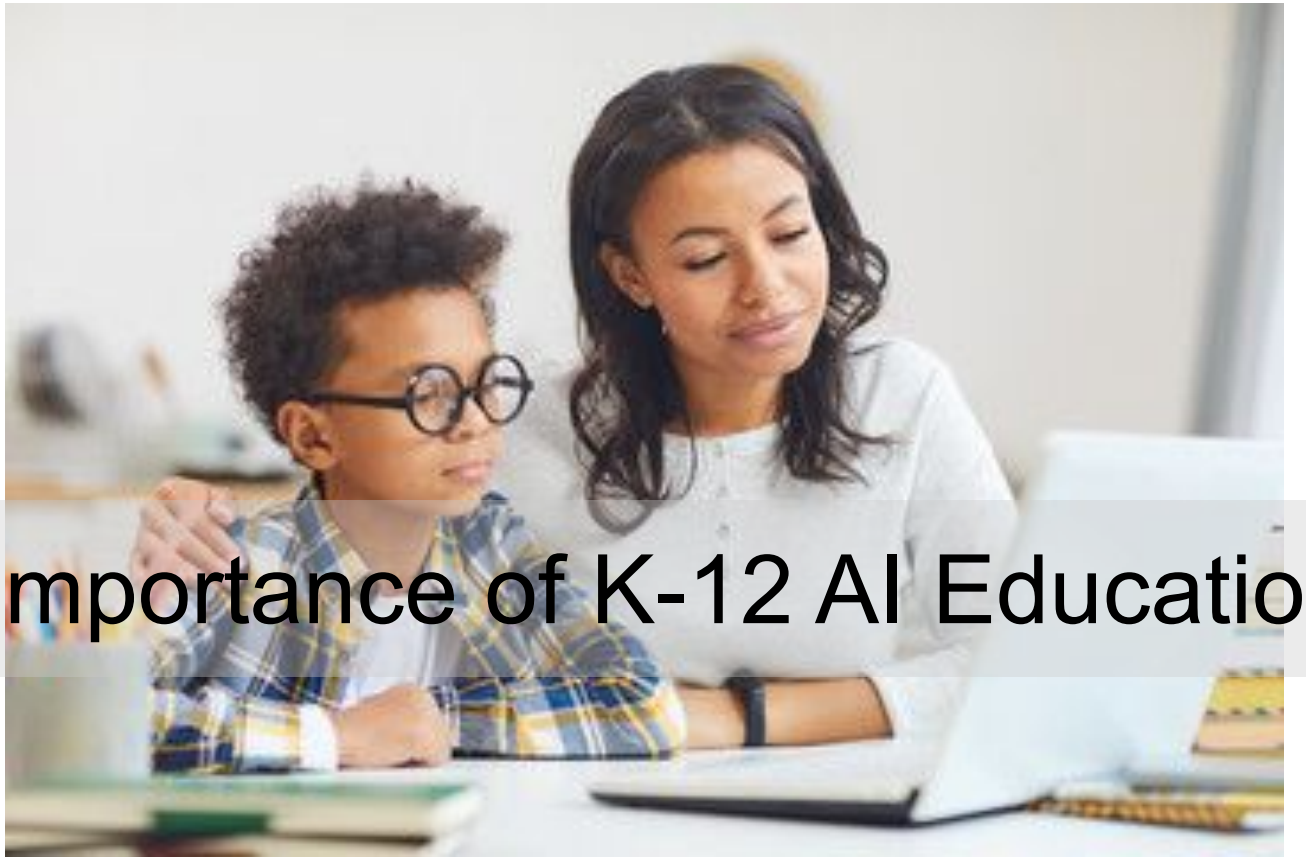
AI in the K-12 Landscape

Christina Gardner-McCune
University of Florida

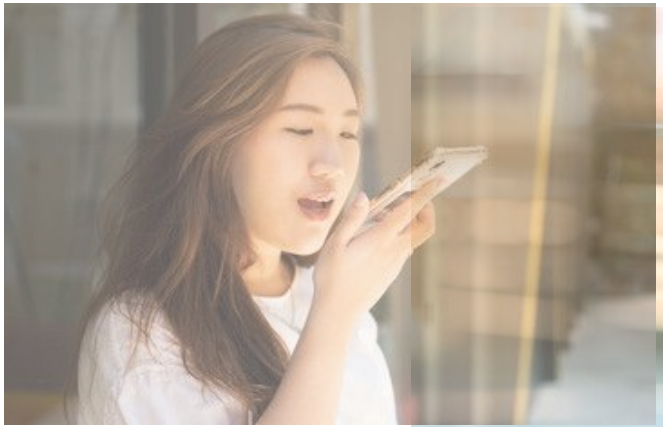
Future of CS Education Summit
CSTA
January 16, 2020



Importance of K-12 AI Education

AI Ubiquity in our everyday lives

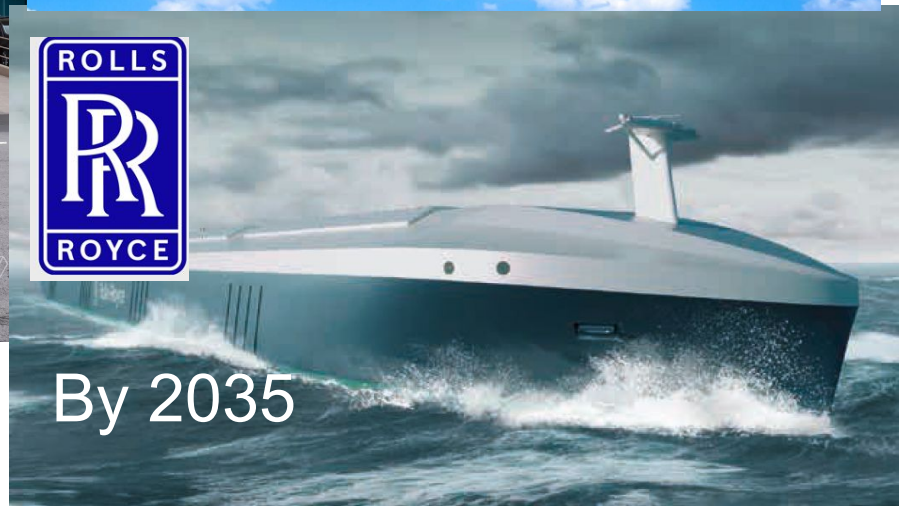
AI is a part of our everyday lives - Seen & Unseen



AI in Manufacturing & Warehouses

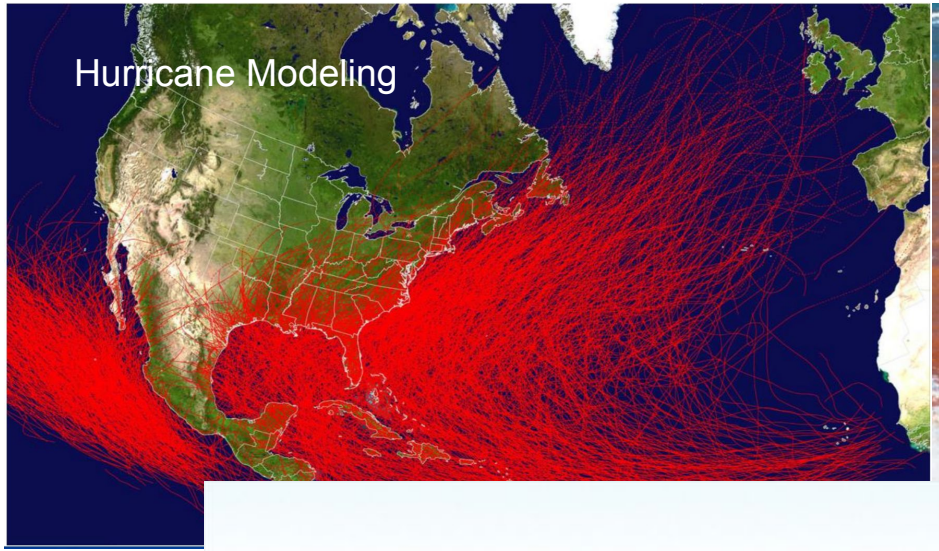
AI in Logistics & Shipping

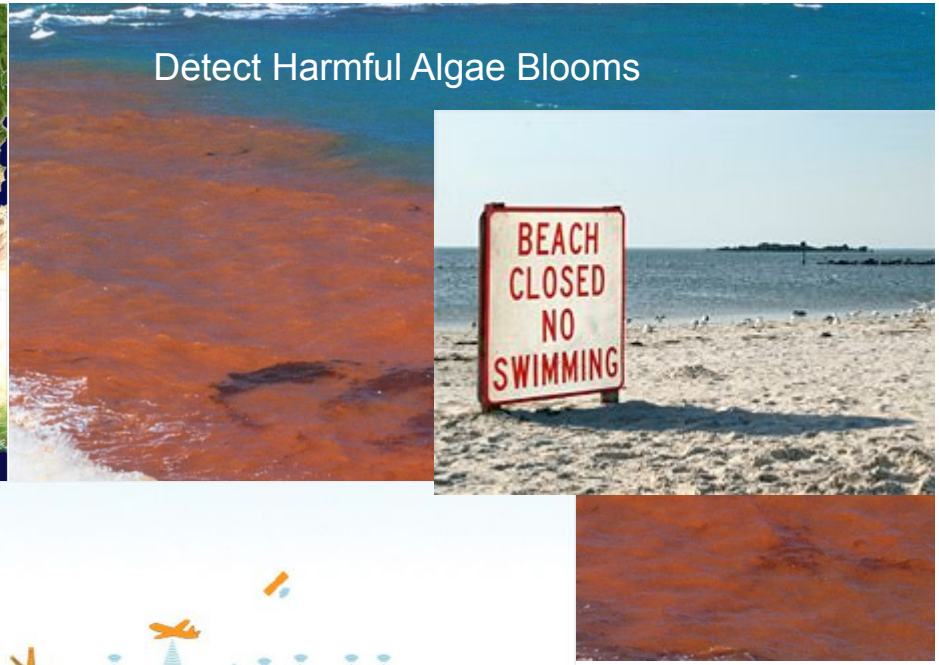
WAYMO



AI in Agriculture

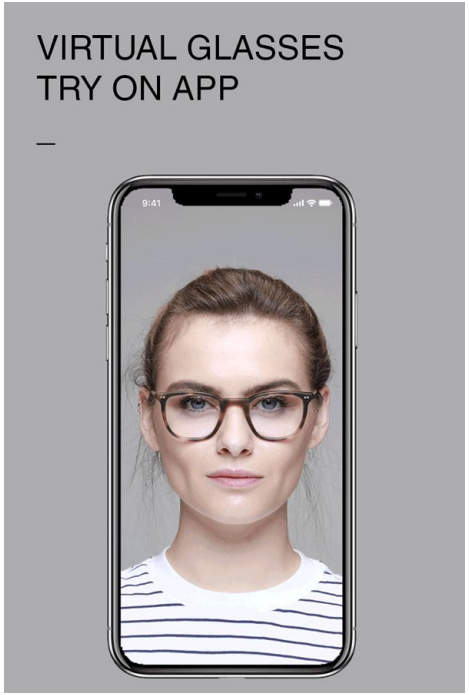
AI in Ocean & Coastal Sensing

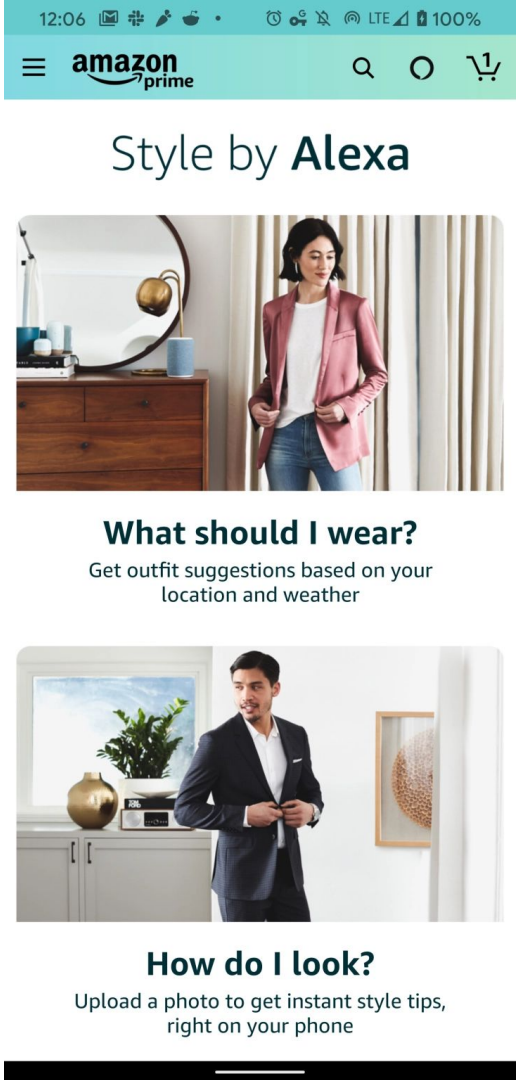




AI in Maritime Weather, Situational Awareness & Security

AI in Fashion & Shopping





AI in Food & Food Production

Deep Fakes:

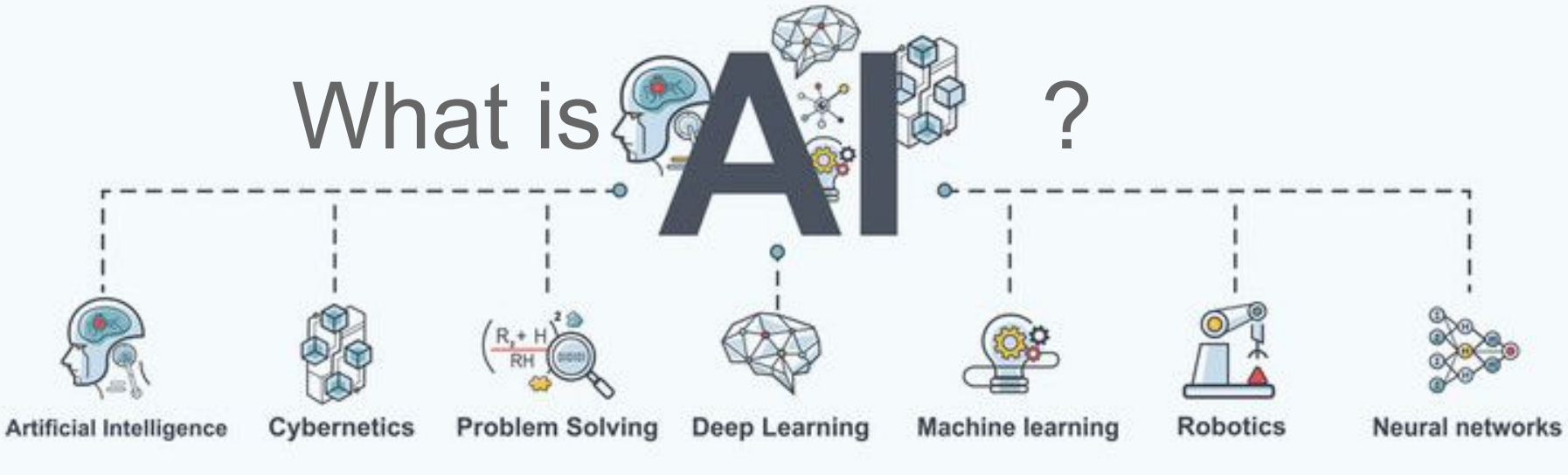
Real or Fake?


