Lesson 12: AI For Oceans

40 minutes

Overview

In this **exploratory** lesson, students will train a machine learning model by classifying fish and other objects.

Purpose

This lesson is designed to quickly introduce students to machine learning, a type of artificial intelligence. Students will explore how training data is used to enable a machine learning model to classify new data. Students should have a positive experience during the tutorial and more importantly should be motivated to keep learning computer science.

Standards

Full Course Alignment

CSTA K-12 Computer Science Standards (2017)

- ▶ **DA** - Data & Analysis
- ▶ **IC** - Impacts of Computing

Agenda

Warm Up (5 minutes)
Build Excitement!

Main Activity (30 minutes)
AI For Oceans

Wrap Up (5 minutes)
Reflection

Extended Learning
A.I. in Current Events

Objectives

Students will be able to:

- Discuss the role artificial intelligence plays in their lives.
- Reason about how human bias plays a role in machine learning.
- Train and test a machine learning model.

Links

Heads Up! Please make a copy of any documents you plan to share with students.

For the teachers

- **CSF - Course F - Slides 2022-2023** - Slides (**Download**)
  ▼ Make a Copy

For the students

- **AI: Impact on Society** - Video (**Download**)
- **AI: Machine Learning** - Video (**Download**)
- **AI: Training Data & Bias** - Video (**Download**)

Vocabulary

- **Machine Learning** - How computers recognize patterns and make decisions without being explicitly programmed

Teaching Guide

Warm Up (5 minutes)

Build Excitement!

Motivate: Explain to students the goals of today's activity. They are going to start using a new tool that will let them train a real machine learning model, a form of artificial intelligence.

Video: The first level of this activity is a video that gives important context around artificial intelligence and machine learning. Watch ***AI: Machine Learning** as a class and debrief afterwards to help students build connections to the content.

Display: Show “Reflect” slide

Reflect: *Do you think technology can predict your actions or interests? Explain why or why not.*

Vocabulary

Display: Show “Vocabulary” slide

- **Machine Learning** - How computers recognize patterns and make decisions without being explicitly programmed.

Main Activity (30 minutes)

AI For Oceans

General Support: As a teacher your role is primarily to support students as they make their way through the tutorial. Here are a few tips that should help students regardless of the level they're working on.

- **Collaborate with Neighbors:** Encourage students to check in with a neighbor to discuss what they are experiencing. Since this tutorial includes videos and students may be wearing headphones it can get easy to "go into a bubble". Help break those barriers by actively pairing students.
- **Read the Instructions:** The instructions usually provide helpful information about what is happening behind the scenes.
- **Go back and try different things:** If students finish quickly, encourage them to go back to "Train More". In the last part of the activity, students can also go back and choose a "New Word". More training data tends to make the machine learning model more accurate and consistent. Students can also learn by purposefully training their model incorrectly, or not training it at all.

Display: Show “AI: What is Machine Learning?” video

1 **Video: AI: What is Machine Learning?**

Teaching Tip

This lesson will not tell students whether they completed the level correctly. It is possible to skip through the different parts of the activity quickly. Encourage students to watch the videos, read the instructions, and try different things along the way. At any time, students can share their findings with you or a classmate.

Training AI

Students can work through the first three levels on their own or with a partner. To program A.I., use the buttons to label an image as either "fish" or "not fish". Each image and label becomes part of the data used to train A.I. to do it on its own. Once trained, A.I. will attempt to label 100 new images on its own, then present a selection that it determined have the highest probability of being "fish" based on its training. Students who consistently label things correctly should see an ocean full of different types of sea creatures, without much (or any) other objects.

Display: Show “Level 2-4 - Train AI to Clean the Ocean” slide

2-4 **Train AI to Clean the Ocean**

2 3 4

Content Corner

Every image in this part of the lesson is fed into a neural network that has been pre-trained on a huge set of data called **ImageNet**. The database contains over 14 million hand-annotated images. ImageNet contains more than 20,000 categories with a typical category, such as "balloon" or "strawberry", consisting of several hundred images. When A.I. is scanning new images and making its own predictions in the lesson, it is actually comparing the possible categories for the new image with the patterns it found in the training dataset.

