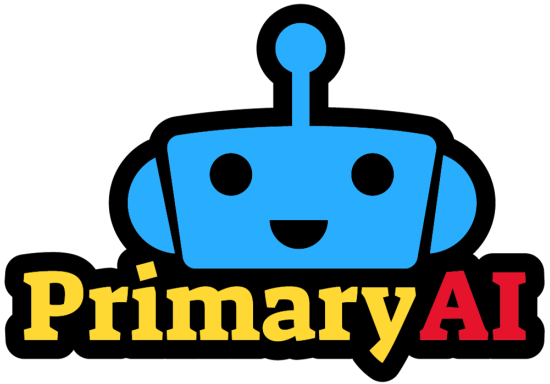
Teaching Computer Science (CS) & Artificial Intelligence (AI)

Project Description

- Building Capacity for Indiana Preservice Computer Science Education.
- IN DOE grant
- PDs & Workshops

AGENDA

- What is CS?
- Why to Teach CS?
- How to Teach CS, AI? Example Curriculum
- Reflections



OBJECTIVES

- To define CS
- To recognize the role of CS in education
- To identify curriculum and strategies of teaching CS
- To reflect and plan next steps

Ice-breaker

- What is CS?
- Why do we teach CS?

Link: **bit.ly/BCPCS2**

1.

What is CS?

Computer science (CS) is the study of computers and algorithmic processes, including their principles, their hardware and software designs, their applications, and their impact on society

Tucker, 2003, p. 6

Where is CS used?

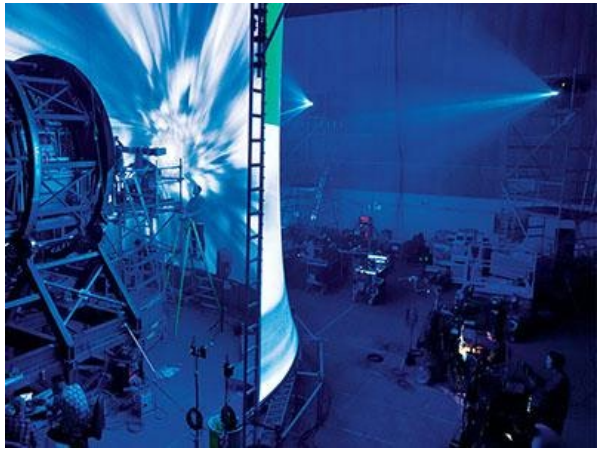
INFORMATION TECHNOLOGY

Designing security software or developing mobile communication devices, networks and applications

MANUFACTURING

Designing and using simulations to improve products

ART



Designing new special effects for movies or composing digital music

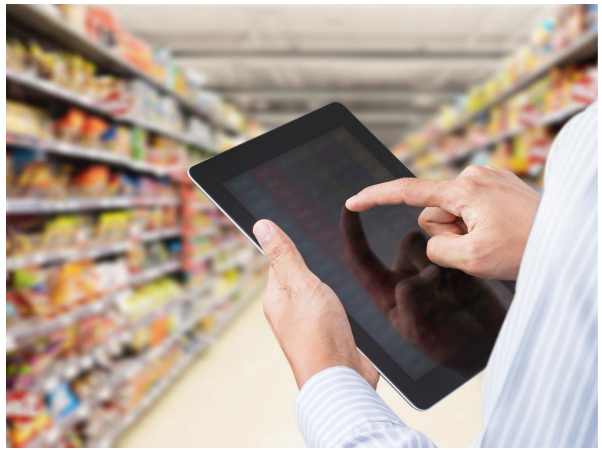
FINANCIAL SERVICES

Designing and overseeing automated trading services

HEALTHCARE

Exploring the vast quantities of data produced by new DNA sequencing techniques, and more

RETAIL



Analyzing data to predict trends and improve inventory management

LAW ENFORCEMENT

Using CS and computer technologies in policing to detect, monitor and position.

ARCHEOLOGY/HISTORY

Analyzing data and patterns collected with latest technology to investigate history and people of the past.

AND MANY MORE …

- Sports analytics
- Radiology
- Entertainment
- Agriculture/farming
- Education
- And many more …

2.
Why to teach CS?

CS IS IMPORTANT BECAUSE…

Not all of today's K-12 students will need to develop their own machine learning algorithms…

…but most will need to be able to identify, understand, and resolve the critical issues around the use of tomorrow's technology

Background of CS in Indiana

SEA 172 Signed Into Law May 2018

"**After June 30, 2021**, each public school, including each charter school, shall include computer science in the public school's curriculum for students in kindergarten through grade 12."

CS Must incorporate K-8
Must offer *at least 1* high school CS course

Adapted from slide created by Jake Koressel

Indiana K-12 Computer Science Standards

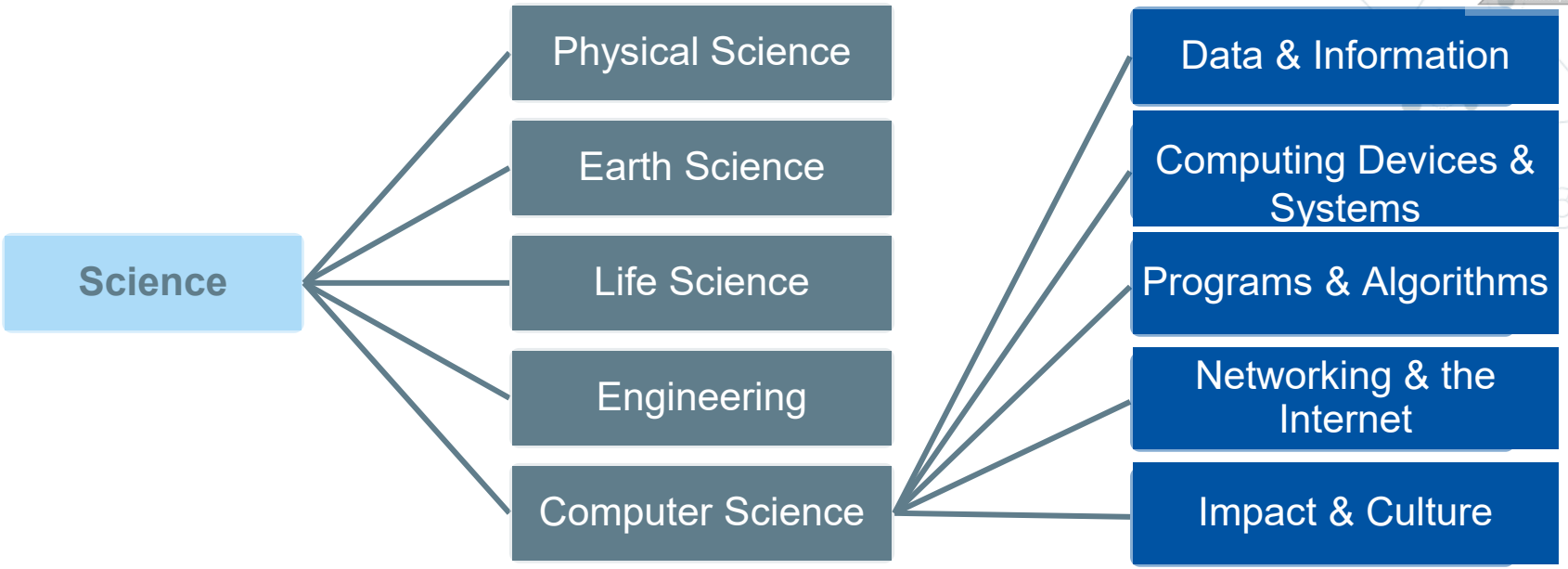
What is Computer Science?

Computer science is “the study of computers and algorithmic processes, including their principles, their hardware and software designs, their [implementation], and their impact on society” (Tucker et. al, 2003, p. 6).

Computer science has also been defined as “the study of computers and ALL the phenomena that arise around them” (Herbert Simon).

Indiana’s Standards

Indiana’s Academic Standards for Computer Science allow for students to be prepared in the everchanging computer science areas providing inquiry-based, hands-on experiences based on two components: Concepts and Practices. K-8 standards have been in place and implemented since 2016 and high school course standards have existed for some time. Particularly in K-8, computer science standards can be integrated into various other subject areas. A variety of elective courses are available for high schools. As students move through grade levels, they will work with and experience the standards at those grade bands (K-2, 3-5, 6-8, and 9-12). The standards are based on the following core concepts and core practices:



K – 8 Science Standards

Adapted/updated from slide created by Jake Koressel

INDIANA - A RECOGNIZED LEADER IN CS EDUCATION

Kathleen Gallagher: Indiana is far ahead of other Midwest states in crucial computer science training

By Kathleen Gallagher Special to the Journal Sentinel

Published 2:48 p.m. CT Oct. 20, 2020 | **Updated 8:22 a.m. CT Oct. 22, 2020**

View Comments

When Pump-CS went virtual this summer, twice as many middle school teachers as expected signed up to learn how to teach computer science. So Marquette University professor Dennis Brylow, who runs Pump-CS, scrounged up two additional facilitators and all 50 teachers got trained.

It was no surprise the extra help came from Indiana.

Indiana Once Again Identified as National Leader in Computer Science Education

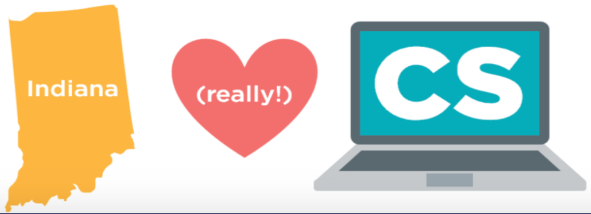
Wednesday, October 14, 2020
Adam Baker
Press Secretary
(317) 232-0550
abaker@doe.in.gov

INDIANAPOLIS – The Indiana Department of Education (IDOE) today shared a 2020 report highlighting Indiana a national leader in computer science education, for the second consecutive year. Created by Code.Org, the Computer Science Teachers Association, and the Expanding Computing Education Pathways Alliance, the 202

Indiana becomes third state in the country to adopt all 9 CS policies

Code.org Jan 18, 2019 · 2 min read

The state of Indiana has joined Arkansas and Idaho as one of just 3 states across the country that have adopted all nine of the Code.org Advocacy Coalition's policies. These policies cement computer science as a fundamental element in the state's education curriculum!



INDIANA CS STANDARDS

Core Concepts

- Data & Information;
- Computing Devices & Systems;
- Programs & Algorithms;
- Networking & the Internet;
- Impact & Culture.

Core Practices

- Fostering an inclusive computing culture;
- Collaborating around computing;
- Recognizing and defining computational problems;
- Developing and using abstractions;
- Creating computational artifacts;
- Testing and refining computational artifacts; and
- Communicating about computing.

CS Standards

- Work in pairs
- Match LOs with Standards

INDIANA CS STANDARDS

3.

How to Teach CS & AI?

