

Virtual Session Norms

- Sessions are recorded.
- By default, you are a viewer. Please use the chat to interact with the presenter and moderator
- If you join on screen, please keep your microphone muted when you are not speaking with the presenter. Video is recommended but optional.
- Remain professional and respectful. Monitor your own airtime and make sure that all voices have a chance to be heard.



Please introduce yourself in the chat:

Name, Location, and Job Role!



Learning Activities for Teaching AI in 6-12

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AI4K12 Initiative

www.ai4k12.org

Presented at the

**2020 CSTA Annual
Conference**

**Monday, July 13, 2020
1:15 - 2:00 PM**

<https://bit.ly/CSTA2020AI4K-12-6-12>





K-12 Teacher Working Group Members



pollev.com/ai4k12

Check out your
responses!



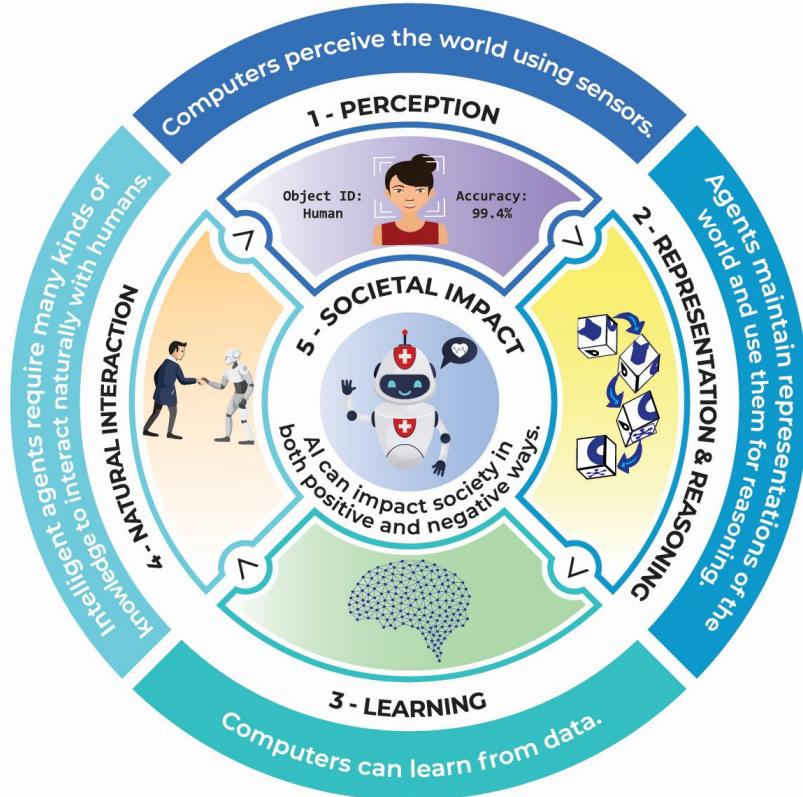
What does
"ARTIFICIAL INTELLIGENCE"
make you think of?



Five Big Ideas in AI

Download a free poster explaining the Five Big Ideas from our website:

<http://AI4K12.org>



Why is this the right time to be teaching AI in K-12?

1. AI is playing an increasingly prominent role in society:
 - Intelligent assistants
 - Self-driving cars
 - Autonomous robots in the workplace (and someday the home)
2. Informed citizens need to understand the basics of AI as our society faces important public policy decisions surrounding AI technologies.
3. AI technologies will cause job loss in some areas, and gains in other areas.
4. There is a growing need for AI-literate workers. Students should be encouraged from a young age to consider STEM careers.





Mission

- Develop national guidelines for teaching AI in K-12
 - Modeled after the CSTA standards for computing education.
 - Four grade bands: K-2, 3-5, 6-8, and 9-12
 - What should students **know?**
 - What should students be able to **do?**
- Develop a curated AI resource directory for K-12 teachers
- Foster a community of K-12 AI resource developers



Sharing is Caring



Session Goal:

- Explore activities, lessons and resources to teach AI to students in grades 6-8 and 9-12.

Learning Activities for Teaching AI in 6-8

1. Train a model to do classification
 - understand **Machine learning**

2. Guess the Animal activity
 - understand **representation** in AI systems



Big Idea #3: Learning

Computers can learn from data.

Machine learning



What have you heard about this ?



Enter your answers in the Chat: (Answer any/ all)

1. Give your definition of Machine Learning ?
2. Where do you see it?
3. Why do you think 6-8 graders should learn about this topic?

ADD a tag in front of your answer so we know which question you are answering

A1:

A2:

A3:



Machine learning

Ability of a computer system to

- automatically learn
- improve its performance on a task
- without being explicitly told how to do that task



