

Educator Guide

Artificial Intelligence

45 minutes

Mapping Terrain

EDUCATION.MINECRAFT.NET

THEME OVERVIEW

You have been sent on an expedition, with a crew of researchers, engineers, and scientists to fly over a remote forest and take photos of the terrain below. These photos will be used to monitor and find areas where illegal logging is occurring or areas of forest with tree disease. The photos will then be use by AI to code a dataset and determine what the forests should normally look like. As the AI locates these different areas, conversation efforts can be directed there to help the delicate ecological systems in those places.

A partner called Terrafuse is using AI to keep track of areas that have had forest fires or areas that are showing signs of possible forest fires occurring. This can greatly help lessen the impact of them. For more information on their activities, click the link below:
https://www.microsoft.com/en-us/ai/ai-for-earth-OOICloud

LESSON OBJECTIVES

By the end of the lesson, students will:

- How to gather and prepare a photographic data for a dataset.
- Use machine learning algorithms to detect anomalies in geographical data
- Understand the concept and application of unsupervised machine learning (optional)

KEY VOCABULARY

Artificial Intelligence – a computer or software that mimics the human way of thinking

ARTIFICIAL INTELLIGENCE CONCEPTS: EXPLANATION

In this lesson, the AI concepts presented have been selected to best explain the process of development of a workflow involving AI within Minecraft. This does not exactly reflect a real-world AI development process and is intended to be just conceptual in nature. Below are the AI concepts used in the lesson in more detail and can be used to reinforce or further expand a student's knowledge.

- Data and Datasets:
    - AI is often used to analyze large amounts of data in multiple ways, as that is something that we cannot easily do. A specific way that an AI can analyze large amounts of data is to find differences in the data over a certain time span. This can be used to track the health of the planet. For example, air quality, global warming, and deforestation.
    - To make an AI understand and interpret a large data set, we cannot just give it any random data and expect a good result. There are certain steps that

need to be taken so that the AI can understand the data in an efficient way. These steps vary depending on the application in which the AI is used, but in general the steps to make and adequate data set is:

- Data gathering – The first step is to gather the data in whatever manner is most suitable for the situation. The data that you collect needs to be relevant to the goal of your project. As an example, if you want to make an AI that tracks the temperature of certain areas, we will most likely need heat signatures of those areas.
- Formatting the data – Data comes from multiple different sources. All these sources may not give you the data in the same format. Once received, the data will need to be configured in a singular format. Using the example form before, some satellites give the measured temperature in Celsius, while others give the values in Fahrenheit. In this case, values would need to be converted to either Celsius or Fahrenheit.
- Cleaning the Data – Any inconsistencies that do not "make sense" (due to equipment malfunction or lack of data in a data point) or that does not pertain to the application must be removed. Once a data set has been formatted and cleaned up it has been labelled.

- Training Set – This data set is used to train and test the AI. It is usually smaller in size than the data set on which the AI will ultimately be applied on. However, it still needs to be good enough to train the AI on the specific application. For example, it would be accurate to use the average temperature of each state in America as opposed to using the average temperature of each country in the world. The smaller size makes it possible to check the AIs results.
- Original Set – This is the biggest data set. The training set is usually extracted from this set. The original set is used for the main purpose of the AI. Using the previous example, this set would have the average temperatures of every country in the world.

- Machine Learning:
  - Machine learning is an important part of artificial intelligence. Machine learning algorithms are a group of AIs that can automatically learn and improve on their own without any direct human interaction. A machine learning algorithm is an algorithm developed to be able to alter certain parts of its code. One specific type of machine learning is:
  - Unsupervised Machine Learning – These algorithms are used when data in a dataset is not labelled. This is usually the case when data is to vast or complex to organize and label. The algorithm is set up in a certain way so as to find and determine certain patterns in an unlabeled dataset. Based on these results it will then adapt its own algorithm and parameters to improve its results. An example of this would be is an unsupervised machine learning

algorithm had a large dataset containing pictures of elephants or lions. As a starting point we would code an algorithm to recognize certain characteristics or elephants and lions; for example: ear shape or color. The algorithm will then determine if the animal in a picture is and elephant or a lion using characteristics provided. As the dataset grows, the ability to determine individual differences increases and so does the unsupervised machine learning algorithm's ability to identify these differences. This type of algorithm is called a classifier. This type of machine learning method will be used in the lesson, as the pictures the AI needs to process will be too complex to label as they can contain a variety of trees, river formations, plains, and migrating animals.
    - This is once again especially useful for wildlife conservation as they monitor and track the health and population of different animal species.

- Data Bias:
    - The term data bias means that the data is incomplete, or it is inherently flawed. There are many kinds of biases in AI that occur in different situations. A common situation where bias can occur in the results is often due to the historical data which the AI was given or trained on was biased to begin with. An example of this would be if we are developing an AI to detect and count different types of animal species from photographs. If the AI has been trained to count animals, but the dataset was 90% bird photographs, the AI would probably not count an accurate number of mammals due to lack of mammal photographs it was originally given. Therefore, the total count of animals would be incorrect.

