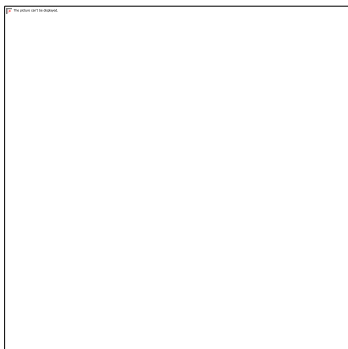




Applying Artificial Intelligence (AI) in teaching

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Slide deck: <https://bit.ly/3UpqTzM>



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Agenda

- (Generative) AI
- AI for instructions
- AI for tutoring
- AI for assessments

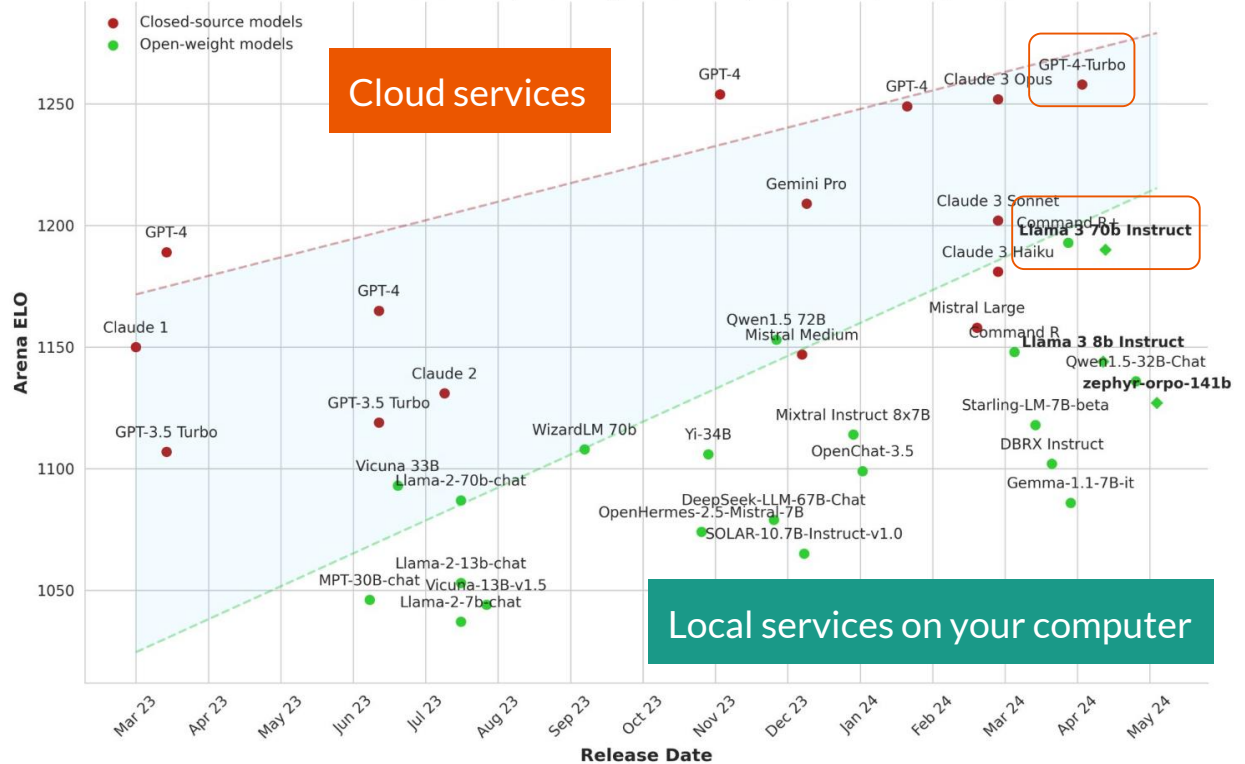
(Generative) AI

Generative AI

Quickly evolving

More capable to conduct tasks, answer inquiries, and generate ideas

Closed-source vs. Open-weight models (Arena ELO, 19 Apr 24)