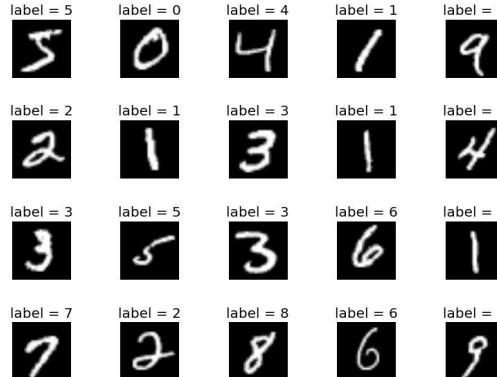
LEARN FROM DATA



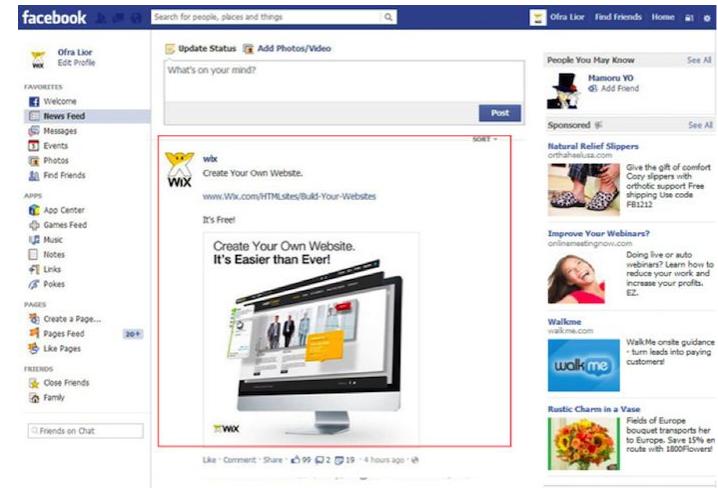
Machine Learning in action : CLASSIFIER



Spam Filters:
Spam, or
not-spam?



Handwriting recognition:
Read a check deposit



Movie recommendation
Romantic? Horror?



Some key ideas we explore in this activity

Machine learning allows a computer to ‘learn’ to do tasks without people explicitly programming them.

Supervised : Use training data to **Train a Model**

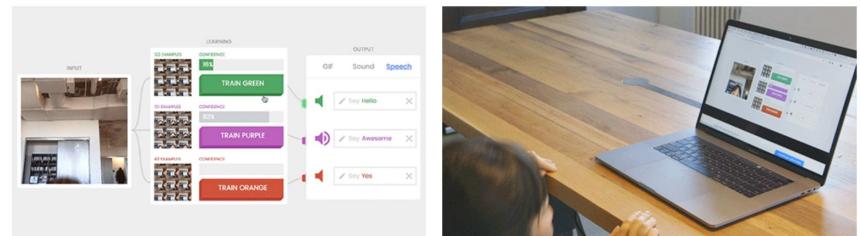
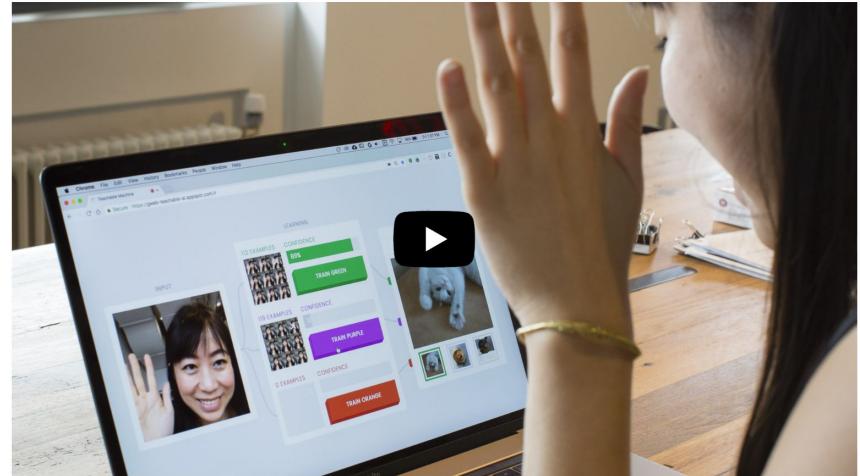
Answer 2 questions

1. What kind of data?
2. How Much data?





- Teach a machine using your camera,
- live in the browser
- no coding required.



<https://teachablemachine.withgoogle.com/>



Rock

50 Image Samples

Webcam

Upload

**Paper**

107 Image Samples

Webcam

Upload

**Scissors**

56 Image Samples

Webcam

Upload



Add a class

Training

Model Trained

Advanced

Preview

Export Model

Input ON

Webcam

**Output**

Rock



Paper



Sciss...



English (U.S.)

release-2-2-2 - 2.2.2#062



Teachable Machine

Woody 

49 Image Samples

 Webcam  Upload



Jessie 

40 Image Samples

 Webcam  Upload



Add a class

Training

Model Trained

Advanced 

Preview  Export Model

Input  ON Webcam 



Output

Woody

66%

Jessie

34%



≡ Teachable Machine

Woody

95 Image Samples

Webcam Upload

Jessie

94 Image Samples

Webcam Upload

Add a class

Preview

Input ON Webcam

Training

Model Trained

Advanced

Output

Woody 100%

Jessie



How to use in the 6-8 classroom

1. Pick 2 items and train model: Set min image samples
2. Done training? Test. Does it classify correctly?
Why ? Why not? When does it not work?
3. Invite a friend to use with your model - are they as successful as you were? Why ? Why not?
4. Add a 3rd object - How does it classify this object? Why?



What did we learn? Answer to our questions

What kind of data?

How Much data?

Training sets - have to be thought about carefully !

Classroom ideas:

Student Reflections on training a model

Peer Review on the model



Machine Learning in Action

Experiment with <https://quickdraw.withgoogle.com/#>

Why is this one so much better than your model?

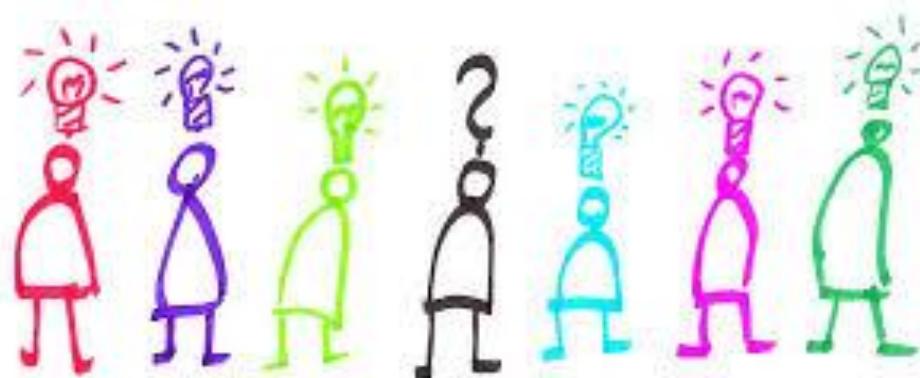
Answer in the chat



MORE DATA !