CS & AI

Artificial intelligence is **a field, which combines computer science and robust datasets, to enable problem-solving (IBM).**

Artificial intelligence is a sub-discipline of computer science. AI, as a whole, tries to enable computers to mimic human intelligence in order to solve complex problems and make decisions at scale, in a replicable manner. (Rice University)

While it may be a decade or two before programming fundamentally changes, in the future software engineers will become designers, guiding AI as it writes code. Currently, there's a tremendous shortage of programmers. This technology will help fill that gap and increase production. (Rice University)

The Classic Three Steps for AI

ANI

Artificial Narrow Intelligence

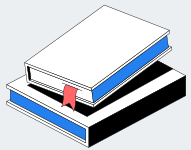
Better than human in one specific task

[machine translation]

AGI

Artificial General Intelligence

Capable like humans in every task



ASI

Artificial Super Intelligence

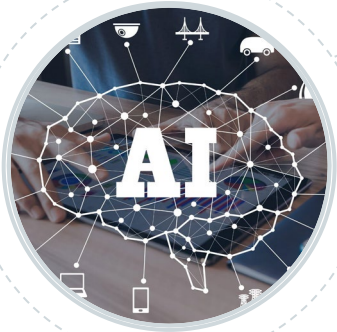
Better than humans in every task

Adapted from CEWIT workshop at IU

Credits: Jon Kohn. 2020. Deep Learning with TensorFlow

AI not AI

- Let’s identify AI generated text and images



BREAK TIME

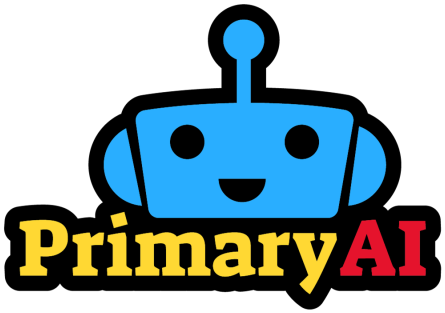
See you on Friday!

DAY 2
Teaching Computer Science (CS) & Artificial Intelligence (AI)

Pre-service teacher PD, Fall 2023
Oct. 13th

DAY 2: WELCOME BACK!

- Teaching Computer Science (CS) & Artificial Intelligence (AI), Pre-service Teachers PD
- Building Capacity for Indiana Preservice Computer Science Education.



Presenter | Dr. Susan Drumm

- Visiting Clinical Assistant Professor @ IUB
- Former public school teacher, librarian, and technology coach
- M.Ed. in Reading, M.L.S. in School Media, Ed.D. in Instructional Systems Technology
- Email: sdrumm@iu.edu

TODAY'S AGENDA

- What is CS?
- Why to Teach CS?
- **How to Teach CS, AI?**
  - **Example Curriculum & Activities**
- **Reflections**

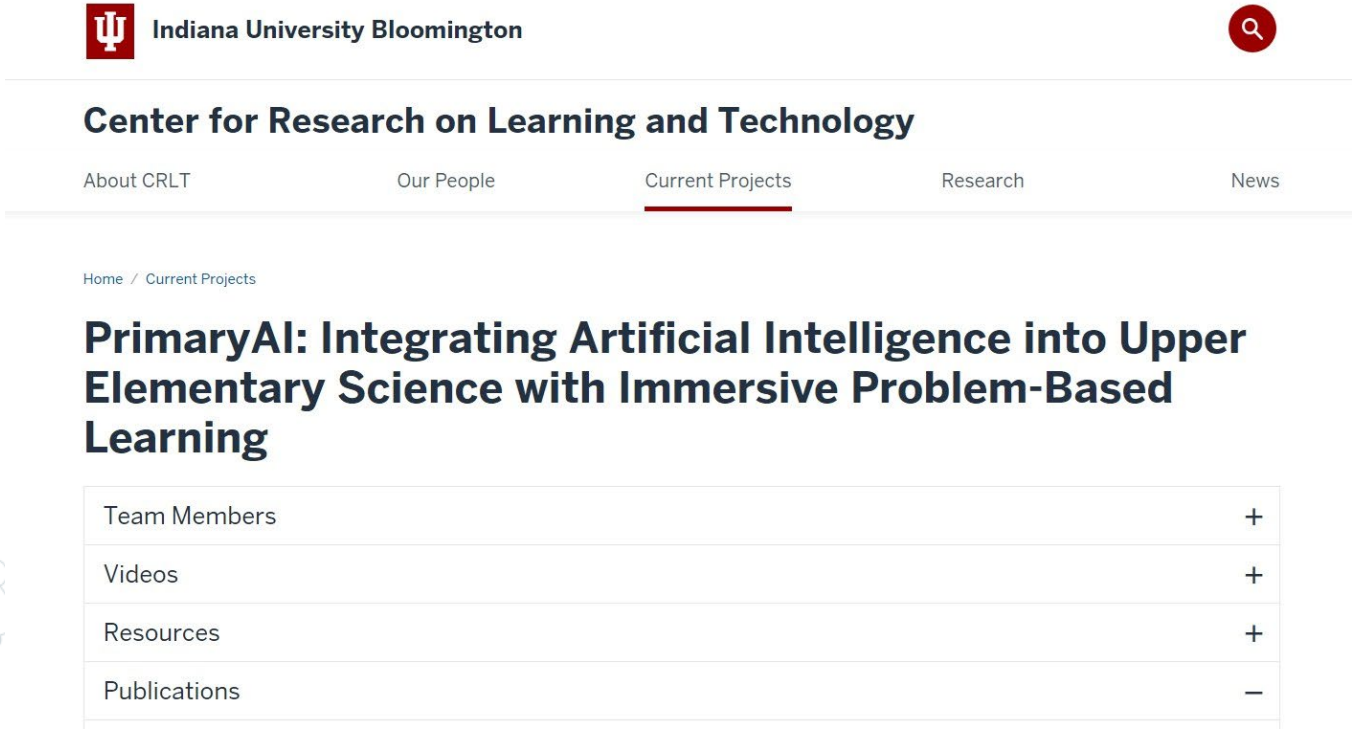
Ice-breaker

What have you learned so far?

3. (continued)

How to Teach CS & AI?

Primary AI | Curriculum (Grades 2-5)



CURRICULUM OVERVIEW

- Problem Based Learning
  - *Driving Question: How can we use our knowledge of science, computer science, and artificial intelligence to help understand and conserve animal populations and their ecosystems in our communities?*
- Life science, computer science, language arts
- Local connection:
  - *EX: Examining invasive species like deer in Bloomington*

Name: _____

Teacher: _____

Date: _____

Class: _____

Lesson #2: Making Scientific Observations

How do scientists make observations when they are outdoors?

First, Scientists start making observations with these important details.

- Date and Time _____
- Title: My scientific observations in the outdoors.
- Where are you located?

  _____

  _____
- Route (how did you get here?)

  _____

  _____
- Weather and light conditions (temperature, cloud types, wind, rain, etc)

  _____

  _____
- Habitat (backyard, park, school yard, forest, desert, wetland, etc with all major and dominant species noted)

  _____

  _____

What is AI?

Can a neural network learn to recognize doodling?

Help teach it by adding your drawings to the world's largest doodling data set, shared publicly to help with machine learning research.

Let's Draw!

Made with some friends from Google


The Future of Work

AI = Artificial Intelligence

AI is the process of computers learning and making decisions.

AI Subfields

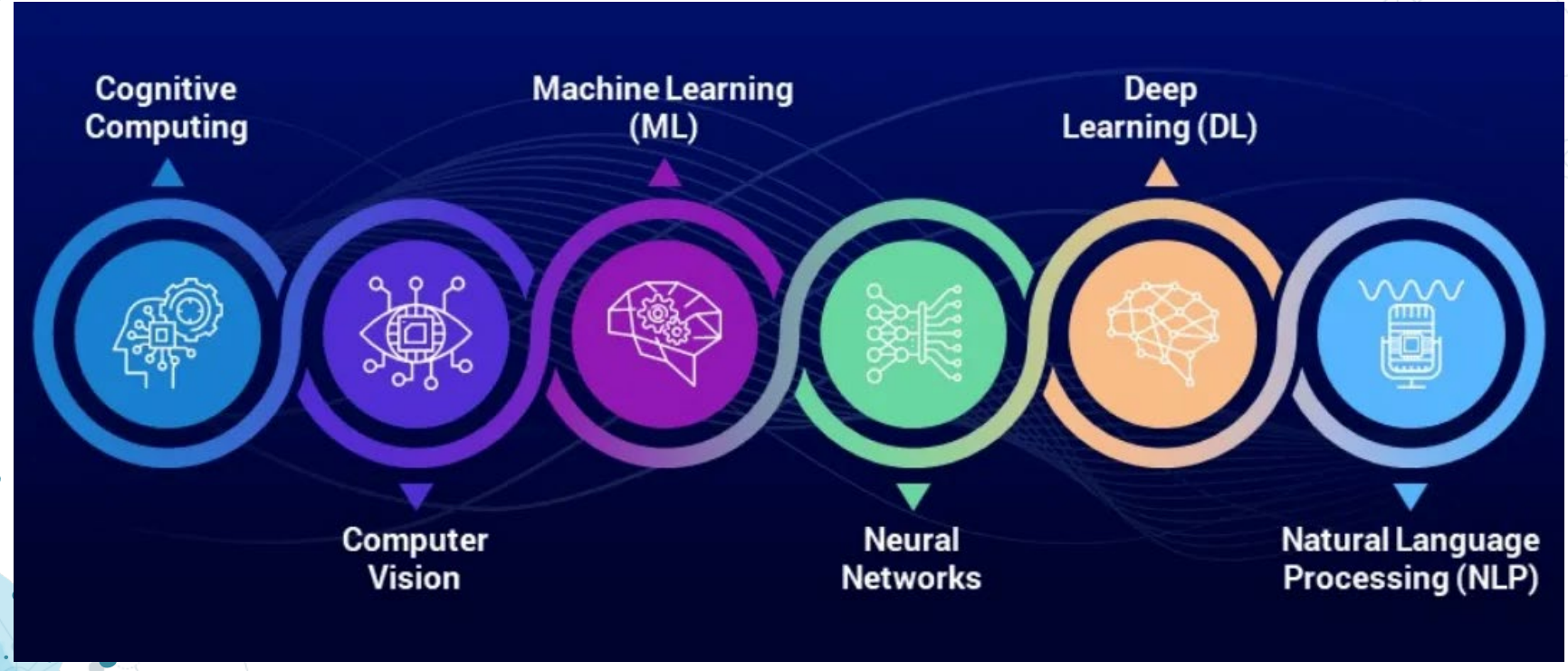
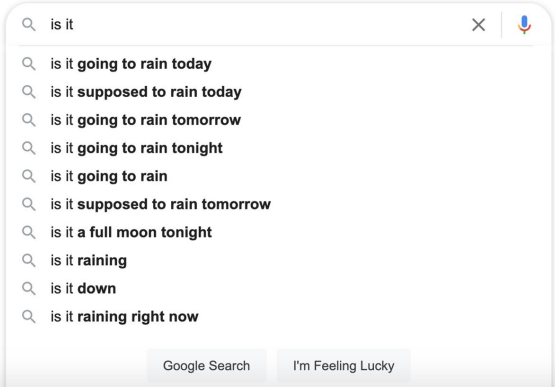


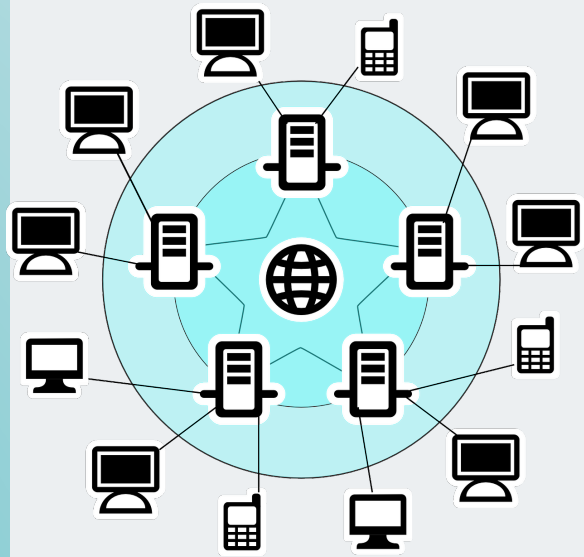
Image from Rancho Labs

So, what does AI look like?