AI
Magic

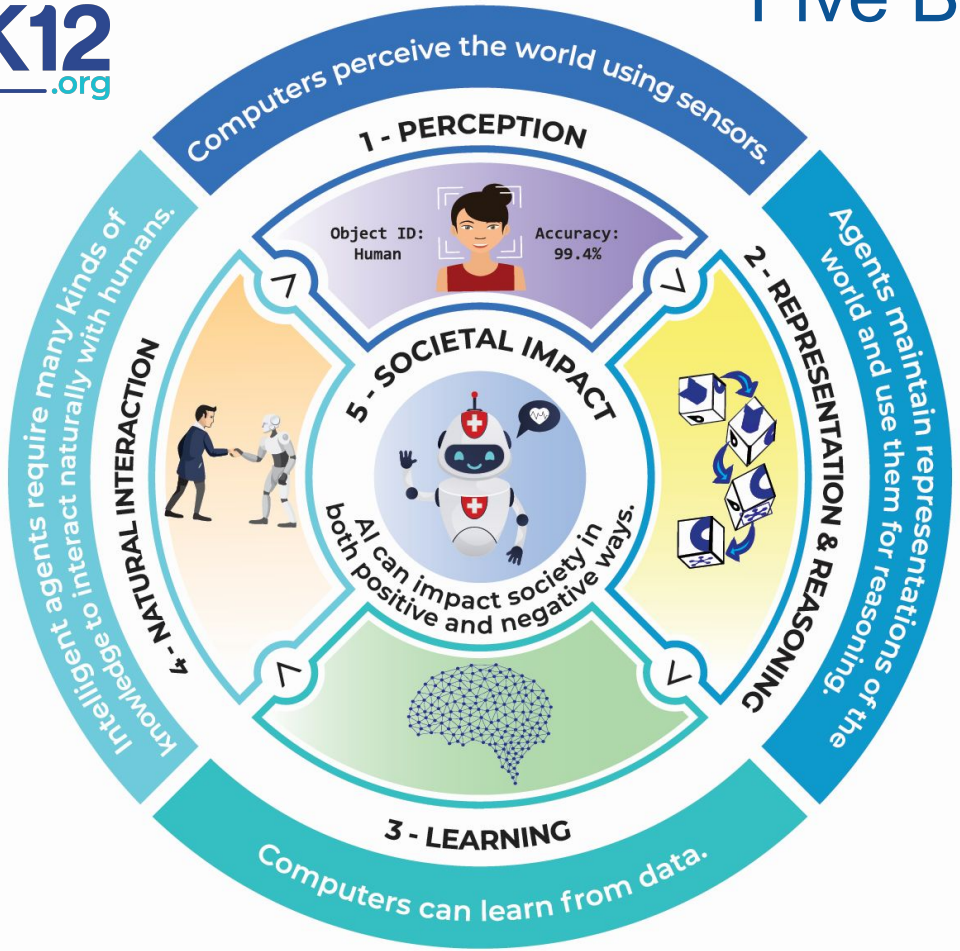
AI is Not Magic

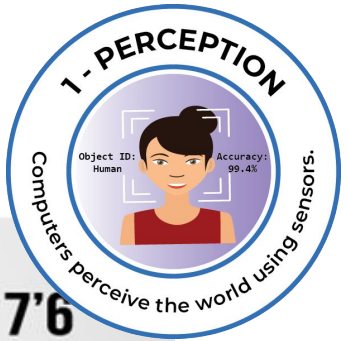
1. AI is playing an increasingly prominent role in society:
    - Intelligent assistants
    - Decision making systems
    - Self-driving cars
    - Autonomous robots in the workplace (and someday the home)
2. Informed citizens need to understand the basics of AI as our society faces important public 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.

What is AI ?


Artificial Intelligence
Cybernetics
Problem Solving
Deep Learning
Machine learning
Robotics
Neural networks

Five Big Ideas in AI

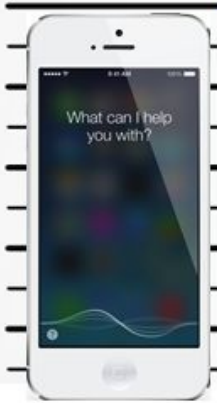




Usual Suspects

7'6"
7'0"
6'6"
6'0"
5'6"
5'0"
4'6"
4'0"
3'6"

7'6
7'0"
6'6"
6'0"
5'6"
5'0"
4'6"
4'0"
3'6"




1 - PERCEPTION
Object ID:
Human
Accuracy:
99.4%
Computers perceive the world using sensors.
Human senses vs. computer sensors
Perception
Perception is the extraction of *meaning* from sensory signals.
12:28
Tuesday, October 18
Emergency call
VISION:
ONLINE
USER:
CAM:A1
CAM:A2
ROTATION-BALANCE-SPEED
CONNECTED

Self-Driving Cars - Sensors & Autonomous Navigation


FORTNITE
AI Agents as Characters & Players

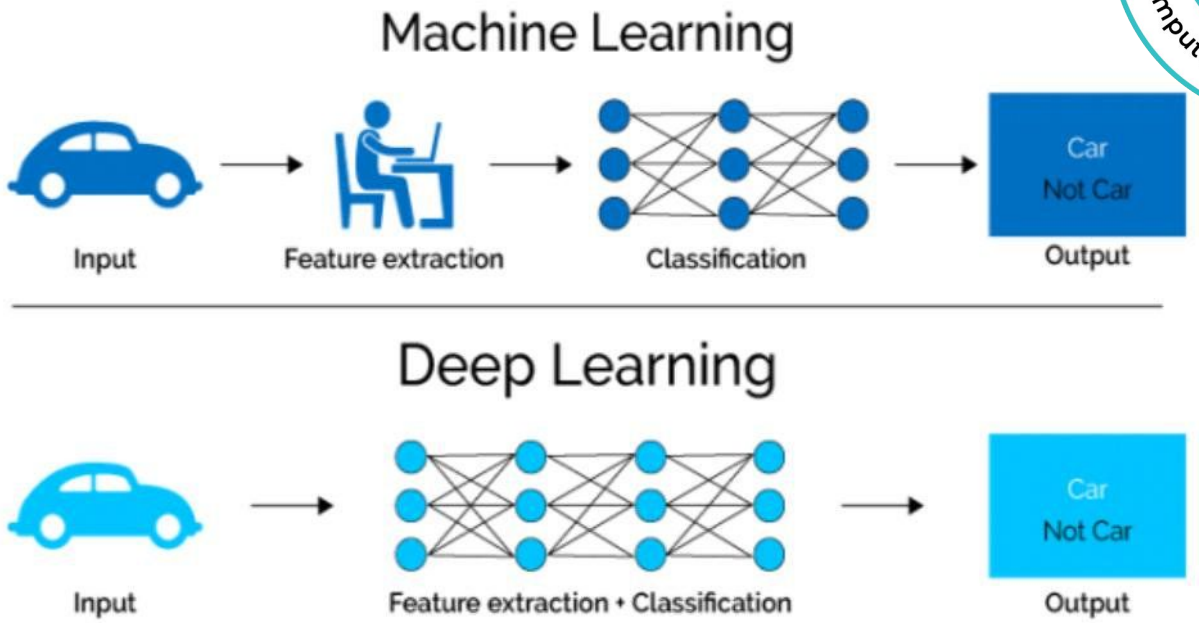

2 - REPRESENTATION & REASONING
Agents maintain representations of the world and use them for reasoning.

TikTok

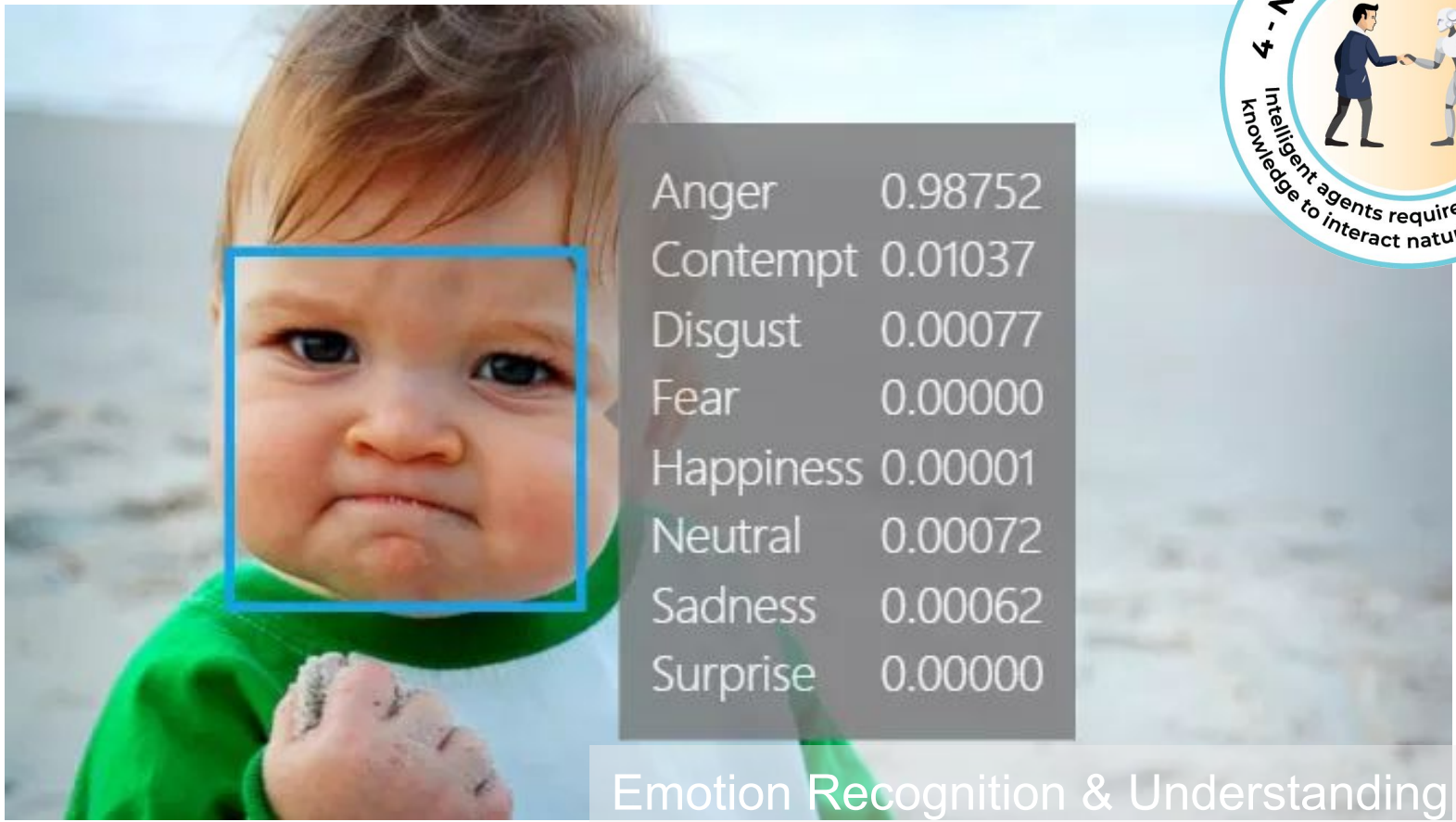
Recommender Systems

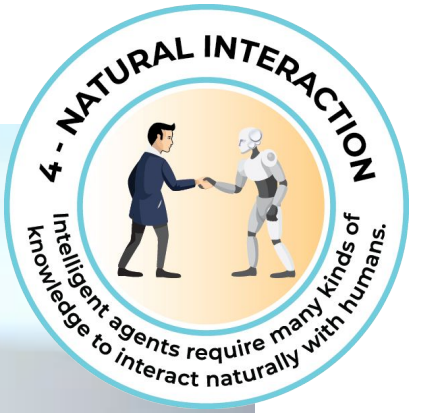
YouTube

Lots of
Training Data



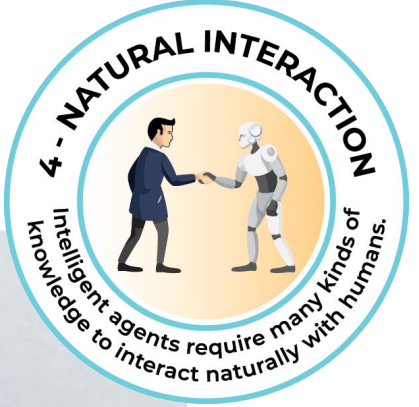
Machine learning gives computers the ability to learn without being explicitly programmed