How did it get so much data?!

Crowdsourcing : Getting us all to play the game:)



How else can we get more data?

Self driving cars : share data



Use customer data with/ without permission ... Give them free stuff in exchange of data

Collect data from our phones everyday as we use apps



Help classify for science

<https://www.zooniverse.org/>



SNAPSHOT SERENGETI



WILDWATCH KENYA



Apps DuckDuckGo My Calendar PowerTeacher Evernote Digitalartforall email computersforcrea... Diseases & Cond... » | Other Bookmarks

**TASK****TUTORIAL**

Is there an animal, human, vehicle, or fire in this image?

Yes

No

NEED SOME HELP WITH THIS TASK?

Done & Talk

Done

FIELD GUIDE





TASK

TUTORIAL

Like	Pattern	Color	Horns	Tail
------	---------	-------	-------	------

Build

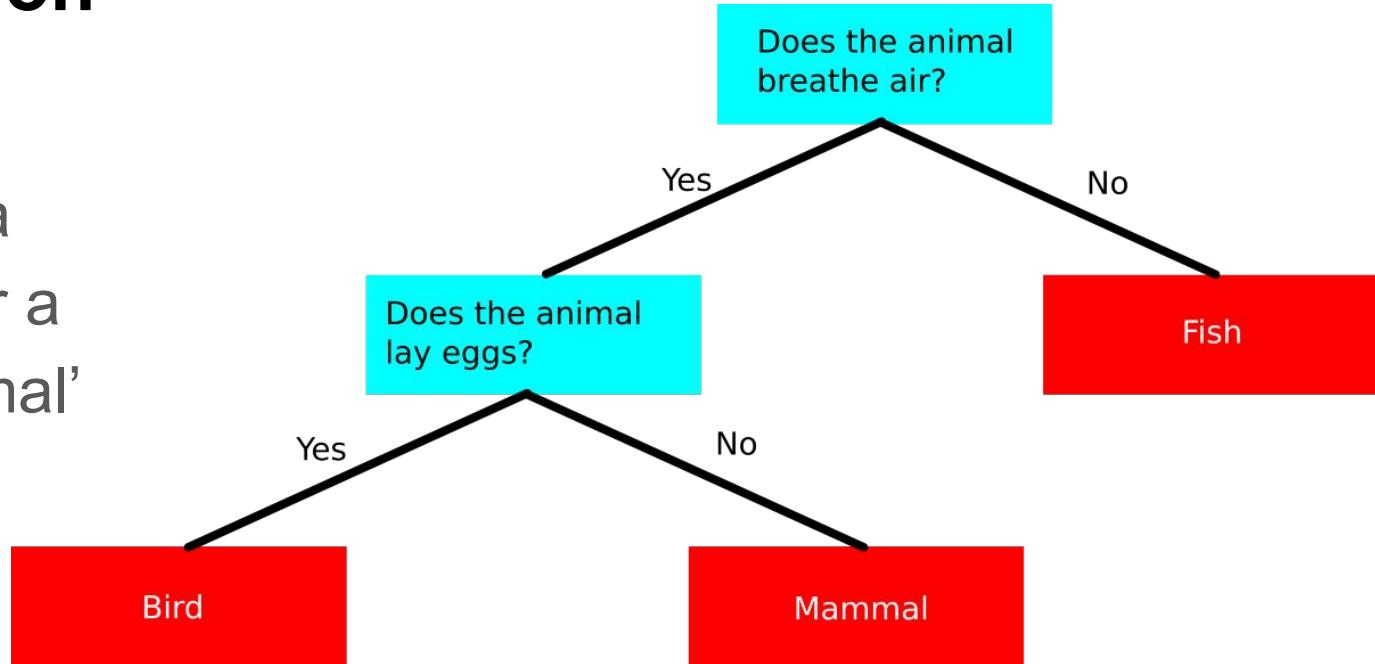
Aardvark	Gazelle	Kudu
Aardwolf	Genet	Leopard
Baboon	Gerenuk	Leopard Tortoise
Bat-eared Fox	Giraffe	Lion
Bird (other)	Ground Squirrel	Livestock
Buffalo	Guinea Fowl	Mongoose
Bushbuck	Hare	Oryx
Caracal	Hartebeest	Porcupine
Cheetah	Hippopotamus	Serval
Civet	Honey Badger	Vervet Monkey
Crane	Human/Vehicle	Warthog
Dik Dik	Hyena	Waterbuck
Duiker	Impala	Wild Dog



Representation

ACTIVITY :

