Teaching AI with Tangible and Generative AI Tools

April 26th, 2024

School of Education, Indiana University Bloomington

INDIANA UNIVERSITY
BLOOMINGTON

Introductions

Workshop Overview

9:30-10:00 Welcome

10:00-10:15 Introduction of the Project

10:15-10:35 Icebreaker with AI activity (Keunjae)

10:35-1:00 PM AI Classification Machine & Working Lunch Time (Dr. Kwon and Matt)

1:00-2:00 Demonstration of lesson plan using Generative AI (Hyojung and Vanessa)

Program Overview

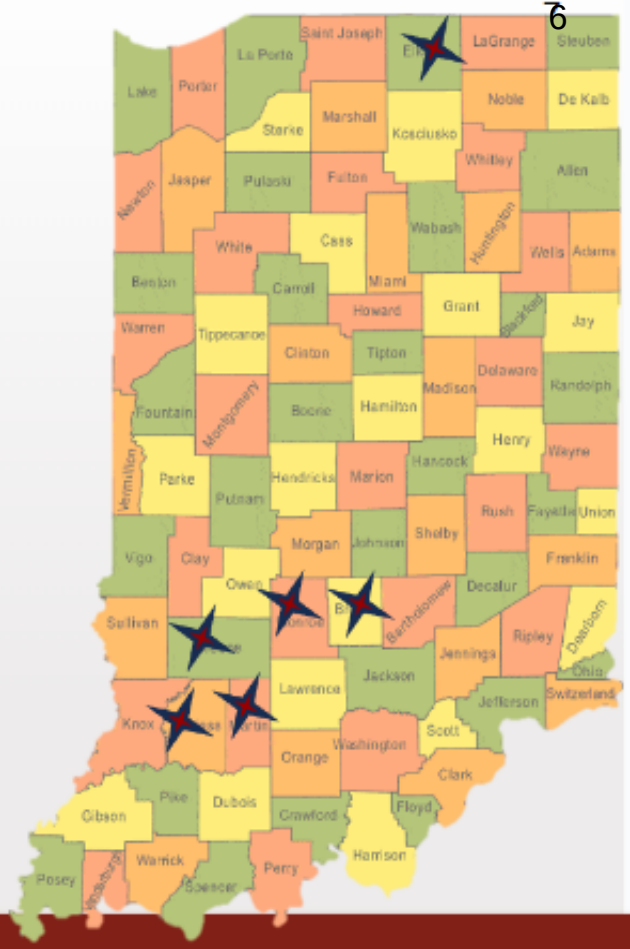
- Build teacher capacity for AI Education in rural schools
- Develop integrated curricula in collaboration with middle school STEM teachers on Artificial Intelligence
- Develop learning activities students enjoy
- Apply ideas students have learned, as well as focusing on the real-world applications and ethical implications of AI

Program Activities

- Professional Development
- Co-design with teachers
- Summer camp (AI for Me) in 2022
- Summer camp (AI for Good) in 2023

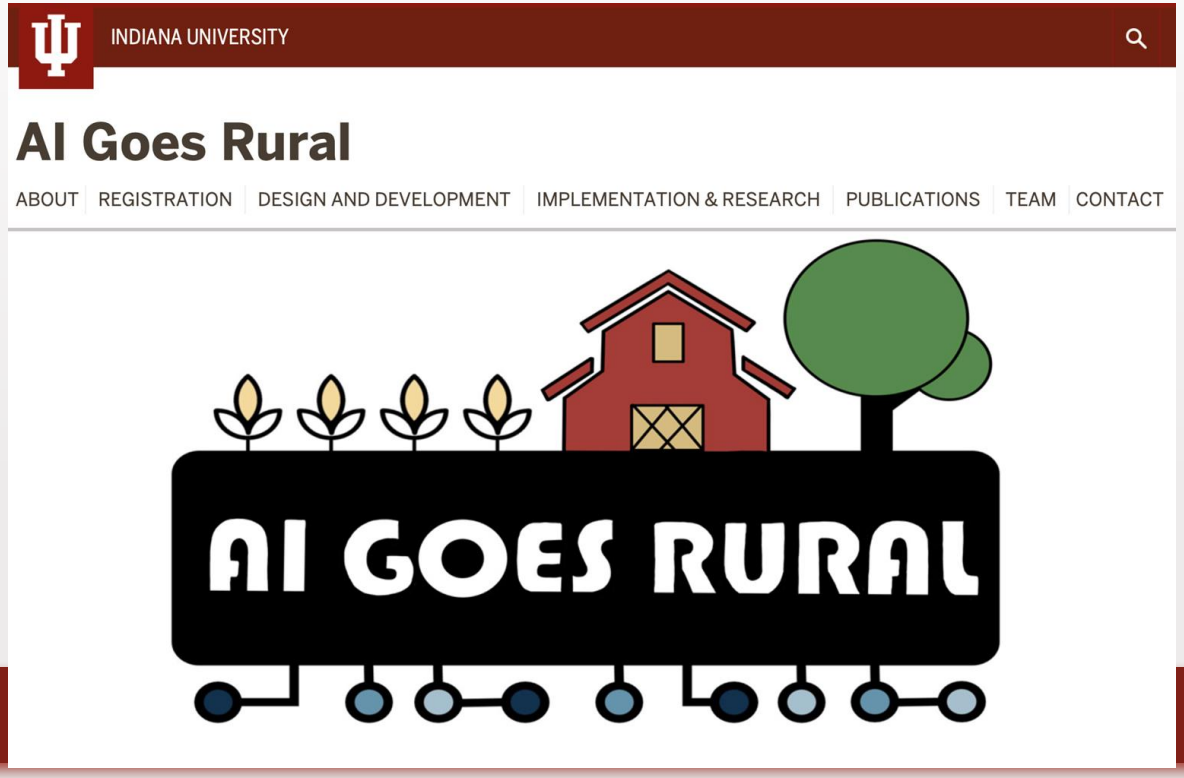
Program Activities

- Implementing curriculum by 6 Teachers from 6 Schools(18 classes), serving 382 students (22-23)
- 9 Teachers from 8 Schools in School Year (23-24)



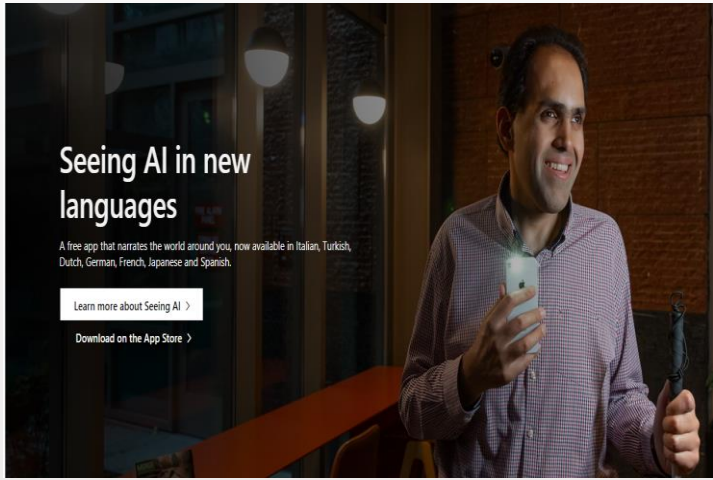
Website

https://aigoesrural.iu.edu/



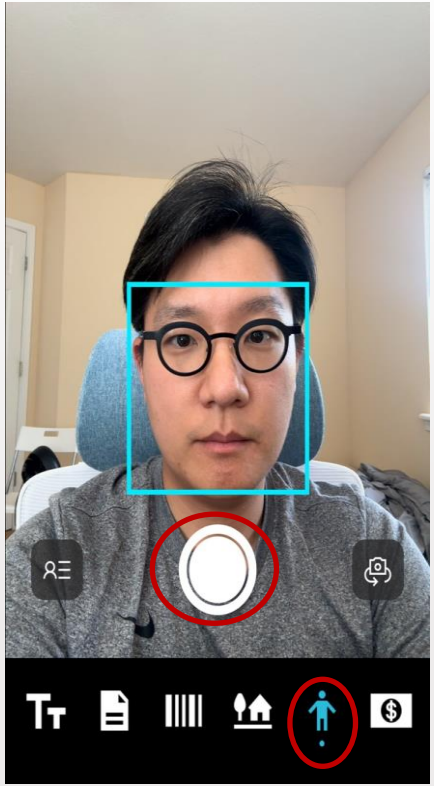
Seeing AI

- An AI-based app designed with and for the blind and low vision community, utilizing the power of AI to open up the visual world
- Assists with daily tasks from reading, to describing photos, to identifying objects, and more



Seeing AI

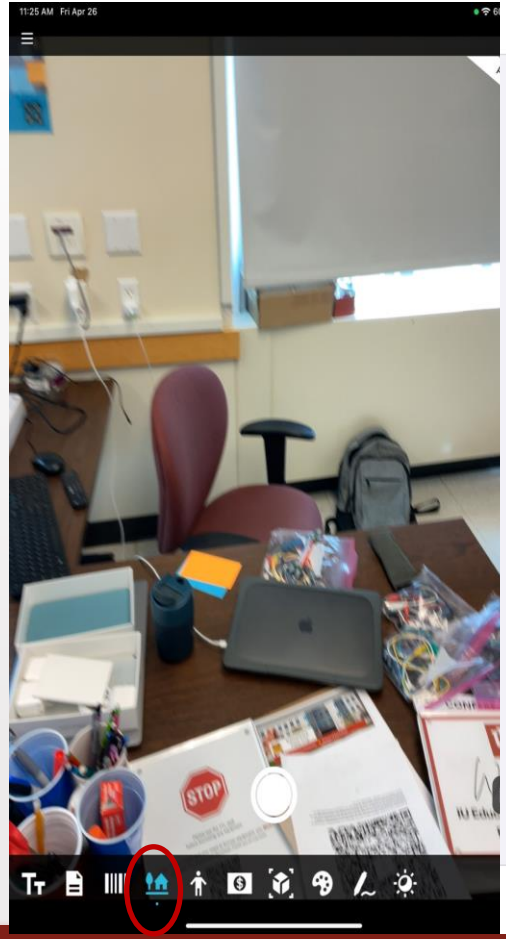
- Let's use iPads to explore the Seeing AI app!
  - Facial Recognition Exploration
    - Activate the 'Person' mode in the Seeing AI app on your iPads by choosing a man-shaped icon
    - Take photos of fellow teachers' face with the app and see what information the app provides about them