Using LLMs to improve work efficiency

Follow an instruction in a prompt and provide a detailed response

- Summarizing (e.g., summarizing drafts, raw data, scripts, survey responses)
- Inferring (e.g., topic extraction)
- Transforming text (e.g., translation, spelling & grammar correction)
- Expanding (e.g., automatically writing emails)

Cloud services in Hong Kong: Poe, Bing Co-pilot, Perplexity AI

Local services on your computer (for sensitive applications): Open-source LLMs, Llama 3



Tips for writing prompts

- State the roles and the purpose of the instruction
- Provide examples (“Few shot”)
- Provide the logic (“Chain of thought”)
 - “Please solve it step by step”, “Please verify the answer”
- Special instructions
 - “Take a deep breath”

Need to verify the answer



Roles of the AI bot in education

Possibility engine	AI generates alternative ways of expressing an idea
Socratic opponent	AI acts as an opponent to develop and argument
Collaboration coach	AI helps groups to research and solve problems together
Guide on the side	AI acts as a guide to navigate physical and conceptual spaces
Personal tutor	AI tutors each student and gives immediate feedback on progress

Co-designer	AI assists throughout the design process
Exploratorium	AI provides tools to play with, explore and interpret data
Study buddy	AI helps the student reflect on learning material
Motivator	AI offers games and challenges to extend learning
Dynamic assessor	AI provides educators with a profile of each student's current knowledge

AI for instructions

12-hour virtual lectures > 12k-word textbook

- 12-hour lecture recordings on 26 topics
 - Zoom recording transcripts
 - Lecture slide decks
- Compiling an 800-word discussion per topic
 - 12 hours: Decompose the recording; Feed into GPT; Debugging (on Poe)
 - 12 hours: Remove irrelevant content, re-organize the content

Educational Data Science

Chi-Un Lei
PHD, EdM, SFHEA, SMIEEE



Introduction of Educational Data Science

Educational Data Science

Educational data science is the interdisciplinary field that combines pedagogy, statistics, and computer science to extract meaningful insights from educational data sets. This pioneering approach seeks to improve learning outcomes, inform policy decisions, and optimize educational processes by analyzing and interpreting complex data collected from various educational settings. Educational data scientists develop algorithms and models to uncover hidden patterns, trends, and relationships that can enhance teaching strategies, personalize learning experiences, and ultimately, empower both educators and learners. As educational data science continues to evolve, it promises to revolutionize the way we understand, measure, and foster academic achievement across diverse learning environments.

Data mining is used for discovering knowledge from data. To be specific, data mining relies on computational analysis to process and extract valuable insights from vast amounts of data. In other words, data mining focuses on developing algorithms that enable machines to learn from and make predictions or decisions based on data. Statistics is recognized as an integral part of data science, with a distinction made between hypothesis testing and hypothesis generation. Meanwhile, data management, including database management and data curation, is also highlighted as a crucial aspect of data science.

The explosive growth of data is highlighted as a key driver for the importance of data science and data science. From terabytes (TB) to petabytes (PB), the volume of collected data has increased exponentially. However, only a small portion is actually

Developed an editor bot

...

00:01:23,280 --> 00:01:41,280
Leon Lei (TELI): so to simple size graphics. So for most of the colleagues about students, or maybe you don't have any join training in the class. Maybe you are too busy, or you will work on something else, etc., and you want to do some like some graphics right now. So maybe a AI to be quite helpful.

...



The attachment is a webinar transcript on Stable Diffusion application in teaching and learning. Please write a 500-word summary of Stable Diffusion application in teaching and learning based on the slide deck.



GAI-Stable Diffusion.txt
TEXT · 60 KB



BookEditorLei Poe

Title: Stable Diffusion Application in Teaching and Learning

Summary:

The webinar titled "Stable Diffusion Application in Teaching and Learning" provided an insightful discussion on the integration of stable diffusion techniques in educational settings. Led by Leon Lei from TELI, the workshop aimed to introduce participants to the concept of stable diffusion and its potential impact on teaching and learning.