Students build a decision tree for a ‘Guess the Animal’ game

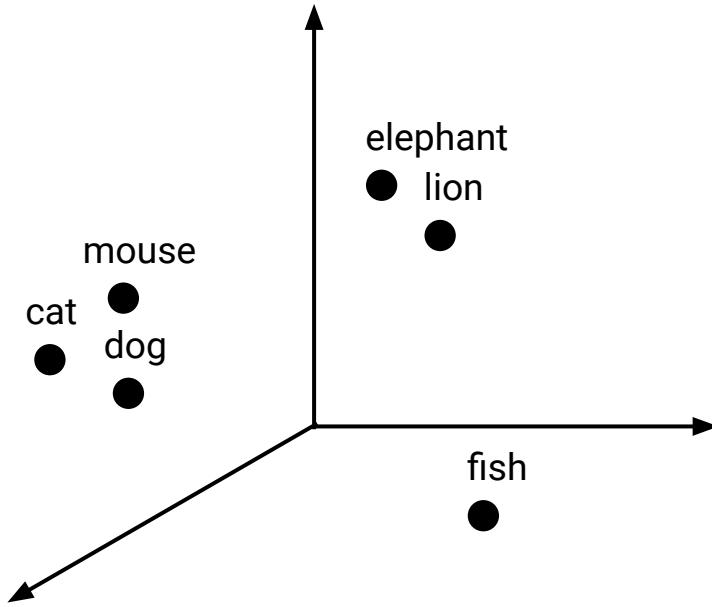


Vector representation : turn Yes / No to 1 / 0

	breathe	air	lay eggs	has hair	4 legs	is a pet	in a jungle	has wings
fish	0	1	0	0	0	1	0	0
dog	1	0	1	1	1	1	0	0
lion	1	0	1	1	1	0	1	0
elephant	1	0	0	1	0	0	1	0
bird	1	1	0	0	0	1	1	1



Imagine a multi -dimension space



This is just a possible way to visualize - it is NOT accurate by any measure!



Teaching AI in 9-12



A photograph of a dirt path winding through a dense row of large, mature trees. The trees have thick, textured trunks and are growing closely together, creating a natural canopy. The path is made of dirt and is surrounded by green grass. The perspective of the path leads the eye towards the center of the frame.

An AI Pathway

Three Tiers of AI4K12 in High School

AI User	CSforAll ... AI4All	Voice assistants, recommendations engines, facial recognition- we are all users of AI. Students may learn about the basic principles of AI technologies and the impacts of those technologies on society.
AI Manager	APCP/APCSA	As students learn CS, they may create projects and applications that incorporate AI technologies. In our careers, many of us will “manage” AI too
AI Developer	Capstone Experiences	Students develop and train AI models using industry tools and practices. This experience is likely accompanied with a 4+ year math pathway.





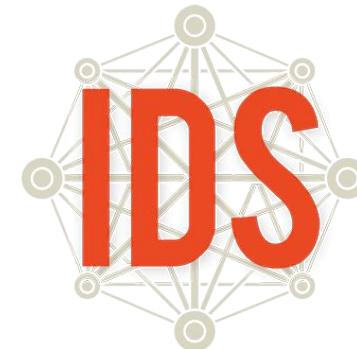
Three Tiers in Action - A Demo with Google Translate

AI User	Google Translate in a World Languages Course	<p>Students might compare and contrast the accuracy of the output of human and AI-powered translators.</p> <p>They might also use an AI-powered translator to hold a real-time conversation with a speaker of another language.</p>
AI Manager	Scratch and Python with Google Translate	<p>Students might incorporate an AI tool like Google Translate into a project using a web-based API.</p> <p>Scratch and Google Translate</p> <p>Google Translate API and Documentation for Python</p>
AI Developer	AutoML Translation with Google Cloud	<p>Students might train a machine learning model using the Google Cloud and the Google Translate API.</p>





Artificial Intelligence
Alternate Curriculum Unit



Introduction to Data Science

How to Implement AI in High School?

Machine Learning Exercises for High School Students
Researchers: Ramsey Young, Jonathan Ringenberg
Mentor: Dr. Qiuming Zhu

College of Information Sciences and Technology, University of Nebraska at Omaha, Omaha, Nebraska, USA

Introduction
Machine learning and neural networks have become key techniques for solving some of society's most difficult problems. This project will introduce students to machine learning which can lead to better decisions in the classroom and beyond. By the end of this project, students will gain the ability to create an informed opinion on machine learning and its potential applications.

Objectives

- High school students learn about perceptron neural network algorithms.
- Students will learn how to implement machine learning in their classroom.
- Create a list that effectively teaches students about the concepts of machine learning and neural networks.
- Expose students to several neural network algorithms.
- Research and discuss with students social issues related to neural networks and machine learning.

Methods

- Locate and implement various existing examples of neural networks.
- Create a list that effectively teaches students about the concepts of machine learning and neural networks.
- Create a list that effectively teaches students about the concepts of machine learning and neural networks.
- Using a LERFT survey administered before and after the completion of the project to evaluate the effectiveness of machine learning lessons and resources taught to students.

Measures

Comparing Attitudes Survey V3.0

Comparing student perceptions of computer science. Additional questions have been added to gather information on student attitudes towards machine learning and advanced computing topics.

Instructional Materials

Students will learn about a perceptron neural network through a series of activities. These activities include several core concepts that are hard coded to go around the track. Students will work in pairs to complete the activities. Each activity has two notebooks each responsible for separate parts of the car's behavior.

Various worksheets and instructional materials

These worksheets and instructional materials are designed to support the implementation of machine learning exercises. They include various worksheets and classroom activities related to machine learning.