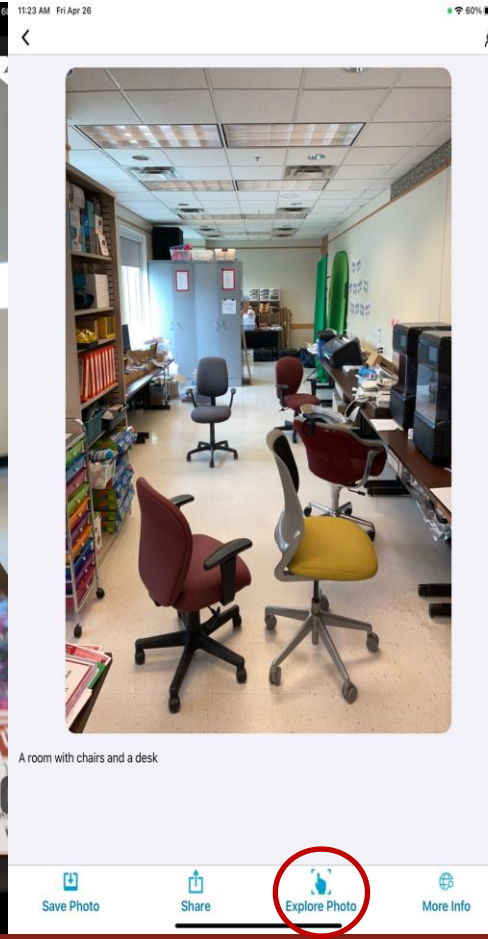


- Pw: aigr00

Seeing AI

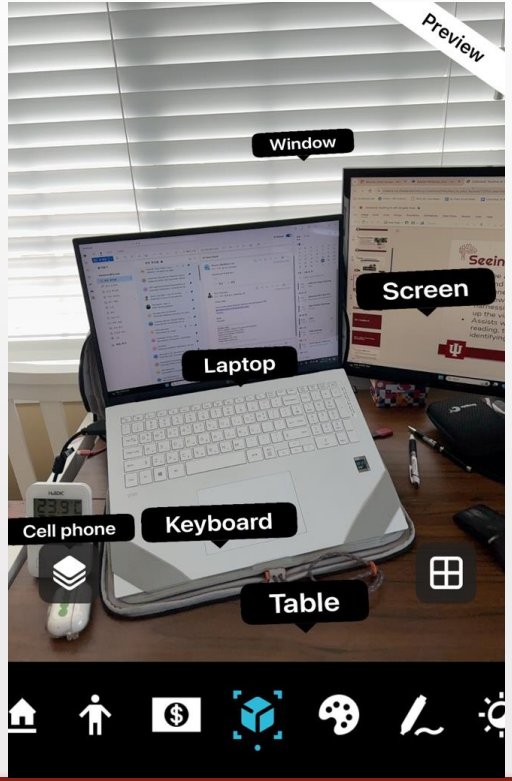
- Let's use iPads to explore the Seeing AI app!
  - Object Detection Exploration
    - Switch to 'Scene Preview' mode within the app by choosing house and tree-shaped icon
    - Scan the classroom environment by taking pictures and click "Explore Photos"
    - See what kind of information that the app provide





Seeing AI

- What types of information can the Seeing AI app provide?
  - Identify the objects or people and describe what they look like, their names, and other characteristics
- Which AI concepts does it use to do so?
  - Computer vision (CV): how AI systems learn to “see” or “detect” the world around them by using sensors.
  - Machine Learning (ML): a process when AI learns for itself through data and understand the patterns



Seeing AI

1. Computer Vision: Image Classification

- Naming everything in a picture detected by sensors (e.g., camera)
- A basic step for teaching computers to recognize objects like a "keyboard" or a "cell phone."

2. Advanced Computer Vision: Semantic Segmentation

- Understand pictures at a super detailed level—by identifying each tiny part of the image (every pixel) and what it represents, like differentiating between a "table" and a "keyboard.

Seeing AI

3. Machine Learning Models: Supervised Learning

- **Trained with Labeled Datasets**
  - Teaching the computer using lots of images (dataset) that are already tagged with the right answers
  - Crucial for the computer to learn correctly and make fewer mistakes when it sees new images
- **Object Detection**
  - Knowing what an object is + finding where it is in a picture.
  - Creates bounding boxes around objects within images

Seeing AI

- Why does it matter to "learn and understand about AI"?
  - AI All Around Us
    - Crucial to equip to understand and interact with AI-driven technologies effectively in their daily experiences where AI is commonplace
    - Broaden more opportunities not just enhance efficiency in current fields, but also unlock future career pathways

➡ Exposure to learning about AI would be beneficial for both students as well as teachers

PD 1. Tangible AI:
AI Classification Machine

AI Classification Machine

Download the slides and follow along!

INTRO

Classification

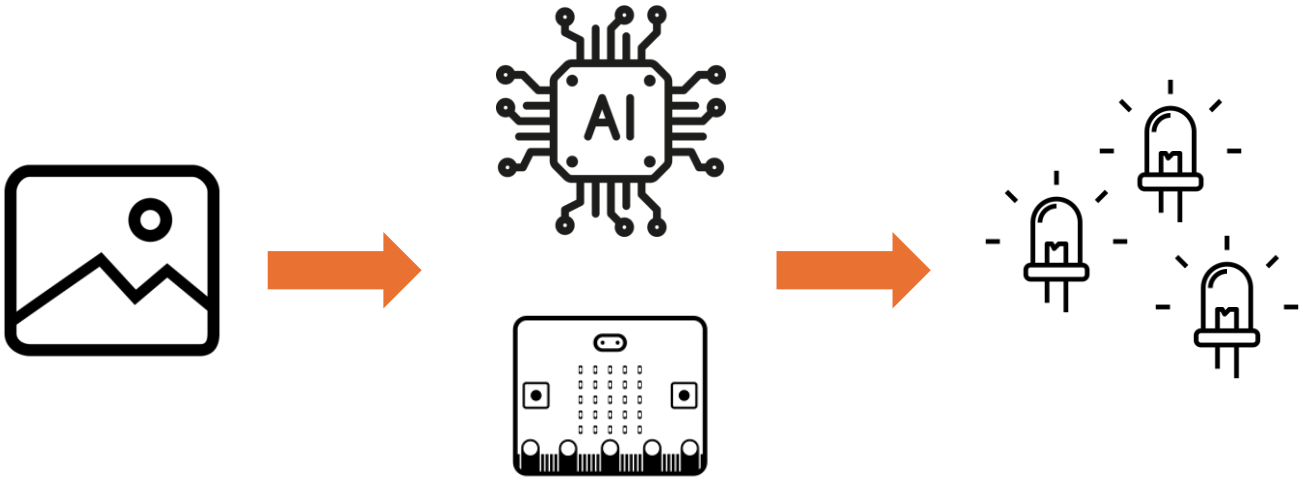
We often want to know if something belongs to one group or another. For example:

- Poisonous vs Non-poisonous
- Recyclable vs Trash
- Legal vs Illegal

Note: Somethings are easier to classify than others and not all classification problems are binary.

INTRO

AI Classification Machine



Input
Image

Processing
AI + Micro:bit

Output
LED Lights

INTRO

What we will do…

- Create an AI model
- Build
- Code
- Connect the AI model to the Micro:bit
- Test
- Share

CREATE AI

Creating an AI model with Machine Learning

C R E A T E A I

It starts with a...

GOAL

Understanding the goal will help to **identify the type and content of the data** needed, the analysis approach, and how to measure success.

CREATE AI

Then comes the...

Data

Types of data:

Numerical/Categorical

Text

Images

Audio/Video

Almost anything that can be digitized

C R E A T E A I

If the goal is...

To build a pet door that will only allow your pets through.

Images of our pets.

What type of data do you need?

What should that data contain?

C R E A T E A I

If the goal is…

To build a system that suggest improvements to your posture when you work out…

What type of data do you need?

What should that data contain?

Images of people working out with correct posture.

CREATE AI

data data data...

Data!

Data is important!

Machine learning needs a lot of **high quality**, **relevant** data that is **free of bias**.

C R E A T E A I

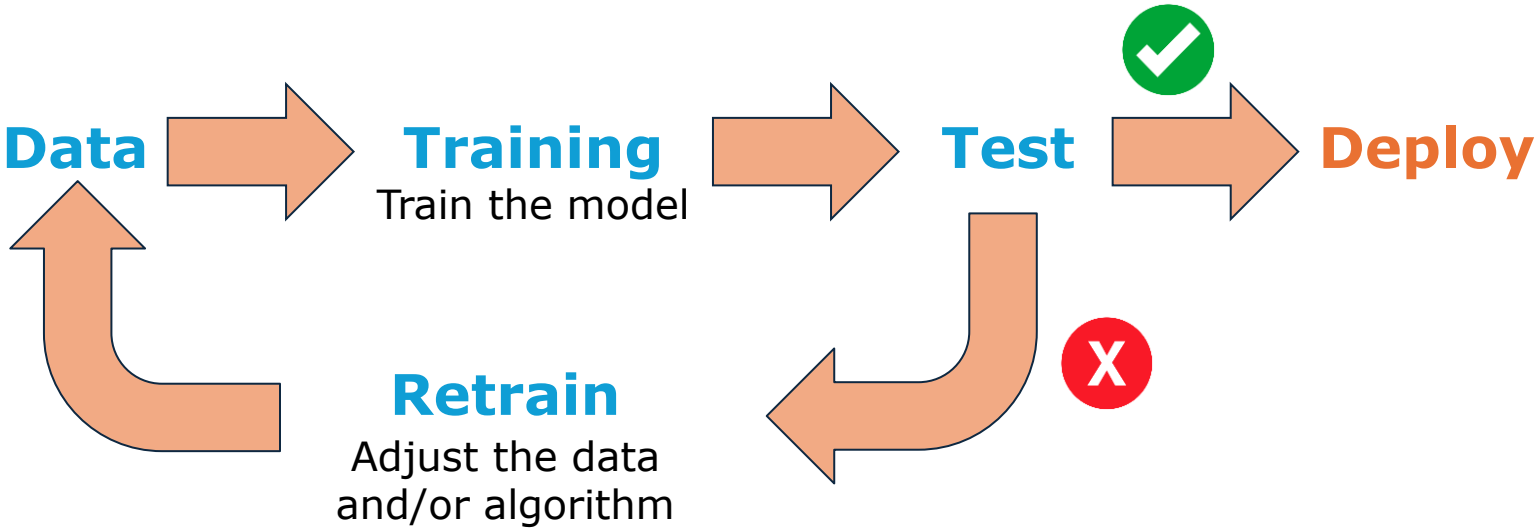
Next comes the...