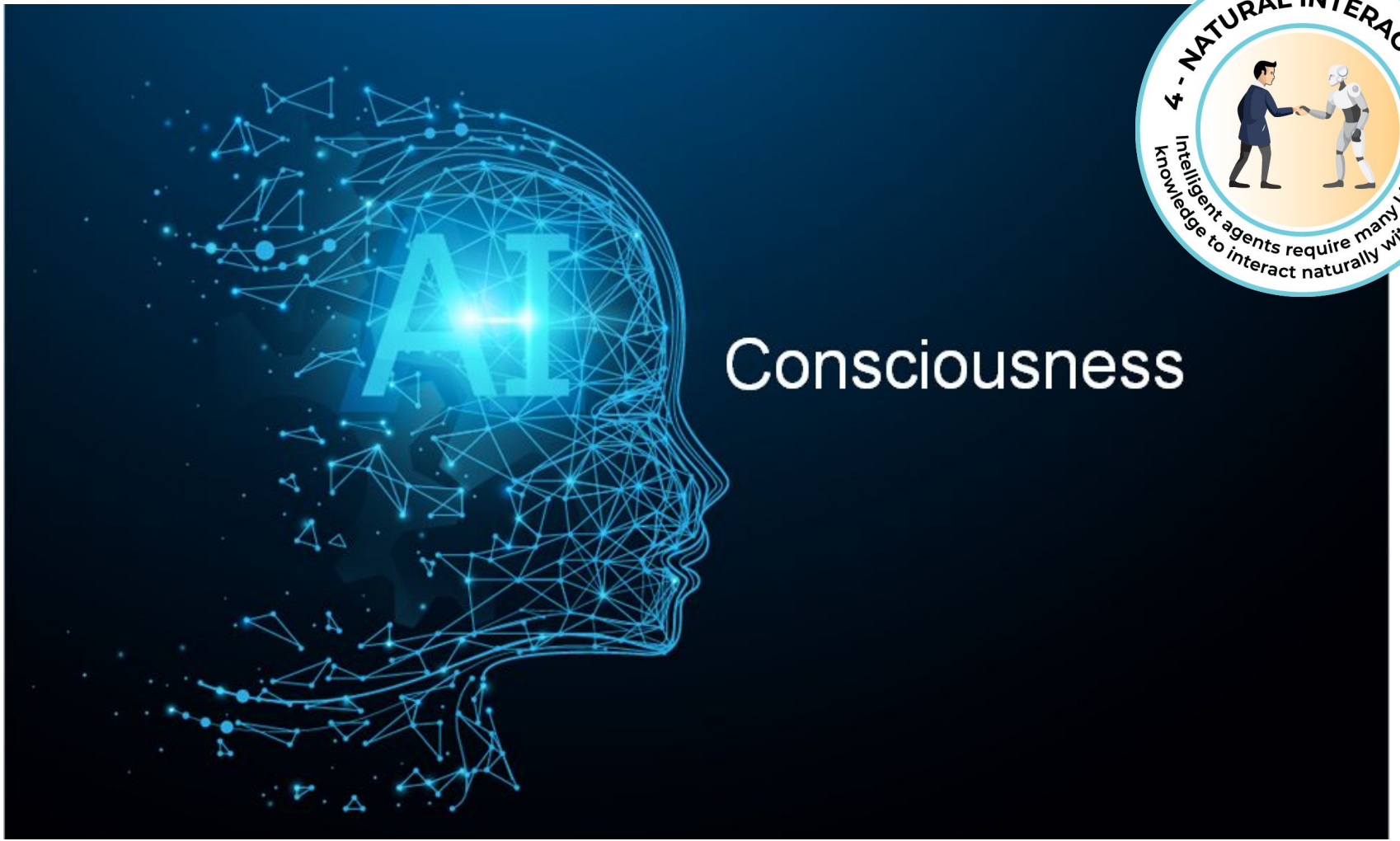
Emotion Recognition & Understanding


4 - NATURAL INTERACTION
Intelligent agents require many kinds of knowledge to interact naturally with humans.
Natural Language Understanding



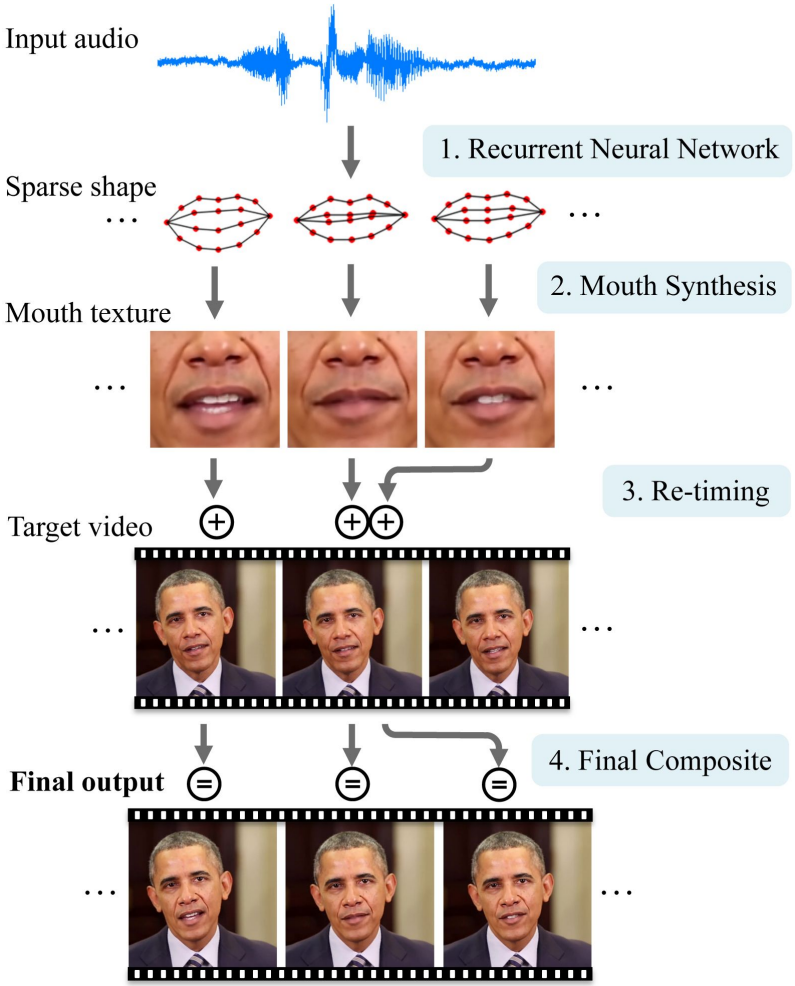
Which of the following would fit through the doorway?

Common Sense Reasoning

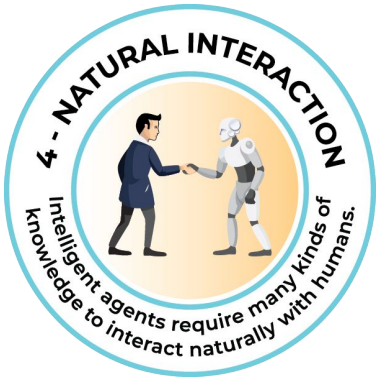

AI
Consciousness
4 - NATURAL INTERACTION
Intelligent agents require many kinds of knowledge to interact naturally with humans.

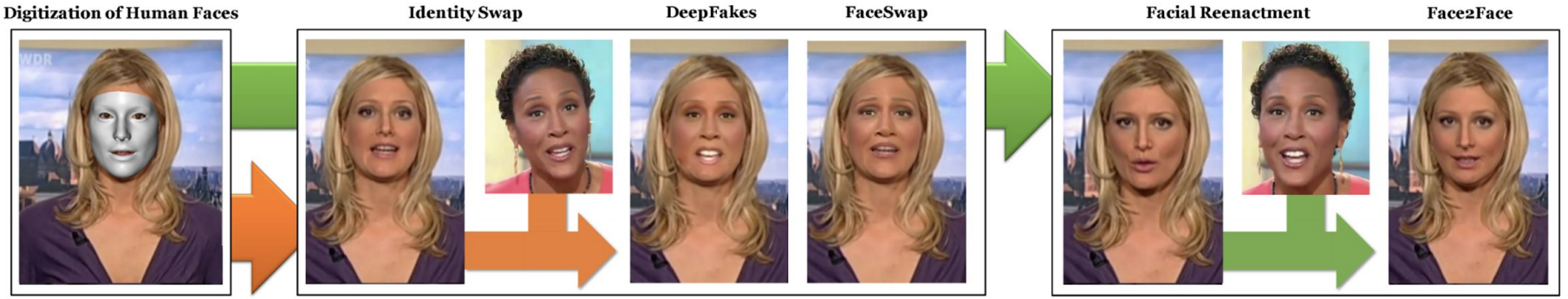
Mobile Medical Diagnosis

Anatomy of a Deep Fake

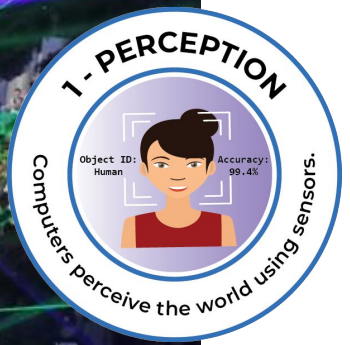


Anatomy of a Deep Fake





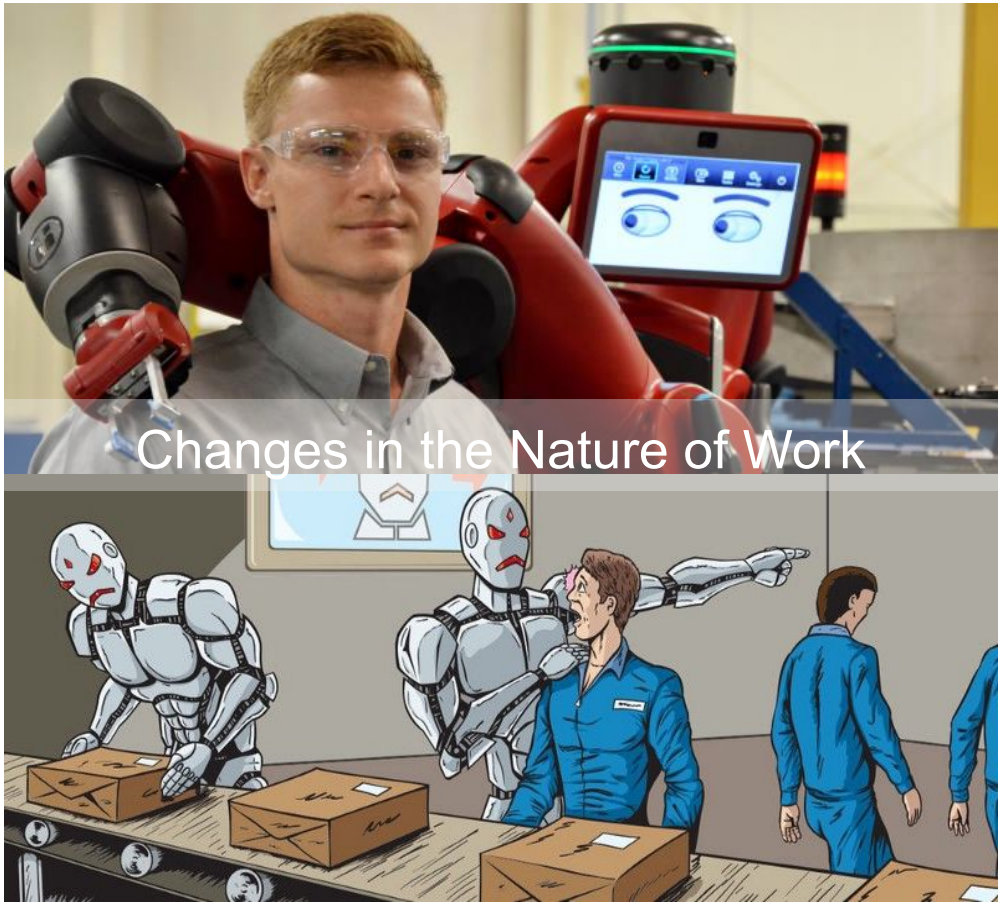
Civil Liberties & AI Limitations




Racial Bias: Sentencing Software
Bernard Parker
Dylan Fugett


5 - SOCIETAL IMPACT
AI can impact society in both positive and negative ways.


5 - SOCIETAL IMPACT
AI can impact society in both positive and negative ways.

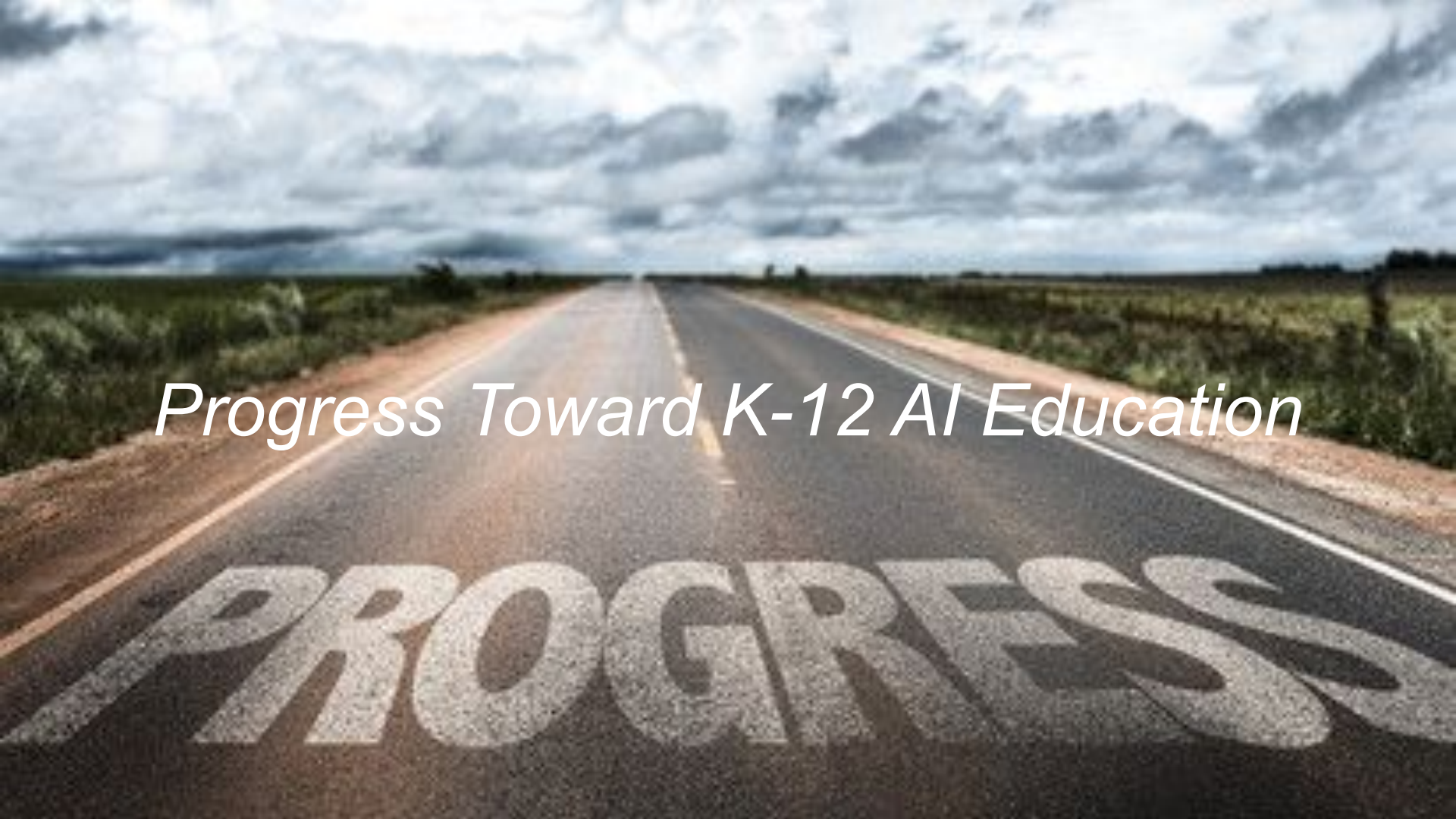

Changes in the Nature of Work

Future of Work

- Users
- Decision Makers
- Developers


Changes in our Culture


5 - SOCIETAL IMPACT
AI can impact society in both positive and negative ways.