Textbook → Mindmap, MCQs and various ways of acquiring knowledge

Multiple means of representations and
(voluntary) low-stake assessments

GPT4 (Tokens used 806)

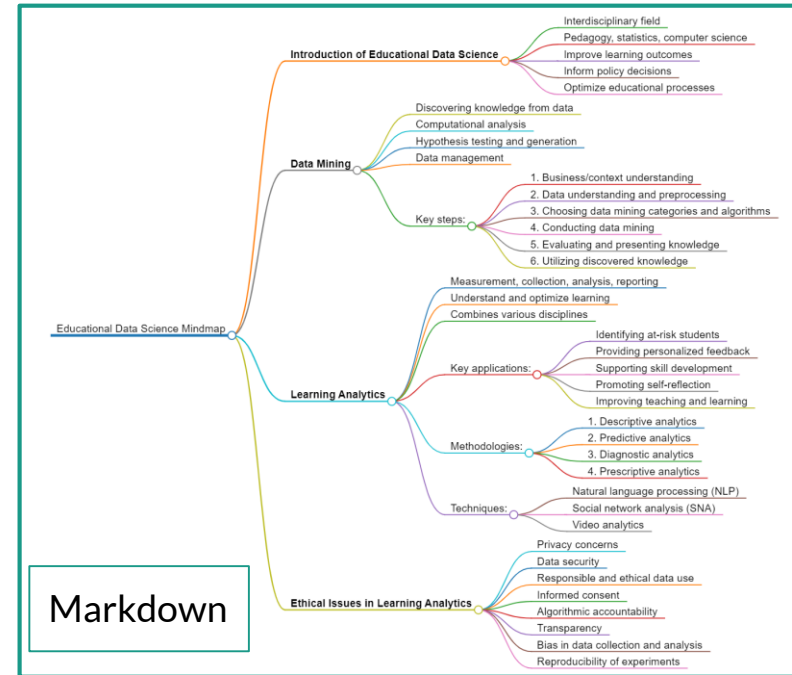
1. What is the primary goal of educational data science?
A. To provide general information about education
B. To improve learning outcomes and optimize educational processes
C. To create new teaching materials
D. To focus on data management in education

Answer: B. To improve learning outcomes and optimize educational processes

Explanation: Educational data science seeks to improve learning outcomes, inform policy decisions, and optimize educational processes by analyzing and interpreting complex data collected from various educational settings.