Training

During training an algorithm is used to learn the **patterns** and **relationships** within the data. The results of the training is a **model**.

CREATE AI

The Machine Learning Process



CREATE AI

Let's Create an AI Model!

We will create an AI model using Google Teachable Machines to classify two (or more) things. For example,

- Checked Shirt vs Plain Shirt
- Red Objects vs Green Objects
- Wearing Glasses vs Not Wearing Glasses

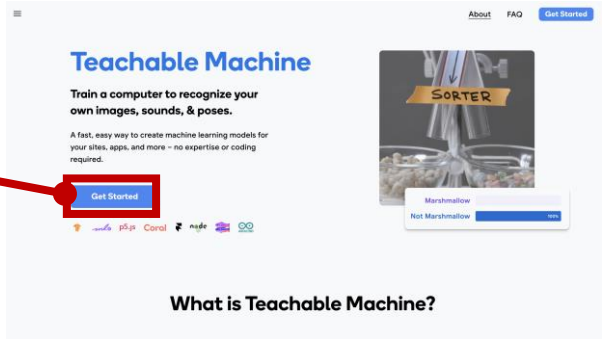
You can choose! In groups of 2, decide what you will classify.

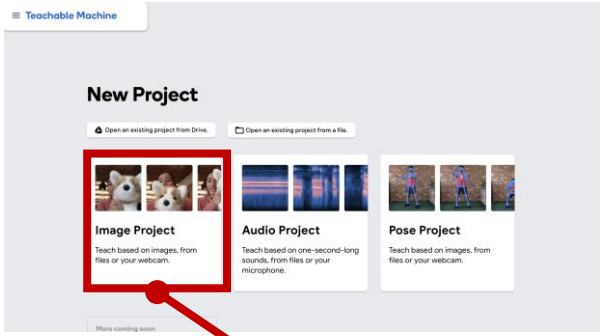
Note: it must be something that you can capture with your laptop's web camera.

C R E A T E A I

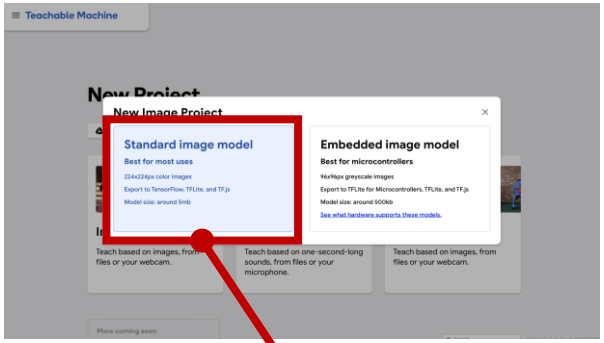
Go to [Google Teachable Machine.](#)

Click the Get Started button.



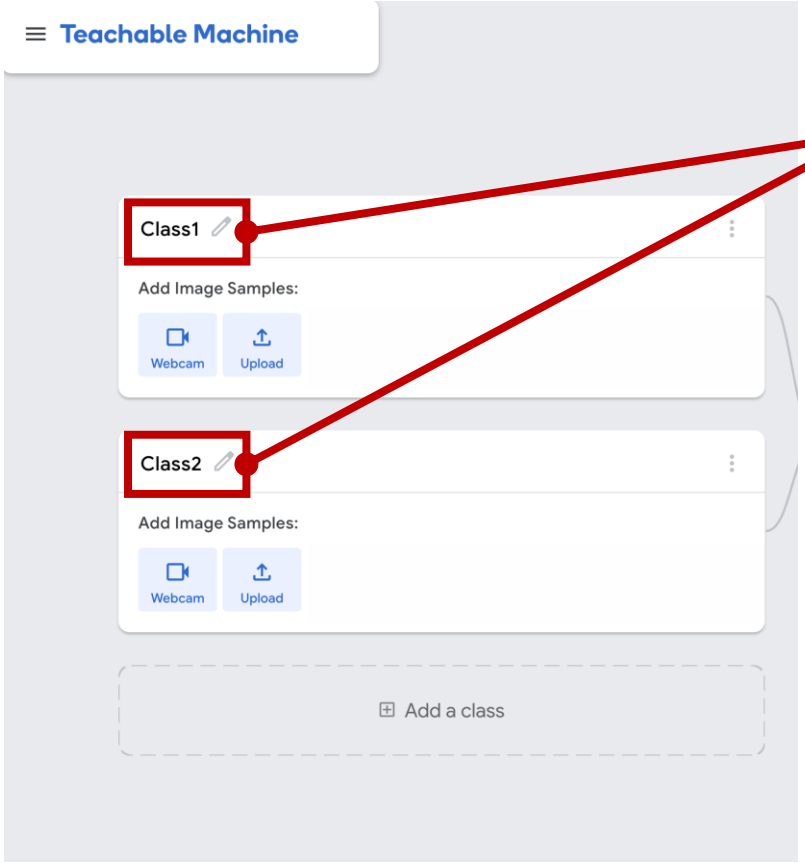


Click on Image Project.



Click on Standard image model.

C R E A T E A I



Rename the classes. Remove the space between the word “class” and the number (e.g., 1 and 2)

C R E A T E A I

Capturing images

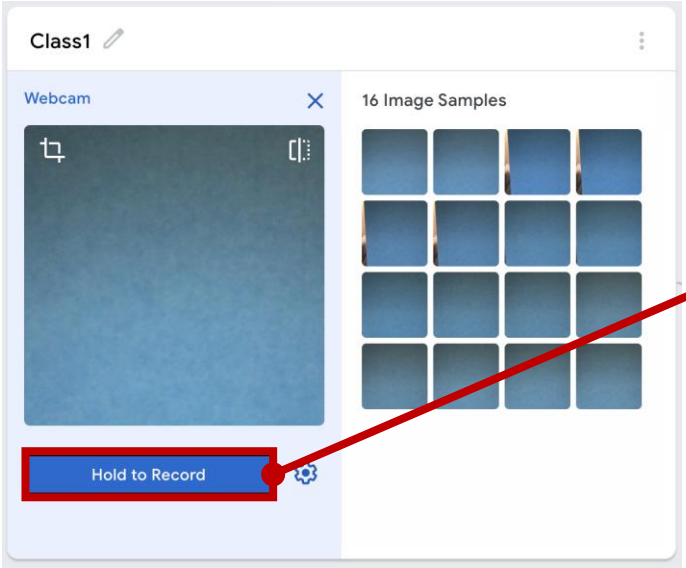
Consider…

- What is your target and what else is in the images that you are capturing. Are there a lot of other object's creating "noise" that might confuse the algorithm?
- How many images will you need to capture?

C R E A T E A I

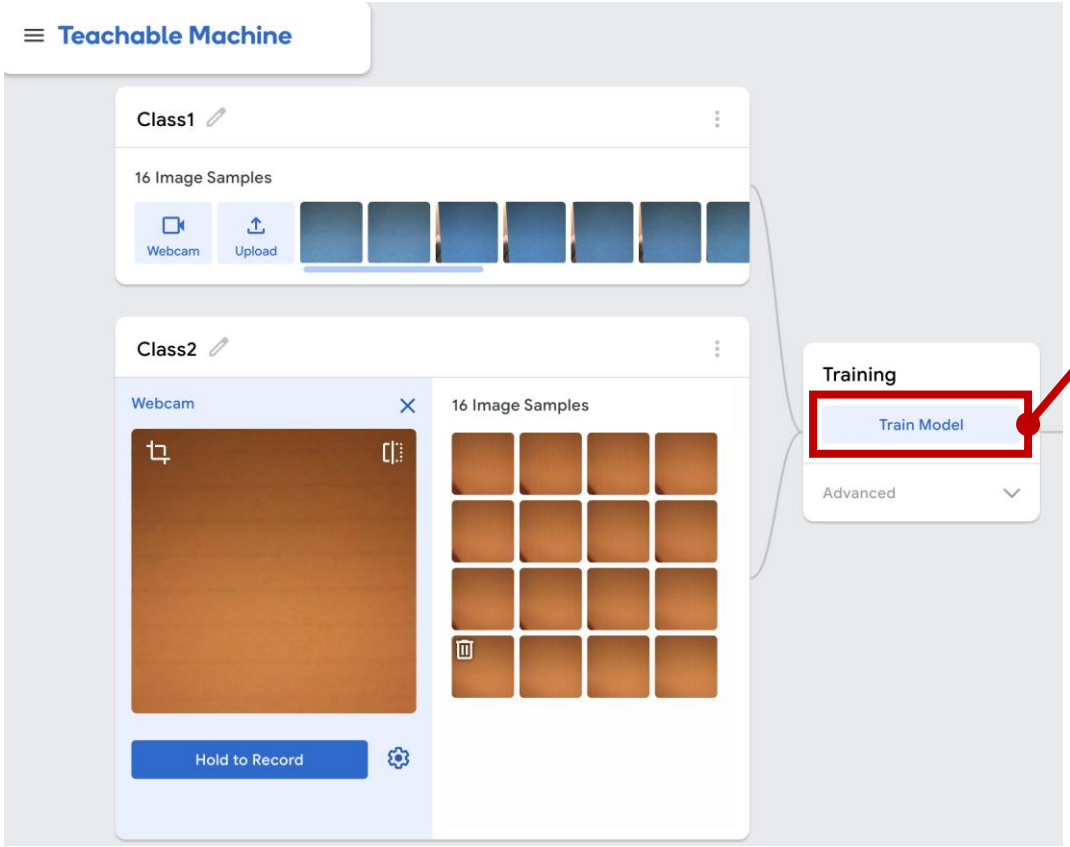
To capture images, click the webcam button.

Note: You may get an alert requesting access to your webcam. Allow access.



Hold your target item up in front of the camera and click the Hold to Record button.

