

## ARTIFICIAL INTELLIGENCE WORKING PRINCIPLES

### Topic 1: The What and How of Artificial Intelligence and Machine Learning, modified for GoSense

<b>Objectives</b>	<p>Students will be able to:</p> <ul style="list-style-type: none"> <li>• Define artificial intelligence and machine learning</li> <li>• Explain how artificial intelligence and machine learning create responses to a query</li> <li>• Participate in activities that demonstrate how a computer learns from experiments</li> </ul>
<b>Essential Question</b>	<ul style="list-style-type: none"> <li>• Define and understand the technology behind artificial intelligence and machine learning</li> </ul>
<b>Assessment Questions</b>	<ul style="list-style-type: none"> <li>• What is artificial intelligence?</li> <li>• What is machine Learning?</li> <li>• How are AI and ML related?</li> <li>• How do the machines learn?</li> </ul>
<b>Standards</b>	<ul style="list-style-type: none"> <li>•</li> </ul>

### How Artificial Intelligence Learns

#### Instructional Activities:

Instructional Activity A: The Sweet Computer: Machines That Learn

Modified from: <http://www.cs4fn.org/machinelearning/sweetlearningcomputer.php>

<b>Time:</b>	approx. 2 class periods
<b>Materials:</b>	<ul style="list-style-type: none"> <li>• Teacher Reference             <ul style="list-style-type: none"> <li>○ <a href="#">The Sweet Machine</a></li> <li>○ <a href="#">Detailed directions</a> for game</li> </ul> </li> </ul> <p>For class set up:</p> <ul style="list-style-type: none"> <li>• flip chart paper, squared, 3x3 grid drawn as large as possible</li> <li>• large X's and O's to fill the grid on the flip chart</li> </ul> <p>For each student:</p> <ul style="list-style-type: none"> <li>• <a href="#">Hexapawn rules</a>-printed,</li> </ul> <p>For each sweet computer:</p> <ul style="list-style-type: none"> <li>• <a href="#">Hexapawn rules</a>-printed,</li> <li>• <a href="#">Game grid and pieces</a>, laminated and cut out</li> </ul>

	<ul style="list-style-type: none"> <li>● <a href="#">Board position cards</a>, color copied, laminated, and cut out 24 plastic cups or small containers</li> <li>● Colored candies (skittles, M&amp;M's, hard candies, jellybeans), the amount of each color for each group is listed below             <ul style="list-style-type: none"> <li>○ 5 red</li> <li>○ 11 yellow</li> <li>○ 13 purple</li> <li>○ 12 brown</li> <li>○ 13 blue</li> <li>○ lots of spare candy for winning rounds                 <ul style="list-style-type: none"> <li>■ Alternately, colored pieces of paper, colored beads, or other manipulatives can be used, will need an additional cup to discard losing pieces</li> <li>■ A non-candy treat can be the reward for winning the round</li> </ul> </li> </ul> </li> </ul>
Vocabulary:	<ul style="list-style-type: none"> <li>● machine learning</li> <li>● artificial intelligence</li> <li>● algorithm</li> </ul>

Directions:

**1. Provide** pre-viewing questions to students. Ask a volunteer student to read a question. Allow students time to record what they know.

- What is artificial intelligence?
- What is machine learning?
- How does a machine learn to predict and return a response?
- How does artificial intelligence respond to a query?
- How are AI and machine learning related to each other?
- What is an algorithm?

Briefly review student answers, but don't comment on their responses.