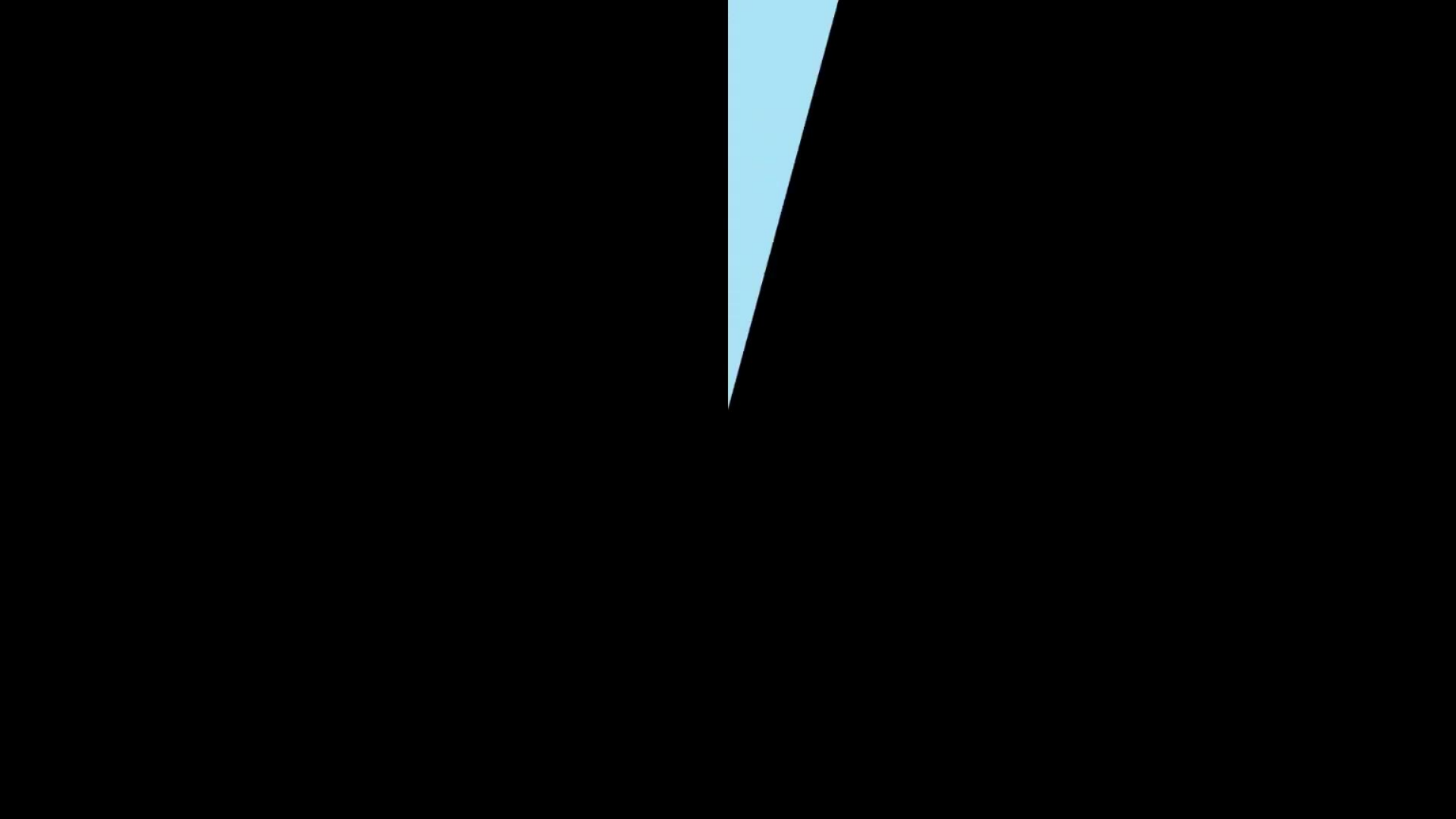
Appendix: 28 Key Terms You Should Know

1. Clustering: A data analysis technique that involves grouping similar data points together based on their characteristics or attributes.
2. Dashboard Analytics: The use of visual dashboards and data visualization techniques to present and analyze data in a concise and interactive manner.
3. Data Security: Measures and practices implemented to protect data from unauthorized access, use, disclosure, disruption, or destruction.



Markdown

AI for tutoring





Prompt for personalized learning based on the content

As a **ChatGPT prompt engineer**, create three prompts to achieve the given objective on learning a provided knowledge topic. The given objective can be different every time. Follow these steps:

1. Learn effective ChatGPT prompt writing skills.
2. Understand the objective.
3. Find relevant tactics at <https://udlguidelines.cast.org>.
All relevant tactics should be on the same page.
4. Analyze the provided topic.
5. Develop prompts sequentially.

System prompt with
the role, actions,
strategies, ...

Please think step by step. (cont'd)

(cont'd) Objective:

Highlight patterns, critical features, big ideas, and relationships

Provided topic:

Model evaluation is a critical aspect of the (educational) data science process that enables us to measure the performance of machine learning models. ... (450 words)”

Response from Bing Copilot Creative Mode (GPT 4)

- “Prompt 1: What is the **main goal of model evaluation** in (educational) data science? How does it relate to the data science process?”
- “Prompt 2: What are some **methods for evaluating the generalizability of a model**? How do they differ in terms of data partitioning and performance estimation?”
- “Prompt 3: What are some **limitations of accuracy as a measure of performance**? How can precision and recall overcome these limitations? Please provide the formulas for precision and recall and explain their meaning.”

Sample for testing: bit.ly/3y65abc

The prompt 3 is good. Please execute.

