AI for Children

Artificial Intelligence Curriculum for Elementary and Secondary Schools

Card

Supervised Learning

(02) Machine Learning Deck

https://kurikulum.aidetem.cz/cards

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Form for comments

These teaching materials were translated using ChatGPT.
Please note possible imperfections in the expressions or wording.

Teaching Material for the AI Curriculum for Elementary and Secondary Schools
Computer Science at Secondary Schools - Cards, Machine Learning Deck

Supervised Learning

Basic information on supervised learning

Machines, much like humans, can learn from examples. To do this, they use a method called supervised learning. Simply put, we don't need to give machines exact instructions or step-by-step algorithms. Instead, we provide examples from which they learn how to perform various tasks on their own. Many things are hard to describe explicitly. For instance, how would you explain to a computer what a cat looks like? Such a description would be extremely complex—if not impossible. There are many cat breeds, with different colors and features. In photos, cats appear from different angles, under different lighting conditions... So instead of describing a cat in detail, we show the machine lots of pictures of cats, and the computer learns to recognize them by itself.

What you've just read is an example of supervised learning. There are other ways machines can learn too, and we'll explore them in upcoming lessons in the Machine Learning Deck.

Supervised (Machine) Learning
If we wanted to create an app using supervised learning that can recognize dogs and cats, we would first need to tell the AI program which images show cats and which ones show dogs. This process is called data annotation – in other words, creating a dataset, just like we did in the previous lesson. In this setup, humans act as the teachers, which is where supervised learning gets its name. After sorting the images into "cat" and "dog" categories, we would train a supervised learning model (in our teaching material, we call it an AI program). Then we would show it images of cats and dogs it hasn't seen before, and observe whether it identifies the animals correctly. If not, we would improve the dataset and retrain the model.

Data Annotation
In supervised learning, data annotation is the process in which humans label or describe data – using tags, comments, and so on – so the learning model can detect patterns or similarities. In the case of recognizing dogs and cats, people label the images as either "dog" or "cat." This annotated data forms a dataset.

Learning Model
A program that learns how to solve different tasks based on many examples or experiences. The learning process has two phases – training and testing. In the training phase, we show the model a large number of examples (videos, images, texts...) and it learns by identifying patterns and similarities. In the testing phase, we present the model with examples it has never seen before and observe how well it can recognize those patterns.

Machine Learning Deck

Dataset
Supervised Learning
Bias
Reinforcement Learning

Lesson presentation
in PDF

Editable presentation
in Canva

Note: For the sake of simplicity, this teaching material refers to datasets only in the context of images and supervised learning.
Note 2: Gender equality is a key value for AI for Children, but to keep our teaching materials concise, we use masculine grammatical forms.

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Classroom Activity

Alien Detective Agency Part II

45 min

Activity description

This activity is a direct follow-up to the Dataset – Alien Detective Agency card. But this time, it's not the students who decide which family the foundling belongs to – it's a neural network. Students will use Google's Teachable Machine, a tool designed for recognizing images, gestures, or audio. They will train a model using images of the Fluff and Earl families, then upload an image of the foundling to see how Teachable Machine classifies it. The result is usually similar – the foundling is assigned to the Earl family with about 90% probability. The students' task is to investigate which features influenced the model's decision. To help with this, they are given several versions of the foundling's appearance.

How does detective agency II relate to supervised learning?

The Teachable Machine app is based on the principles of supervised learning.

Lesson Overview

Recommended Age, Lesson Length
Children aged 11–15, 45 minutes.

Building Blocks
Supervised learning.

What Are the Students Learning?
Supervised learning (for classification tasks) is a method by which an AI program learns to recognize new data based on a prepared dataset.

Why Are They Learning This?
Goal for the Machine Learning Card Deck:
Students will critically evaluate how artificial intelligence systems make decisions.

How Do We Know They Have Learned It?
They train a supervised learning model to recognize images.

Tools
Teacher: Projector and presentation device.
Students: Computer, laptop or tablet (but not Android OS) for each student or group, plus images of aliens.