Examples of AI



Examples of Things that are NOT AI



01

Unit 1

Introduction to ecosystems, population studies, and AI

Unit 1: Introduction to Ecosystems, Population Studies, and AI

01

Introduction to Ecosystems and Population Studies

02

What is AI?

03

What can AI do for us? *Why should we care?*

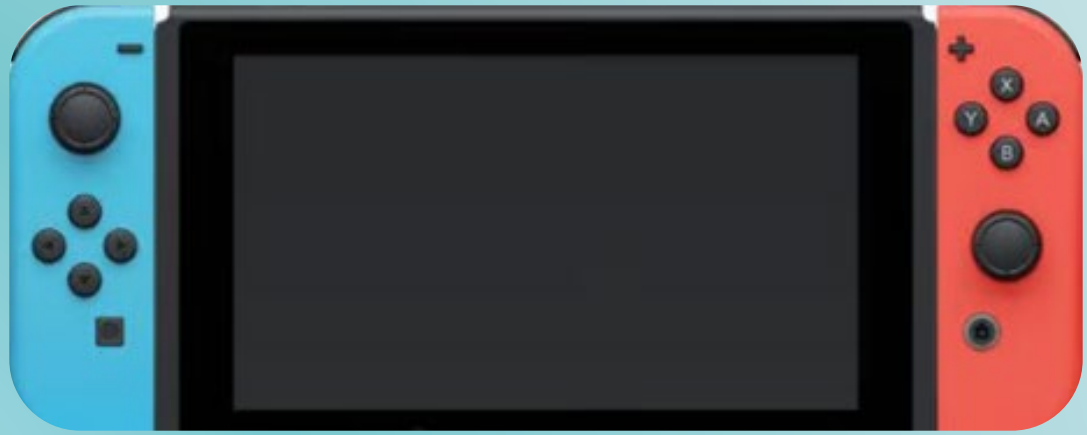
Siri

Spotify

Refrigerator

Dash and Dot

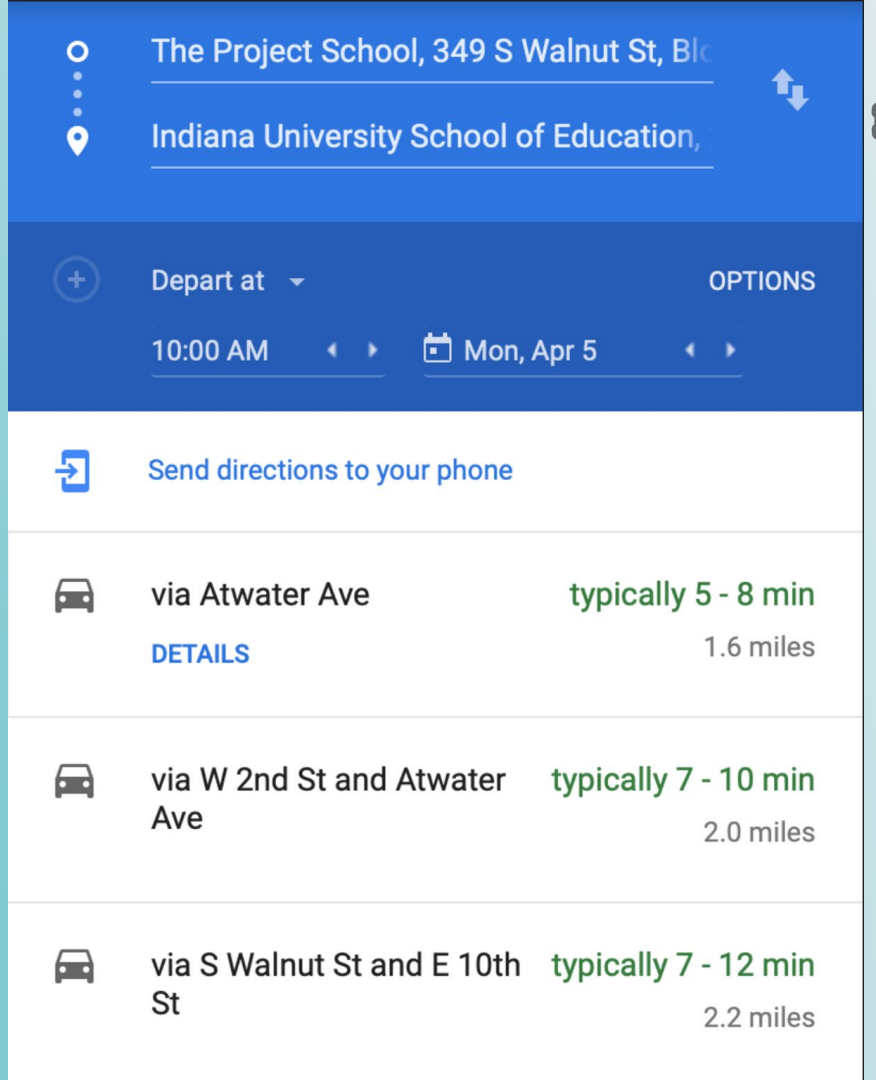
Nintendo Switch



Google Maps and AI

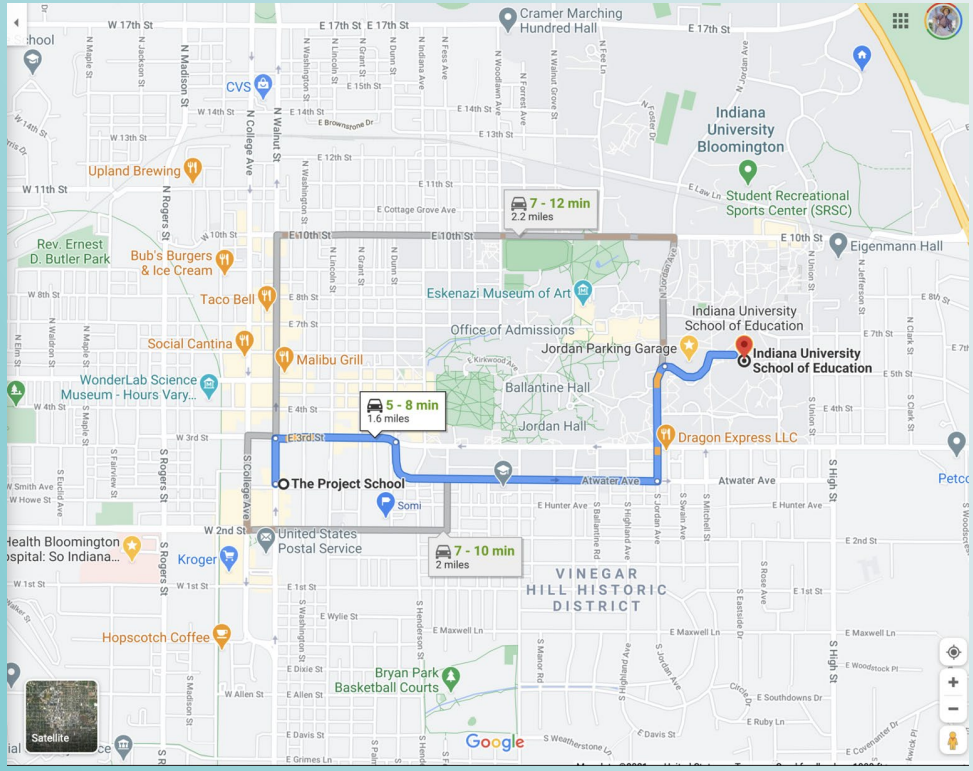
Google Maps help us plan out how to get from one place to another. Here's an example of a route to get from The Project School in Bloomington to the Indiana University School of Education.

Notice that there are 3 choices.