Quick Share-out: *How well did A.I. do? How do you think it decided what to include in the ocean?*

Using Training Data

Display: Show “Discuss” slide

Discuss: *How do you think your training data influences the results that A.I. produced?*

In small groups, students share their responses. Circulate the room and listen to student ideas. This can be followed with full class discussion, or students can jump right back into the tutorial.

Goal: Get students to reflect on their experience so far. It is important at this point that they realize the labeling they are doing is actually programming the computer. The examples they show A.I. are the "training data".

Display: Show “Training Data & Bias” video

5 **Video: Training Data & Bias**

In the second half of the activity, students will teach A.I. about a word of their choosing by showing it examples of that type of fish. As before, A.I. doesn't start with any training data about these labels. Even though the words in this level are fairly objective, it's possible that students will end up with different results based on their training data. Some students may even intentionally train A.I. incorrectly to see what happens. If students are reflecting on how **machine learning** works, it should be encouraged!

Display: Show “Level 6 - Using Training Data” slide

6 **Using Training Data**

Content Corner

The fish in this tutorial are randomly generated based on some pre-defined components, including mouths, tails, eyes, scales, and fins, with a randomly chosen body color, shape, and size. Rather than looking at the actual image data, A.I. is now looking for patterns in these components based on how the student classifies each fish. It will be more likely to label a fish the same way the student would have if it has matching traits.

Impacts on Society

Display: Show “Social Impact of AI” video

Say: *Artificial intelligence systems learn from the data we give it, but sometimes we might not give it enough data or we might give it data that makes it act strangely.*

Think back to the examples of artificial intelligence we discussed at the beginning. Think of a time where machine learning might have got something wrong in the real world? (For example, voice recognition fails to understand you.)

7 **Video: Impacts on Society**

Display: Show “Reflect” slide

Reflect:

- *Could training data actually create problems? How?*

Discuss: Beginning in small groups then moving to whole class, students share their responses.

Goal: The goal of this discussion is to bring students back to the context of artificial intelligence in the real world.

Say: *Some ways to fix this are by using a lot of training data, and making sure we understand the problem well ourselves so we give the right kinds of data. In the final part of the activity you’re going to teach A.I. a word that could be interpreted in different ways.*

Teach A.I. a new word

Here, as before, students will use training data to teach A.I. to recognize different types of fish. The words in this list are intentionally more subjective than what students will have seen so far. Encourage students to decide for themselves what makes a fish look "angry" or "fun". Two students may choose the same label and get a very different set of results based on which fish traits were their focus. Encourage students to discuss their findings with each other or go back and choose new words. Each student will rely on their own opinions to train A.I. which means that A.I. will learn with the same biases held by the students. As students begin to see the role their opinion is playing, ask them to reflect on whether this is good or bad, and how it might be addressed.

Display: Show “Level 8 - Teach A.I. a New Word” slide

8 **Teach A.I. a new word**

Teaching Tip

You can share these stories with your class to help them see how AI will impact the future.

- **Food Waste Is a Serious Problem. AI Is Trying to Solve It**
- **AI tech can identify genetic disorders from a person's face**
- **How an AI Startup Designed a Drug Candidate in Just 46 Days**
- **MIT AI tool can predict breast cancer up to 5 years early**
- **The Army steps up its pace on self-driving cars**
- **San Francisco says it will use AI to reduce bias when charging people with crimes**
- **AI is helping scholars restore ancient Greek texts on stone tablets**

Display: Show "Share Out" slide

Quick Share-out: *Where have you seen or experienced artificial intelligence in your lives?* Examples from the video include:

- email filters
- auto-complete text
- video recommendation systems
- voice recognition
- translation apps
- digital assistants
- image recognition

Prompt: *Based on what you saw in the video, what is **machine learning**?*

Discuss: Beginning in small groups then moving to whole class, students share their responses.

Goal: Get students familiar with the world of artificial intelligence.

Say: ***Machine learning*** *refers to a computer that can recognize patterns and make decisions on its own based on data. In this activity you're going to give the computer data to train it. Imagine an ocean that contains creatures like fish, but also contains trash dumped by humans. What if we could train a computer to tell the difference and then use that technology to help clean the ocean?*

Wrap Up (5 minutes)

Reflection

Display: Show "Reflect" slide

Reflect: *How could artificial intelligence be used to solve a problem in the world?*

Extended Learning

A.I. in Current Events

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