Digital Competence
Communication and Collaboration.

Bloom's Taxonomy
Understanding: Students understand how supervised learning works and what kinds of tasks it can solve.
Applying: They use Teachable Machine to annotate and train a model to recognize images.
Analyzing: They analyze how the model identifies and classifies images, and which attributes are key for decision-making.

Five Big Ideas
3-A-II Nature of Learning (Finding patterns in data).
3-A-III Nature of Learning (Training a model).
3-C-I Datasets (Feature sets).

Engage

10 min

Recall

Presentation slide 02

Think back to the Alien Detective Agency activity, where we tried to figure out which family the little foundling belongs to. How did we come to a conclusion?
Possible answer: We looked for attributes shared by the Fluff and Earl families and used those to assign the foundling to one of them.

Did you find some attributes more important than others?
Possible answers: ears, fur, colors...

Vote

Identifying the right attributes and making a final decision wasn't easy or clear-cut. What do you think would happen if we let artificial intelligence make the decision instead?
Students can vote on the outcome. You can even create a simple poll in advance using a tool like SmartPolls. It's free and doesn't require registration.

Understand

25 min

15 min

Activity 1

Students will create a dataset and train a supervised learning model.
They can work individually or in groups. They'll need tablets (not running Android), laptops, or desktop computers with internet access.

Presentation slide 03

Share the QR code with your students (you'll find it on slide 03 of the presentation) or give them the folder link where they can download the training and testing data:
https://bit.ly/aliens_01
Training data: folders 01_Earls and 02_Fluffs
Testing data: folders 03_Foundling and 04_Other Foundlings
Note: The ZIP file will need to be extracted. 😌

Presentation slide 04

In your browser, go to the Teachable Machine website (QR code available on slide 04 of the presentation): teachablemachine.withgoogle.com
→ Click Get Started → Image Project → Standard Image Model.
→ Rename Class 1 to "Fluffs" and Class 2 to "Earls".
→ Upload all the corresponding alien images into the Fluffs class.
→ Do the same for the Earls class.
→ Click Train model (don't close the browser window – training may take a moment).
→ In the final step, either show the foundling to the webcam or upload its image from folder 03.
→ In the bottom right corner, check the result – the model will show the probability of which family the foundling belongs to.
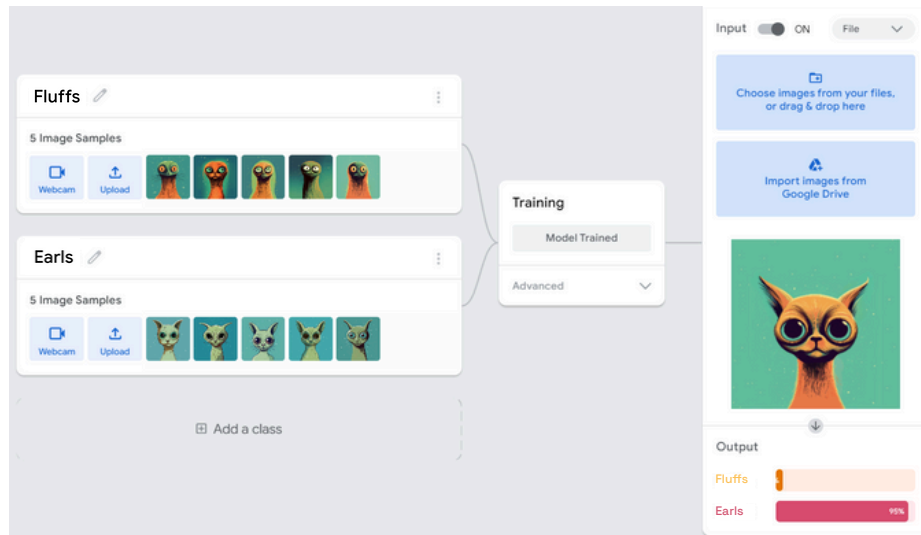
Discuss the output of the machine learning model with your students.