Research Paper References

Research Paper References for Teachers under Grant No. CNS-07111306



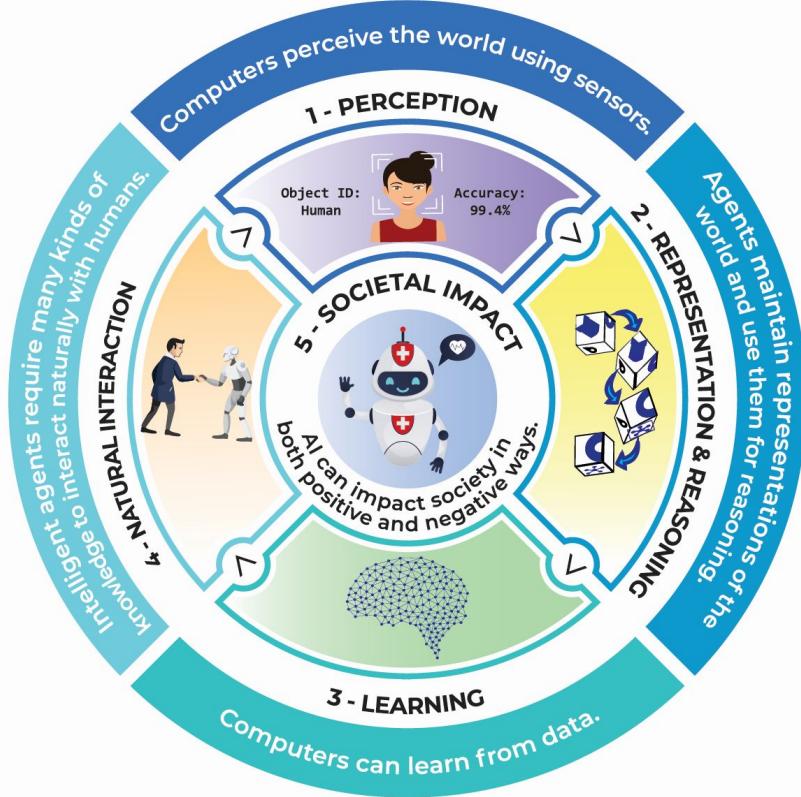
Examples of AI Implementation Across The Three Tiers

AI User	Academic Integration, Introductory CS, Data Science	Bootstrap UCLA CenterX Introduction to Data Science Exploring Computer Science AI Unit
AI Manager	AP CS Principles Content, Support for Create and Explore (RIP) PT	CS Principles Unit ISTE AI Project Guides (Coming Soon!)
AI Developer	Capstone Course Experience	Machine Learning Crash Course Machine Learning as a Service - ISTE AI Project Guides



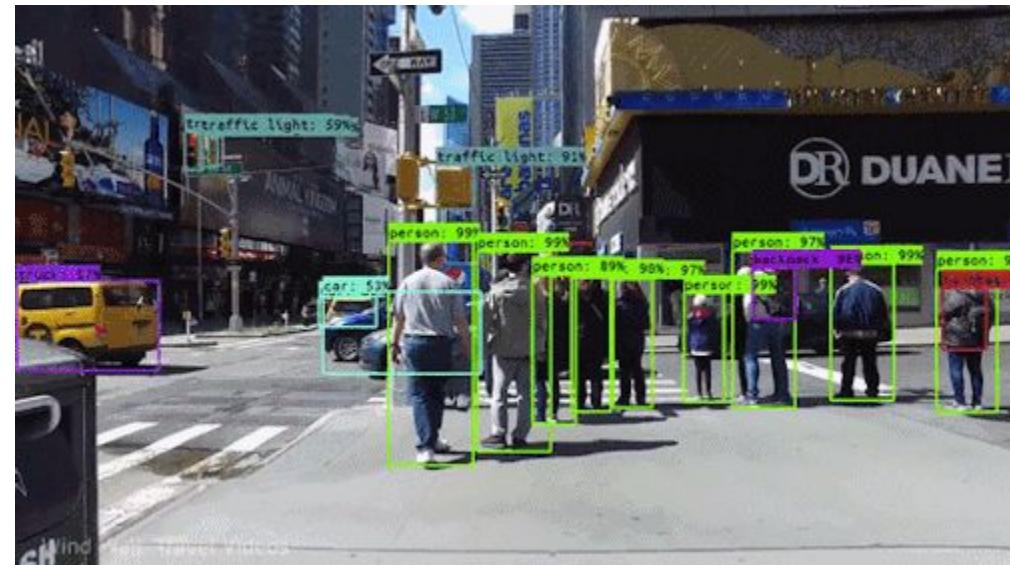
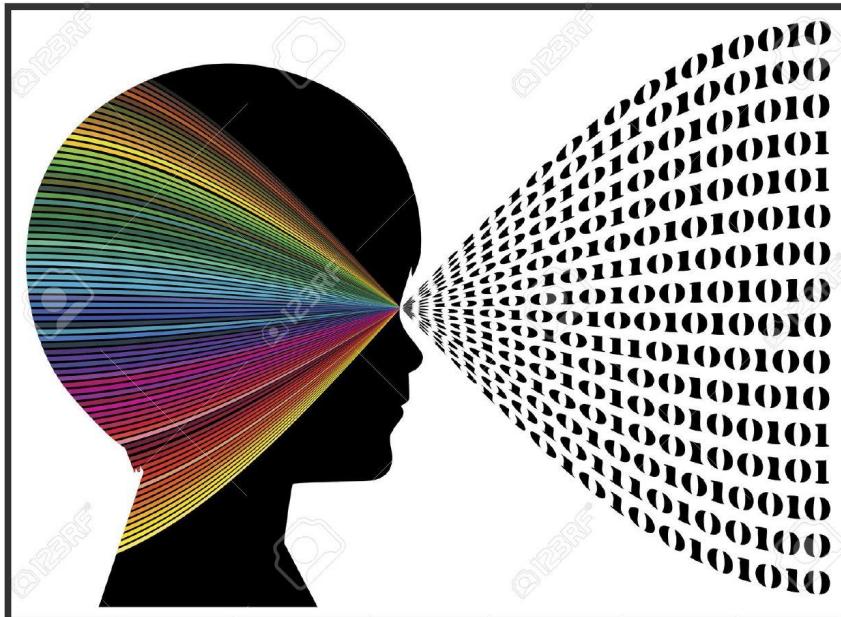


Five Big Ideas in AI



Big Idea #1: Perception

Computers perceive the world using sensors.