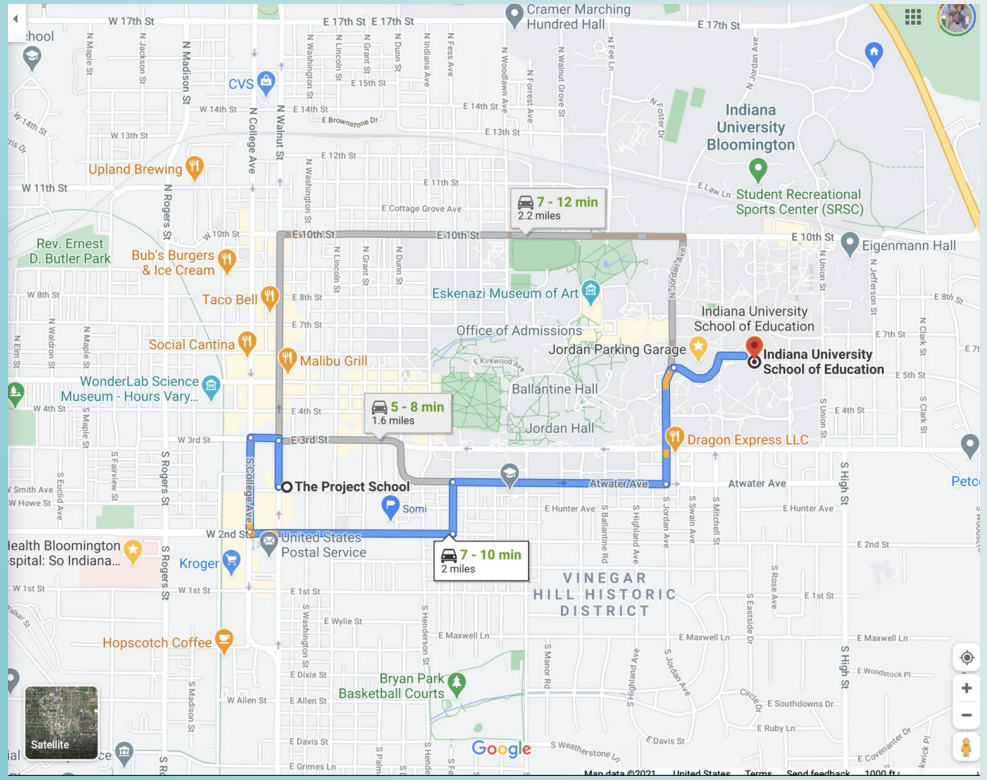
Google Maps and AI

Choice number 1 shows the shortest distance by number of miles



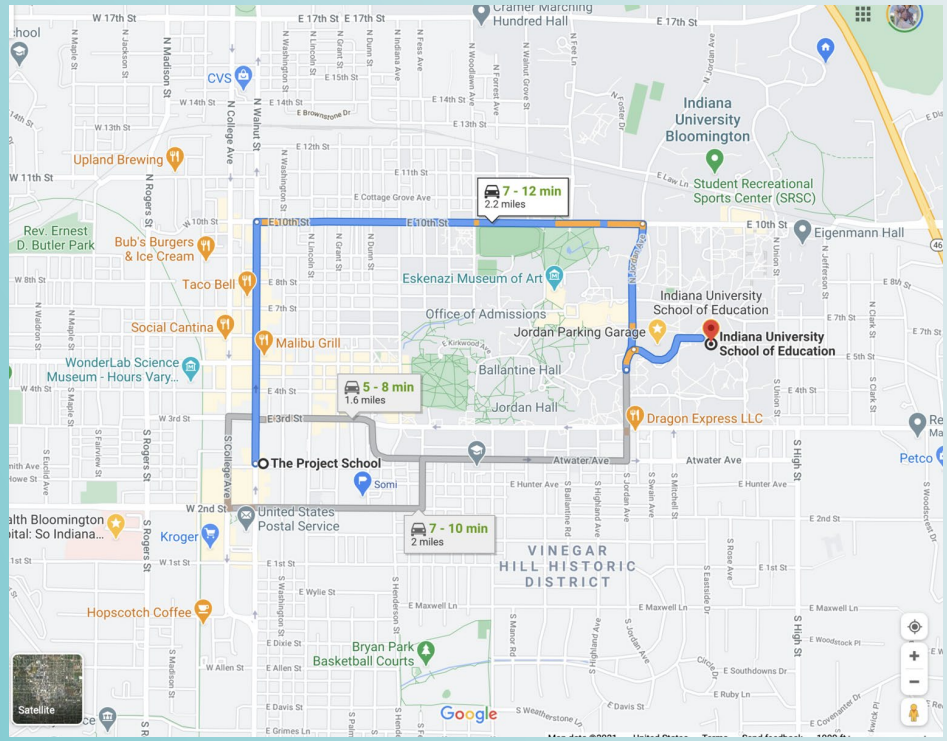
Google Maps and AI

Choice number 2 shows the next shortest route by number of miles



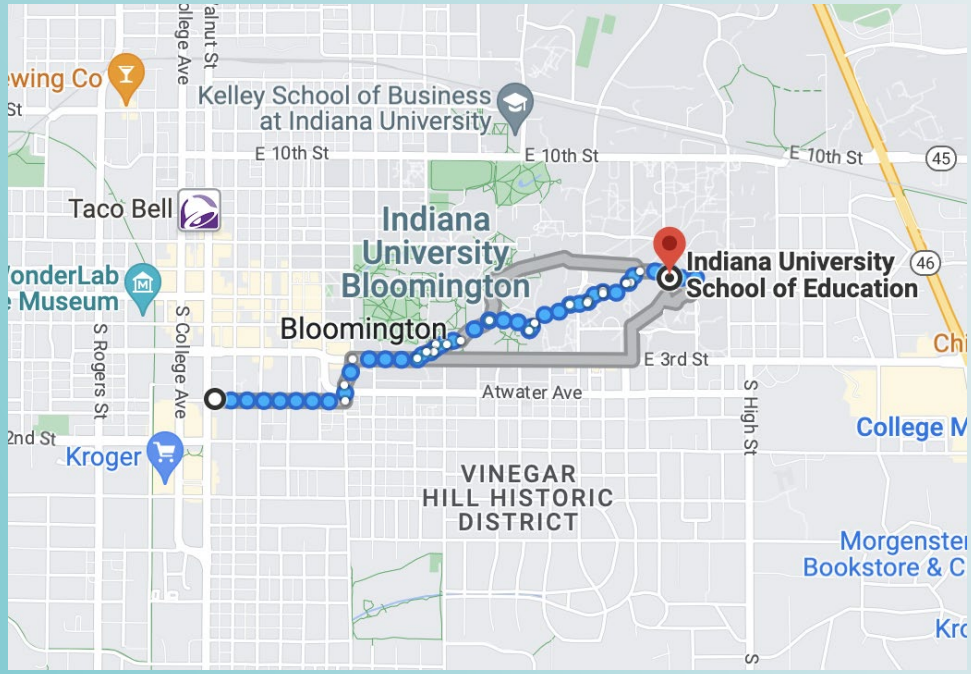
Google Maps and AI

Choice number 3 shows the next shortest route by number of miles



Google Maps and AI

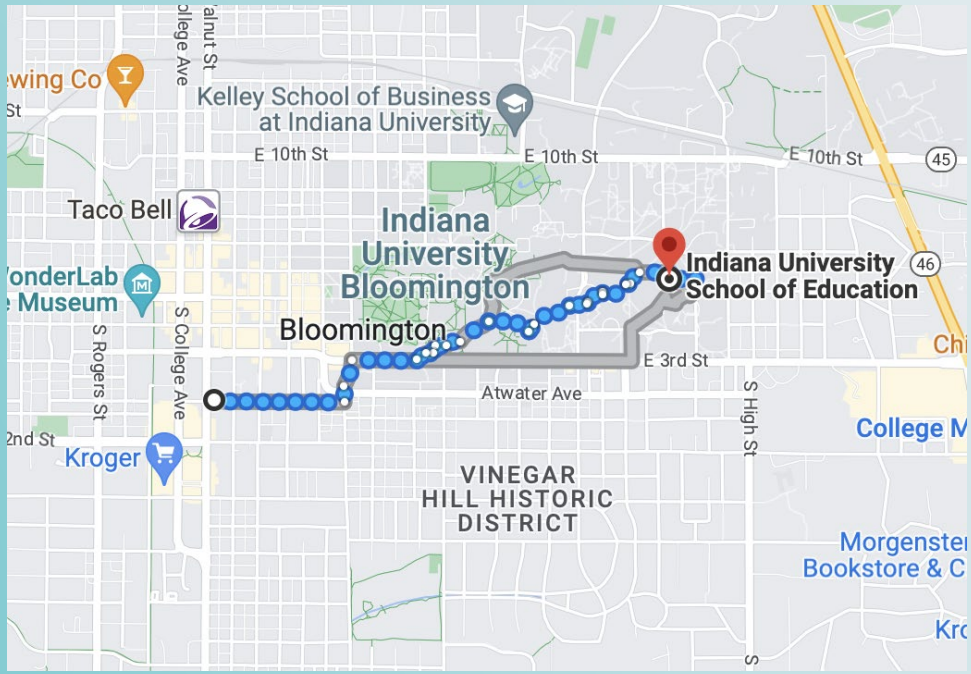
Choice number 4 shows how to get there by walking



Google Maps and AI

The AI will change while you are IN-ROUTE if there are better options.

AI is CONSTANTLY using data and assessing the plan



02

Unit 2

Computer Vision

Unit 2: Computer Vision

01

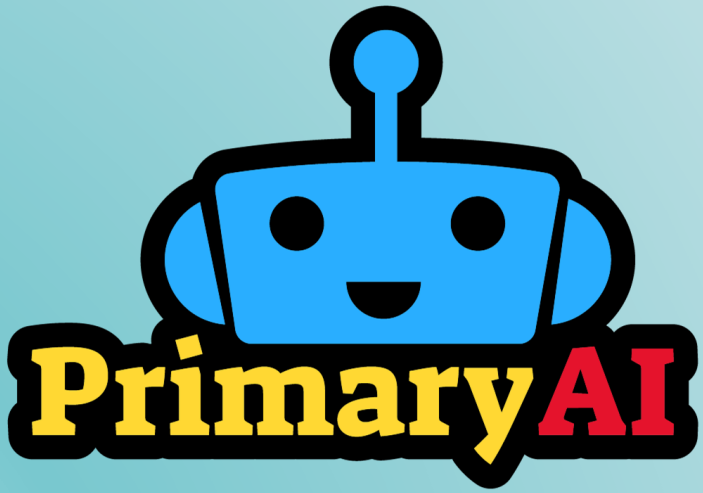
How do machines see and learn about the world around them?

02

How do computers see colors and lines?

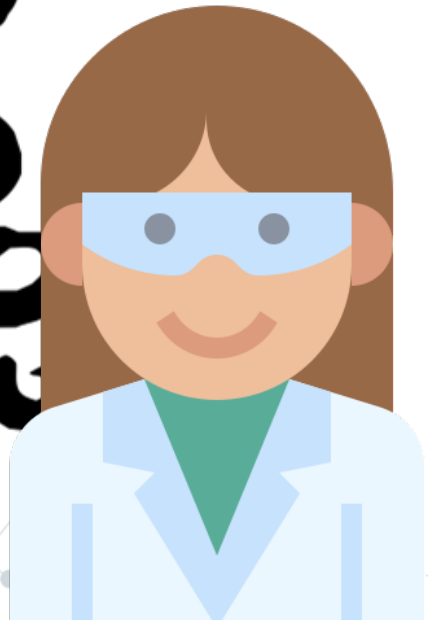
03

How do computers see shapes?



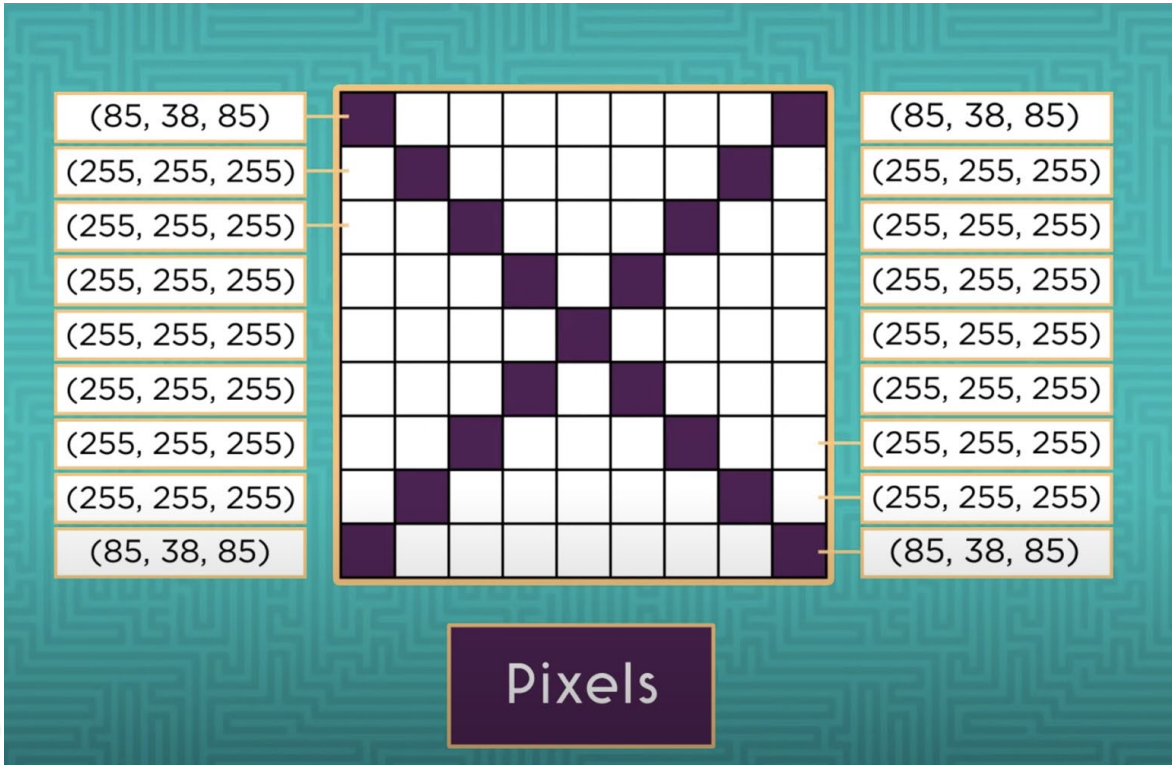
How Do Computers See Colors & Lines?

Animals, humans, and computers all use different senses to gather data.