The model classified the foundling as a member of the Earl family. Which attributes do you think had the biggest influence on the result?
The correct answer is that the ears of the foundling played a key role in the model's decision. All other attributes (color, fur, beard, eyes…) had little to no effect in this case. However, do not tell this to the students – the next activity will guide them to discover it on their own.

Activity 2   10 min

Students upload each image from the 04_Other Foundlings folder into Teachable Machine (note: they can't upload multiple images at once). They observe how the classification probability changes. For example, the image "Foundling_4" (with no ears) is almost always classified as a Fluff with nearly 100% certainty.

Presentation slide 05

Discuss with students. Suggested questions:
Did the model classify all foundlings the same way?
Why did the model evaluate some foundlings differently?
Which attributes do you think influenced the model the most?

Presentation slides 06 and 07

Have students first read slides 06 and 07 of the presentation, then ask the following questions:

**Why do you think this method is called "supervised learning"?**
Possible answer: Because we act as the teachers by providing labeled data (annotations) that the model uses to learn.

What would happen if we didn't give the model any labeled examples?
Answer: Without examples, the model wouldn't be able to find patterns, and classification wouldn't be possible.

Presentation slide 08

What happens if students show their own face to the camera in Teachable Machine instead of the foundling's face? (Slide 06 in the presentation.) Switch from File to Webcam in the dropdown menu.
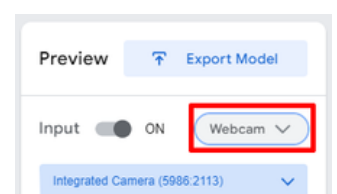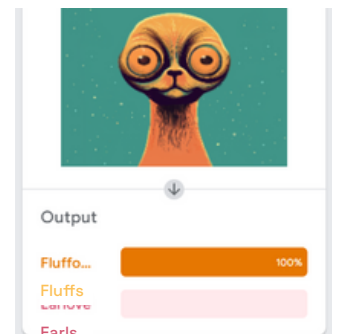
Reflect

10
min

Think about it.

We saw that ears were a key attribute in deciding which family the foundlings belonged to. Why do you think that was the case?
Possible answer: Because they stand out the most. However, it's important to emphasize to students that we don't actually know the real reason. Often, people have no clear insight into which patterns or features these systems use to make decisions. That's why it's crucial to provide balanced, well-labeled data and to test these systems thoroughly, so we can be sure they're making decisions that align with our goals.

Explain

Artificial intelligence programs — like Teachable Machine — use a method called supervised learning. This approach involves showing the model examples along with their labels. Explain how we did this in Teachable Machine.
Possible answer: We did it by creating classes in Teachable Machine, which we named Fluffs and Earls. We then added members of each family into the corresponding class. This way, we told the model who belongs where. Based on this labeling, the model was able to identify patterns (similarities) during training. Later, when it had to recognize a found creature, it looked for those patterns (like ears and other features) in the image.

Why do you think this method is called supervised learning?
Possible answer: Artificial intelligence doesn't know what's what on its own — we have to show it. People take on the role of its teachers, and that's why this method is called supervised learning.

Argue

Do you think the model made the right decision? And how can we actually tell? What could we do to help the model make better decisions?
Possible answer: We could provide it with many more examples during the training phase, so it can form a clearer understanding of the task. We would also test the model repeatedly using a wide variety of images to make sure it's making accurate decisions.

If there's extra time

Activity

Create your own dataset for a new image class.
You can combine images from both families so that the foundling is assigned to this new "mixed" family (class) called the "Fluff-Earls." Create a new class named "Fluff-Earls" and upload your selected images to Teachable Machine. When choosing your images, try to intentionally influence the model's output so that the found alien gets assigned to this class.

Test how different types of alien faces affect the model's decision.

Follow-up lesson

In this lesson, students trained their own machine learning model.
In the next one, they'll continue working with the theme of the alien detective agency. They'll once again let artificial intelligence decide where the little foundling belongs, but this time they'll focus on the idea that perhaps they didn't provide the model with the right or complete data.

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