Progress Toward K-12 AI Education
PROGRESS

K-12 AI Education (Circa May 2018)

- CS K-12 Education is exploding in the US and abroad.
- We are not as far along when it comes to AI, but many countries are trying China, UK, Thailand, Korea, and EU Countries

- The 2017 CSTA Computing Standards contain just two sentences about AI.
  - Both are for the 11-12 grade band. Nothing for younger students.

3B-AP-08	11-12	Describe how artificial intelligence drives many software and physical systems.	Algorithms & Programming	Algorithms	Communicating
3B-AP-09	11-12	Implement an artificial intelligence algorithm to play a game against a human opponent or solve a problem.	Algorithms & Programming	Algorithms	Creating

The AI4K12 Initiative, a joint project of:

AAAI (Association for the Advancement of Artificial Intelligence)

CSTA (Computer Science Teachers Association)

With funding from National Science Foundation ITEST Program (DRL-1846073)

Carnegie Mellon University
School of Computer Science

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 educators, researchers, and resource developers

K-12 Teacher Working Group Members

Grades K-2
Vicky Sedgwick (Lead)
Susan Amsler-Akacem
Dr. April DeGennaro
Melissa Unger (New)

Grades 3-5
Kelly Powers (Lead)
Dr. Marlo Barnett
Dr. Phillip Eaglin
Alexis Cobo (New)

Grades 6-8
Sheena Vaidyanathan (Lead)
Padmaja Bandaru
Josh Caldwell
Charlotte Dungan
Rachael Smith (New)

Grades 9-12
Jared Amalong (Lead)
Dr. Smadar Bergman
Kate Lockwood
John Chapin (New)

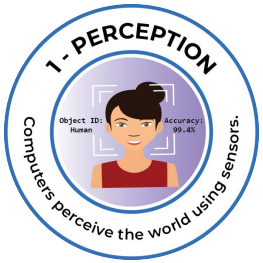
Guidelines, Not Standards

- Guidance to teachers, educators, curriculum developers, professional development providers
- Recommendations, not requirements
- Addresses a diversity of learners and implementations
- Meant to be revised—a living document

Principles for Scoping & Refinement of Guidelines

Guidelines need to have real-world relevance to students in that gradeband

1. E.g., guidelines would enable students to e***xplain how a self-driving car (AI-enabled technology) works and the types AI systems or subsystems involved in the functionality and decision making***
2. E.g., guidelines would enable students to ***explain the process by which ML models are developed*** from data collection to types of training and sources of bias etc
3. E.g., guideline would equip students with the skills to ***use, modify, and create AI systems using developmentally appropriate tools***
4. E.g., understand the implications of AI on ….



Big Idea #1: Perception - Progression Chart

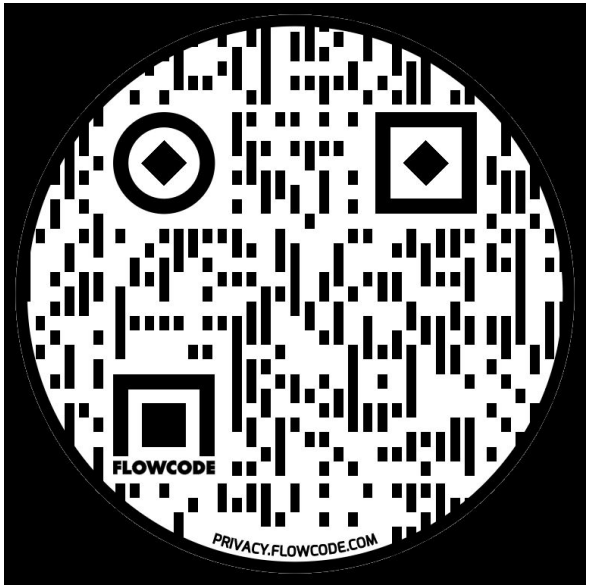
AI4K12.org

Draft Big Idea 1 - Progression Chart

www.AI4K12.org

Big Idea #1: Perception	*Computers perceive the world using sensors.*	**Perception is the extraction of meaning from sensory information using knowledge.**	**The transformation from signal to meaning takes place in stages, with increasingly abstract features and higher level knowledge applied at each stage.**	LO = Learning Objective: what students should be able to do. EU = Enduring Understanding: what students should know.
Concept	**K-2**	**3-5**	**6-8**	**9-12**
Sensing (Living Things) **1-A-i**	**LO:** Identify human senses and sensory organs. **EU:** People experience the world through sight, hearing, touch, taste, and smell.	**LO:** Compare human and animal perception. **EU:** Some animals experience the world differently than people do. **Unpacked:** Bats and dolphins use sonar. Bees can see ultraviolet. Rats are have no color vision; dogs are red-green colorblind. Dogs and rats can hear higher frequences than humans.	**LO:** Give examples of how humans combine information from multiple modalities. **EU:** People can exploit correlations between senses, such as sight and sound, to make sense of ambiguous signals. **Unpacked:** In a noisy environment, speech is more understandable when the speaker's mouth is visible. People learn the sounds associated with various actions (such as dropping an object) and can recognize when the sound doesn't match their expectation.	N/A – for AI purposes, this topic has already been adequately addressed in the lower grade bands. *Other courses, such as biology or an elective on sensory psychology, could go into more detail about topics such as taste, smell, proprioception, and vestibular organs.* *Possible enrichment material: look at optical illusions (Muller-Lyer illusion, Kanizsa triangle) and ask which ones are computer vision systems also subject to.*
Sensing (Computer Sensors) **1-A-ii**	**LO:** Locate and identify sensors (camera, microphone) on computers, phones, robots, and other devices. **EU:** Computers "see" through video cameras and "hear" through microphones.	**LO:** Illustrate how computer sensing differs from human sensing. **EU:** Most computers have no sense of taste, smell, or touch, but they can sense some things that humans can't, such as infrared emissions, extremely low or high frequency sounds, or magnetism.	**LO:** Give examples of how intelligent agents combine information from multiple sensors. **EU:** Self driving cars combine computer vision with radar or lidar imaging. GPS measurement, and accelerometer data to form a detailed representation of the environment and their motion through it.	**LO:** Describe the limitations and advantages of various types of computer sensors. **EU:** Sensors are devices that measure physical phenomena such as light, sound, temperature, or pressure. **Unpacked:** Cameras have limited resolution, dynamic range, and spectral sensitivity. Microphones have limited sensitivity and frequency response. Signals may be degraded by noise, such as a microphone in a noisy environment. Some sensors can detect things that people cannot, such as infrared or ultraviolet imagery, or ultrasonic sounds.
Sensing (Digital Encoding) **1-A-iii**	N/A	**LO:** Explain how images are represented digitally in a computer. **EU:** Images are encoded as 2D arrays of pixels, where each pixel is a number indicating the brightness of that piece of the image, or an RGB value indicating the brightness of the red, green, and blue components of that piece.	**LO:** Explain how sounds are represented digitally in a computer. **EU:** Sounds are digitally encoded by sampling the waveform at discrete points (typically several thousand samples per second), yielding a series of numbers.	**LO:** Explain how radar, lidar, GPS, and accelerometer data are represented. **EU:** Radar and lidar do depth imaging: each pixel is a depth value. GPS triangulates position using satellite signals and gives a location as longitude and latitude. Accelerometers measure acceleration in 3 orthogonal dimensions. **Unpacked:** Radar and lidar measure distance as the time for a reflected signal to return to the transceiver. GPS determines position by triangulating precisely timed signals from three or more satellites. Accelerometers use orthogonally oriented strain gauges to measure acceleration in three dimensions.

V.0.1 - Released May 28, 2020 Subject to change based on public feedback 1



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Big Idea #3: Learning - Progression Chart

AI4K12.org

Draft Big Idea 3 - Progression Chart

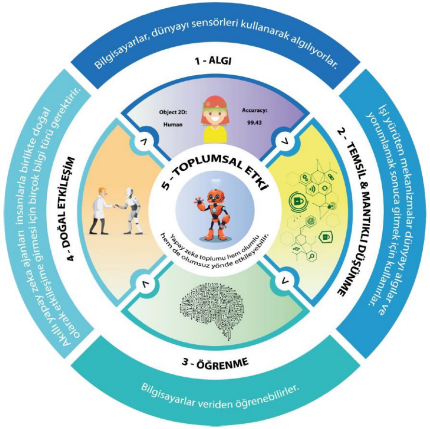
www.AI4K12.org

Big Idea #3: Learning	*Computers can learn from data.*	LO = Learning Objective: What students should be able to do.	EU = Enduring Understanding: What students should know.	Unpacked descriptions are included when necessary to illustrate the LO or EU
Concept	**K-2**	**3-5**	**6-8**	**9-12**
Nature of Learning *(Humans vs. machines)* **3-A-i**	**LO:** Describe and provide examples of how people learn and how computers learn. **EU:** Computers learn differently than people. **Unpacked:** People learn by observation, by being told, by asking questions, by experimentation, by practice, and by making connections to past experience. Computers learn by finding patterns in data, or by trial and error. **Activities:** Describe a time when you learned something by being told, by watching another person, or by asking questions. A demo such as Teachable Machine can be used to illustrate a computer learning something from positive and negative examples.	**LO:** Differentiate between how people learn and how computers learn. **EU:** Both people and computers can learn by finding patterns in data, or by trial and error. But people are flexible learners who can adapt to unfamiliar situations and learn in other ways, such as by observing others, by asking questions, or by making connections to prior learning. **Unpacked:** People are natural learners, while computers have to be programmed to learn. Presently there are two ways that computers can be programmed to learn: they can learn by finding patterns in human-supplied examples, or they can learn by trial and error.	**LO:** Contrast the unique characteristics of human learning with the ways machine learning systems operate. **EU:** People learn by observation, by being told, by asking questions, by experimentation, by practice, and by making connections to past experience. Computers learn by applying specialized algorithms to large amounts of training data, or by thousands or even millions of trial and error experiences, to solve narrowly defined problems. **Unpacked:** People are flexible learners who employ multiple strategies. Computers use specialized algorithms that require large amounts of data or many trials, and only solve narrowly defined problems. While humans can construct reasoners by explicitly programming them, for complex problems it is often more convenient to let the machine learning algorithm do the work.	**LO:** Define supervised, unsupervised, and reinforcement learning algorithms, and give examples of human learning that are similar to each algorithm. **EU:** Both supervised and unsupervised learning algorithms find patterns in data. Supervised learning uses features to predict the class label supplied by a teacher; unsupervised learning groups similar instances together, creating its own classes. Reinforcement learning uses trial and error to find a policy for choosing actions that maximizes the reinforcement signal. **Unpacked:** Supervised learning is like being corrected by a coach. Unsupervised learning is like noticing that your store has three kinds of customers based on their distinctive purchasing patterns. Reinforcement learning is like trying different moves in a video game and seeing which yields the most points (greatest reward).
Nature of Learning (Finding patterns in data) **3-A-ii**	**LO:** Identify patterns in labeled data and determine the features that predict labels. **EU:** Classes can be defined in terms of feature values. The relevant features can be inferred by examining labeled examples. **Unpacked:** To give students a feel for the problem of learning to classify we must ask them to learn a class that's not intuitively obvious, e.g., learn "poisonous fish" by examining cartoon fish images labeled "poisonous" or "not poisonous". They can then be asked to describe which features indicate a fish is poisonous, e.g., red fish with square heads. Using images as input simplifies the task because the features are intuitive, even though the classification rule should not be.	**LO:** Model how supervised learning identifies patterns in labeled data. **EU:** When learning to classify labeled data, the patterns (or rules) that are discovered can be expressed as weights in a neural network or nodes in a decision tree. **Unpacked:** This extends the K-2 version by having students draw a decision tree instead of merely verbalizing their proposed rule. In addition, the task can be made richer in 3-5 by increasing the number of classes or by making the class definitions more complex. For example, a fish could be poisonous if it is either red with a square head or blue with a round head or purple with pointy spines and any shape head. Each node of the decision tree can test one feature value, e.g., color, so complex features require deeper trees.	**LO:** Model how unsupervised learning finds patterns in unlabeled data. **EU:** Unsupervised learning is useful when we don't know in advance what classes exist. It discovers patterns (or classes) in data by grouping nearby points into clusters. Once a set of clusters has been found, new points can be classified based on distance from the cluster boundaries. **Unpacked:** This can be done graphically using points in the plane and visually constructing cluster boundaries by outlining (e.g., drawing an ellipse around) each cluster.	**LO:** Model how machine learning constructs a reasoner for classifcation or prediction by adjusting the reasoner's parameters (its internal representations). **EU:** Supervised learning adjusts the parameters of a mathematical model (selected in advance by a human) to generate correct classifications or predictions. This model could be a simple linear equation, a high-degree polynomial, or an even more complex nonlinear equation such as a deep neural network. The internal representations that encode the relationship between inputs and outputs express the "patterns" found in the data. **Unpacked:** In regression, we pick a mathematical model such as a linear equation y=mx+b and then adjust its parameters to fit a set of data points as best we can. The model can then be used to predict a y value for any x value. Linear regression can be done with a ruler by eyeballing the distance between the line and the points. Students can model polynomial or logistic regression by giving them a graphical display with sliders to control the parameter values. They can manually adjust the sliders to reach what they perceive as a best fit to the data. More advanced students can be shown how quality of fit can be measured mathematically using mean squared error. For classification problems the Y value is either 1 for "in class" or 0 for "not in class" and the decision boundary is the line or surface y=0.5.