COMPUTERS USE PIXELS TO “SEE” COLORS

COMPUTER VISION & PIXELS

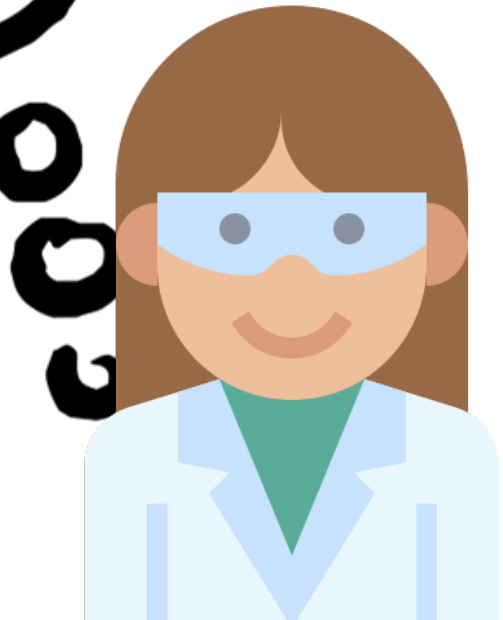


Can you think of some examples of pixels?

Can you think of some examples of pixels?

Pixels tell computers what colors to display.

Because computers don’t have eyeballs that detect colors, computers use what they can to understand colors.



NUMBERS!

How can computers use numbers to represent colors?


TURQUOISE
64
0
255
224
0
255
208
0
255
BINARY
R:01000000
G:11100000
B:11010000

COMPUTER VISION & PIXELS

Color	Color name	(R,G,B)	Color	Color name	(R,G,B)
	Black	(0,0,0)		Silver	(192,192,192)
	White	(255,255,255)		Gray	(128,128,128)
	Red	(255,0,0)		Maroon	(128,0,0)
	Lime	(0,255,0)		Olive	(128,128,0)
	Blue	(0,0,255)		Green	(0,128,0)
	Yellow	(255,255,0)		Purple	(128,0,128)
	Cyan	(0,255,255)		Teal	(0,128,128)
	Magenta	(255,0,255)		Navy	(0,0,128)

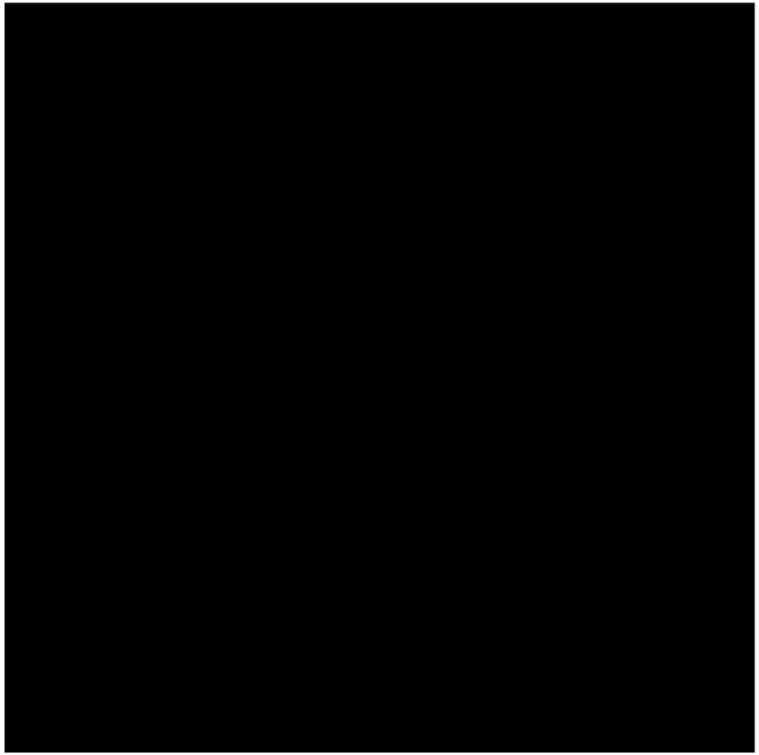
RGB Explorer

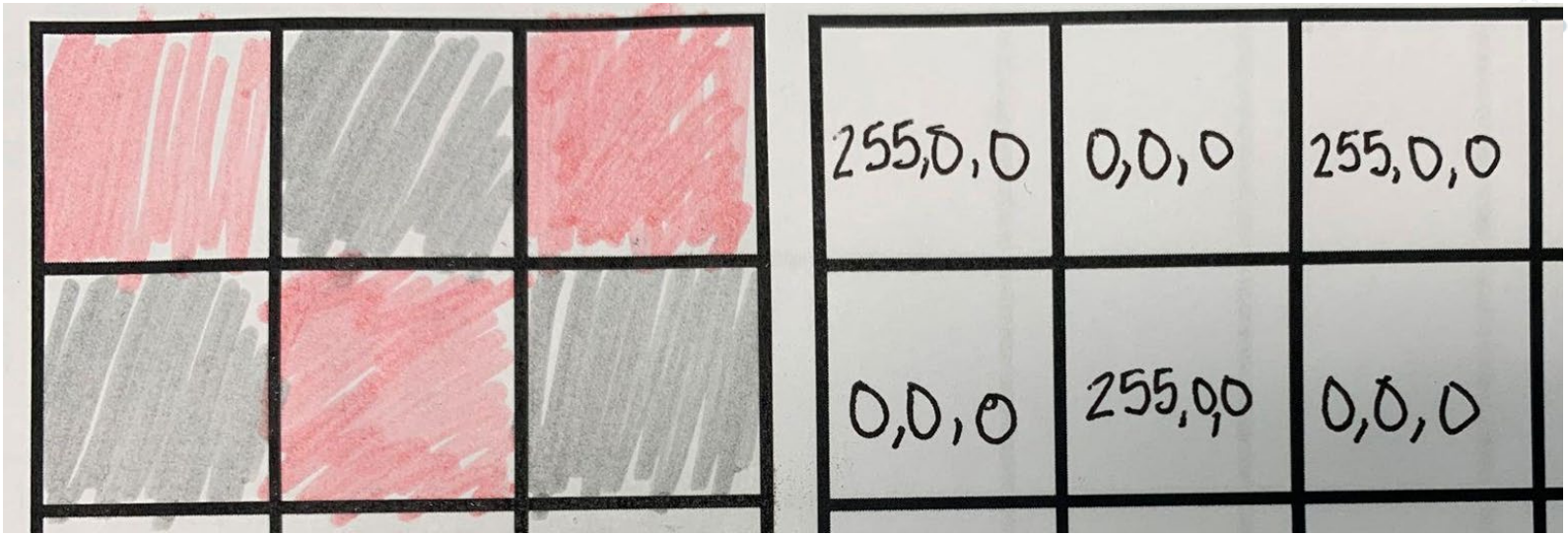
red:

green:

blue:

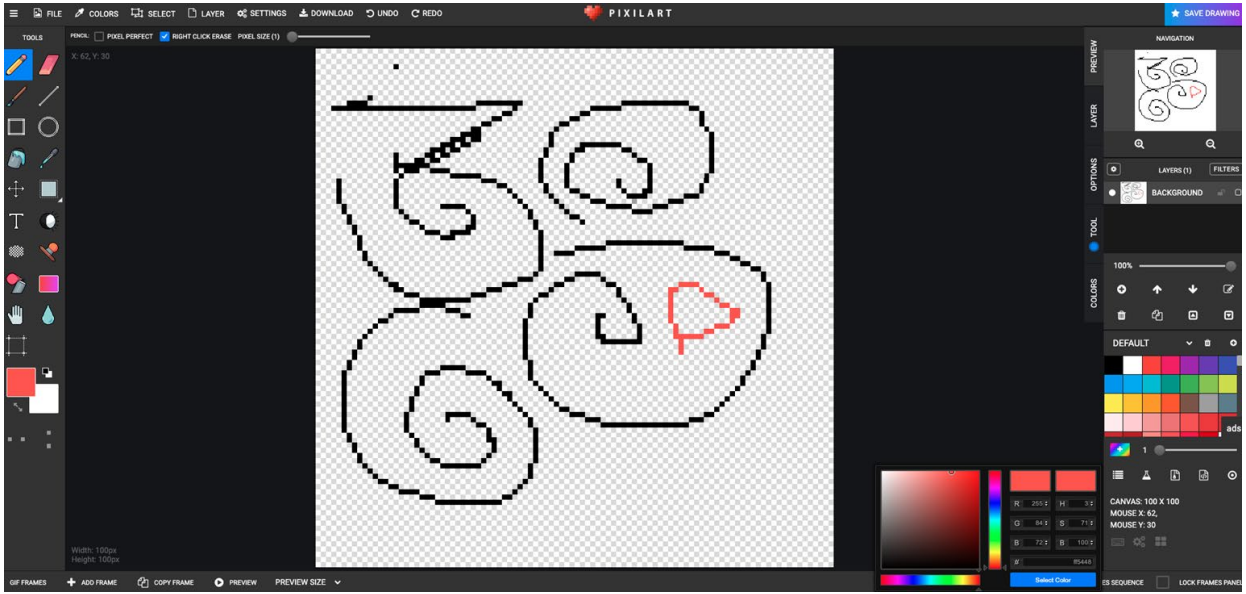
`red:0 green:0 blue:0`

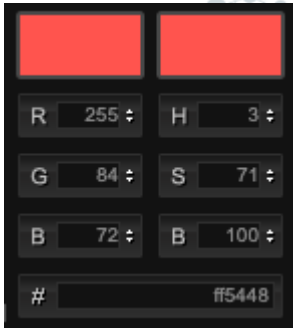



255,0,0
0,0,0
255,0,0
0,0,0
255,0,0
0,0,0

Let’s play with Pixels and make PixelArt!

