Mention that it is a good habit to check the source materials. There is a potential bias in this scenario. Teacher-predicted grades are generally higher than algorithm-predicted grades. Private schools with smaller class sizes tend to receive heavier weighting on the higher teacher-predicted grades and so the algorithm has a bias for students from private schools.		
Difference between a formula and a model Students might be wondering what is the difference between a formula and a model. Teachers may walk them through definitions and examples. Formula describes a specific relationship between variables. In this example, it's the relationship of Revenue with the quantity of lemonade sold and its unit price. Whereas a model describes a more complex system with many factors. For instance, you can make a model to predict your profit from selling	5 min	Students will have a better understanding of what is a model and how it can be useful.

lemonade. There are many factors in place (such as the weather) and you have to make assumptions. You can calculate for different scenarios and make predictions and evaluations.		

Part 4: Reflections Total Time: 8 min

1. Is this AI? Ask the students, if they think the data science activity they have done is AI? And ask them to give reasoning. If they think it is AI, then ask in this case what is the data, what is the algorithm and what is the output? Data - student scores Algorithm - a series of steps to calculate the final score Output - final score	3 min	Students will try to distinguish between AI and non-AI. They also might have a question on whether predicting grades is AI. The key here is not to avoid the question, but draw it out and emphasize that real situations are much more complex.

Anything else you'd like to share? Some students might think this doesn't feel like AI, it's just doing maths and using spreadsheets. We can say that artificial intelligence is applying mathematical concepts to create systems that can perform tasks that typically require human intelligence. We have a simplified version of predicting grades in this lesson, but reality is more complex and the data sets would be much larger.		
2. What happened eventually? The UK decided to abandon the predicted A-Level and GCSE results and use the teachers' predicted grades instead. There was an annual increase of 10% in the number of top grades awarded. Ask students what they think. The IB results were NOT overturned. The Norwegian Data Protection Authority ordered IB Organization to submit their methodology. After reviewing, the Norwegian authority deemed the prediction process to have violated the fairness, transparency and accuracy requirements.	5 min	The situation is interesting that if we rely on humans, there is a 10% inflation of top grades. This makes for good discussion and reflection. Despite all the conundrum in the media about using AI. Humans are very much prone to errors too. The IB results is a good prelude to the ethical principles unit. Key words such as fairness and transparency are introduced.

Here, transparency is an issue because the public does not know how grades are calculated. Fairness is an issue because some people complain that students from low-income school districts might be biased against if the algorithm uses historical data. If you are going to teach about ethical principles of AI, here is a good place to tell students that they will be learning about a framework to evaluate AI technologies.		

Part 5: Closing - Knowledge Check & Unit Feedback Total Time: 13 min

1. Close the Class with a Farewell Greeting Ask students to fill the knowledge check form. QR code and the short link is also provided on the presentation.	10 min	Teachers can use the knowledge check as an assessment, or simply as more questions for discussions.

2. Close the Class with a Farewell Greeting Thank students for completing the class. Quickly recap. Share the date and time of the next session. Tell students that in the next session and preview the next session.	3 min	