

**Background**

The goal of this lesson is to introduce children to the concept of artificial intelligence (AI) and its applications in agriculture, specifically its ability to differentiate between items. By engaging in three activities, children will develop a rudimentary understanding of how AI technology can be utilized to differentiate between items (animals or plants) that would assist farmers in managing their farms more efficiently and sustainably.

As humans, we made rules to categorize animals. The process of creating rules to sort animals is similar to what artificial intelligence does. Humans input data or pictures into Artificial Intelligence applications labeling items as to what they are or aren’t. AI then runs the rules to generate the pattern matches.

**What to Do**

Children will be classify animals into two categories: Cow and Not a Cow. They will then decide on what the rules are to classify an animal as a cow. Once rules are established, they will explore the idea of machine learning and artificial intelligence and code a robot to visit cows on a programming mat. Finally, the children will create cow art by following the rules for a cow similar to how AI creates art.

**lesson: Introducing the Activity**

What is a cow? Children will explore what makes a cow a cow.

**lesson: Robot Programming and AI Art**

In this hands-on lesson, children will be introduced to the concepts of artificial intelligence and machine learning through the topic of cows. Children will decide what a cow is and is not to create rules for cows. Children will start learning the concept of computer coding by coding robots to go to pictures of cows. This lesson assists children in developing a rudimentary understanding of how AI technology can be utilized to differentiate between items (animals or plants) that would assist farmers in managing their farms more efficiently and sustainably.

**lesson: Facilitator notes:**

Before the lesson, prepare the following items.

* Print off the pictures of cows and other animals.
* Decide which type of robot the children will be using during this lesson. Possible robots to use include BeeBots, Hexbugs, Botley, Dash, Cubetto, etc.
* Create the programming mats needed for the type of robot the children will be using. The programming mats will need to have pictures of cows and other animals.
* Decide on the art medium that the children will use to create their cow art pieces. Mediums could be crayons, markers, color pencils, watercolor, etc.
* Optional: If children will struggle with the drawing of cows, prepare pictures of cow body parts for children to use in their cow art. These pieces may be cut apart ahead of time or children may be allowed to cut them apart themselves.
* Create AI pictures of a cow using an online AI photo generator. Photos can look computer generated and have mistakes.

**Intended Audience:**

Grades K-4

**Learning Standards**

NGSS Standards:

2-LS4-1: Make observations of plants and animals to compare the diversity of life in different habitats.

Iowa Core Standards:

21.K-2.ES.1: Communicate and work appropriately with others to complete tasks.

3-5-ETS1-2. Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.

**Lesson Objectives**

Participants will:

* Understand that humans and computers can differentiate between categories of items.
* Understand that AI can be utilized in food production.
* Understand that computers can create art by following rules.

**Time Needed**

90 minutes

**Equipment and Supplies**

* Pictures of Cows and Non-cows
* Robots and programming mats
* Art Supplies
* Whiteboard or large paper
* Markers

**Getting Ready**

* Print off pictures of cows and other animals.
* Prepare robots and programming mats.
* Prepare art materials.

**Prepared by: (Authors)**

Brenda Welch – Iowa State University

**AI Decision Making: What is a Cow?**

**Step 1: Opening (5 minutes)**

* Ask children: What is a cow? (Accept answers.)
* Ask children: How do you know what a cow is? (Accept answers.)
* Show children a couple pictures of animals that could be found on a farm. Ask the children to decide if each picture is a cow or not a cow. Place the pictures into two groups: Cow and Not a Cow.

**Step 2: Cow or not a Cow (15 Minutes)**

* Divide into groups of 2-4 giving each group a set of cards containing pictures of cows and non-cows.
* Ask each group to separate the pictures into cows and not cows.
* As a large group, look at the two piles of pictures that the children created, cows and not cows. Ask children: How did you decide which animal was a cow and which animal was not? (Accept answers.)
* Ask: If you had to create a definition of those term words, what would it be? (Record the various definitions.)
* Ask children: If we had to teach someone else what a cow was, would our definition work? (Accept answers.)

**Step 3: How does a Computer know what a cow is?**

* Introduce the term “Machine Learning” to children. Explain that machine learning gives computers examples of information to help the computer generate answers. It allows the computer to generate patterns with the given data without people entering the right answer all the time.
* Machine Learning is part of AI or Artificial Intelligence. Artificial Intelligence is when a computer can perform a task that normally requires human thought.
* Ask children: If we needed to teach a computer what a cow was, what should we input into the computer? (Accept answers.) Assist children in realizing that the rules they just created would help the computer determine what a cow is.
* Have the children create the rules that they would give the computer. Show the pictures of the animals to the children again and have them use the computer rules to determine if each animal is a cow or not.
* As the children test the rules, discuss what changes need to be made. You can explain that this is part of testing the machine learning that AI does. It is always testing the rules that it is given to test the programming.