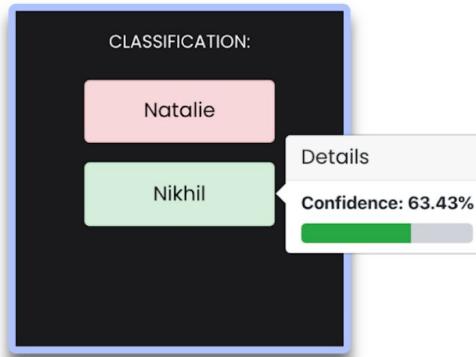
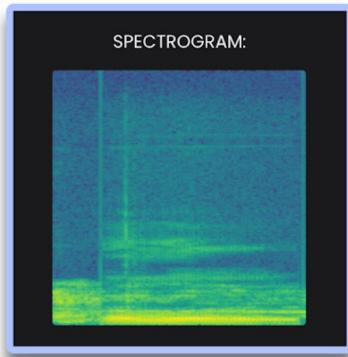


Perception is the extraction of *meaning* from sensory signals.

What types of sensors could be used to generate a dataset for an AI model?

Feel free to share examples in the chat.

Personal Diary in AppInventor

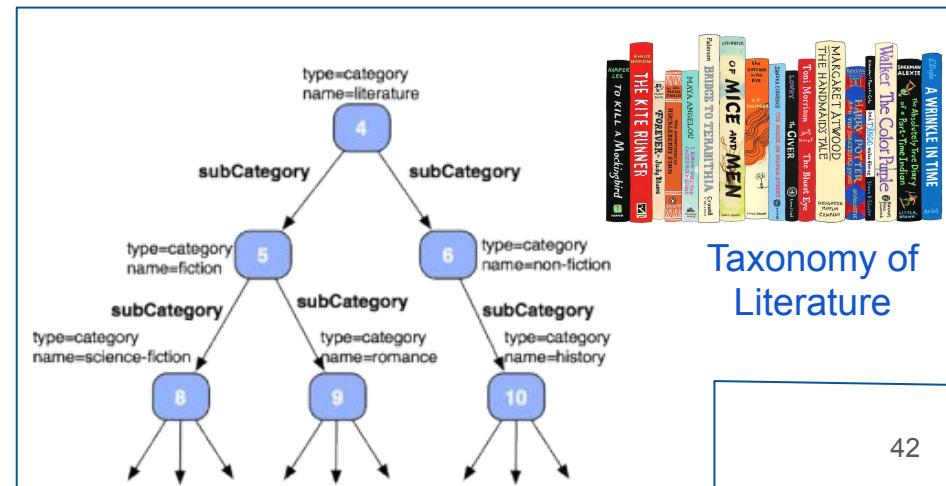
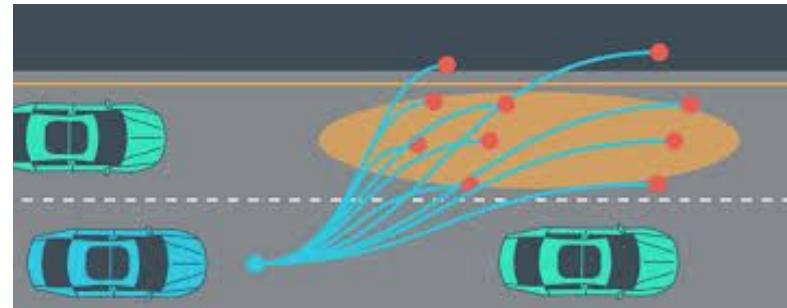


Export

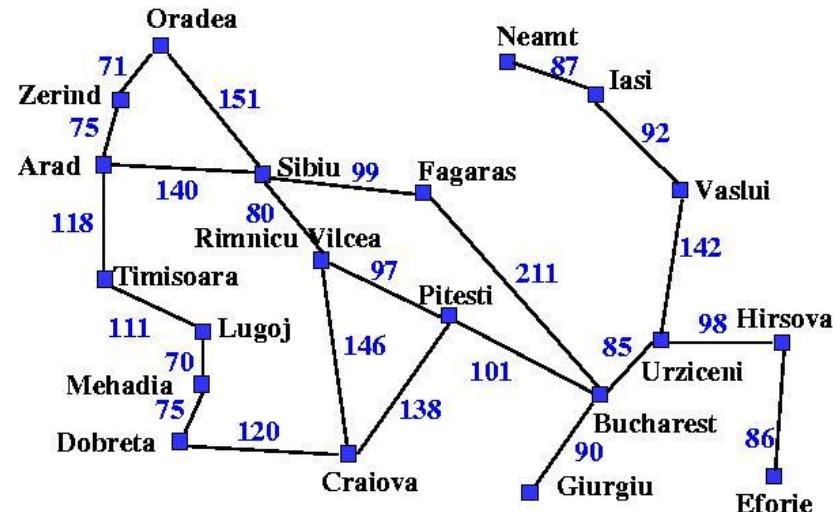
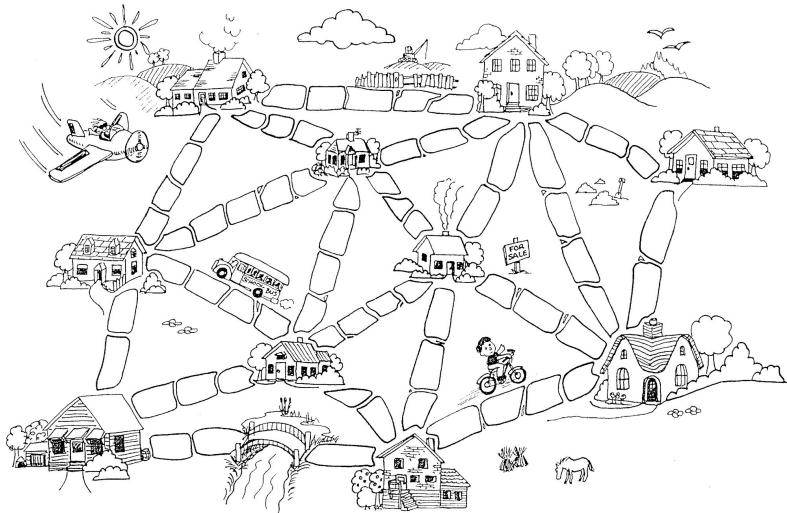