C R E A T E A I

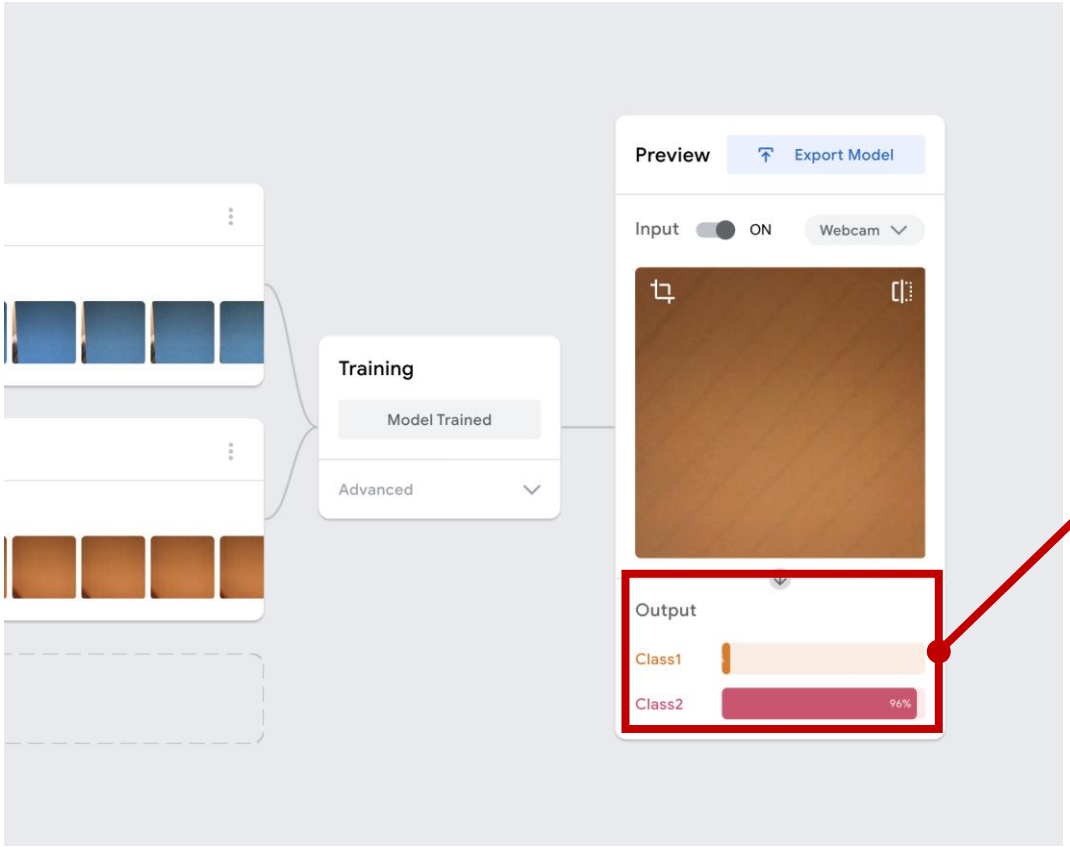


Once you have captured images (data) for both classes…

Click the Train Model button.

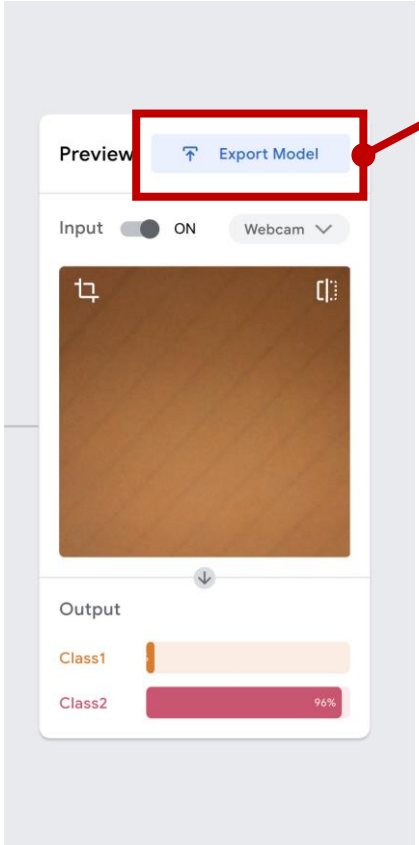
Note: Do not switch tabs while it is training.

C R E A T E A I



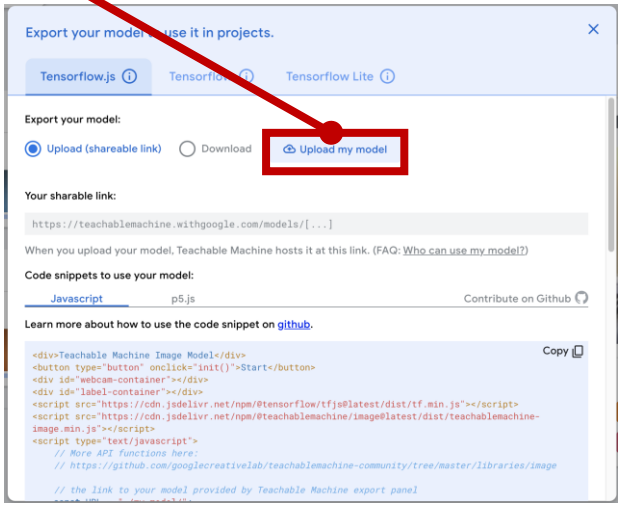
After the model is trained, check to make sure it can predict the class correctly (approx. > 95%)

C R E A T E A I

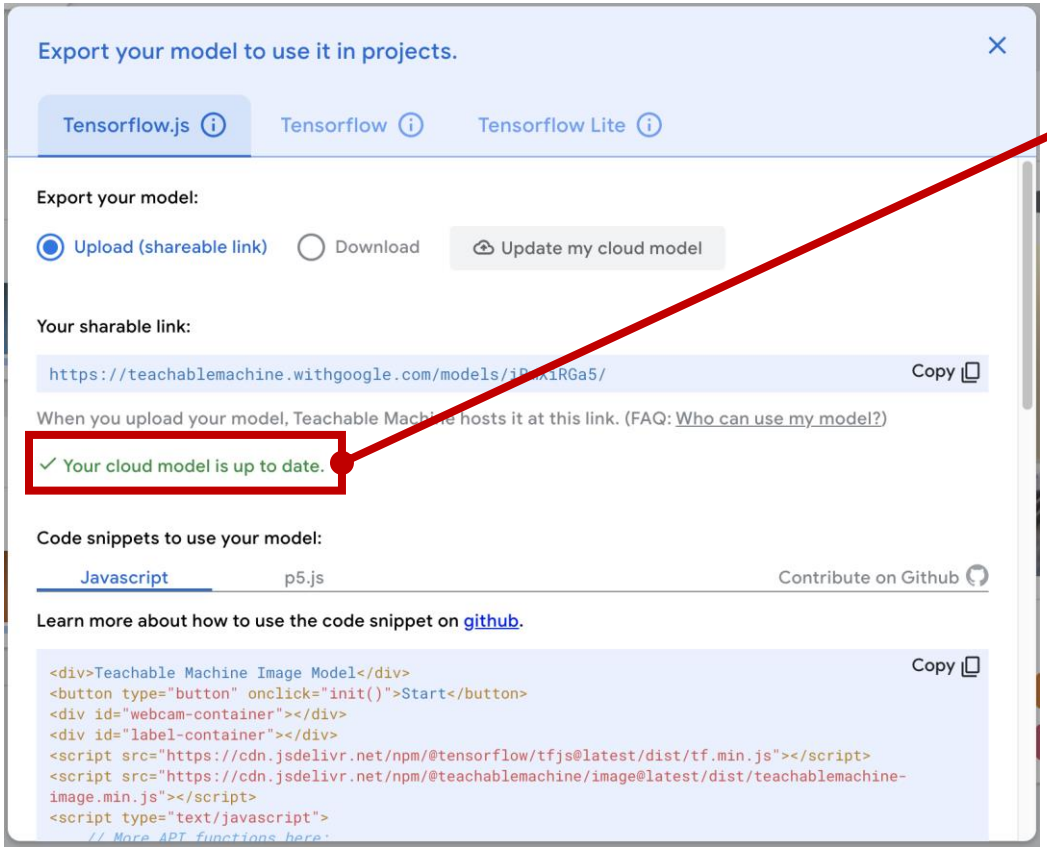


If the predictions are good, click the Export Model button.

Then click the Upload my model button.



C R E A T E A I



After the model is uploaded there will be a green checkmark.

Pause here.

Leave this browser tab open, we will use the shared URL for the model later.

BUILD

Connect Neopixel to Micro:bit

Connect the Neopixel to the Micro:bit with alligator clips. Use the following mapping:

Micro:bit		Neopixel
0	⟷	White Wire
3V	⟷	Red Wire
GND	⟷	Blue Wire

Note: Many other microelectronics can be used in place of the Neopixel (e.g., servos, motors, oLED displays, etc.)

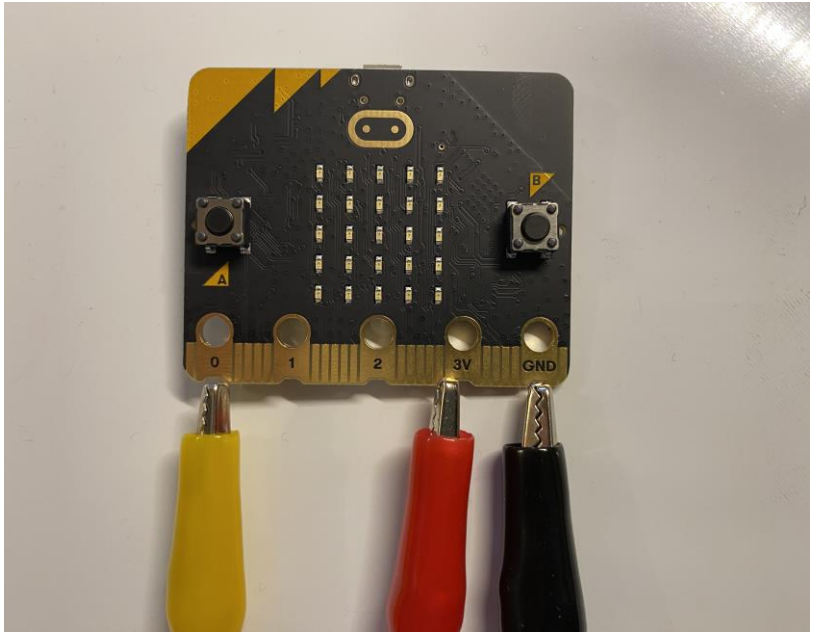
BUILD

Connect Neopixel to Micro:bit

Connect alligator clips to the Micro:bit at:

- 0
- 3V
- GND

Note: The color of the alligator clips does not mater.