**Step 4: Program Cow Detection Robots (20 Minutes)**

* Inform the children that they will be working with a partner to program a robot to recognize cows. They will need to program the robot to only stop at the pictures of cows on the programming mat.
* As the children work on programming the robots, check on the groups and assist as needed.
* Once all groups have been successful programming the robot, bring the group back together.
* Ask: Were you able to program your robots to stop at the pictures of cows?
	+ What did you do to make it work?
	+ What problems did you have?
	+ Were your robots really learning how to tell what a cow was?

**Step 5: Create a Cow (15 minutes)**

* Explain to children that computers are now able to create art because of AI and machine learning. This is called generative AI. The computer can take the data that has been programmed into it and generate art based on patterns.
* Show children cow artwork generated by AI. Compare the pictures to the rules they created for knowing what a cow is. Ask:
	+ Are these pictures of cows?
	+ What did AI get right in the pictures?
	+ What did AI get wrong in the pictures?
	+ What new rule(s) does AI need?
* Explain that they will be creating pictures of cows, using the rules that they created for a cow.
* Pass out the art materials and allow the children to create their cows. (If children will struggle with the drawing of cows, prepare pictures of cow body parts for the children to use in their cow art. These pieces may be cut ahead of time.)
* Bring children together and have children show off their art creation.
* Ask children:
	+ How does your cow follow the cow rules?
	+ Is everyone’s cow the same?

**Digging Deeper**

* Why might we want AI to differentiate between animals? (Accept answers.)
* Why would a farmer need a computer to know the difference between animals? (Accept answers.)
* Dairy farmers can put collars on their dairy cows that contain an electronic tag. These tags allow the computer system to keep track of how often each cow is milked, how much each cow eats, how much milk each cow produces, and even if the cow is sick. Would it be possible to program a computer to identify a cow by how she looks, so if she loses her collar or electronic tag, the famer can keep track of her?

**Expand and Explore**

* Could we program AI to differentiate between other agricultural products such as plants?
* Why might we want AI to differentiate between plants? (Accept answers.)
* How could a farmer use a computer’s ability to know the difference between plants? Could the computer tell the sprayer or drone to spray only the weeds to get rid of them and make sure that the corn or soybean plants are not hurt by the spray?

**Talk it Over.**

**Share**

Share with your friends and your parents about how you can create rules to decide between two or more categories.

**Process**

How was your experience programming a robot?

What went well?

What should you change for next time?

**Generalize**

Who can use the information learned in this lesson?

**Apply**

Think about how AI can be used in agriculture. What are other uses of AI?

**Career Connection**

The following career area(s) connect to this activity:

**Agricultural Engineer:** Agricultural engineers design and develop technologies to improve farming efficiency, sustainability, and productivity. They may work on projects involving AI-driven systems for crop monitoring, automated harvesting equipment, and precision agriculture solutions.

**Data Scientist:** Data scientists analyze large datasets to extract insights and patterns that can inform decision-making processes. In agriculture, data scientists may use AI algorithms to interpret agricultural data, such as weather patterns, soil composition, and crop yields, to optimize farming practices and resource management.

**Software Developer (AgTech):** Software developers specializing in agricultural technology (AgTech) design and build software solutions tailored to the needs of the agriculture industry. They may develop AI-powered applications for farm management, predictive analytics, and decision support systems.

**Agricultural Scientist:** Agricultural scientists conduct research to improve crop production, environmental sustainability, and food security. They may collaborate with engineers and data scientists to integrate AI technologies into agricultural practices, such as developing AI-driven models for crop disease detection or pest management.

**Farm Management Consultant:** Farm management consultants provide advice and expertise to farmers on optimizing farm operations, increasing productivity, and implementing new technologies. They may specialize in recommending AI-based solutions for farm automation, data-driven decision-making, and precision agriculture.

**Precision Agriculture Specialist:** Precision agriculture specialists help farmers adopt precision farming techniques and technologies to optimize resource use and increase crop yields. They may utilize AI tools for remote sensing, satellite imagery analysis, and automated monitoring to improve field management practices.

**Agricultural Extension Agent:** Agricultural extension agents work with farmers and agricultural communities to disseminate research-based information, training, and support services. They may educate farmers on the use of AI technologies for data-driven decision-making, crop management, and sustainable agriculture practices.

**Agricultural Educator**: Agricultural educators teach students about farming practices, agricultural technology, and environmental stewardship. They may incorporate lessons on AI in agriculture to prepare students for careers in the evolving field of agricultural science and technology.

**Rural Development Specialist:** Rural development specialists focus on improving economic opportunities and quality of life in rural areas. They may explore the potential of AI technologies to enhance agricultural productivity, diversify rural economies, and address challenges faced by farming communities.

**Learning More**

Consider this an opportunity to educate other about AI and how you were using it in an educational way. Share your project as a communication exhibit at your local fair.

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