**2. Share** video YouTube [Crash Course Artificial Intelligence Preview](#)

### 3. Vocabulary Development

**Review** the following terminology:

- **Artificial Intelligence:** the theory and development of computer systems able to perform tasks that normally require human intelligence, such as visual perception, speech recognition, decision-making, and translation between languages. (Oxford Languages)
- **Machine Learning:** the use and development of computer systems that are able to learn and adapt without following explicit instructions, by using algorithms and statistical models to analyze and draw inferences from patterns in data. (Oxford Languages)
- **Algorithm:** the use and development of computer systems that are able to learn and adapt without following explicit instructions, by using algorithms and statistical models to analyze and draw inferences from patterns in data. (Oxford Languages)
- **Ask** students if any of their responses on the Student Worksheet might have changed? Allow a few moments for students to update their responses, but do so in a different font color. If doing on paper, have responses written in a different medium (pencil, pen, marker, or use a highlight to mark changes)

**4. Tell:** Machine learning is a subset of artificial intelligence. Artificial intelligence encompasses a broader range of ideas and tools. Machine learning is what enables us to use different applications that can return a response to a query. To do that, the machine has to learn specific algorithms and

then apply them based on the data on which it was trained. The more data it has to learn from, the better it will become at predicting a response. Generally, we call this technology AI, but more specifically, what we're going to be working with are programs that have been designed with machine learning. What we're going to do first is an activity to show you how machines can learn. This activity is called "The Sweet Computer: Machines that Learn."

Put the large chart paper on the floor or large desk space and place the X's and O's in their respective boxes. Make sure there is enough room for students to gather around the demo board. Lay out the board position cards/cups, group them by the numbered move for ease of use. Ask for three volunteers, one will be the Sweet Computer (X's), another is the human (O's), and the third person moves the pieces on the board for the computer. Using the directions from the game, explain how the game, Hexapawn, is played.

**5. Divide** students into groups of 3.

**6. Pass Out** a set of [Hexapawn Rules](#) to each group, as well as a [game board](#), three each of X's and O's.

**7. Instruct** students to play several rounds of the game and keep track of what they observe happening. Allow students ample time to complete enough rounds of the game for the Sweet Computer to win consistently. If a group accomplishes this task quickly, have group members change places and rerun the experiment.

**8. Discuss** what generalizations you can make about how the "computer" learns to play the game. See page 3 of the guide pages for an explanation of what happens.

### Instructional Activity B: AI Card Game

Adapted from: [MIT DAILY Workshop](#), and [Kids Code Jeunesse](#)

Time:	Approx. 2 class periods
Materials:	<p>Teacher Resources:</p> <ul style="list-style-type: none"> <li>● <a href="#">MIT DAILY Workshop</a> - Decision Trees</li> <li>● <a href="#">Kids Code Jeunesse</a> - AI Card Game</li> </ul> <p>For each group of five:</p> <ul style="list-style-type: none"> <li>● create a color copy of <a href="#">characteristics cards</a>, cut out and laminate (if desired)</li> </ul> <p>For each student:</p> <ul style="list-style-type: none"> <li>● digital access to the <a href="#">Decision Tree template</a>, will need to make a copy and share</li> </ul>
Vocabulary:	<ul style="list-style-type: none"> <li>● machine learning</li> <li>● artificial intelligence</li> <li>● algorithm</li> <li>● classifier</li> <li>● features</li> <li>● decision tree</li> </ul>

Directions:

**1. Discuss:** What have students discovered about machine learning from the Sweet Computer.

Replies should convey that the computer finds patterns that are successful and continues to repeat the correct choices. If the Sweet Computer activity was not conducted, share the Preview Questions and Student Worksheet to gather students prior knowledge from Instructional Activity A.