Big Idea #2: Representation and Reasoning

Agents maintain representations of the world, and use them for reasoning.



Muddy City Problem



Rock Paper Scissors

		Player B		
		R	P	S
Player A		R	0	-1
		P	1	0
		S	-1	1

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Rock-Paper-Scissors: You vs. the Computer

Computers mimic human reasoning by building on simple rules and statistical averages. Test your strategy against the computer in this rock-paper-scissors game illustrating basic artificial intelligence. Choose from two different modes: novice, where the computer learns to play from scratch, and veteran, where the computer pits over 200,000 rounds of previous experience against you.

Note: A truly random game of rock-paper-scissors would result in a tie statistic for each player winning, tying and losing one-third of the time. This game uses a slightly modified algorithm so that ties are included and analyzed. While this computer won't win all rounds, over time it can exploit a person's tendencies and patterns to gain an advantage over its opponent.

HUMAN VS. COMPUTER

Choose your opponent:

Novice

Veteran

Play against a computer that has no previous experience and learns to play based solely on your tendencies.

Play against a computer that uses data gathered from thousands of games of rock-paper-scissors across other people.

By GABRIEL DANZIG and TOM JACKSON | Send Feedback
Additional Programming: Xayanin V. and Paul Lau/The New York Times
Revised game data courtesy of Green Beams

Related Links

- Amicus of Expansive Lawyers, Replaced by Cleverer Software

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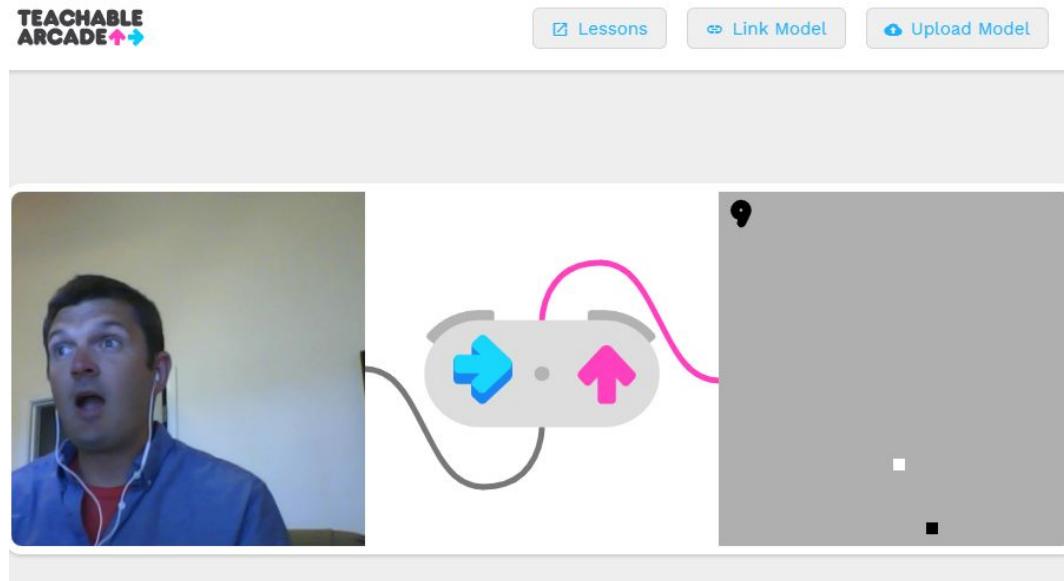


Big Idea #3: Learning

Computers can learn from data.



Teachable Arcade

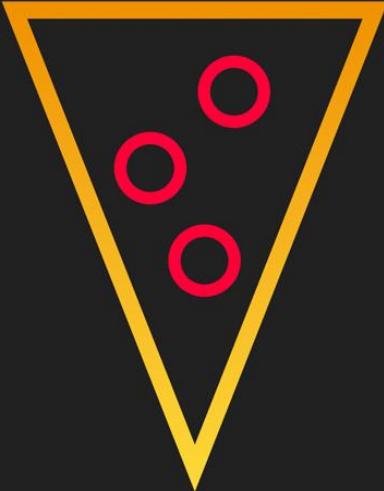


Neural Network Building Game



Slice of ML

Slice of Machine Learning



PIZZA

SLICE OF
MACHINE LEARNING

Can you train a computer to identify pizza? Learn how in this interactive tutorial that teaches you how to build a machine learning classification model using a decision tree.

LET'S DO THIS

Google

The image shows a promotional card for a machine learning tutorial. It features a large yellow downward-pointing triangle containing three red circles. To the left of the triangle are small yellow arrows pointing up, down, left, and right. The word "PIZZA" is written at the bottom of the triangle. To the right of the triangle, the text "SLICE OF MACHINE LEARNING" is displayed in white. Below this, a paragraph describes the tutorial: "Can you train a computer to identify pizza? Learn how in this interactive tutorial that teaches you how to build a machine learning classification model using a decision tree." A yellow button labeled "LET'S DO THIS" is located at the bottom. The word "Google" is in the bottom right corner.