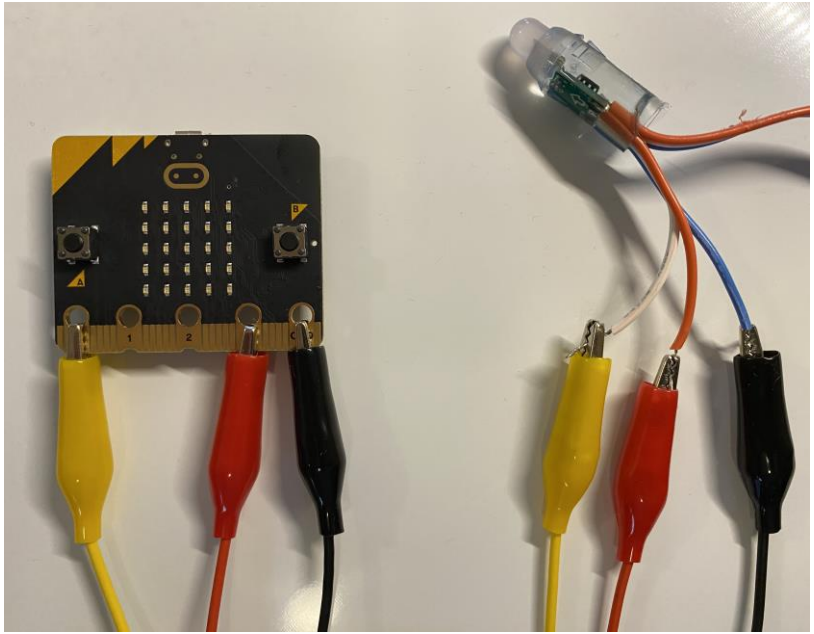
BUILD

Connect Neopixel to Micro:bit

Connect the other end of the alligator clips to the Neopixel.

Micro:bit		Neopixel
0	⟺	White Wire
3V	⟺	Red Wire
GND	⟺	Blue Wire

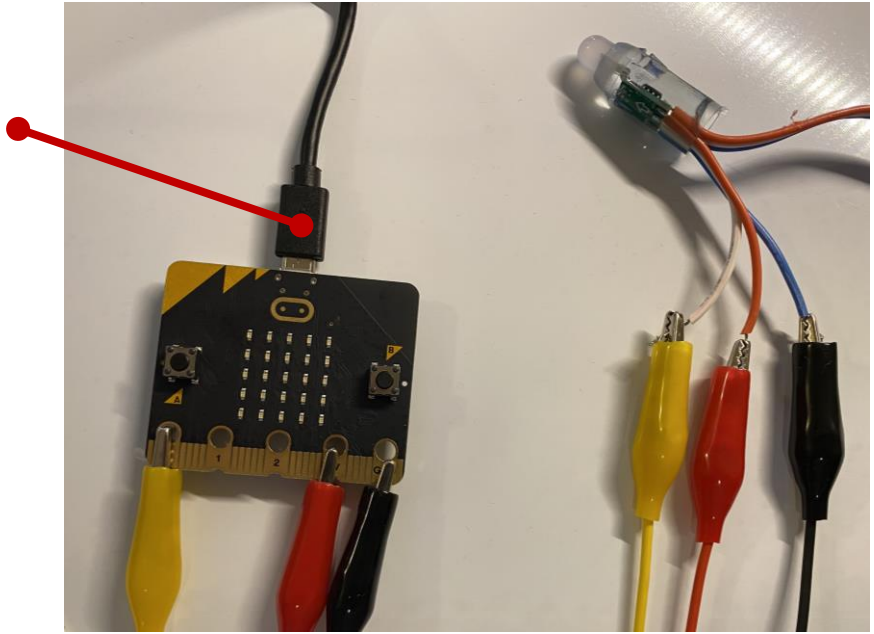
Note: The color of the alligator clip does not matter.



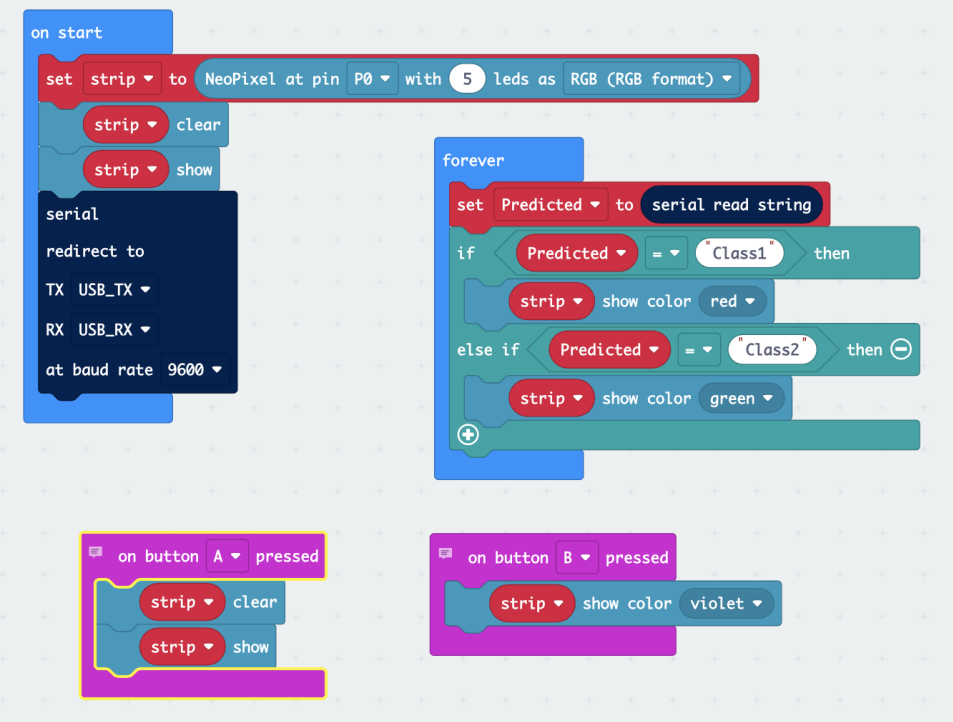
BUILD

Connect Micro:bit to Computer

Connect the Micro:bit to the computer with a USB cable.



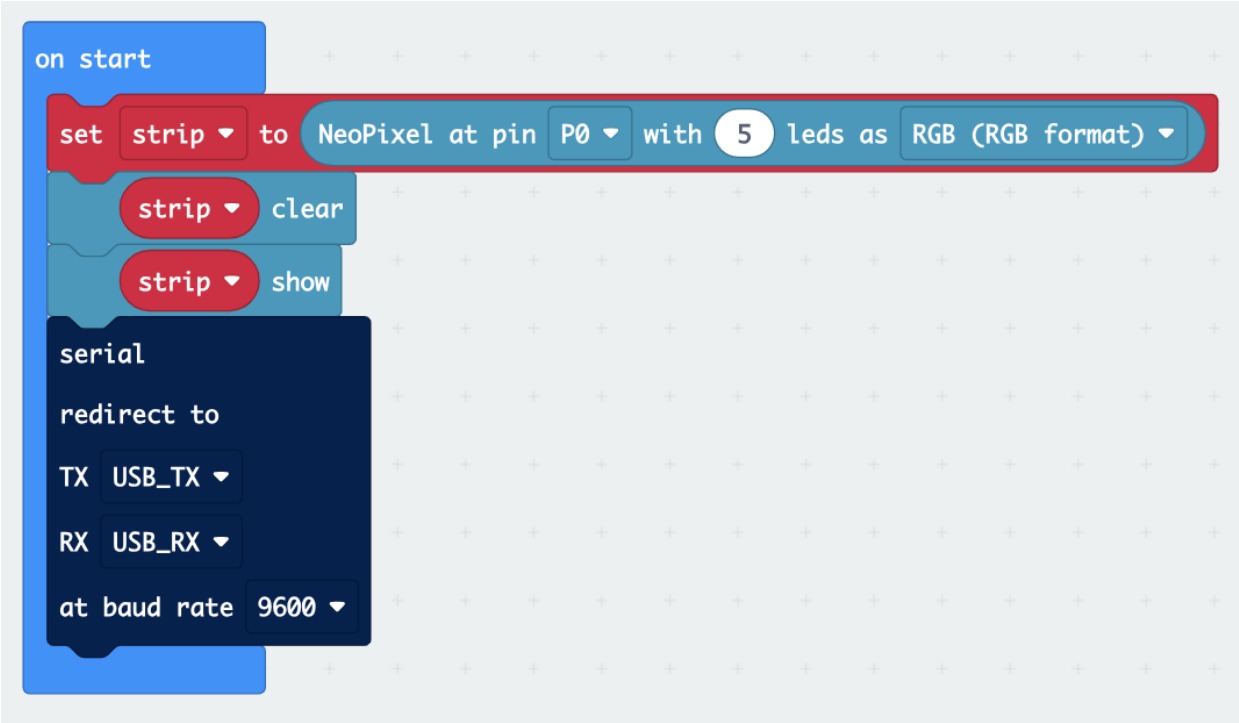
CODE



Open the code:

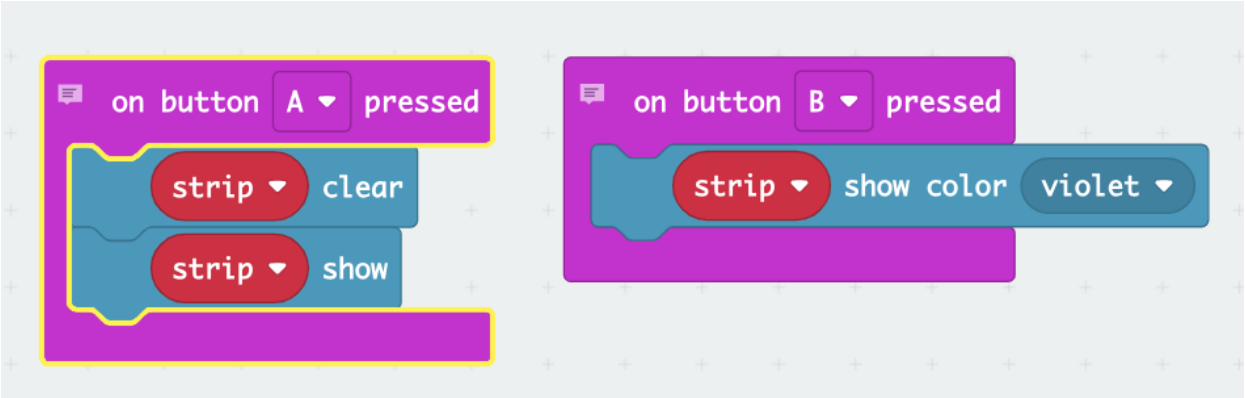
https://bit.ly/micro-classifier

C O D E



This block of code initializes the Neopixel and a serial connection that will receive data via the USB connection.