2. **Share** video YouTube: stop video at 5:44

[Machine Learning & Artificial Intelligence: Crash Course Computer Science #34](#)

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**Review** the following terminology

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- **Machine Learning:** the use and development of computer systems that are able to learn and adapt without following explicit instructions, by using algorithms and statistical models to analyze and draw inferences from patterns in data. (Oxford Languages-Google)
- **Algorithm:** the use and development of computer systems that are able to learn and adapt without following explicit instructions, by using algorithms and statistical models to analyze and draw inferences from patterns in data. (Oxford Languages-Google)
- **Classifier:** an algorithm that automatically orders or categorizes data into one or more of a set of “classes.” One of the most common examples is an email classifier that scans emails to filter them by class label: Spam or Not Spam. ([Monkey Learn](#))
- **Features:** represents a measurable piece of data that can be used for analysis: Name, Age, Sex, Fare, and so on. Features are also sometimes referred to as “variables” or “attributes.” ([Data Robot](#))
- **Ask** students if any of their responses on the Student Worksheet might have changed? Allow a few moments for students to update their responses, but do so in a different font color. If doing on paper, have responses written in a different medium (pencil, pen, marker, or use a highlight to mark changes)
  - If Sweet Computer activity was not performed, have students fill in the boxes and then discuss their responses.

**4. Decision Tree:** Activity based on MIT DAILY Workshop activity, Teacher [Script](#) and [slide](#), [Directions](#) on how to implement activity.

**5. Activity:** Now that students have seen how a decision tree works and what it is designed to do, extend that with the following card sorting activity from [Kids Code Jeunesse](#).

**6. Create** groups of five students. One will be the “AI” and the other four will be the features creators. Following the directions for the game, play several rounds so students can change jobs and experience the different roles.

- **extension:** once students have played a round or two, time students to see who can guess the object the quickest or in the least amount of guesses.

**6. Wrap Up:** In student journals, or as a discussion, have students reflect on their experience with the decision trees. How did it make sorting things easier? More difficult? How might this be applied to other situations? Discuss how the card guessing game went. What was the experience like as the “AI”? What made the object easy or difficult to guess? Is there anything that could be done to make it easier and quicker to guess the object? What strategies could be applied for playing the game next time?

**7. Extension:** Have students create additional cards for the deck using Google Drawings or another drawing tool. Either create objects that fit into the existing features cards or create an object and additional features cards. Have other groups test out the additional cards and provide feedback on the new items.

Instructional Activity C: Can You Help Train a Computer?

Adapted from [Quick Draw the Data](#)

Time:	Approx. 1 class
Materials:	Teacher Reference: <ul style="list-style-type: none"> <li>• <a href="https://quickdraw.withgoogle.com/#">https://quickdraw.withgoogle.com/#</a></li> </ul> For each student: <ul style="list-style-type: none"> <li>• <a href="#">What Did I Draw</a> doc</li> <li>• Computer for each student</li> <li>• Paper</li> <li>• Pencils</li> </ul>
Vocabulary:	<ul style="list-style-type: none"> <li>• machine learning</li> <li>• artificial intelligence</li> </ul>

Directions:

**1. Warm Up:** On the board, draw a doodle of a house, or something similarly simple. Have students guess what it is, but don't say it out loud. On the [What Did I Draw?](#), or in a journal, write down what features lead them to guess the image. Allow 3 minutes to respond, then turn to a partner and discuss what they wrote. Note any differences that partner thought of on worksheet.

**2. Tell** students that they've now had the opportunity to do some activities that simulate the "learning" of a computer and how complex it can be. Now it's time to try one more activity that will help you train an active program that is working on recognizing hand drawn images. This is an experiment created by Google.

**2. Share** video YouTube [A.I. Experiments: Quick, Draw!](#)

**3. Tell** students to navigate to the website: <https://quickdraw.withgoogle.com/#>

**4. Model** how to navigate the website to the students. Allow students the opportunity to train the program. After working on training several different images, students will see the results of their drawings. Ask them to look at how the program dissected their image and tried to categorize it. Also look at what others have drawn.

**5. Wrap up:** Have students refer back to the student worksheet to the Reflection box. Choose one of their drawings and respond to the following:

- Fill in what image they chose.
- Write down what other ideas the computer thought they were drawing.
- Then have them reflect on how the computer is able to determine what they drew based on the features it has learned to recognize. i.e. cats usually have pointed ears and whiskers



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