LESSON ACTIVITIES

Direct Instruction (Teacher-Led; "I Do")

We will continue to explore AI and how they are used in real life situations. Today's lesson is about mapping terrain. (**slide 1**)

Review the objectives for the lesson with students. (**slide 2**)

Review the important vocabulary with students. (**slide 3**)

You have been sent on an expedition, with a crew of researchers, engineers, and scientists to fly over a remote forest and take photos of the terrain below. These photos will be used to monitor and find areas where illegal logging is occurring or areas of forest with tree disease. The photos will then be use by AI to code a dataset and determine what the forests should normally look like. As the AI locates

these different areas, conversation efforts can be directed there to help the delicate ecological systems in those places. (**slides 4-5**)

Guided Instruction (Teacher Modeling; "We Do")

At this time, have all students log into Minecraft: Education Edition. Navigate to the AI-Lesson: "Mapping Terrain". **(slide 6)**

Activity 1: Flying High (slides 7-13)

Objective: Take Pictures of the terrain
(NO CODING IS REQUIRED FOR THIS ACTIVITY)
Explanation:
For this first activity, you will need to gather data by taking pictures of the terrain. You will be flying over the forest in one of the many helicopters, taking pictures in various locations. A large quantity and quality of data is especially important when developing an AI, as the AI will learn and improve from it.

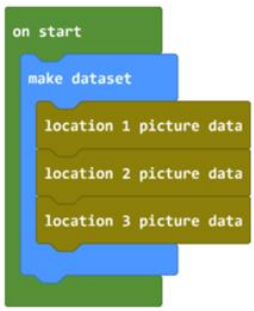
Independent Work (Teacher Support; "You Do")

Activity 2: Mapping Everything Out (slides 14-18)

(There is coding in this activity)
Objective: Code a dataset using pictures from Activity 1.

Explanation:
You will now need to code a dataset from all of the pictures you took in the last activity. This dataset will then be used to create a geographical map of the entire area that will then be used by an AI.

Use an on start coding block with a make dataset coding block inside. Place the three location picture data coding blocks from the toolbox inside of the make dataset coding block.



Now when the code is run, a map will appear of the surrounding forest.

Activity 3: Detecting Anomalies (slides 19-23)

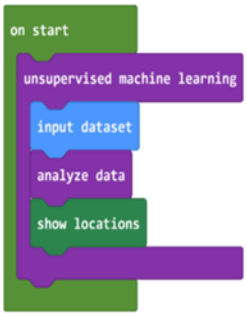
(There is coding in this activity)

Objective: Find the new location of the ocelots and mark them on a map

Explanation:

You will need to code an AI. The dataset that was just made needs to be imported into the algorithm and then needs to be analyzed. Finally, the AI needs to be given the goal to show the locations where it has detected anomalies between how the forest looks normally and when discrepancies appear. Such as tree diseases and illegal logging.

First, place a unsupervised machine learning coding block inside of the on start coding block. After that, place an input dataset coding block inside. Followed by and analyze data coding block. Then place a show locations coding block.



Now when the code is run, markers will appear on the map showing the discovered locations.

Activity 4: Problem Solving (slides 24-36)

(THERE IS NO CODING IN THIS ACTIVITY)

Objective: Shut down identified areas

Explanation:

You will drive with the Biologist in a jeep to the two different locations on the map identified by the AI. These locations, once verified as correct, will then need to be shut down using banners.

LESSON CONCLUSION

Ask students about the skills that they have learned during the lesson to reinforce the concepts learned.

1. How does the AI find different areas where illegal logging or forest disease has occurred?

Answer: The AI looks for differences between how the forest looks normally and when discrepancies appear. Such as tree diseases and illegal logging.

2. Why is it important to detect places where illegal logging is occurring?
   Answer: It is important to maintain and preserve the ecosystems of forests before they are disrupted too much.

These questions can also be used as a formative assessment. A printable version of these questions can also be found at the end of the document.

EDUCATIONAL STANDARDS

UNITED STATES: CSTA

- 1B-DA-07 Use data to highlight or propose cause-and-effect relationships, predict outcomes, or communicate an idea.
- 1B-AP-09 Create programs that use variables to store and modify data.
- 1B-IC-18 Discuss computing technologies that have changed the world, and express how those technologies influence, and are influenced by, cultural practices.

UNITED STATES: ISTE

- 1.3.d Students build knowledge by actively exploring real-world issues and problems, developing ideas and theories and pursuing answers and solutions.
- 1.5.b Students collect data or identify relevant data sets, use digital tools to analyze them, and represent data in various ways to facilitate problem-solving and decision-making.
- 1.6.c Students communicate complex ideas clearly and effectively by creating or using a variety of digital objects such as visualizations, models or simulations.

AUSTRALIAN F-10 CURRICULUM: DIGITAL TECHNOLOGIES (YEAR 3 AND 4)

- (ACTDIK008) Recognising that numbers, text, images, sounds, animations and videos are all forms of data when stored or viewed using a digital system
- (ACTDIP009) Using software to sort and calculate data when solving problems
- (ACTDIP010) Explaining what the problem is and some features of the problem, such as what need is associated with the problem, who has the problem and why
- (ACTDIP010) Designing and implementing a simple interactive digital solution using a visual programming language

UK NATIONAL CURRICULUM: COMPUTING (KEY STAGE 2)

- Design, write and debug programs that accomplish specific goals, including controlling or simulating physical systems; solve problems by decomposing them into smaller parts
- Use sequence, selection, and repetition in programs; work with variables and various forms of input and output

NAME: _____ **DATE:**_____

FORMATIVE ASSESSMENT: MAPPING TERRAIN

How does the AI find different areas where illegal logging or forest disease has occurred?	
Why is it important to detect places where illegal logging is occurring?	