OPTION #1: PIXEL ART: https://www.pixilart.com/

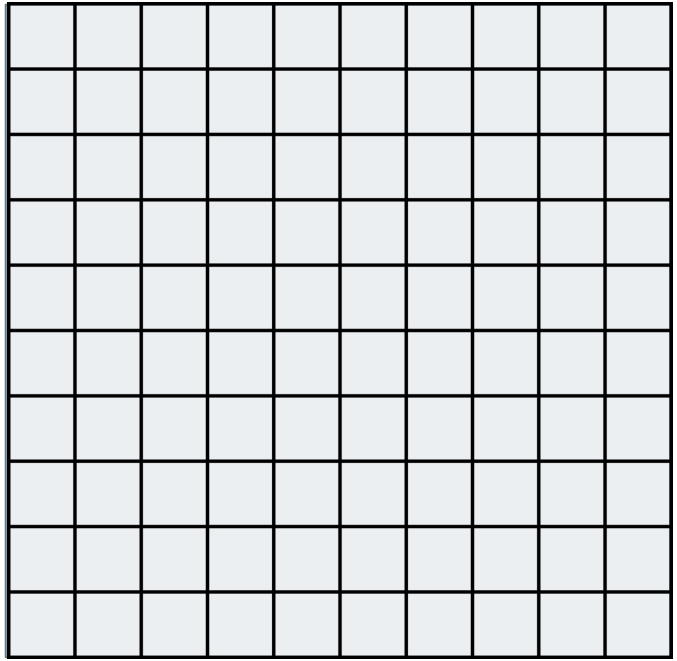


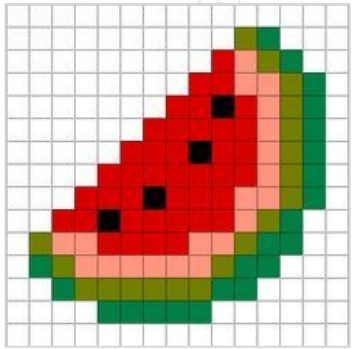


OPTION #2: GRAPH PAPER PIXEL ART

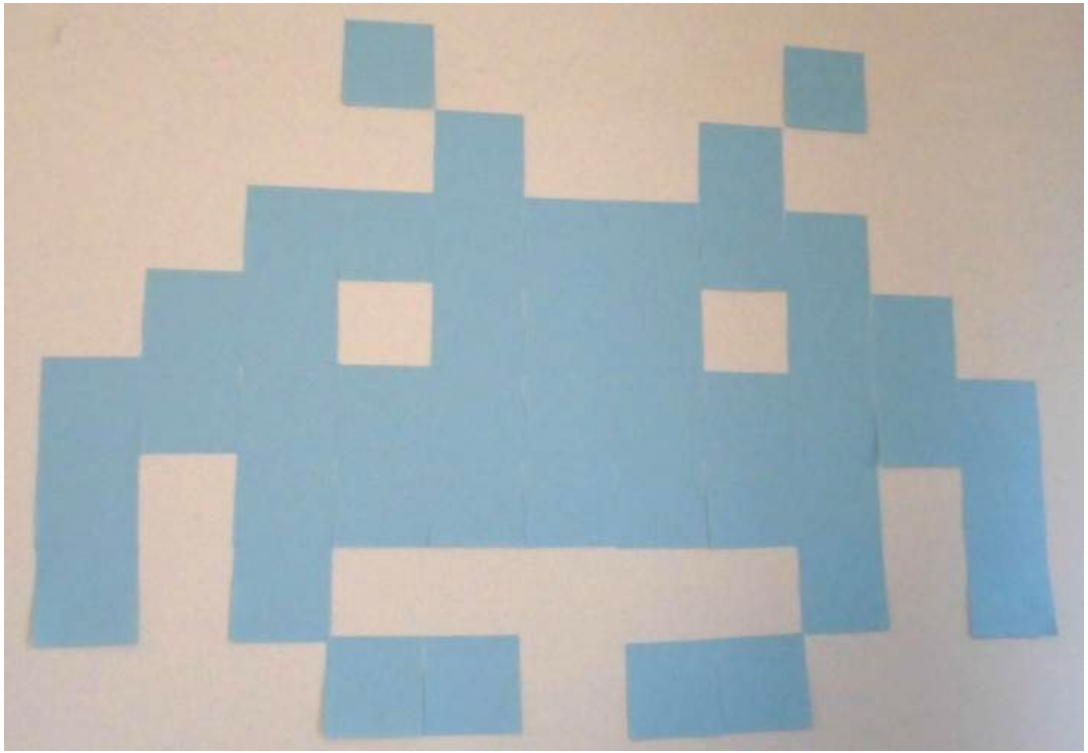
Ideas to get started:

- Animal
- Emoji
- Food
- Sport
- Hero





OPTION #3: POST-IT NOTES



03

Unit 3

Machine Learning

Unit 3: Machine Learning

01

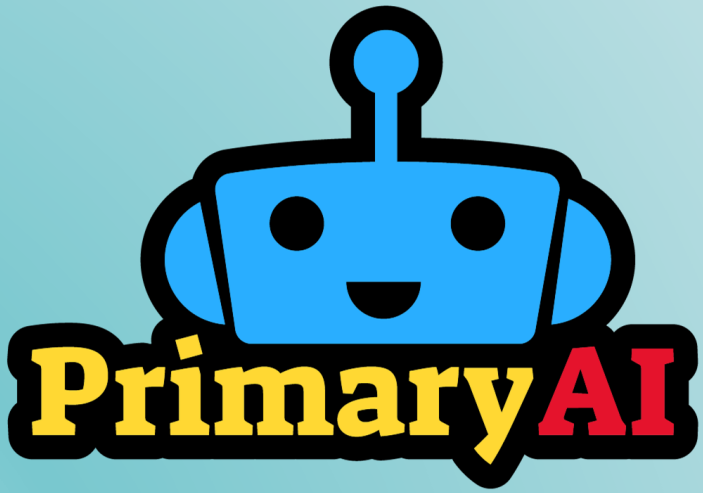
How do machines learn?

02

How does machine learning use data?

03

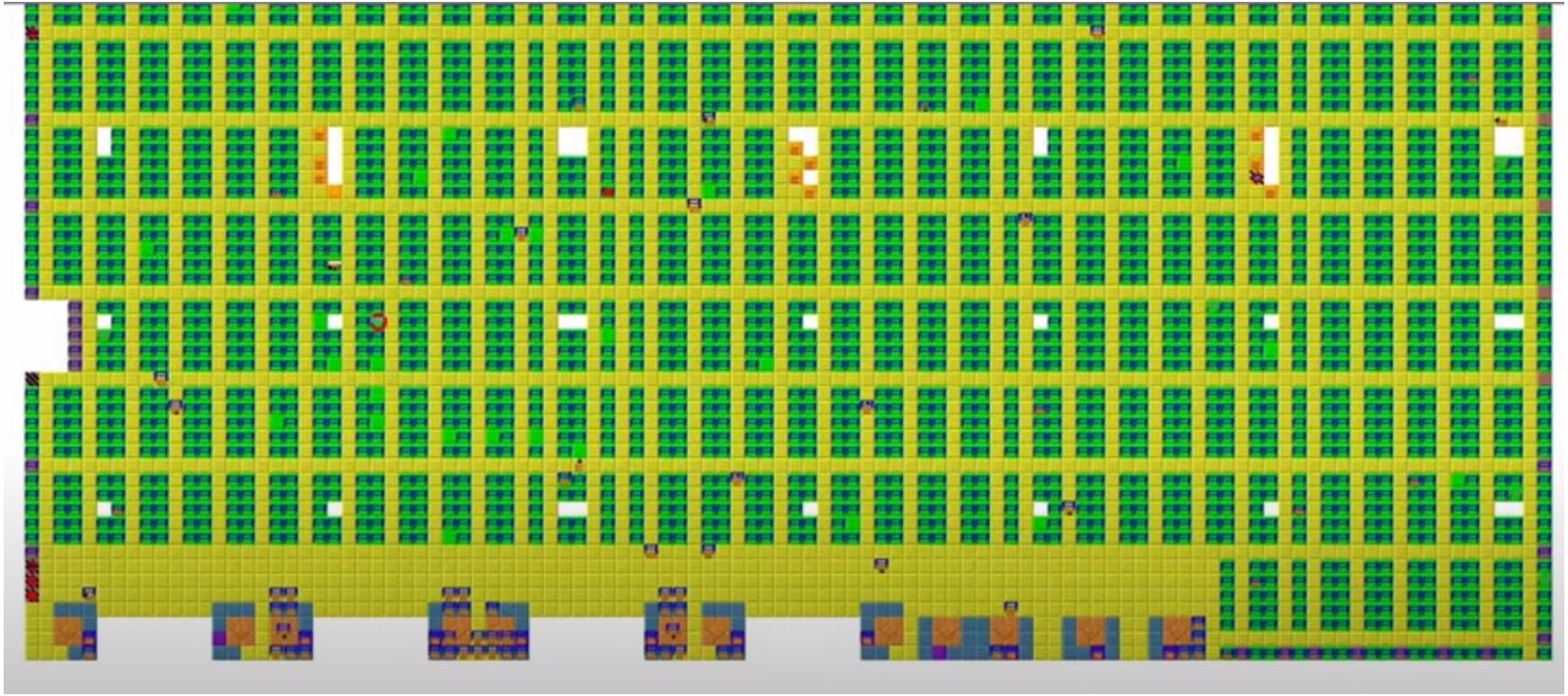
What kinds of data does AI use?



How Do Machines Learn?


BettyBot
1577
WIRED

HOW DOES THE ROBOT KNOW WHICH PATH TO TAKE?



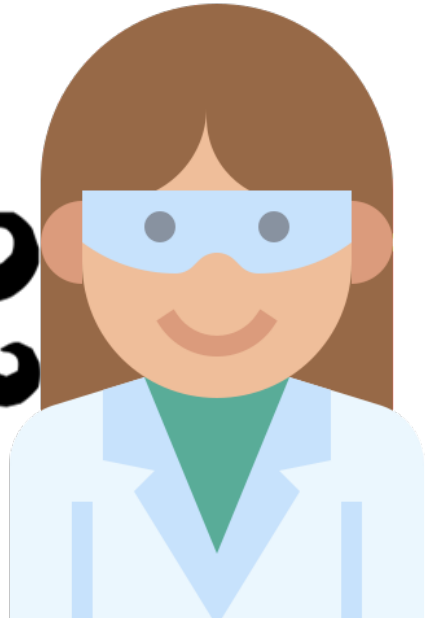

HOW AI
WORKS
MACHINE
LEARNING
C O
O E


STEP BY STEP
PROGRAMMING
The Traditional Way
when run
move forward
turn left
repeat 5 times
do move forward
turn left
move forward
MACHINE
LEARNING
Using Trial and Error
MORE VIDEOS

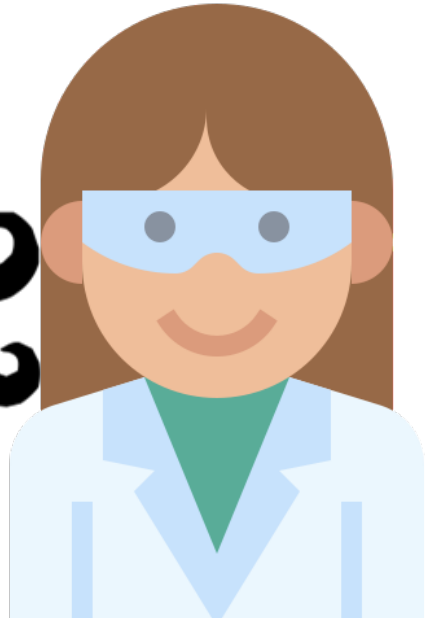
AI computers can learn and then make decisions

Different types of machine learning:

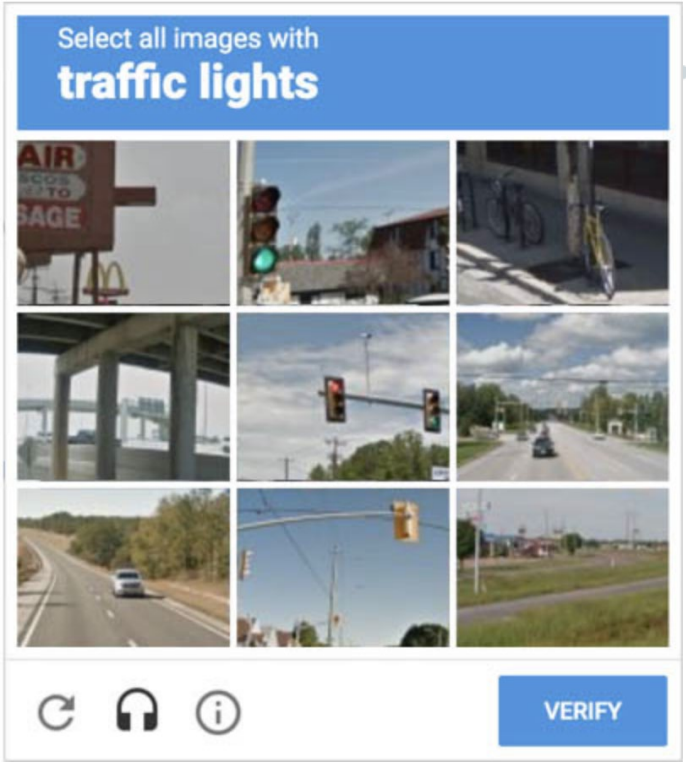
1. Supervised Learning
2. Unsupervised Learning
3. Reinforcement Learning