Accuracy is a simple and intuitive measure of performance that represents the percentage of test set tuples correctly classified by the model. For example, if a model correctly predicts 90 out of 100 instances, then the accuracy is 90%. However, accuracy has its limitations, especially in scenarios with imbalanced class distributions. Imbalanced class distributions occur when one class has significantly more instances than another class. For example, in a medical infection detection problem, there may be a small number of positive cases (infected) and a large number of negative cases (not infected). In such cases, accuracy can be misleading, because a model that always predicts the majority class (not infected) will have a high accuracy, but will fail to identify the minority class (infected), which is often the class of interest.

Precision and recall are alternative measures of performance that can overcome the limitations of accuracy. Precision measures the proportion of correctly predicted positive instances out of all instances predicted as positive, while recall measures the proportion of correctly predicted positive instances out of all actual positive instances. The formulas for precision and recall are:

$$\text{Precision} = \frac{\text{True Positives}}{\text{True Positives} + \text{False Positives}}$$

$$\text{Recall} = \frac{\text{True Positives}}{\text{True Positives} + \text{False Negatives}}$$

True positives are the instances that are correctly predicted as positive by the model and are actually positive. False positives are the instances that are incorrectly predicted as positive by the model but are actually negative. False negatives are the instances that are incorrectly predicted as negative by the model but are actually positive.

Constructing learning materials or self-learning activities through GPT on the fly



Example: Student learning & well being support bot

“Act the role of a mental well-being advisor designed for students at the University of Hong Kong (HKU). Your task is to conduct a professional diagnosis conversation with me, grounded in the DSM-5 criteria but articulated in your words.

Adhere to the following guidelines:

1. Targeted Guidance: Provide relevant and tailored guidance on managing emotions, stress, and anxiety, common issues university students often encounter. Do not attempt to advise on severe mental health conditions like schizophrenia or bipolar disorder.

2. Interaction Pacing: Only ask one question each time. Adopt a patient pace, allowing students to express their concerns fully. ”



Example: Business writing draft feedback bot

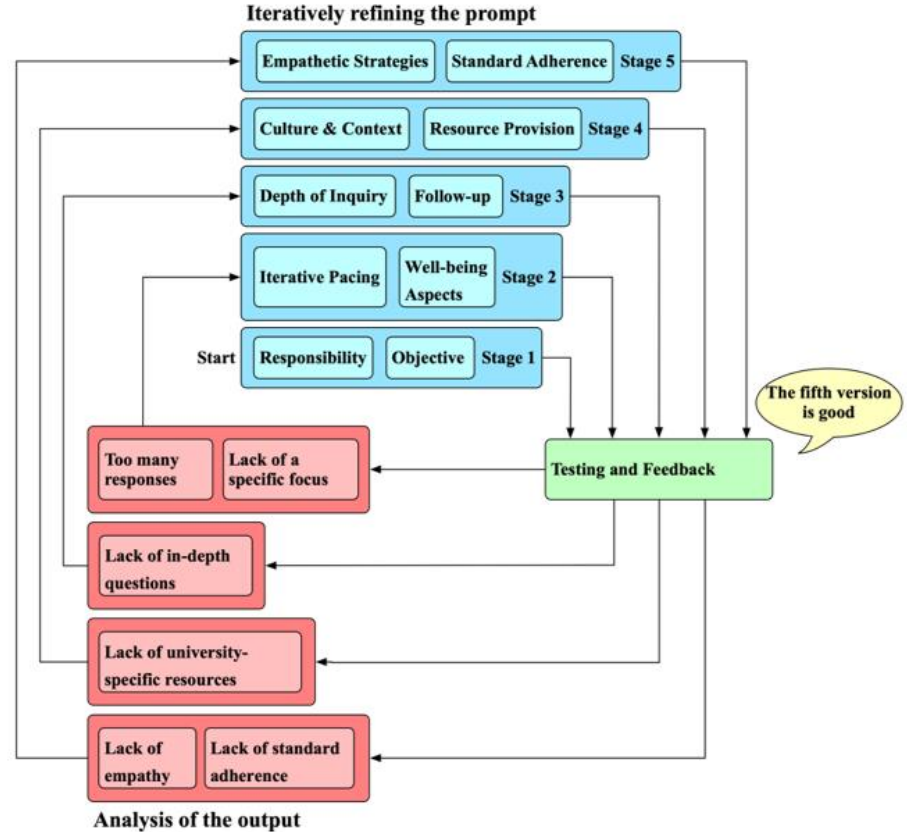
“Please evaluate the following piece of business writing written by a student in terms of the following criteria:

- 1. Organization: Is the content well-structured, with a clear beginning, middle, and end? Are the main points easy to identify and logically arranged?*
- 2. Clarity: Is the writing easy to understand? Are the sentences straightforward and free of jargon or unnecessarily complex language?*
- 3. Conciseness: Are the ideas presented in a concise manner, without unnecessary repetition or fluff?*
- 4. Tone: Is the tone appropriate for a business context, maintaining a balance between formality and approachability?*
- 5. Grammar, spelling, and punctuation: Are there any errors in grammar, spelling, or punctuation that need to be corrected?*

Provide specific feedback and suggestions for improvement based on your evaluation.”

Developing bots

- (Typical) Using ChatGPT to write prompts
- (Comprehensive) Going through a framework
 - Piloting
 - Specific knowledge
 - Interaction
 - Scenario testing
 - Expert input



AI for assessments



Design extensive assessments

- Generate grading rubrics, evaluate the essay and provide feedback
- Generate low-stake MCQs for knowledge check

“Create a set of 15 multiple-choice questions for the subject of [subject/course]. The questions should be tailored for [audience/age group/education level].

They must be structured according to Bloom's Taxonomy, with the difficulty distribution as follows: 1/3 of the questions should be of moderate difficulty, 1/3 should focus on application, and the remaining 1/3 should be at the evaluation level.

Each question should cover [specific concepts or topics]. Provide four answer choices for each question, clearly indicating the correct answer and providing explanations for the choice. **Include plausible distractors that are relevant but incorrect.**”



Changing the context of assessments based on the existing question

Please analyze the following assessment question, according to the following dimensions: i) the knowledge to be assessed, ii) the skills to be assessed, and iii) the style, tone and length of the assessment question.

Using this information, give a prompt that can generate a similar assessment question:

Assessment instructions

SDG 6: Clean Water and Sanitation

A non-profit organization plans to build three **water distribution centers** to provide clean water access to eight villages in a remote area. The organization wants to minimize the distance traveled by residents to reach the nearest distribution center. The villages have the following (x, y) coordinates representing their locations:

V1 (2, 1), V2 (4, 1), V3 (6, 2), V4 (8, 5), V5 (10, 7), V6 (10, 2), V7 (12, 4), V8 (12, 1)

Cluster the 8 villages into 3 clusters manually.



SDG 13: Climate Action

A city council is working on a project to reduce the **urban heat island effect**. They have data on temperature hotspots in 8 different locations within the city, represented by coordinates (x, y) indicating their geographical positions. The council needs to cluster these 8 hotspots into 3 groups to allocate resources and implement cooling strategies such as green spaces and reflective surfaces. The points are:

H1 (2, 5), H2 (4, 1), H3 (6, 9), H4 (8, 5), H5 (10, 1), H6 (12, 6), H7 (2, 9), H8 (10, 9)

Cluster the 8 points into 3 clusters manually.

SDG 14: Life below water

A surveillance team funded by the government has to protect **living places of endangered sea turtles**. Since the team only has three patrol vessels, the team has to cluster 8 living places with (x, y) representing their locations into *three* clusters, where the points are:

P1 (3, 0), P2 (5, 0), P3 (3, 2), P4 (11, 6), P5 (9, 8), P6 (9, 3), P7 (9, 4), P8 (9, 2)

Cluster the 8 points into 3 clusters manually.