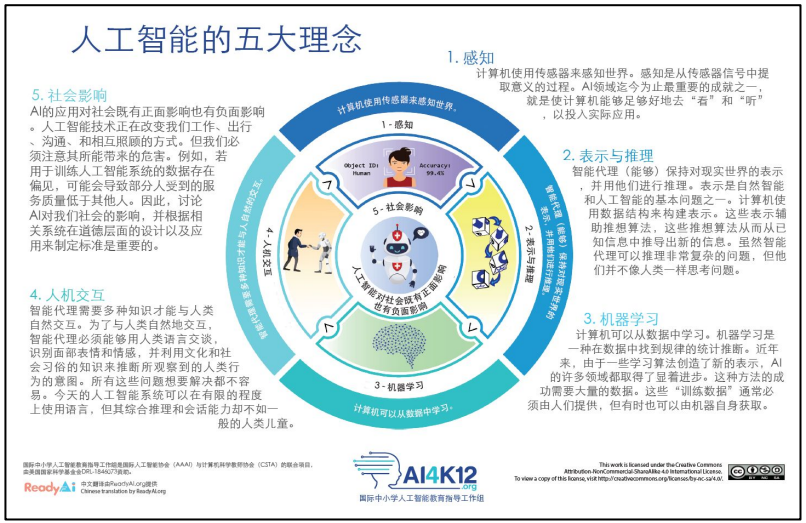
bit.ly/3oT0xE9

Adoption of the Big Ideas

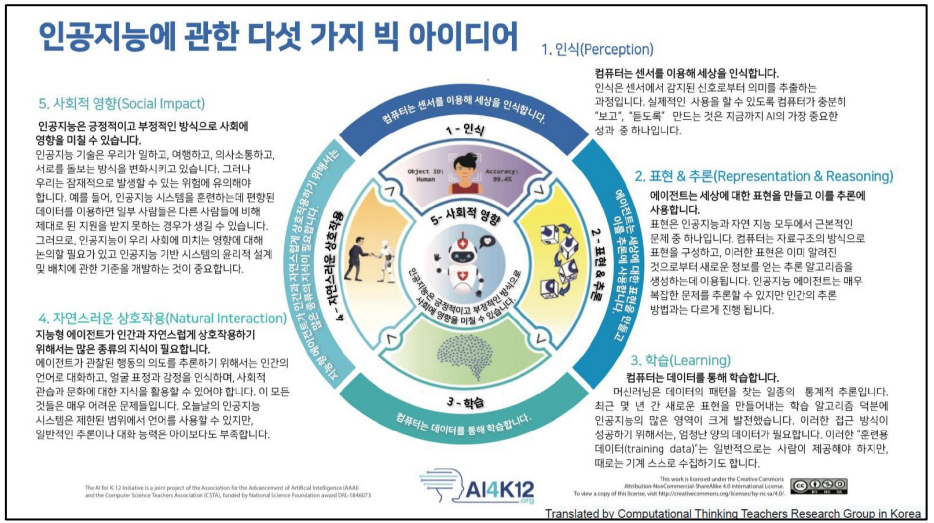
- Now being adopted by curriculum developers in the US and elsewhere.
- Translations available in Chinese, Japanese, Korean, Arabic, Hebrew, Hindi, French, Spanish, German, and Portugese, and Turkish.

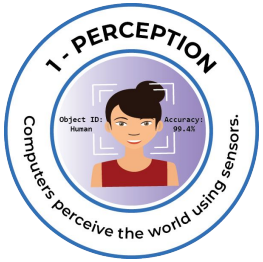


Chinese



Korean





Big Idea #1 – What should students be able to do?

Grades K-2:

- **Identify sensors on computers, robots, and intelligent appliances.**
- Interact with intelligent agents such as Alexa or Siri.

Grades 6-8:

- **Explain how sensor limitations affect computer perception.**
- Explain that perception systems may draw on multiple algorithms as well as multiple sensors.
- Build an application using multiple sensors and types of perception (possibly with Scratch plugins, or Calypso).

Grades 3-5:

- Describe how sensor inputs are converted to analog or digital signals.
- Demonstrate a limitation of computer perception.
- **Build an application using perception (possibly with Scratch plugins, or Calypso).**

Grades 9-12:

- **Describe the domain knowledge underlying different forms of computer perception.**
- Demonstrate speech recognition difficulty in handling homophones and other types of ambiguity.

Big Idea #2 – What should students be able to do?

Grades K-2:

- **Construct a model of something and compare it to the thing being modeled**
- Use a decision tree to make a decision

Grades 6-8:

- **Design a graph model of their home or locations in their community and apply reasoning to determine the shortest path to key locations on their map**
- Create/design a representation of an (animal) classification system using a tree structure.

Grades 3-5:

- **Create/design a representation of an (animal) classification system using a tree structure.**
- Describe how AI representations support reasoning to answer questions

Grades 9-12:

- Draw a search tree for tic-tac-toe
- **Describe the differences between types of search algorithms**

Big Idea #3 – What should students be able to do?

Grades K-2:

- Learn from patterns in data with “unplugged” activities
- **Use a classifier that recognizes drawings.** Use Google Autodraw or Cognimates Train Doodle to investigate how training sets work to identify images and discuss how the program knows what they are drawing

Grades 3-5:

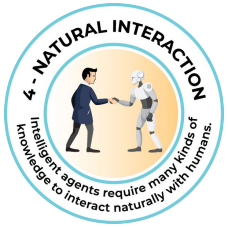
- Describe and compare the three different machine learning approaches: supervised, unsupervised and reinforcement learning.
- **Modify an interactive machine learning project by training its model.**
- Describe how algorithms and machine learning can exhibit biases.

Grades 6-8:

- **Identify bias in a training data set and extend the training set to address the bias**
- **Hand-simulate the training of a simple neural network**

Grades 9-12:

- **Train a neural net (1-3 layers)** ***TensorFlow Playground***
- **Trace and experiment with a simple ML algorithm**



Big Idea #4 – What should students be able to do?

Grades K-2:

- **Identify words in stories that have positive and negative connotations.**
- Recognize and label facial expressions into appropriate emotions (happiness, sadness, anger) and explain why they are labeled the way they are
- **Experiment with software that recognizes emotions in facial expressions**

Grades 3-5:

- **Identify how humans combine multiple inputs (tone, facial expressions, posture, etc) in order to understand communication.**
- Describe some tasks where AI outperforms humans, and tasks where it does not

Grades 6-8:

- Construct a simple chatbot
- **Explain and give examples of how language can be ambiguous**
- **Reason about the nature of intelligence, and identify approaches to determining whether an agent is or is not intelligent.**

Grades 9-12:

- **Demonstrate how sentence parsers handle ambiguity**
- Explore the Google Knowledge Graph
- **Identify and debate the issues of AI and consciousness**

Big Idea #5 – What should students be able to do?

Grades K-2:

- **Identify common AI applications encountered in their daily lives**
- Discuss whether common uses of AI technology are a good or bad thing

Grades 3-5:

- **Explore how behavior is influenced by bias and how it affects decision making**
- Describe ways that AI systems can be designed for inclusivity

Grades 6-8:

- Explain potential sources of bias in AI decision making
- **Understand tradeoffs in the design of AI systems and how decisions can have unintended consequences in the function of a system**

Grades 9-12:

- **Critically explore the positive and negative impacts of an AI system**
- **Design an AI system to address social issues (or explain how AI could be used to address a social issue)**

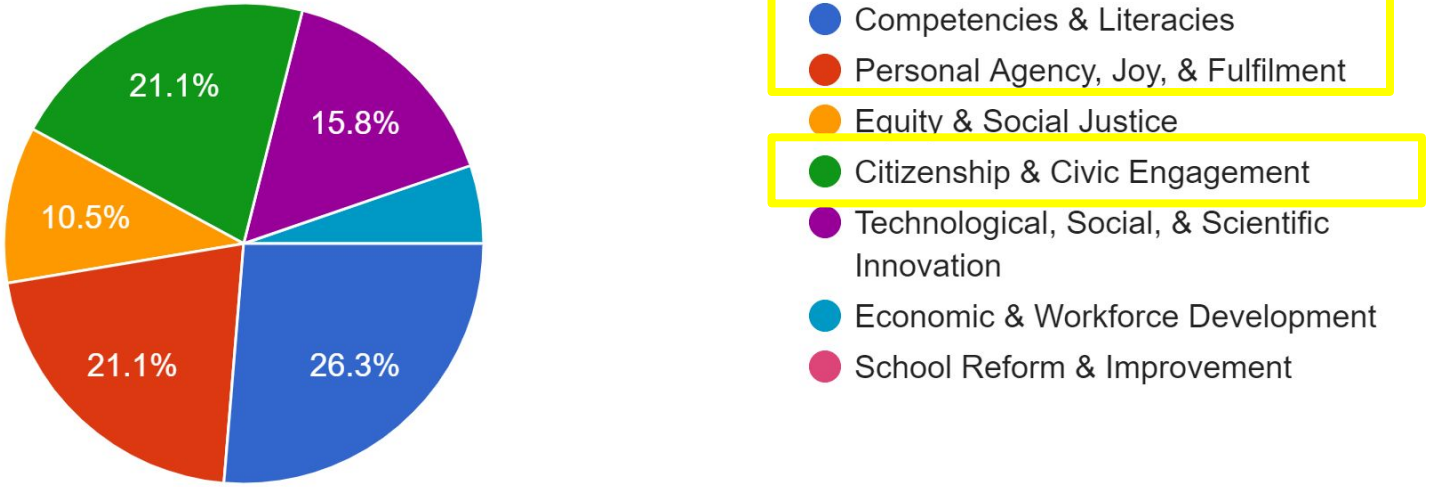
AI in the CURRICULUM

Integration, Standalone CS Courses, & Pathways

Snapshot:
AI For K-12 Working Group Perspective on the Guidelines

What is your primary reason for wanting K-12 students to learn about AI

19 responses



AI into the Curriculum:

Grades K-2

- Integration all subjects including computing
- Mostly unplugged & Teacher lead Demos

Grades 3-5

- Integration all subjects including computing
- Mix: unplugged, AI tools

Grades 6-8

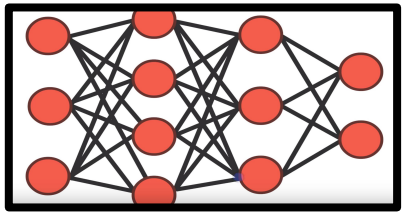
- Integration all subjects including computing
- Standalone Course
- Pathway

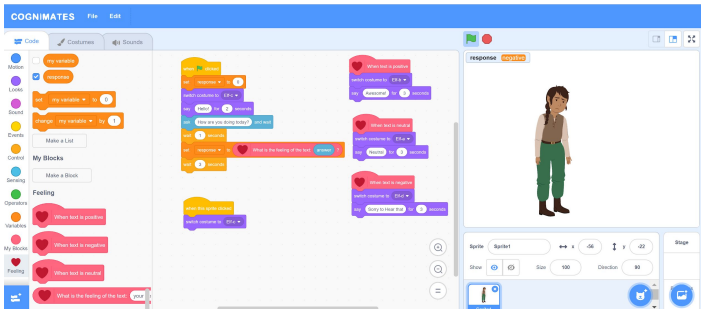
Grades 9-12

- Integration into CS Courses
- Standalone Course
- Pathway

Guidelines for supporting K-12 students

1. **Use transparent AI demonstrations** *that help students see what is going on inside the black box: it's not magic!*
2. **Help students build mental models** of *what is happening under the hood in AI applications.*
3. **Encourage students to develop AI applications** *using AI services.*





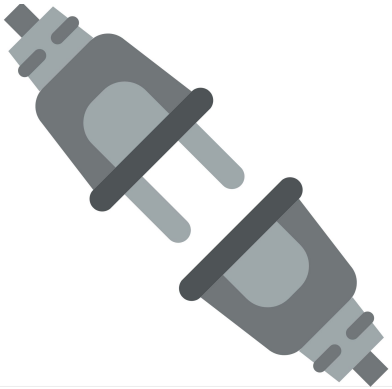
Student Activity Considerations

- **Experiment with AI agents** to investigate their behavior
- **Hand simulate** AI algorithms
- Encourage students to **build their own AI applications**
- **Explore case studies of AI-related societal issues** from multiple perspectives

These activities promote understanding of:

- How AI works
- Limitations of AI
- Systems thinking (AI systems are built from smaller components)
- Sources of bias in AI
- Societal impacts of AI systems

Diversity, Equity, & Inclusion



Overview of AI Tools & Resources for K-12

Professional Development Course

Artificial Intelligence Explorations and Their Practical Use in Schools

www.iste.org/learn/iste-u/artificial-intelligence

Course Dates:

Summer 2019 Session: June 3 - September 13

Enrollment period: ***Now until July 12****

ENROLL NOW

ENROLL A GROUP

Fall 2019 Session: October 14, 2019 - January 27, 2020

Enrollment period: ***Now until October 28****

Course Details:

- Grade Level: 6-12
- Course Length: 30 hours
- Cost: $224 Member / $299 Non-member
- Course Style: asynchronous with instructor

AI4All: Online Student Portal

http://ai-4-all.org/open-learning

The AI4All Open Learning platform will offer a series of online AI courses for high school students. As of summer 2019, the first course is in beta test. This courses focuses on the basics of machine learning.

High School Curricula

Exploring Computer Science

Exploring Computer Science - AI Unit

http://www.exploringcs.org/for-teachers-districts/artificial-intelligence

AI Foundations by ISTE and IBM

ISTE®

IBM Watson

AI Foundations powered by ISTE and IBM

Online course offerings

Suggested audience

14 – 20 +

Course duration

15 hours

Supported languages:

English, Portuguese, Spanish, French

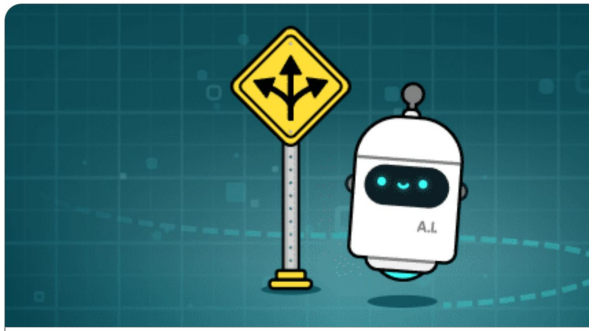
https://www.ptech.org/open-p-tech/curriculum/artificial-intelligence/ai-foundations-powered-by-iste-and-ibm/

https://code.org/ai

How AI Works

Learn about how AI works and videos. Featuring Microsoft CE experts.