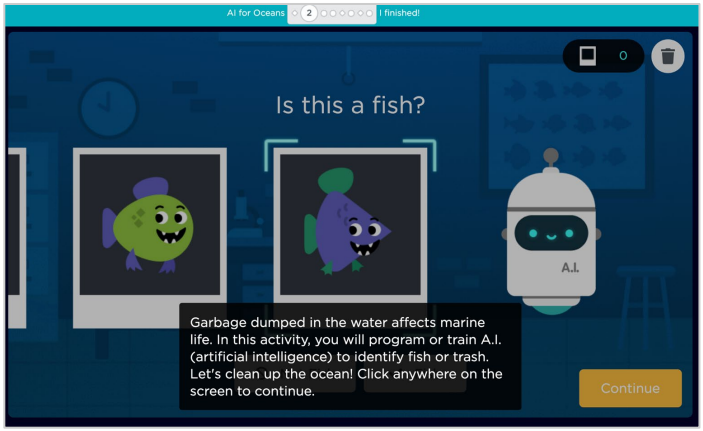
Supervised learning is when a human tells the computer exactly what something is

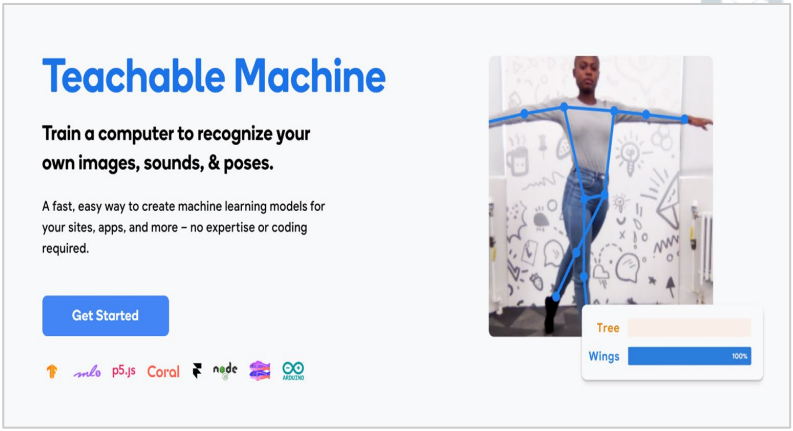


SUPERVISED LEARNING EXAMPLE



CHOOSE THE GAME YOU WANT TO PLAY

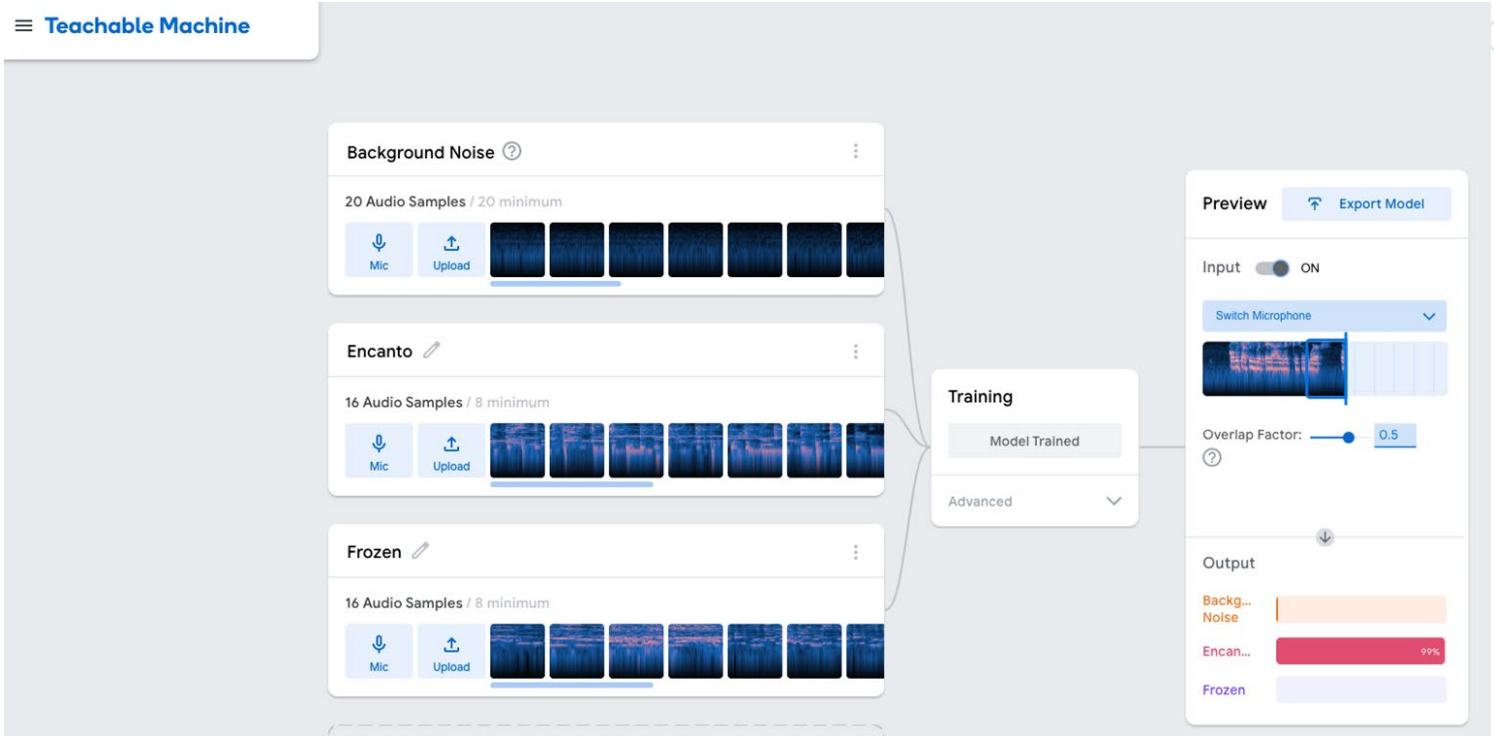




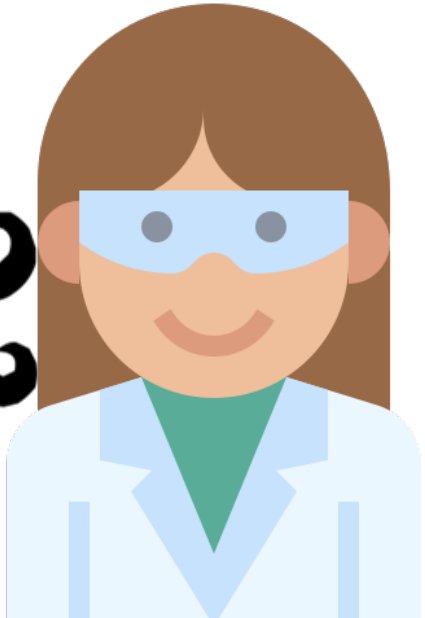
Let's Train AI!

- bit.ly/fishgame12
- bit.ly/Machine1

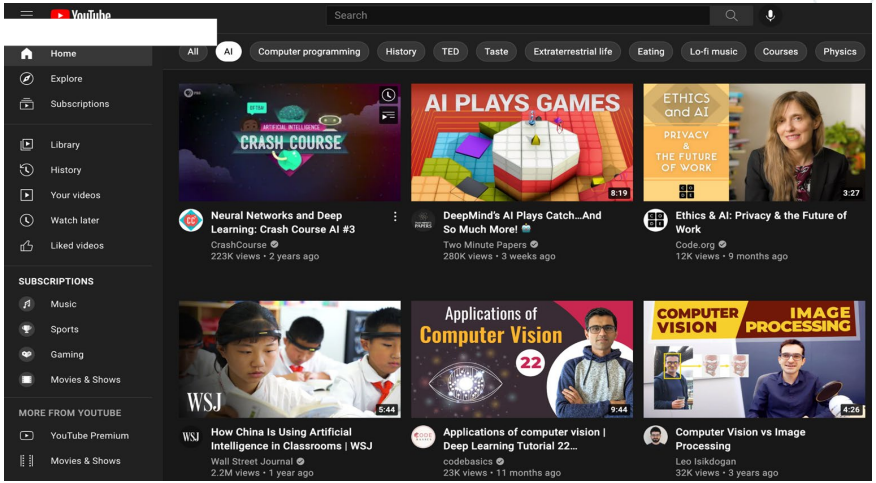
TEACHABLE MACHINE WITH SOUND



Unsupervised learning is when a computer looks at large amounts of data for patterns and identifies something without a human's help



UNSUPERVISED LEARNING EXAMPLE

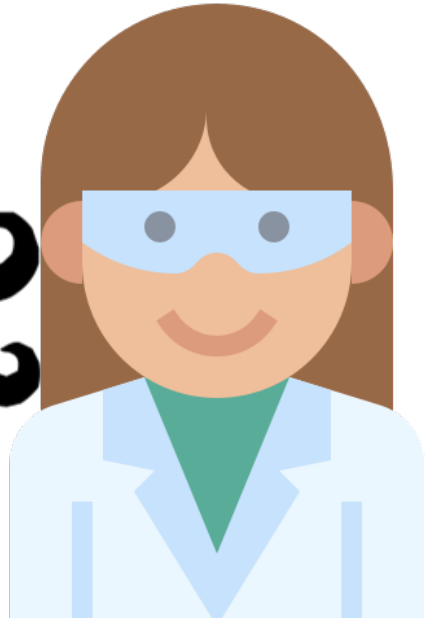


SORTING TIME!

THE SORTING GAME!

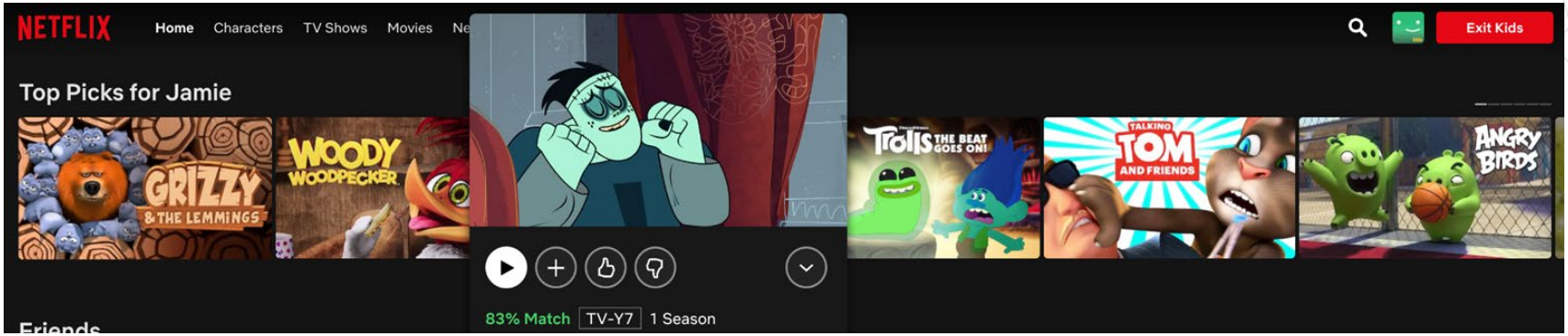
https://docs.google.com/presentation/d/1rlcu27EsnUafsBgQIs_pXxBchWLT9hC2pOyntM9I_uQ/edit#slide=id.p

Reinforcement learning is when a computer learns through positive or negative reinforcement