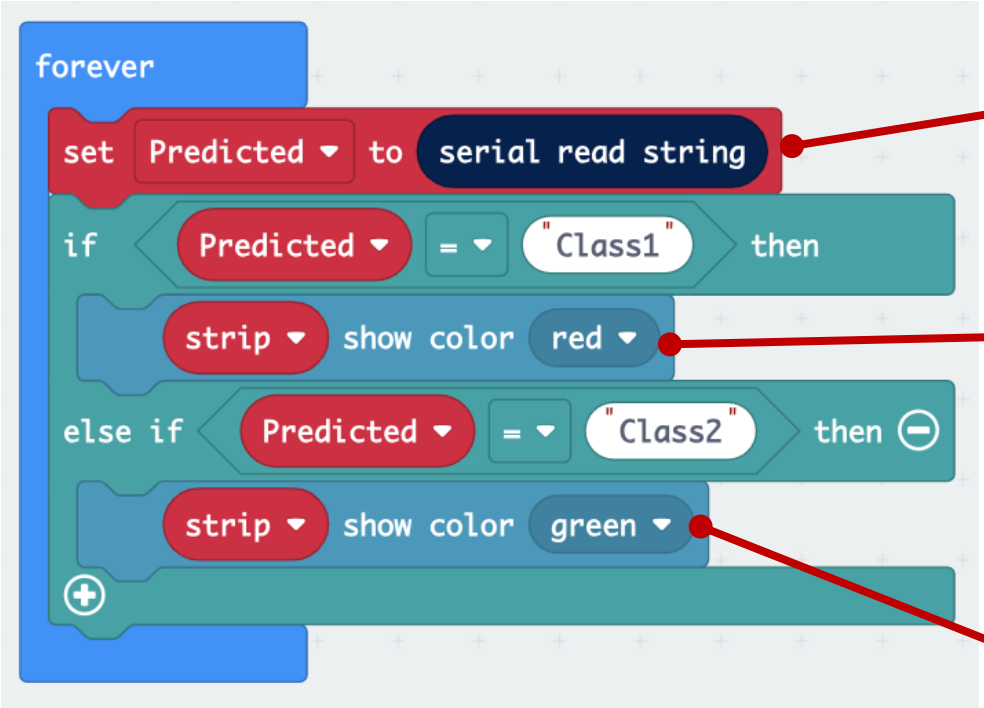
C O D E



These blocks of code can be used to verify the Neopixel is connected correctly. Press B and the Neopixel will light up violet. Press A and the Neopixel will shut off.

Note: These blocks are not needed but are helpful for debugging.

C O D E

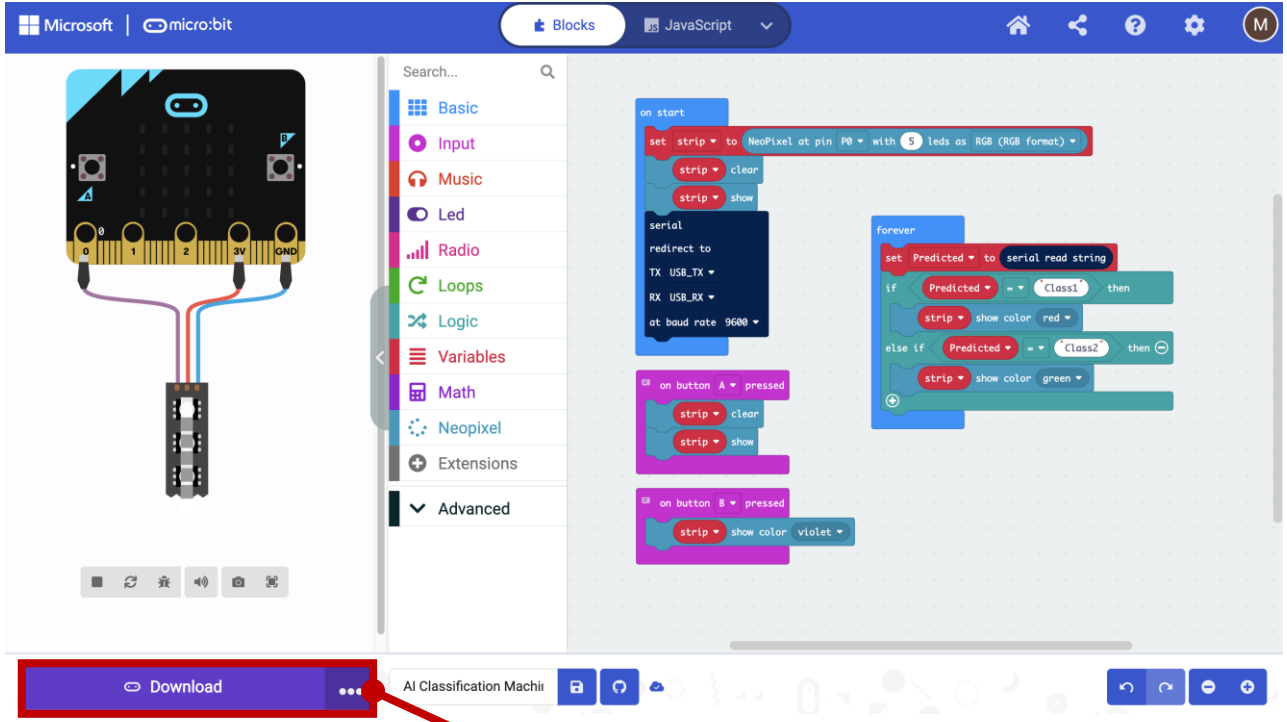


Gets the prediction from the AI model.

The Neopixel lights up Red if the predication is Class1

The Neopixel lights up Green if the predication is Class2

C O D E

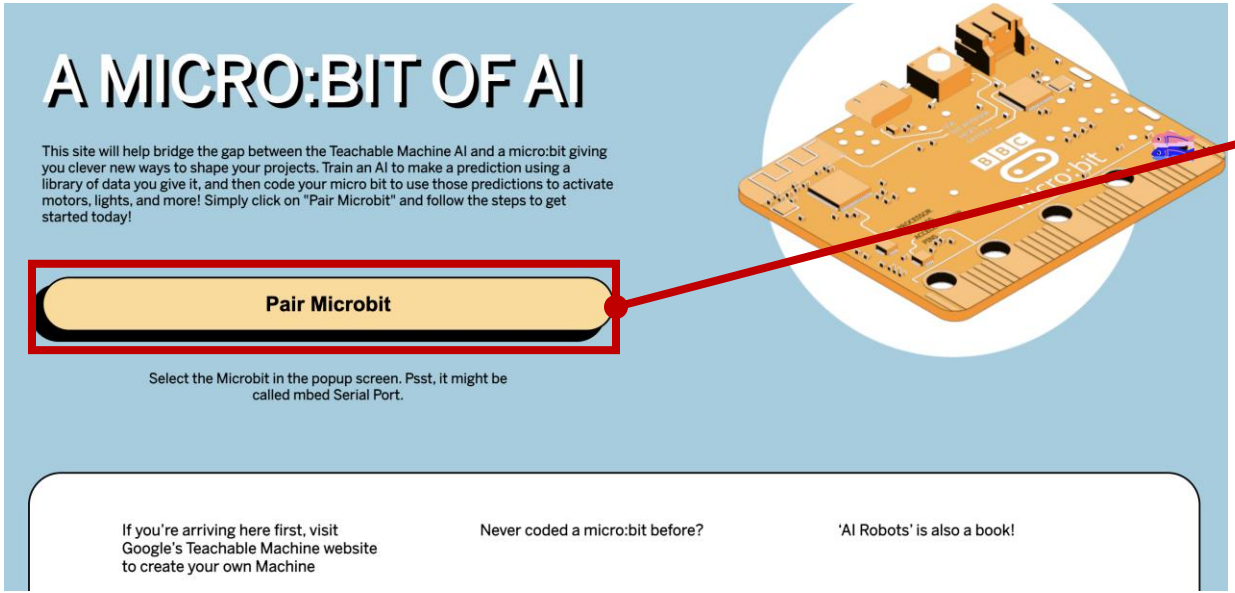


Click the Download button

C O N N E C T

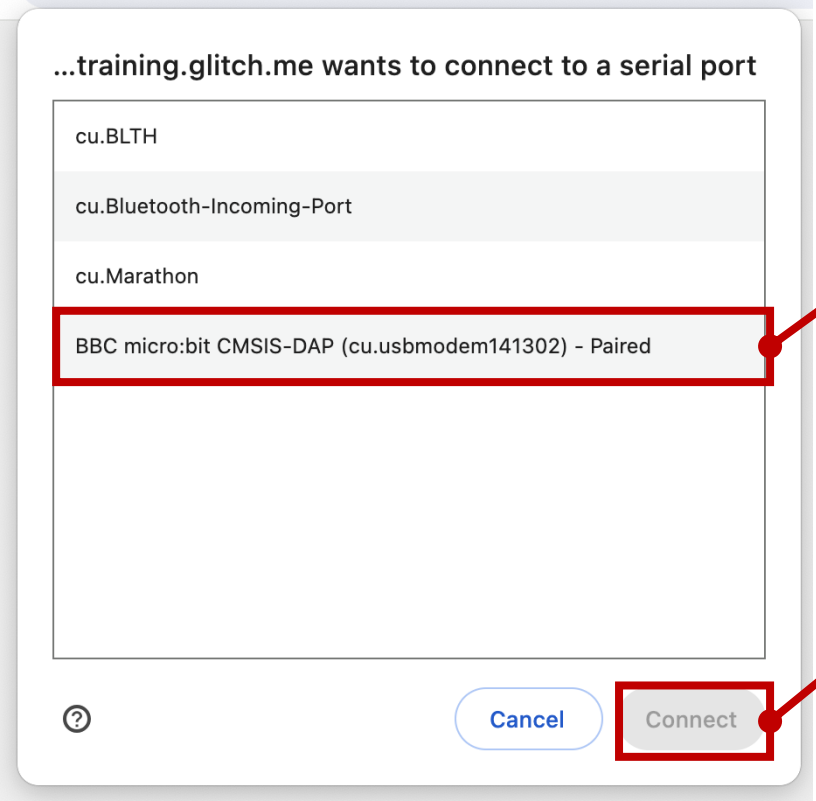
Go to A Micro:bit of AI website:

https://ai-training.glitch.me/



Click the Pair Microbit button.