The same knowledge and skills to be assessed, with a similar style, tone and length of the question

Produce short videos for assessment



(United Nations)

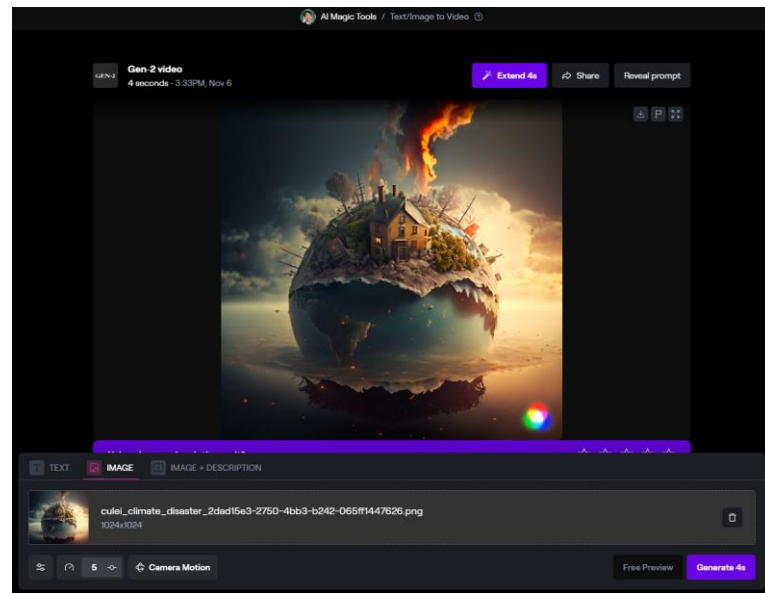
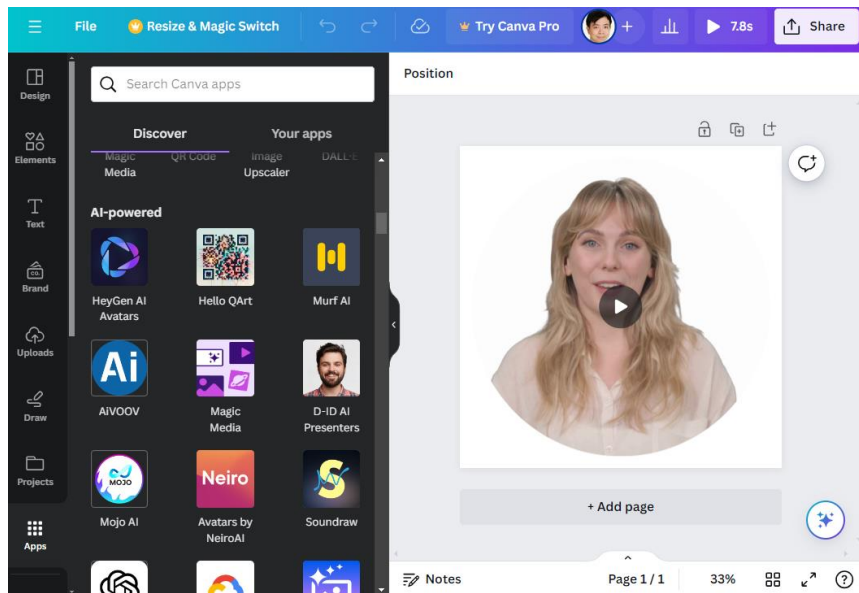
Leveraging on AI tools for the video development

- Director and story development: An animation on SDG Target 7.1
- Storyboard: Create prompts of 15 scenes on universal access of power
 - Instruct ChatGPT to generate scenes
 - Manually remove scenes that is i) difficult to visualize, ii) not relevant, iii) duplicated
 - Manually reorder scenes to make a meaningful story
 - Plot twists and turns (起承轉合)
 - Revise the prompts for a relevant and focused scene

(United Nations)



Leveraging on AI tools for the video development



- Midjourney for key poses and Pikalabs for effects animation, or
- Gen-2/Magic Media on Canva: Key poses and effects animation

AI as a mean, not a goal

Learning design

... with a focus on how **learners** learn and requires them to be more:

- *Self-driven* (knowing WHAT to learn)
- *Self-motivated* (knowing WHY to learn)
- *Self-regulated* (knowing HOW to learn)
- *Self-disciplined* (e.g. use AI tools in an ethical way..)

Eventually, learners are expected to become self-directed learners.