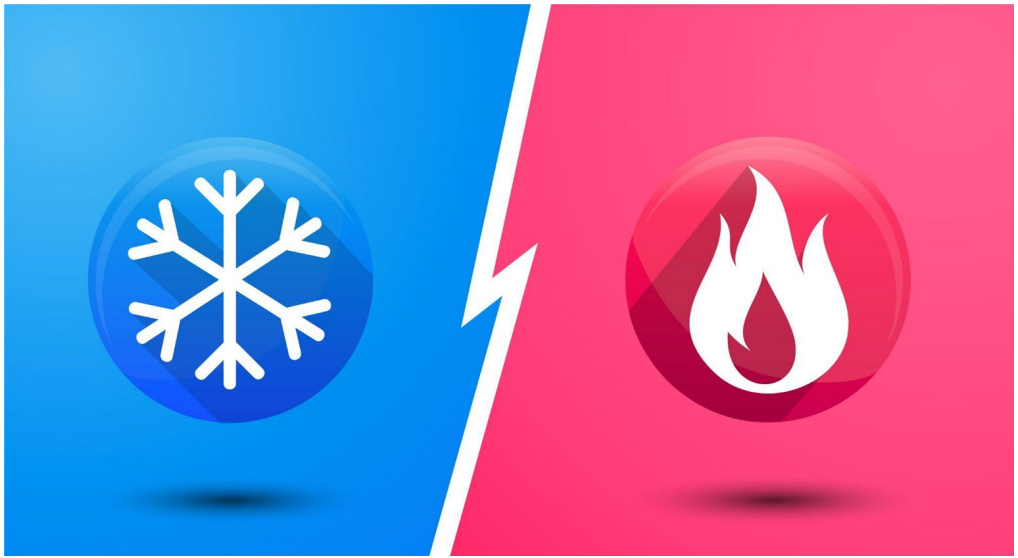
REINFORCEMENT LEARNING EXAMPLE

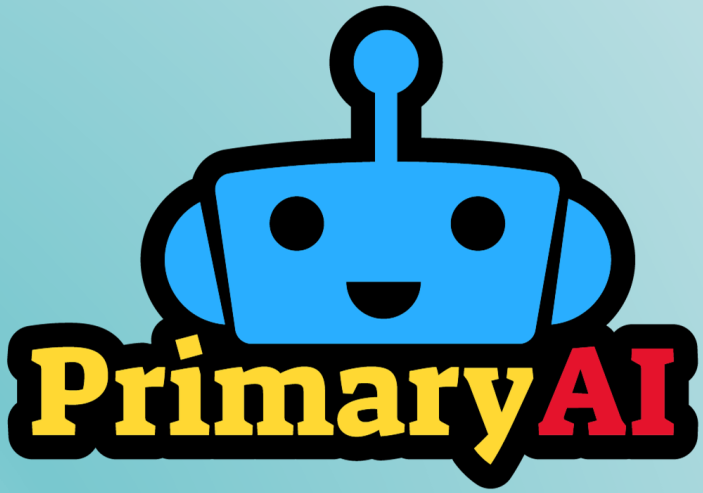
REINFORCEMENT LEARNING EXAMPLE



REINFORCEMENT LEARNING EXAMPLE

- Simple game of Hot and Cold





How does Machine Learning use Data?

WE USE OUR BIAS TO MAKE DECISIONS

- Based on favorite sports team or actor/actress
- Based on favorite person or friend
- Examples:
  - Selecting which grocery line will move faster
  - Selecting which driving lane will go faster

WHO WOULD YOU LINE UP BEHIND?

WHO WOULD YOU LINE UP BEHIND?

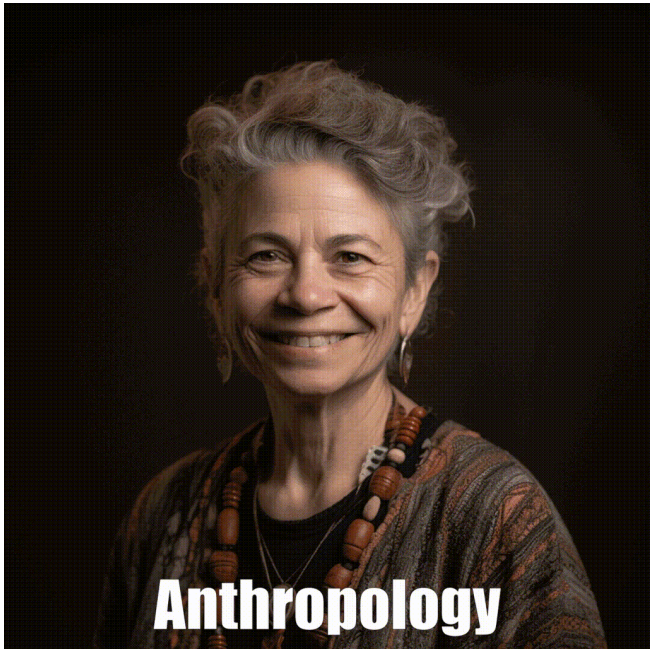

HOW AI
WORKS
TRAINING
DATA & BIAS
CODE

EXAMPLES OF HARMFUL DATA BIAS

- Seatbelts: Designed for men, children and women injured more often (47% more likely to be injured)
- Google Speech Recognition: 70% more likely to recognize male speech
- Smartphones: Designed for larger hands
- Soap Dispensers: Designed for certain skin tones and locations

AI ETHICS

GenAI is biased



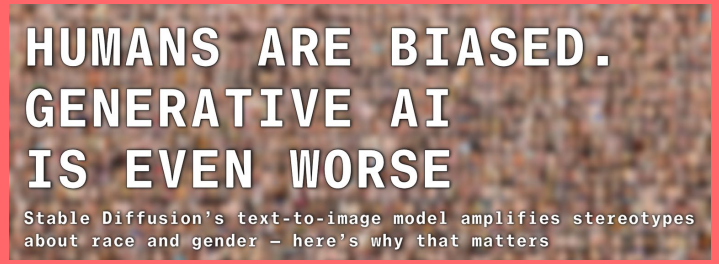
Credits: Bloomberg technology.

AI-generated Barbies reinforce racist stereotyping

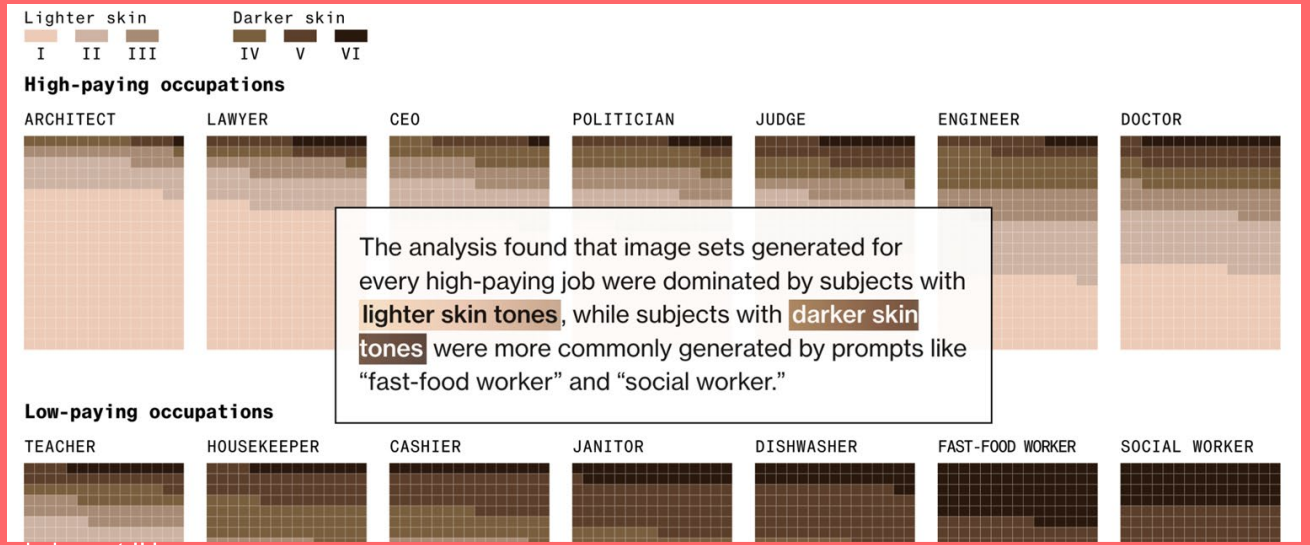
Barbie

Adapted from CEWIT Workshop at IU .

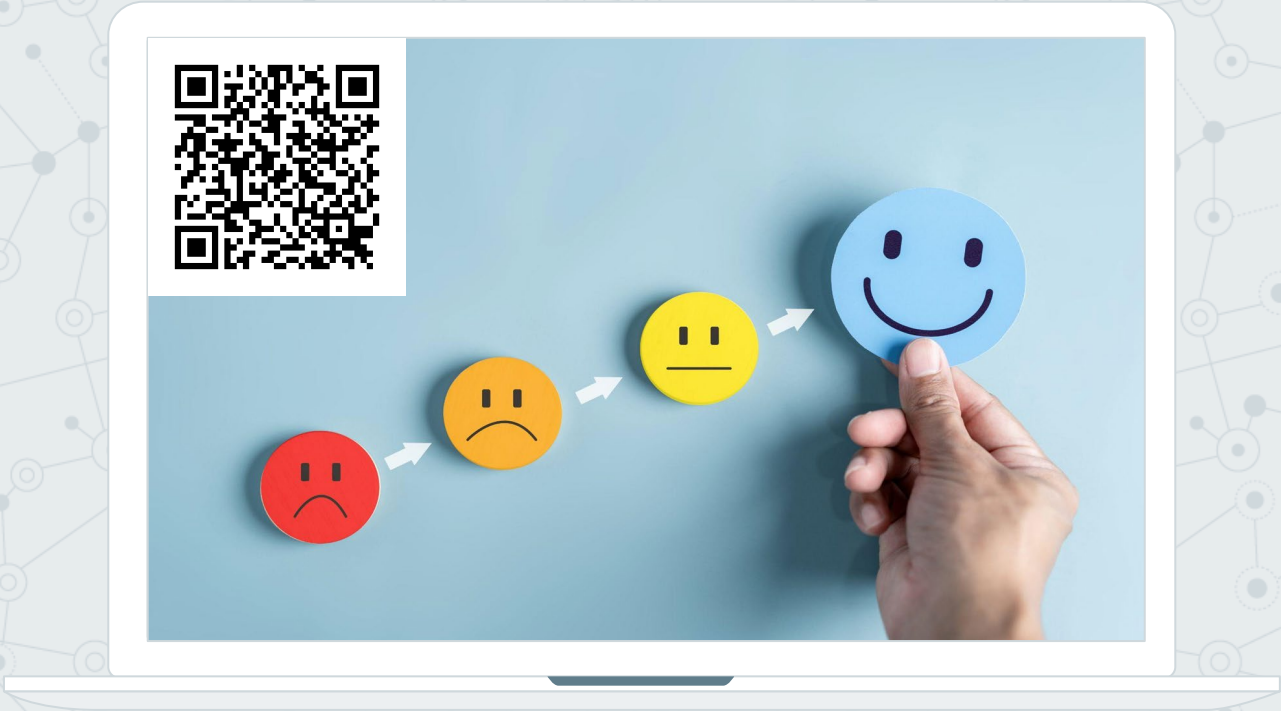
Bloomberg Study



Bloomberg



Adapted from CEWIT Workshop at IU .



Post PD Survey link: bit.ly/Post_PDSurvey

Thank You!

Any questions?

CREDITS

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