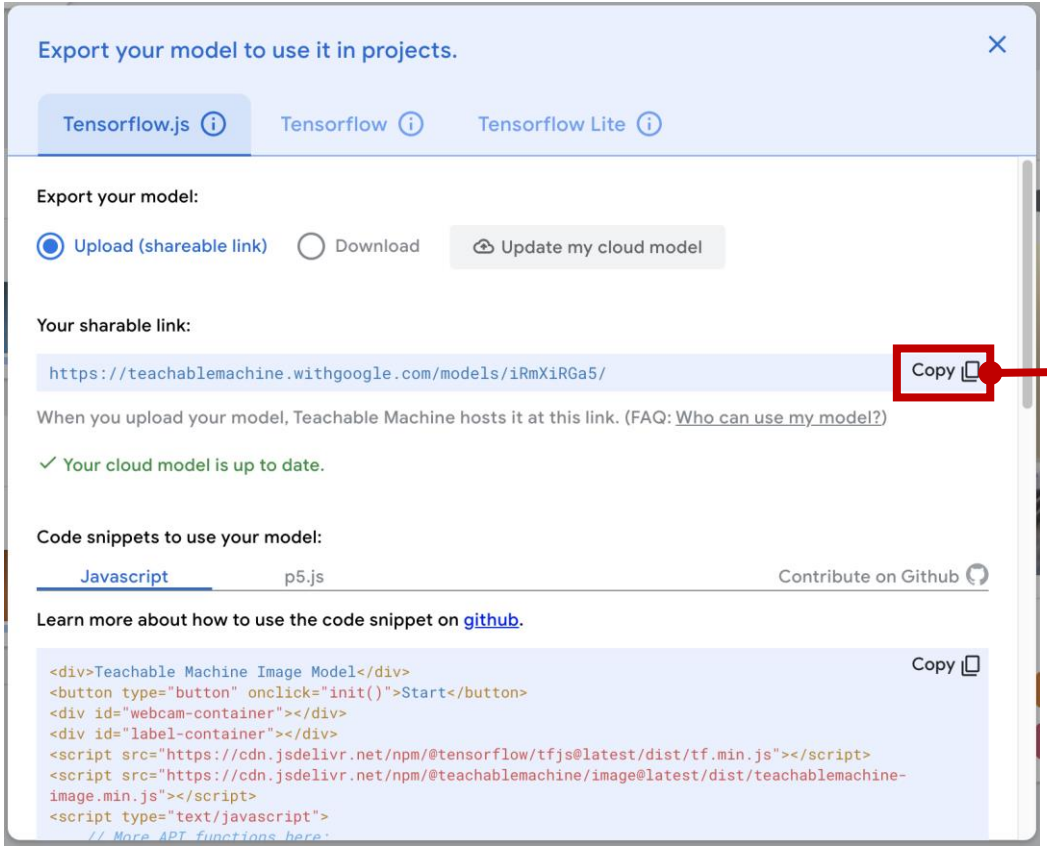
CONNECT



Select the Micro:bit.

Click the Connect button.

C O N N E C T

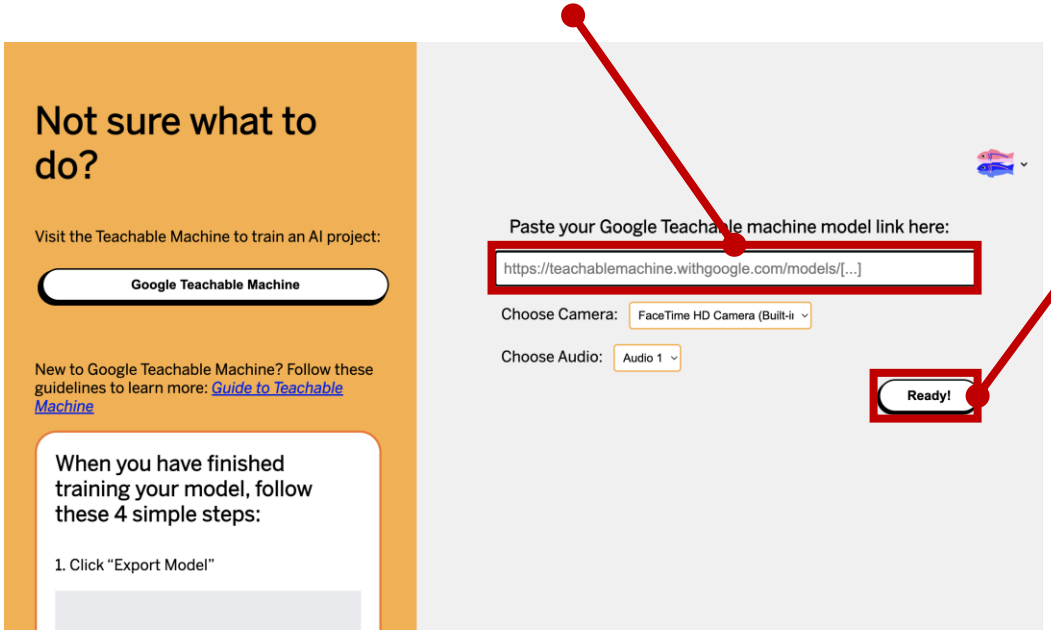


Go back to the Google Teachable Machines browser tab.

Copy the shareable link to your model.

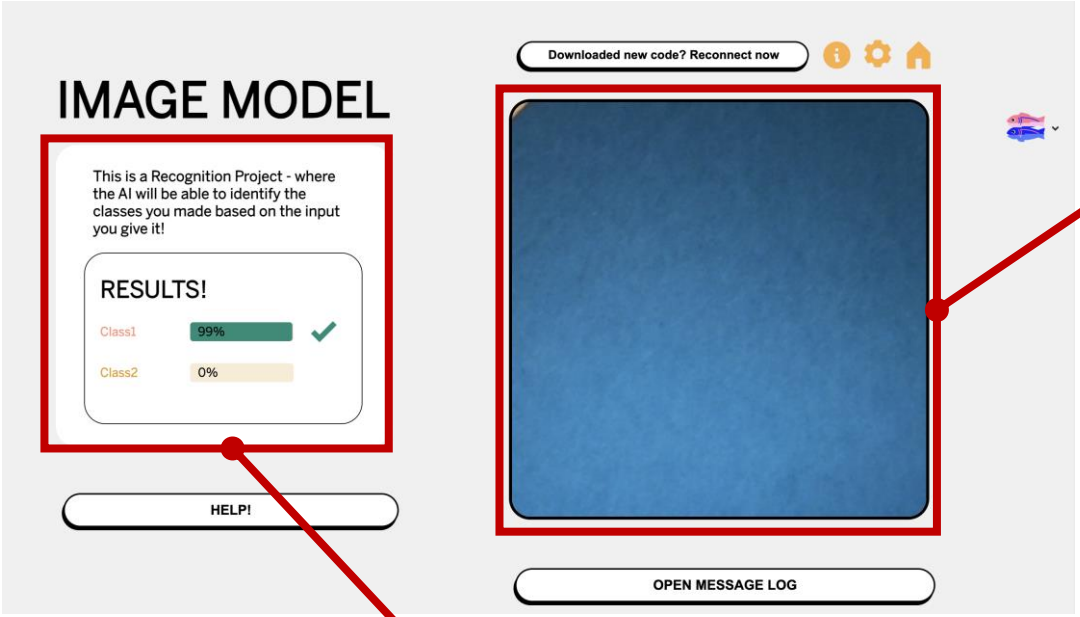
C O N N E C T

Paste the shareable link for your AI model from Google Teachable Machines here.



Click the Ready button.

T E S T



The image input.

The models prediction based on the image input.

T E S T

Test your Classification Machine

- Test with new data (data that you did not use to train the AI model).
- Does it classify the new data correctly?
- If not, what could you do to fix it?

S H A R E

Who wants to share their AI Classification Machine?

S H A R E

Discussion

1. What were your challenges during this activity?
2. How could this activity be adapted to integrate with your curriculum?
3. What should be considered before integrating this activity i nto the curriculum?

PD 2. Lesson Plans Using Generative AI

Using Gen AI in Math Lesson

- **Learning Objective**

In this activity, students will...

- Solve complex algebra questions by applying a step-by-step problem-solving process
- Use Generative AI to generate an answer and the optimal solution for the problem
- Engage in self-reflection by comparing one's solution to the one generated by AI
- Refine one's answer and solution

Using Gen AI in Math Lesson

- **Generative AI sources**
  - Chat GPT: https://chat.openai.com/
  - Perplexity: https://www.perplexity.ai/
  - Anthropic Claude: https://claude.ai/login?returnTo=%2F

- **Assumptions**
  - Generative AI provides a model performance of the math solution
  - Students learn through the process of comparing their work to the model performance, finding discrepancies, and modeling the optimal performance

Using Gen AI in Math Lesson

Lesson Plan

45 minutes	Step1: The teacher delivers a lesson on algebra according to the curriculum (equations and inequalities, linear and exponential relationships). Strategies: • Go through worked questions with the class • Demonstrate how to use a step-by-step problem-solving process to do a math equation • Engage with students by asking them what they have learned at the end of the lesson.
3 minutes	Step 2: • The teacher puts students into groups of three or four and provides each team with a complex algebra question to solve. Each group of students will be working on different questions. • Teacher encourages students to apply what they have learned in the previous lesson • Teacher goes around the room and facilitates students to use the step-by-step problem-solving process.

Using Gen AI in Math Lesson

Lesson Plan

20 minutes	Step 3: • Students are given time to solve the problem using the ratios and mathematical principles learned during the previous steps. • Students document the problem-solving process in a step-by-step sequence Strategies: • Assign a specific student or two students to play the role of a documenter. • Strategically group students according to their level of prior knowledge. For example, form a group so that there is at least one student who is struggling, and one student who is good at math.
5 minutes	Step 4: • The teacher presents the students with a prompt for generative AI. • Students use Generative AI (Chat GPT) to ask for a step-by-step solution for the same algebra question using the prompt.