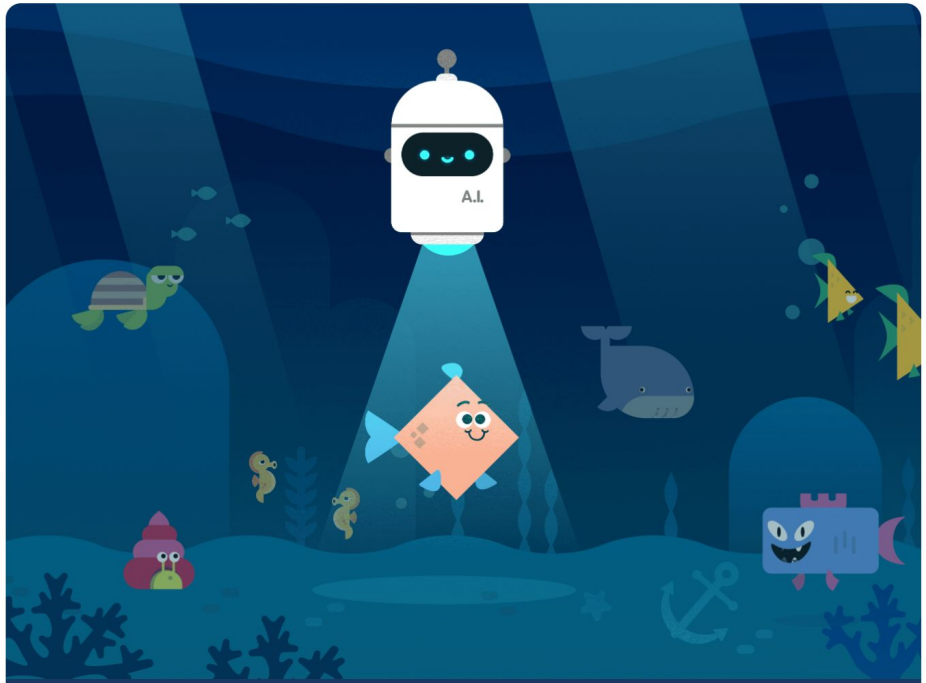
Watch the videos



AI and Ethics

Students reflect on the ethical implications of AI, then work together create an "AI Code of Ethics" resource for AI creators and legislators everywhere.

View lesson plan



AI for Oceans

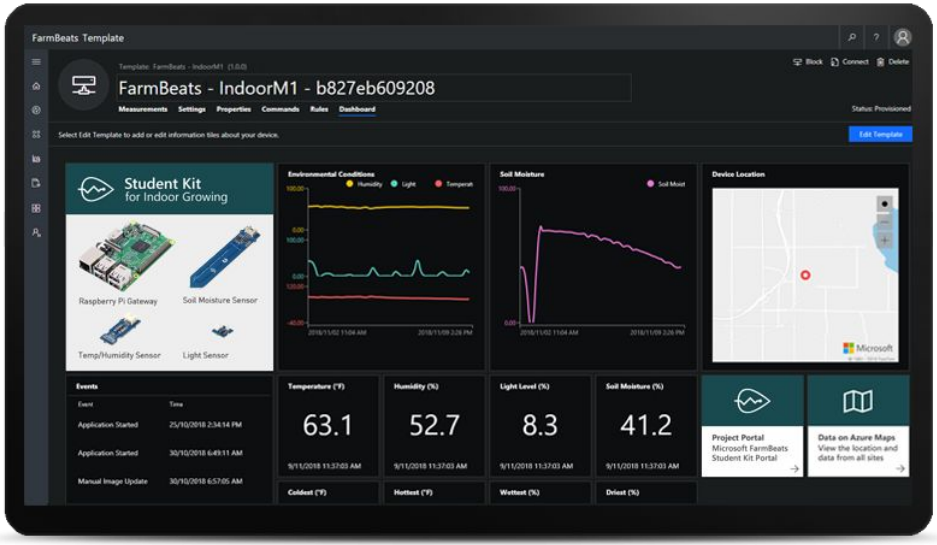
Learn about machine learning and ethical use of AI.

#CSforGood

Available in 25+ languages | Grades 3+

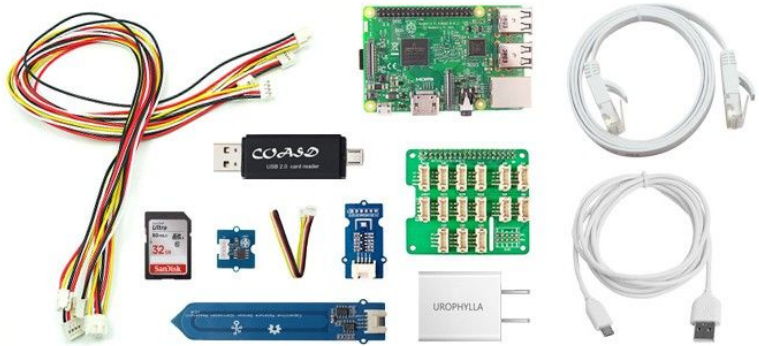
Try now

Microsoft's Farm Beats Kit



The easy-to-use FarmBeats kit includes

- preconfigured Microsoft Azure cloud services
- a Raspberry Pi with soil moisture, light, ambient temperature, and humidity sensors to collect data.
- The data is then visualized in an online dashboard that provides insights to help students.

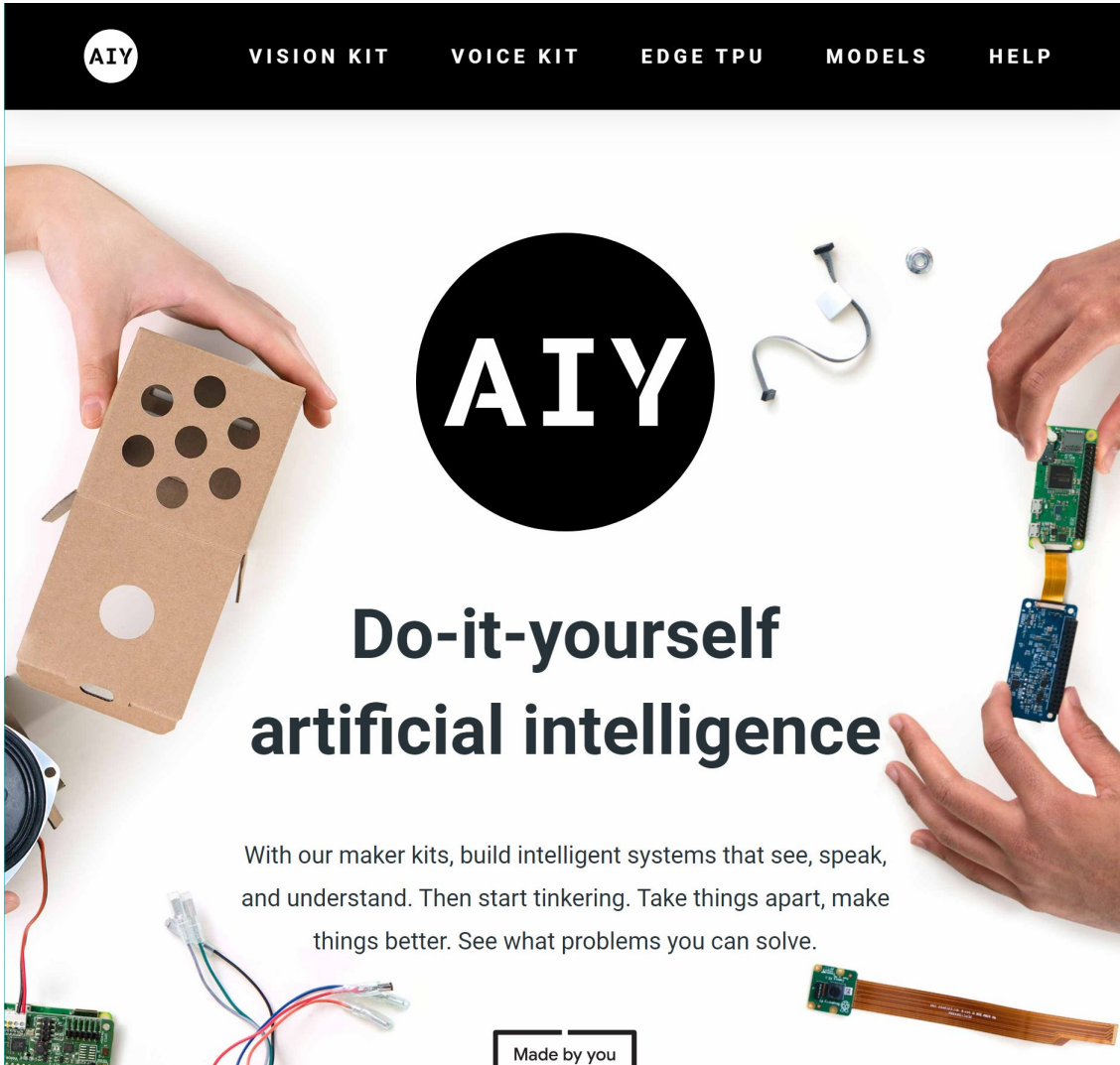


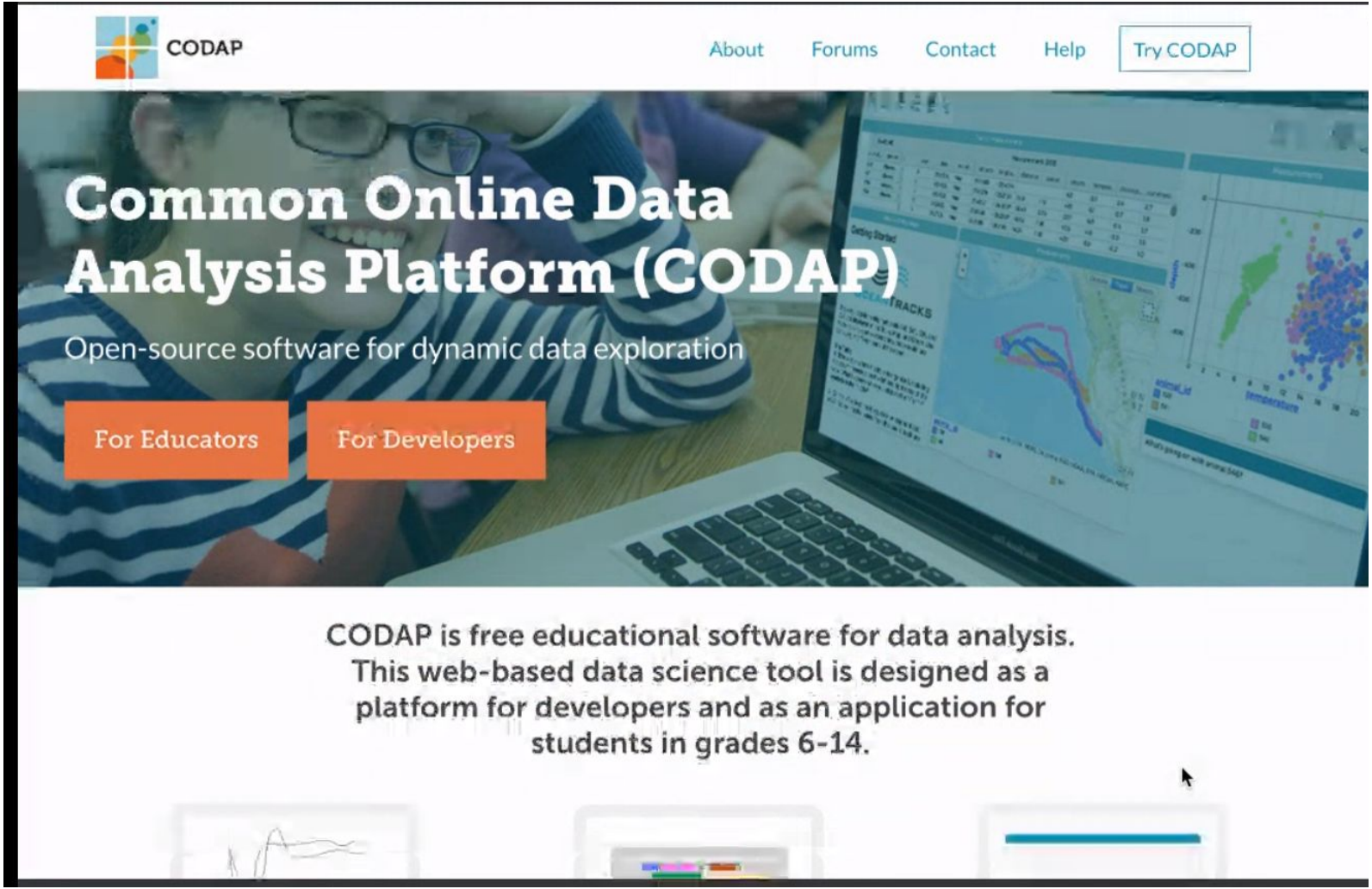
Partnership

Future Farmers of America and Microsoft are working together to create activity guides and resources to help chapters get started with using the technology.

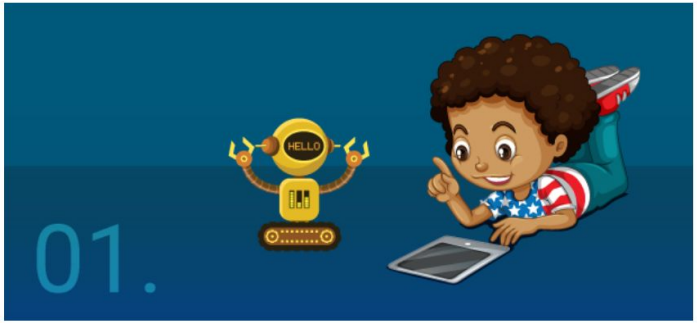
AIY - With Google

https://aiyprojects.withgoogle.com/

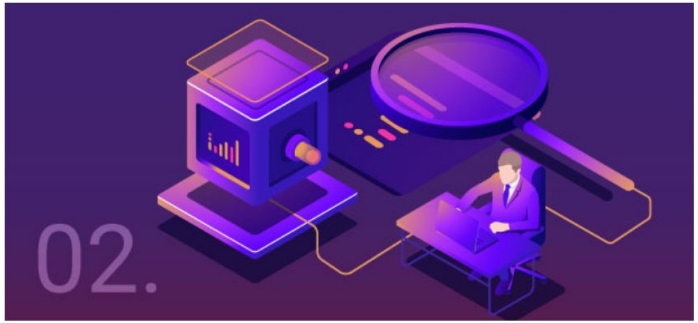



CODAP
About
Forums
Contact
Help
Try CODAP
Common Online Data Analysis Platform (CODAP)
Open-source software for dynamic data exploration
For Educators
For Developers
CODAP is free educational software for data analysis. This web-based data science tool is designed as a platform for developers and as an application for students in grades 6-14.