Big Idea #4: Natural Interaction

Intelligent agents require many types of knowledge to interact naturally with humans.



Humans are among the hardest things for AI agents to understand.

Create a Chatbot

```
(env) Dales-MBP:python dalelane$ python chatbot.py
What would you like to know about owls?
> How many types of owl are there?
There are over 200 species of owl. Some common ones include Barn Owls, Eagle Owls, Snowy Owls, Elf Owls, Great Horned Owls, and Tawny Owls.

> What sort of things do owls eat?
It depends on the species of owl. Small owls eat invertebrates (such as spiders, insects and worms). Larger owls eat animals like fish, birds, mice, shrews and voles.

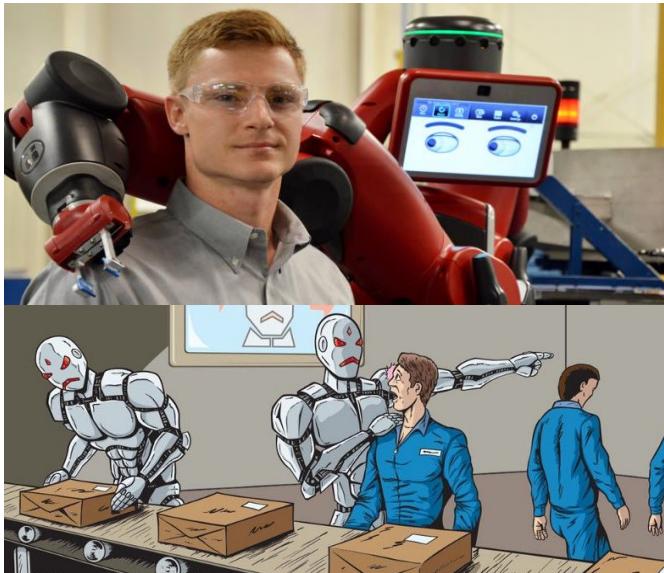
> What is the capital city of France?
I don't understand. Ask me something else!
```

> █

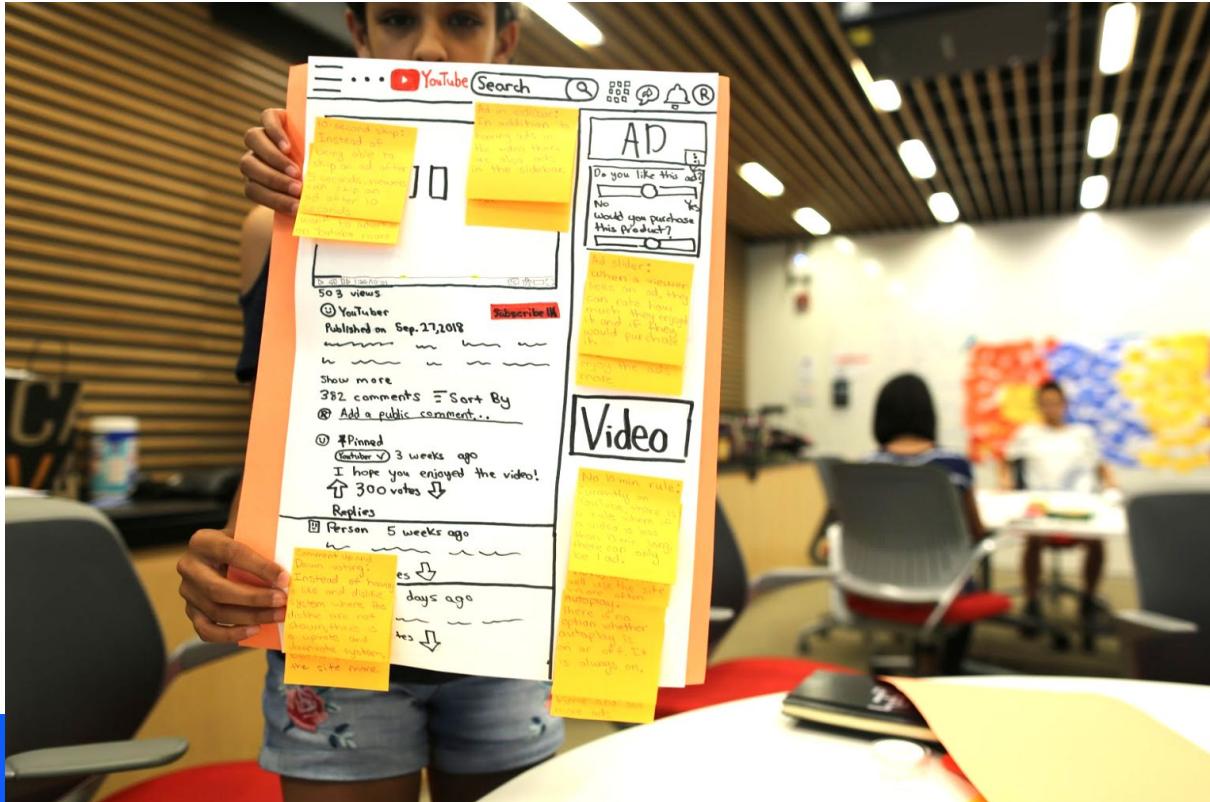


Big Idea #5: Societal Impact

“Artificial Intelligence can impact society in both positive and negative ways.”



MIT AI + Ethics Unit



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Questions?



Additional 6-12 AI Instructional Resources

Find more Learning Activities for Teaching AI in 6-12 on the AI4K12 website: www.ai4k12.org



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