Using Gen AI in Math Lesson

Lesson Plan

20 minutes	Step 5: • Students compare their solution to what Chat GPT has generated. • Students will discover different ways to tackle one question. • Students will discuss what they think the most optimal solution is and why. • Students will identify mistakes and gaps in their own solution by comparing it to the one provided by Generative AI.
20 minutes	Step 6: • Each group shares their experience with the class. • While sharing, the teacher encourages students to present if and how the solutions and answer solved by the students differed from the one from Gen AI. Strategies: Facilitate the sharing session with the following questions • What strategies did you use when solving the problem? • What is one thing you learned about Generative AI?

Let's Practice

- Sample Problem
  - **Last week 24,000 fans attended a football match. This week three times as many bought tickets, but one-sixth of them canceled their tickets. How many are attending this week?**
  - **The average monthly rainfall for 6 months was 28.5 mm. If it had rained 1mm more each month what would the average have been?**

- Sample Prompt
  - Prompt 1: Solve the equation
  - Prompt 2: Provide a step-by-step solution to the equation.

Using Gen AI in Art Lesson

- Learning Objective

In this activity, students will...

  - Improve their critical thinking and reasoning skills
  - Develop one's own understanding on the idea of art and beauty

- Image Generating AI sources
  - Stable Diffusion: https://platform.stability.ai
  - Deep AI: https://deepai.org
  - PIXLR: https://pixlr.com

Using Gen AI in Art Lesson

Lesson Plan

Time	Description
15 minutes	Step 1: • The teacher instructs the student to create a drawing of a certain subject. (for example, a cat). • Students work on their drawings individually.
3 minutes	Step 2: • The teacher put students into groups of three or four.
10 minutes	Step 3: • In a group, students use Generative AI (Deep AI or Stable Diffusion) to create an image of a given subject. Strategies: • Depending on the platform, students can ask for specific positive or negative prompts, lighting, composition, color, style that guides the image. • Teacher facilitates students to use the different prompts and functions of the image generator.

Using Gen AI in Art Lesson

Lesson Plan

20 minutes	Step 4: • With the AI generated image, students as a group compare their own drawing with the image created by Gen AI. • Then the group engage in critical thinking by asking the following questions. • Describing: What do I see? • Analyzing: How is the image organized? • Interpreting: What is happening? What is the image trying to say? • Evaluating: What do I think of the work?

Using Gen AI in Art Lesson

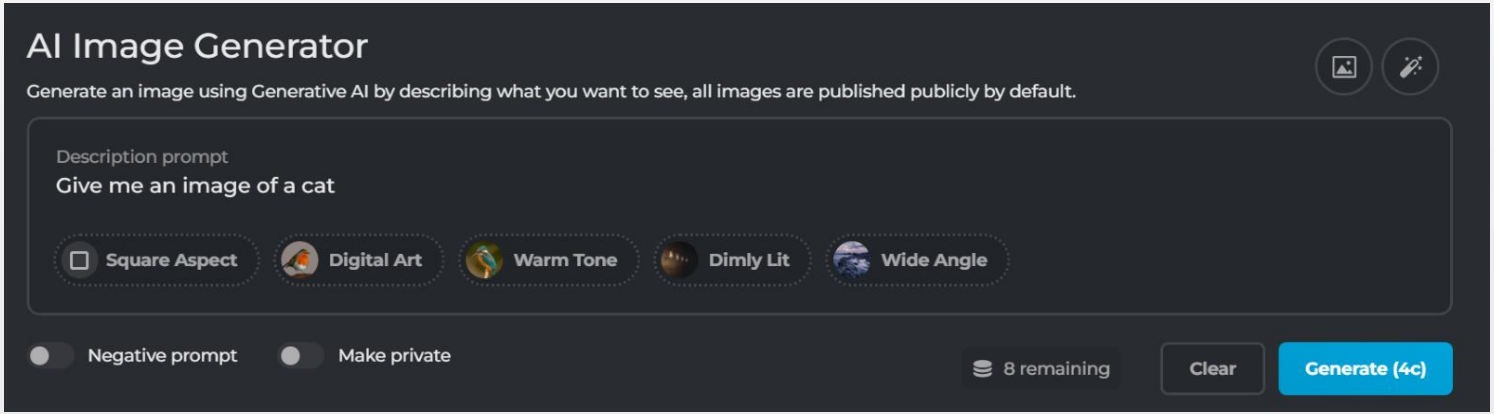
Lesson Plan

20 minutes	Step 5: • Students in group ask the following question for critical thinking and share their ideas • What is art? (What defines art?) • Is it (image generated by AI) art? • How does images generated by AI compare to art created by humans?
20 minutes	Step 6: • Students get together as a class and share their ideas on what defines art.

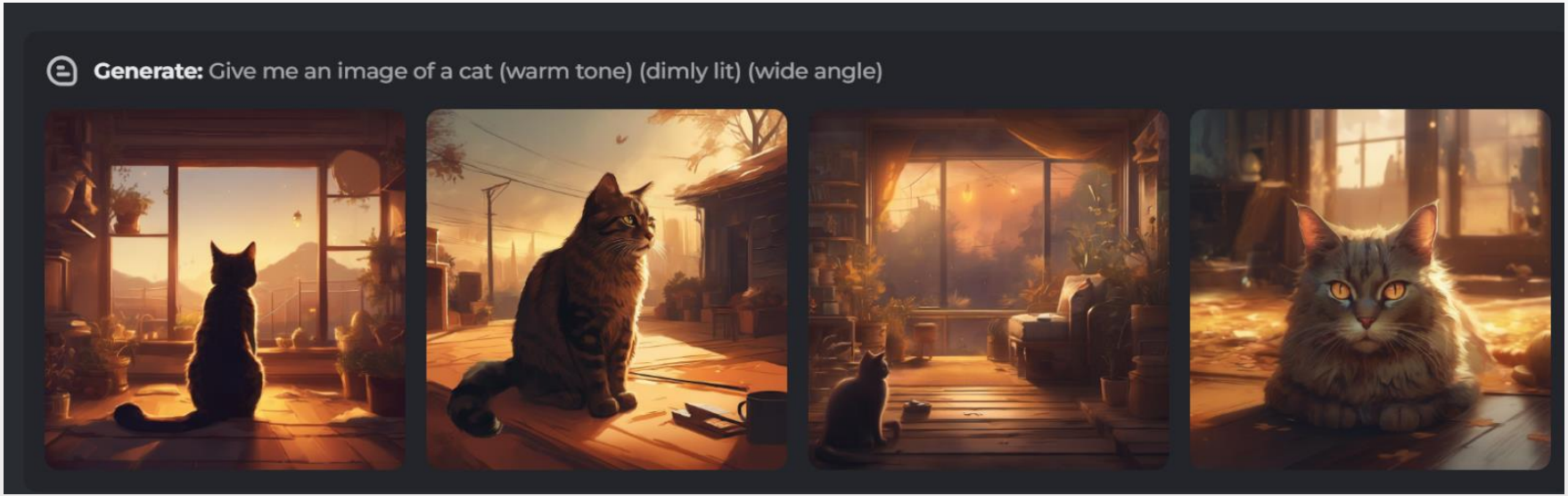
Let's Practice

Sample Prompt for PIXLR

- PIXLR: https://pixlr.com
- Prompt: Give me an image of a cat



Let's Practice



Let's Practice

Debriefing Questions for Students

- What do I see in this art?
- What is the subject of this art?
- How is the composition of objects organized?
- What is the most used color in this art?
- What is the theme of this art?
- What do you feel by looking at this art?
- What do you think the message is that the art is trying to convey?
- What is art?
- What defines art? (What makes art?)
- Is it (image generated by AI) art?
- How do images generated by AI compare to art created by humans?

General Science Gen AI Activity

General Science Gen AI Activity

Objectives

In this activity, students will:

- Investigate and analyze the scientific plausibility of science fiction stories generated using Gen AI.
- Optional: Investigate and analyze the scientific plausibility of existing science fiction stories using Gen AI (or complete as an additional step for comparing and contrasting results and findings against the Gen AI generated stories).
- Gain understanding of prompt engineering using the RISEN Framework.

General Science Gen AI Activity

2 mins	Introduce the Gen AI tool to learners, and direct them to the site. Magic School AI: https://www.magicschool.ai/ is recommended.
5-10 mins	Students are to create an environmentally-related science fiction story starring the students as characters, remaining mindful of their prompts and their relationships to the outcomes of the Gen AI responses. Instruct them to take notes on key changes in their generated stories according to prompts constructed. (See the prompt engineering steps using the RISEN framework and example).

RISEN FRAMEWORK

- **Role**: Establish the role of the AI. Set the stage for the type of response expected.
- **Instructions**: Make it clear what you want the AI to do, giving clear directions.
- **Steps**: Break the task down to steps that are manageable while ensuring a logical progression.
- **End Goal**: Define the objective of the prompt.
- **Narrowing**: Set applicable constraints or limitations to the AI response to tailor to your specific needs.

RISEN Framework Example

- **Role**: Marketing expert
- **Instructions**: Create a marketing strategy for an eco-friendly water bottle.
- **Steps:** Start with the market analysis, next outline the target demographics, then propose marketing channels and tactics.
- **End Goal**: Increase brand awareness and sales within the first quarter post-launch.
- **Narrowing**: Focus on the digital marketing strategies with a budget of $20,000.

General Science Gen AI Activity

5mins	Have students share some of their stories with each other and/or the class.
8-10 mins	Have students analyze the scientific plausibility of the events and technology described in their stories (using approved search engines according to school or district), and the selected Gen AI tool. Students may require guidance at this stage according to their information-seeking skill levels.

General Science Gen AI Activity

8-10 mins	Discuss with students their research methods, and findings. Discuss their findings using the Gen AI tool and their findings using other online sources. Compare and contrast findings and discuss student Gen AI prompts used.
5-8 mins	Repeat the process again as an iterative cycle using the RISEN prompt engineering steps (found below in the next section). Discuss any student-observed changes in results and findings related to scientific plausibility and/or prompt construction.

Resources

Magic School AI: https://www.magicschool.ai/

General Science Gen AI activity sheet

Canva Magic
Media: https://www.canva.com/design/DAGDoZpepZs/7RdbmfcoQ9lFtIRy6dNMdQ/edit