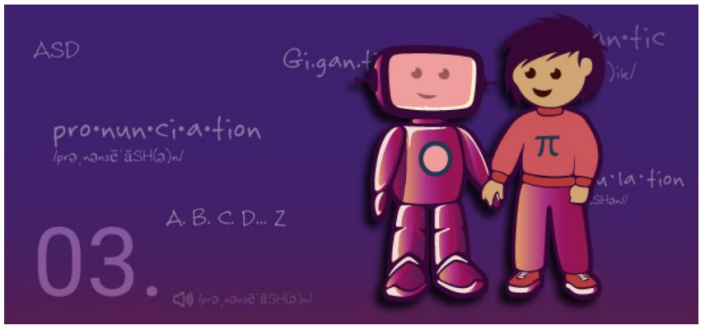
MIT AI Education Website - https://aieducation.mit.edu/



AI Literacy in K-12



AI for Vocational-Technical and Adult Education.

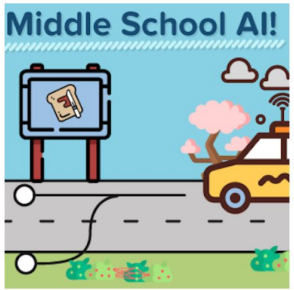


AI and Personalized Learning in the Classroom

Inclusivity and Creativity in the Era of AI

MIT Curricula & Research - https://aieducation.mit.edu/projects.html

DAILy AI Curriculum

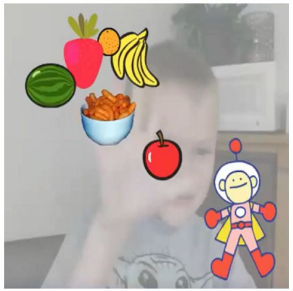


DAILy is a middle school AI curriculum focusing on on AI concepts, ethical issues in AI, creative expression using AI, and how AI relates to your future.

AI & Ethics for Middle School

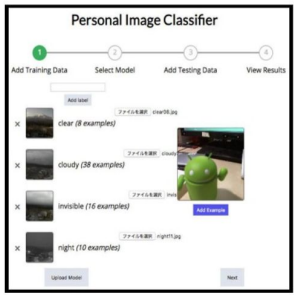
The AI & Ethics Project seeks to develop an open source curriculum for middle school students on the topic of artificial intelligence and its ethical implications.

Dancing with AI



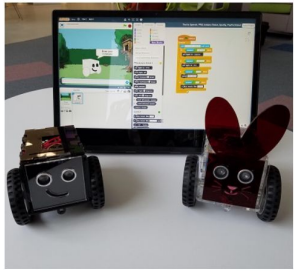
Dancing with AI is a week-long curriculum in which middle school students get to build interactive AI projects using a series of newly developed Scratch extensions allowing for natural interaction.

Personal Image Classifier



Students can create and train image classification models in App Inventor.

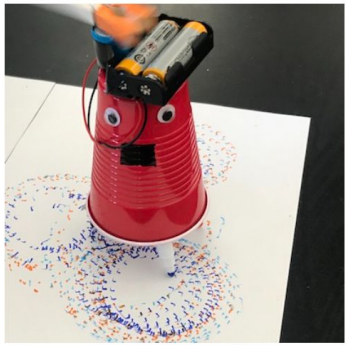
How to Train Your Robot



Bringing AI to middle school during Massachusetts STEM Week with i2 Learning.

MIT Curricula & Research - https://aieducation.mit.edu/projects.html

Primary School AI for K-2nd Grade

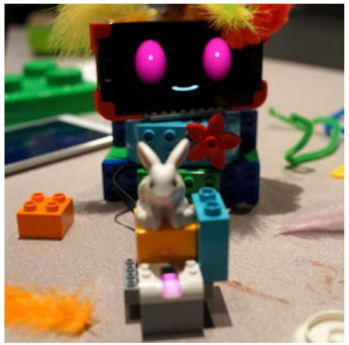


Primary AI for K-2nd grade introduces early elementary school students to robotics and artificial intelligence.

AI & Data Privacy Activities

Data and privacy design activities developed for the Girl Scouts of Eastern MA.

PopBots: Early AI Education



The PopBots Platform is a tool to introduce young children to programming, robotics, and artificial intelligence by allowing them to build and program their own robots.

Primary School AI for 3-5th Grade

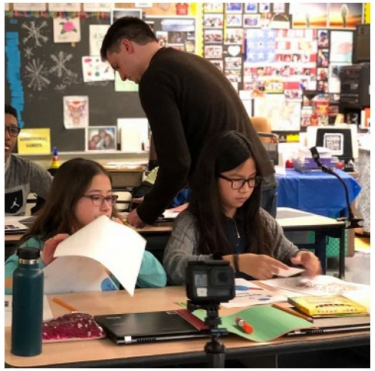
Primary AI for 3-5th grade introduces upper elementary school students to robotics, artificial intelligence, and design thinking.

MIT Curricula & Research - https://aieducation.mit.edu/projects.html

Careers in AI

A video series about experts in AI.

Creativity & GANs for Middle School



Teaching middle school students the practices and ethical implications of creative machine learning techniques, such as GANs and style transfer.

PRG AI Blocks

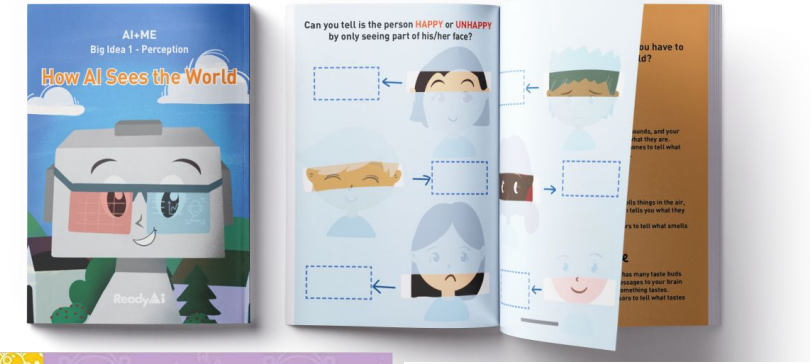
Various extensions to the Scratch programming languages allow students to build AI-enabled projects.

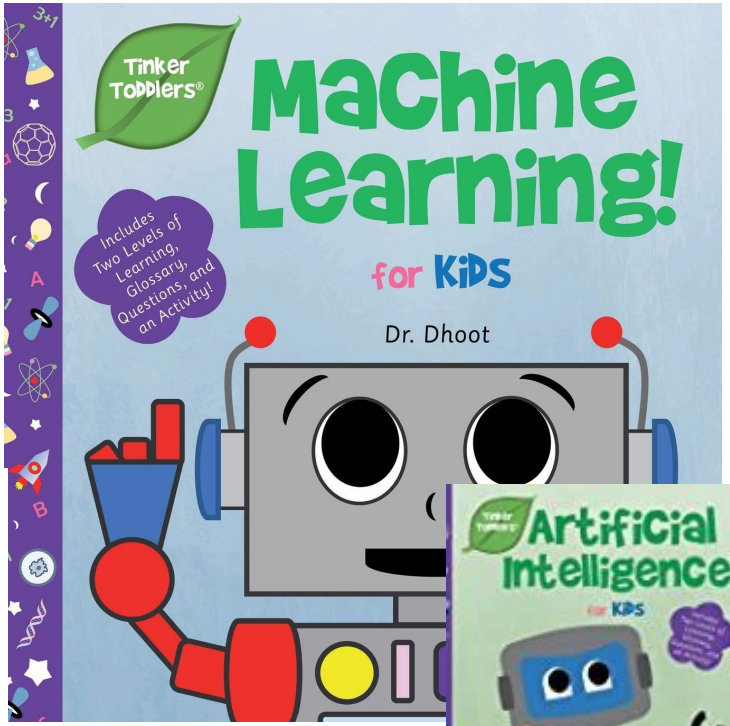
Creativity with Scratch and AI

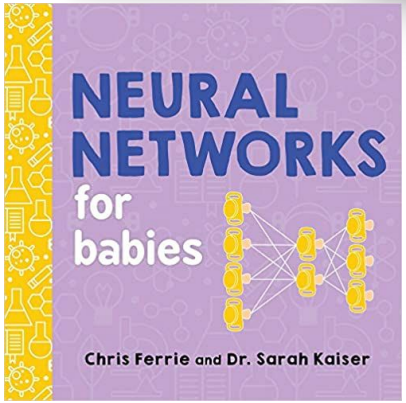
Scratch helps kids learn to think creatively, reason systematically, and collaborate.

Book Series for younger children

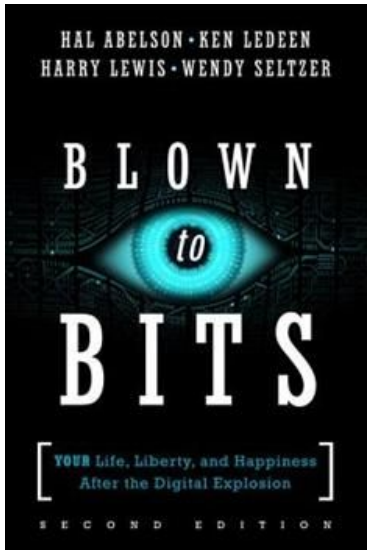
Ready AI AI+Me 5 Big Idea Book Series

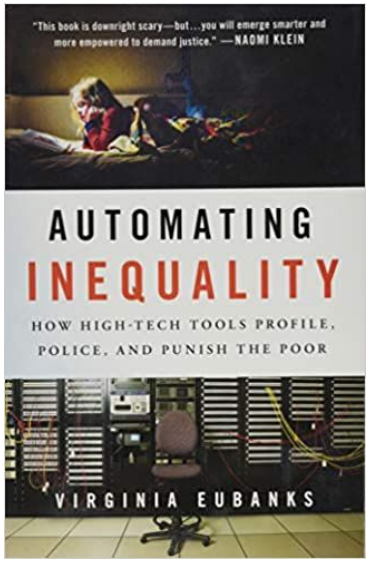


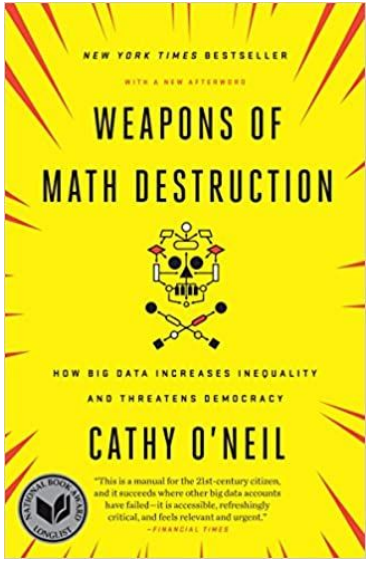


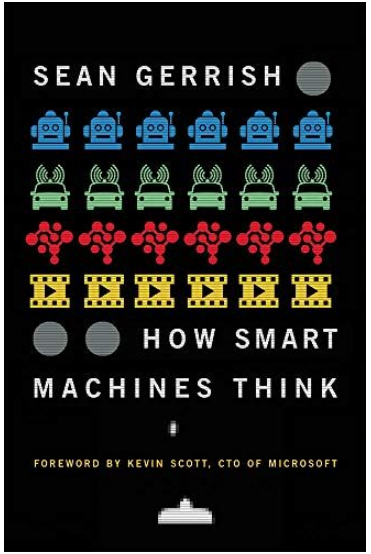


Books: Contemporary AI Issues









Appropriate for Adults & High School Students

Activity, Resources, and Tool Collections

AI4K12 Resource Directory

[ai4k12.org](ai4k12.org)

AI for Teachers

https://aiforteachers.org/teaching-resources

Browser-based Tools & Demos

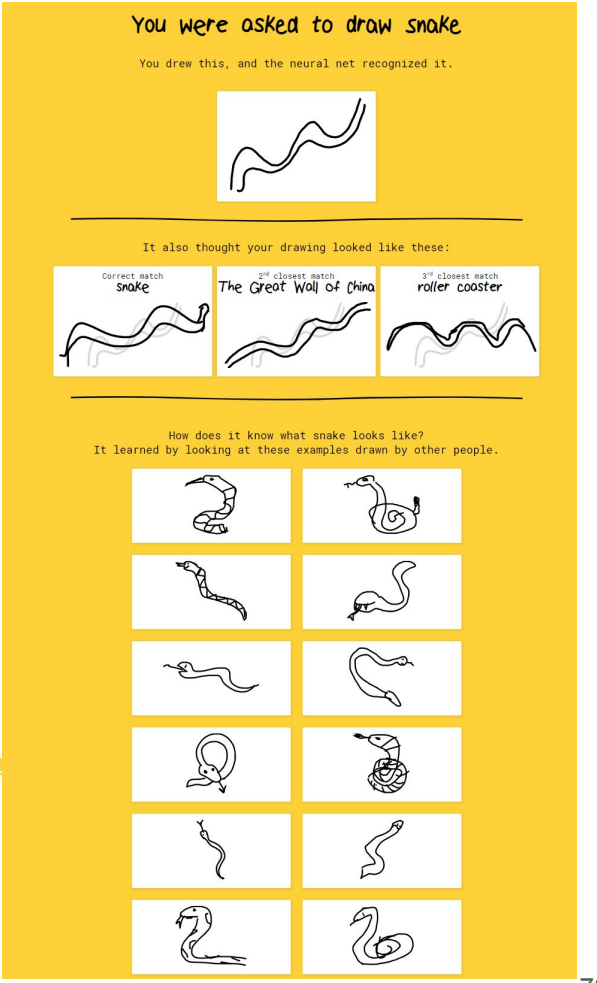
Google's Quick, Draw!

https://quickdraw.withgoogle.com/

Can a neural network learn to recognize doodling?

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

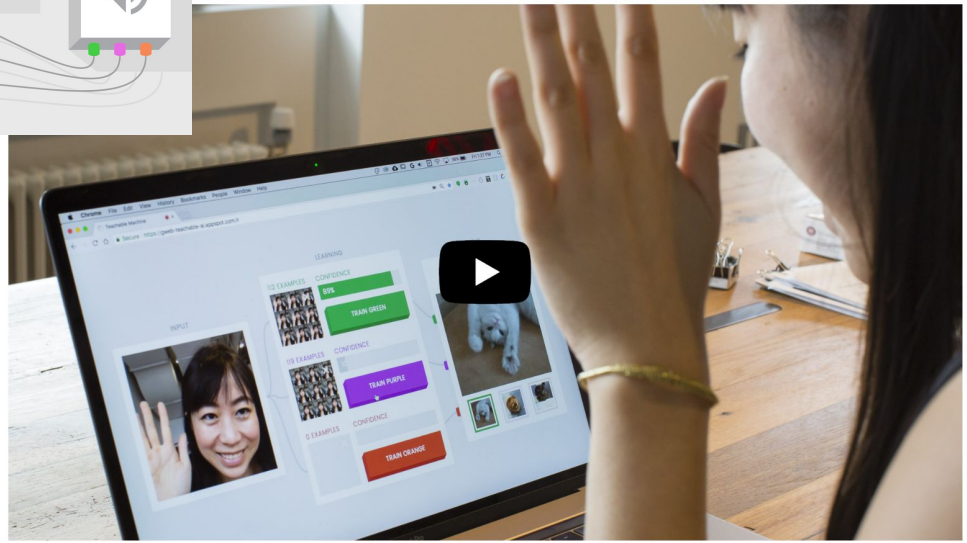
Let's Draw!

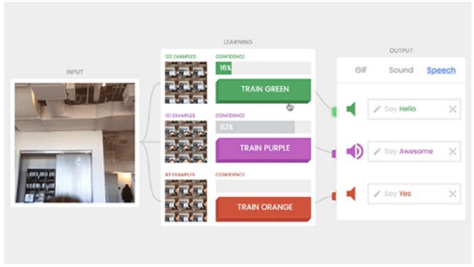


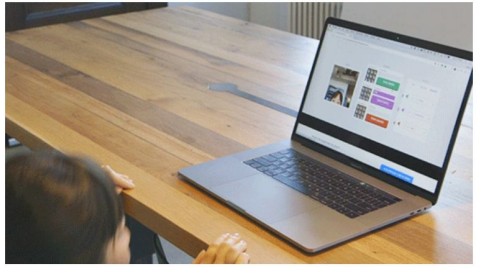
TEACHABLE MACHINE

Built with TensorFlow

- Teach a machine using your camera.
- Live, in the browser.
- No coding required.



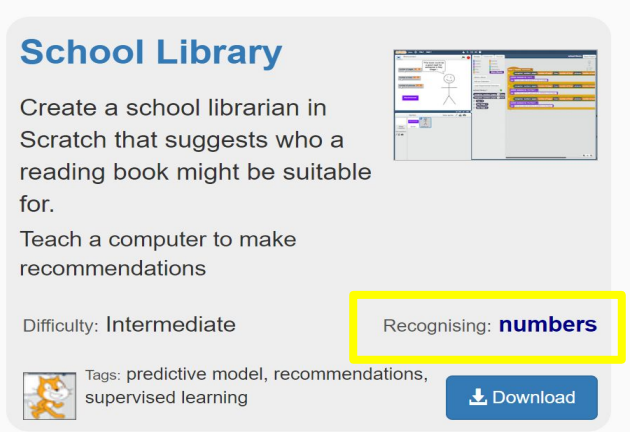




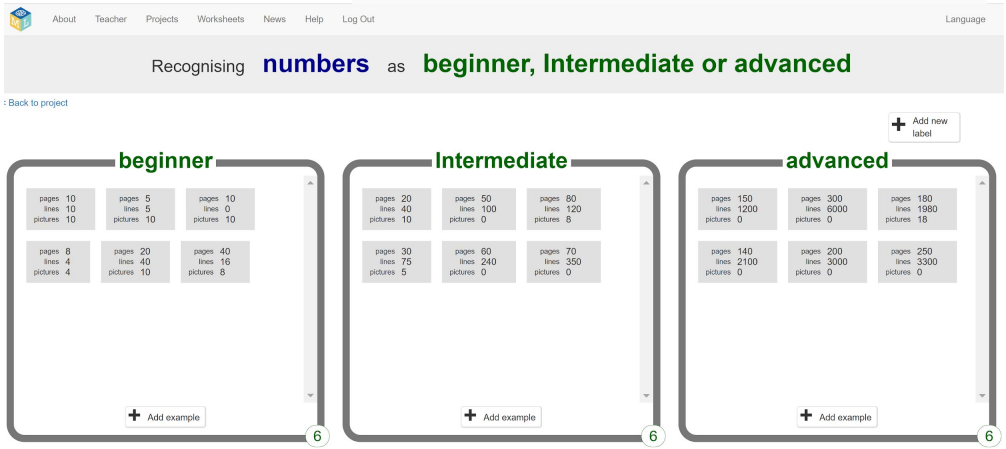
https://experiments.withgoogle.com/teachable-machine

Machine Learning for Kids

https://machinelearningforkids.co.uk



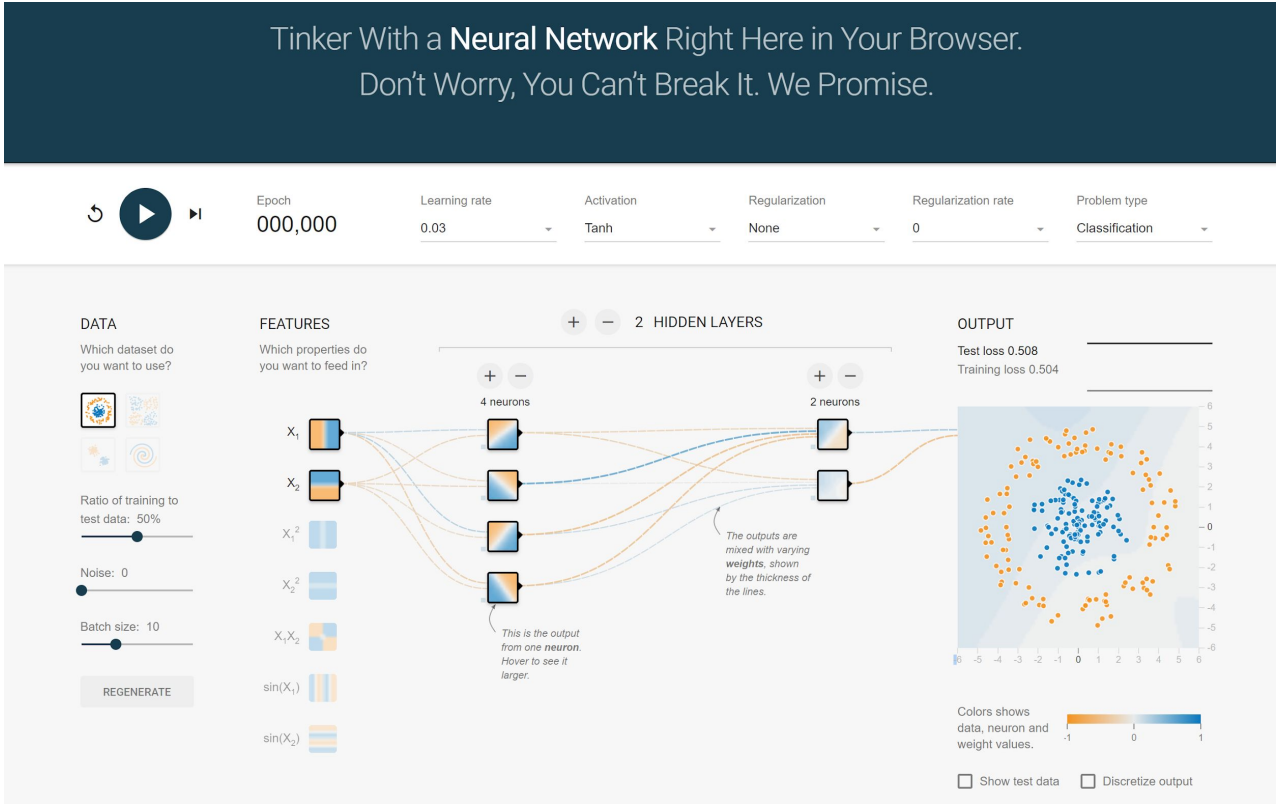
1. Collect examples of things you want to be able to recognise
2. Use the examples to train a computer to be able to recognise them
3. Make a game in Scratch that uses the computer's ability to recognise them



It is being built by Dale Lane using APIs from IBM Watson Developer Cloud.

TensorFlow Playground

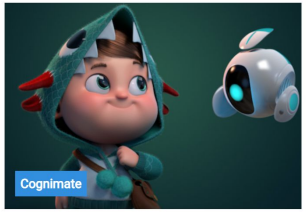
https://playground.tensorflow.org

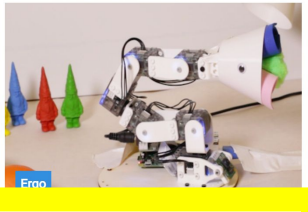


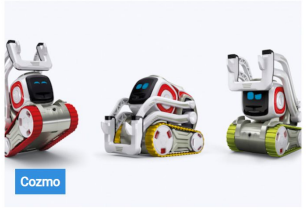
Tutorial: https://cloud.google.com/blog/products/gcp/understanding-neural-networks-with-tensorflow-playground

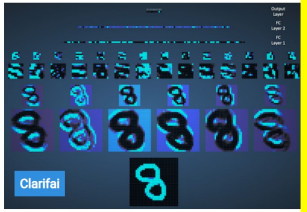
COGNIMATES

http://cognimates.me



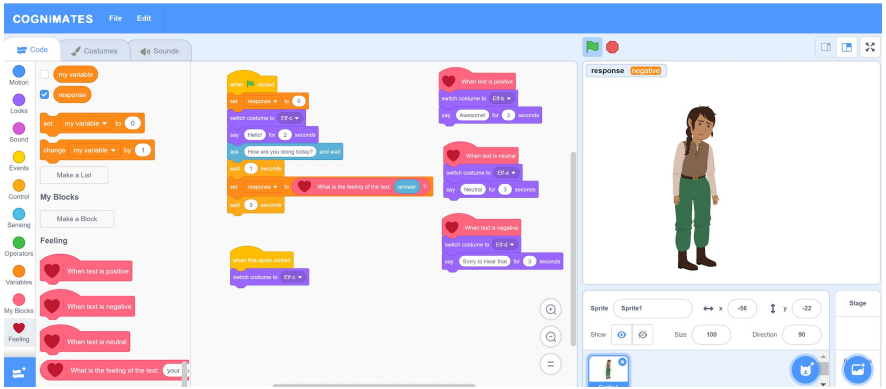






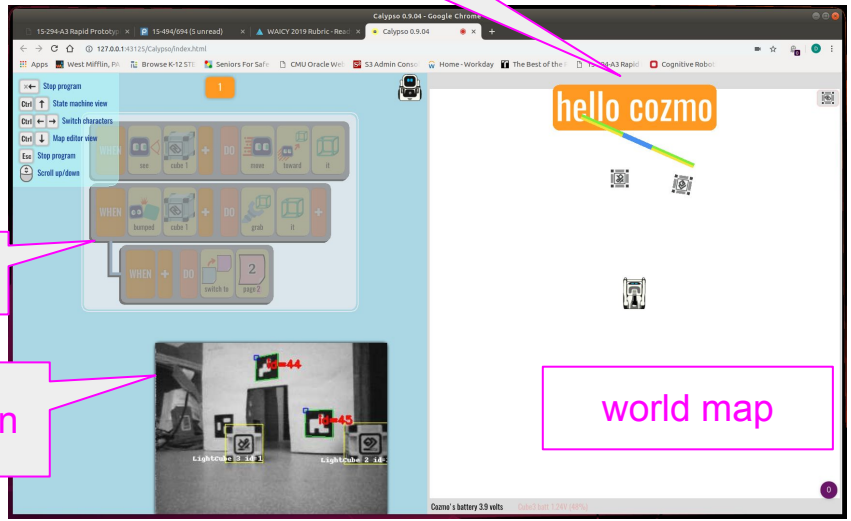
Cognimates offers AI extensions for Scratch, such as:

- speech recognition
- sentiment analysis
- visual pattern detection
- robot control



Created by Stefania Druga, Personal Robots Group at MIT Media Lab, directed by Cynthia Breazeal

Calypso for Cozmo



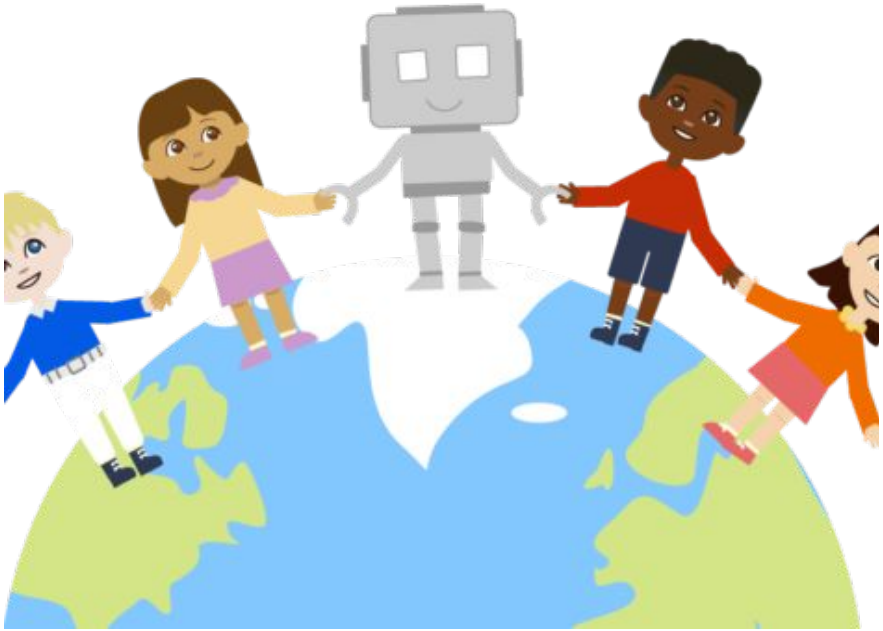
- A robot intelligence framework that Incorporates multiple AI technologies:
  - Computer vision; face recognition
  - Speech recognition and generation
  - Landmark-based navigation
  - Path planning
  - Object manipulation
- Rule-based pattern matching language inspired by Microsoft's Kodu Game Lab
- Teaches computational thinking: "Laws of Calypso", idioms, etc.
- