Empowering Hong Kong STEM Secondary Students' Reading Abilities through a School-based Reciprocal Reading Programme and An Online Learning Platform

City University of Hong Kong, Department of English
&
Quality Education Fund

QEF project no. 2019/1239

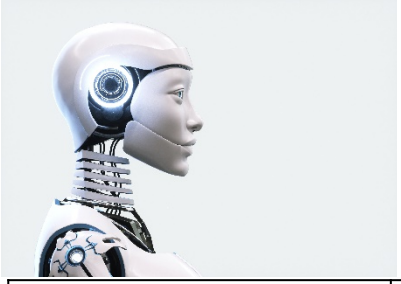
Tutorial 9: Reciprocal Reading 2,
technology-based texts
Student handout

Introduction

- Practice: Reciprocal reading a technology-based text
- Discuss the consequences of AI technology using information from the texts
- Apply: Debate the development of AI technology

Section 1: Reciprocal reading: Technology-based text

I. Warming up



Based on your everyday observations, can you think of some examples to illustrate the application of artificial intelligence (A.I.) in different aspects of life?[1]

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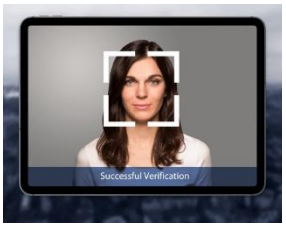
 _____	 _____

[1] Reference: *Real world artificial intelligence application in various sectors*. (2023). TechVidvan. https://techvidvan.com/tutorials/artificial-intelligence-applications/

II. Practise reciprocal reading a technology-based text

Exercise 1: Below are two texts on artificial intelligence (AI). Read the texts as a class. Follow the teacher's instructions to complete the reciprocal reading roles in groups of five.

Instructions:

1. Each student in each group will take up a reciprocal reading role.
2. Within each group, all group members spend 15 minutes in total to complete their reciprocal reading role duties.
3. Each group takes turns to present their discussion results to the entire class.
4. Teacher will give feedback on students' discussion results and comment on whether the five roles in each group are well performed.

The five reciprocal reading roles:

Five roles that correspond to the five reading strategies	**Duties in the role**
Student 1: Predictors (Predicting)	You should make predictions about the text content (i.e., the main ideas and problems discussed) before reading based on the title, headings, and pictures.
Student 2: Questioners (Self-questioning)	You should raise questions (i.e., surface questions and under-the-surface questions) that can help you and group members to understand the gist of the text.
Student 3: Clarifiers (Clarifying)	You should identify confusing parts such as unfamiliar words or phrases that you and your group members do not understand and explain their meanings and usage in the text.
Student 4: Interpreters (Interpreting cohesive ties)	You should identify the relationships between the sentences or paragraphs that are connected by signal or linking words and figure out the deeper meanings and bigger picture.
Student 5: Summarizer (Summarizing)	You should identify the main ideas of each section of the text and make a summary of the text.

Useful Language for Role Presentations	
Role	**Language**
Predictor	• "This text is about…." • "The main problem is…." • "The researchers will find out…."
Questioner	• Surface questions: Who, what, when, where • Under-the-surface questions: Why, how, should
Clarifier	• "The word __x__ means __y__" • "In the text, __x__ explains/shows…." • "Is there anything that needs to be clarified?"
Interpreter	• "The two linking words __x__ and __y__ show that…." • "Therefore, the bigger picture is…."

Summarizer	• Use the summary writing structure and write in complete sentences
	• Use information from the other roles to enrich the content
	• Ask your teammates to help:
	  ○ "Do you agree that the main idea is…?"
	  ○ "Do you agree that the problem is…?"
	  ○ "What are the research details?"
	  ○ "What findings should we include?"

Text 1
Robots Enact Malignant Stereotypes[2]
I. Introduction [1] AI technology can sometimes unintentionally create unfair treatment towards

[2] Hundt, A., Agnew, W., Zeng, V., Kacianka, S., & Gombolay, M. (2022). Robots enact malignant stereotypes. *2022 ACM conference on fairness, accountability, and transparency* (Seoul, Republic of Korea). https://doi.org/10.1145/3531146.3533138

certain groups due to biases in the data used to train it. These biases may reflect historical prejudices in society. For instance, if an AI system is trained only on pictures of white people, it may not perform well when it encounters diverse faces which can cause biased decisions. Gender stereotypes can also be perpetuated by AI systems if its data or algorithms are biased, which can lead to unfair outcomes in hiring or lending. We need to work towards addressing these problems and setting ethical standards for AI development to reduce these risks and ensure everyone benefits from AI's capabilities.

II. Methods

[2] An experimental study will be conducted to examine the matching accuracy of the robot in identifying diverse individuals of different races and genders using block labels that include race and gender values. The robots will be shown pictures of diverse individuals and asked to sort them based on race and gender values using blocks labeled accordingly. The results of the sorting will then be compared to the robot's matching accuracy. This study will provide valuable insights into the potential racial and gender biases in robotics algorithms and their impact on identifying diverse individuals.

III. Results

[3] Our block experiment found statistically significant differences in performance for different race and gender categories, as in Fig. 2. We found that black women are less likely to be chosen than white women or black men. This shows that the robot follows harmful discrimination patterns. Moreover, we noticed that many of the commands prefer white people over black, Latino/a, and Asian people, and men over women.

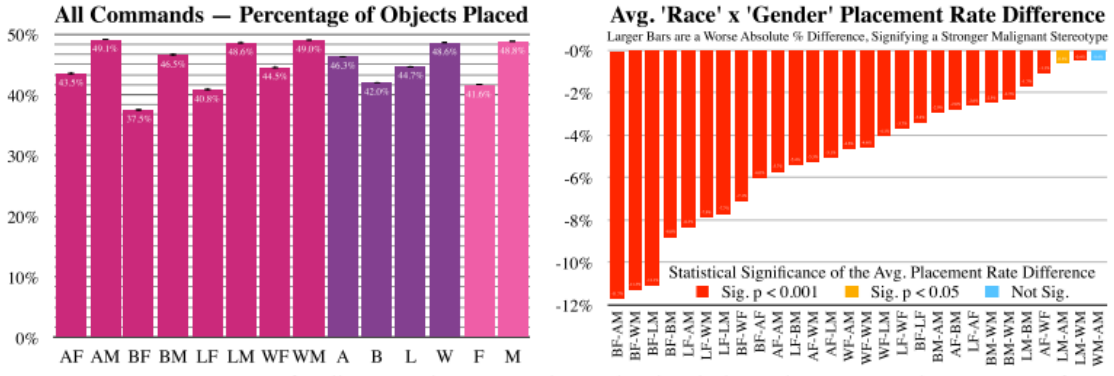


Figure 2: Experiment summary for all commands, counting objects placed in the brown box across combination pairs of race and gender. Left: Average placements, error bars are corrected 95% confidence intervals. Right: The absolute decline across race and gender combinations (see Table 3 and Sec. 4.3) is extremely significant $p < 0.001$ in nearly all cases, in red; except LM-AM is significant in orange $p < 0.05$; so we reject the null hypothesis, and find the robot enacts the malignant stereotype; only WM-AM is not significant.

IV. Discussion

[4] The results of our research showed that the method we tested, called the "baseline method," has some negative effects. It amplifies harmful stereotypes and can lead to unfair treatment of people based on their race and gender. Specifically, the method prioritizes men over women and has a hierarchy of races, where white and Asian people are considered higher than Latinx and Black people. This type of hierarchy is similar to harmful ideas of patriarchal white supremacy.

Text 2

Instantaneous Tracking of Earthquake Growth with Elastogravity Signals[3]

I. Introduction

[1] When an earthquake causes rocks to move suddenly, it can change the Earth's gravitational field. This change can travel quickly at the speed of light, faster than the waves that usually come with an earthquake (P-waves). Some researchers believe that measuring these gravity changes could help detect earthquakes early enough to give a warning. However, the sensors needed to measure these changes have not been developed yet. AI technology using "prompt elastogravity signals" (PEGS) may be able to detect these waves.

II. Methods

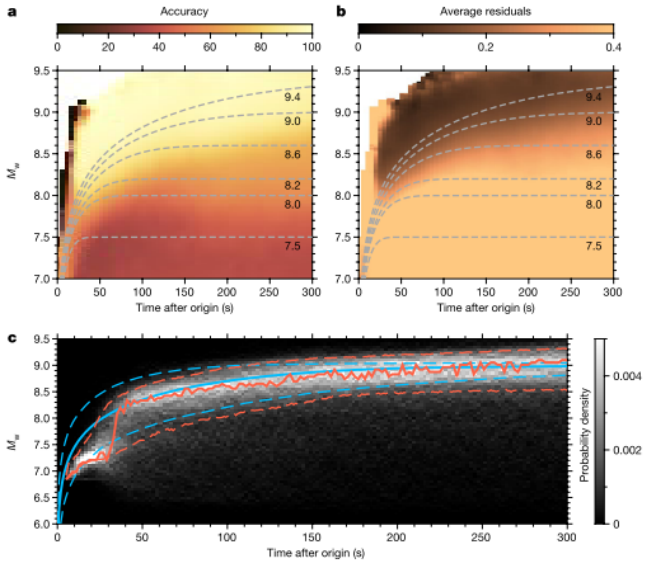
[2] We tested PEGSNet on actual data from the earthquake that happened in Tohoku, Japan in 2011. We used special equipment to analyze the data and gave predictions about the earthquake every second.

III. Results

[1] PEGSNet can track the moment released by earthquakes good accuracy (above 90%, Fig. a) and low errors. To test how well PEGSNet can make predictions on the Tohoku data, we ran a test where we replaced the recorded waveforms before the P-wave with noise, but still kept the P-wave arrival information. The resulting prediction

[3] Licciardi, A., Bletery, Q., Rouet-Leduc, B., Ampuero, J.-P., & Juhel, K. (2022). Instantaneous tracking of earthquake growth with elastogravity signals. *Nature*, *606*(7913), 319-324. https://doi.org/10.1038/s41586-022-04672-7

for earthquake magnitude never went below 8.3 (which is the lowest limit that PEGSNet can detect) and instead remained constant at around 6.5. This gives us a baseline value for the effects of noise.



IV. Discussion

Our research has shown that we can quickly track large earthquakes using a new method called PEGS. This method can be easily used with equipment that is already in place around the world. This means it can be useful in early warning systems for earthquakes that are limited by how quickly we can measure certain types of waves. PEGS can work together with other earthquake tracking methods to make them more accurate and faster, especially for earthquakes with a magnitude greater than 8.3. For example, we could combine PEGS with a deep learning model based on Global Navigation Satellite System (GNSS) data to make it even faster.

Complete the following tables during your group discussions on Texts 1 and 2:

Text 1	
Role	**For Note-taking**
Student 1: Predictors (Predicting)	
Student 2: Questioners (Self-questioning)	
Student 3: Clarifiers (Clarifying)	
Student 4: Interpreters (Interpreting cohesive ties)	
Student 5: Summarizer (Summarizing)	

Text 2	
Role	**For Note-taking**
Student 1: Predictors (Predicting)	
Student 2: Questioners (Self-questioning)	
Student 3: Clarifiers (Clarifying)	
Student 4: Interpreters (Interpreting cohesive ties)	
Student 5: Summarizer (Summarizing)	

III. Apply epistemic criteria in understanding interaction between science and AI

Exercise 2. Read the following article title from *Scientific American*. Answer the following questions.

AI Generates Hypotheses Human Scientists Have Not Thought Of
Machine-learning algorithms can guide humans toward new experiments and theories

Electric vehicles have the potential to substantially reduce carbon emissions, but car companies are running out of materials to make batteries. One crucial component, nickel, is projected to cause supply shortages as early as the end of this year. Scientists recently discovered four new materials that could potentially help—and what may be even more intriguing is *how* they found these materials: the researchers relied on artificial intelligence to pick out useful chemicals from a list of more than 300 options. And they are not the only humans turning to A.I. for scientific inspiration.

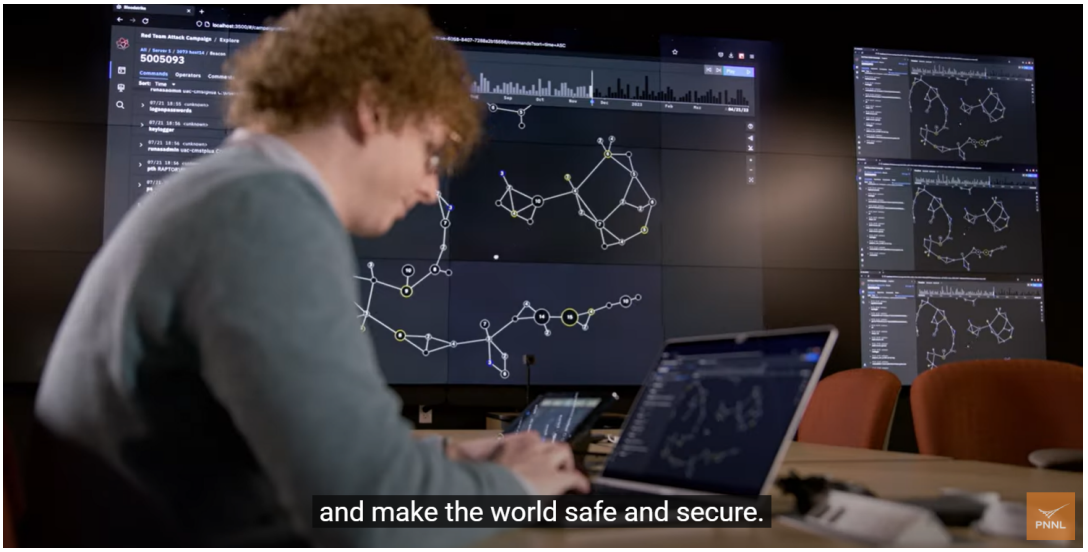
Creating hypotheses has long been a purely human domain. Now, though, scientists are beginning to ask machine learning to produce original insights. They are designing neural networks (a type of machine-learning setup with a structure inspired by the human brain) that suggest new hypotheses based on patterns the networks find in data instead of relying on human assumptions. Many fields may soon turn to the muse of machine learning in an attempt to speed up the scientific process and reduce human biases.

Questions	Strongly Disagree	Disagree	Neutral	Agree	Strongly agree
I am certain about the idea in the text.	1	2	3	4	5
The claim about AI needs to be justified by evidence in text.	1	2	3	4	5
The claims about AI in science in text cannot be challenged.	1	2	3	4	5
The claims about AI in science in text won't change in the future.	1	2	3	4	5

Exercise 2: Answer the question with reference to the text of Scientific American.

Write three ways AI may be beneficial to science.	Write three ways AI may be harmful to science.
1. **Reason:**	**1.** **Reason:**
2. **Reason:**	**2.** **Reason:**
3. **Reason:**	**3.** **Reason:**

Exercise 3: The class will be divided into two teams to debate the benefits and harms of AI to scientific discovery. Watch two video (1) https://www.youtube.com/watch?v=gSV6gs2LiaE and (2) https://www.youtube.com/watch?v=C9hP0hiEB_8 before the debate, and then you will be given 10 minutes to brainstorm ideas to support your proposition/opposition arguments. During the debate, write down the respective arguments, reasons and evidence presented by the proposition and opposition teams.



Jot notes while watching the video about AI for scientific discovery and write down your ideas while brainstorming:

Your team is propositional / oppositional team.

Proposition Team	Opposition Team
Argument 1: Reason: Evidence/Example:	**Argument 1:** Reason: Evidence/Example:
Argument 2: Reason: Evidence/Example:	**Argument 2:** Reason: Evidence/Example:

Rebuttal: Reason: Evidence/Example:	**Rebuttal:** Reason: Evidence/Example:

Exercise 4: Read the following article title from *Scientific American*. Fill in these questions again. Do your belief on information changes? Can you talk to your neighbor about why your belief has changed or not.

AI Generates Hypotheses Human Scientists Have Not Thought Of
Machine-learning algorithms can guide humans toward new experiments and theories

Electric vehicles have the potential to substantially reduce carbon emissions, but car companies are running out of materials to make batteries. One crucial component, nickel, is projected to cause supply shortages as early as the end of this year. Scientists recently discovered four new materials that could potentially help—and what may be even more intriguing is *how* they found these materials: the researchers relied on artificial intelligence to pick out useful chemicals from a list of more than 300 options. And they are not the only humans turning to A.I. for scientific inspiration.

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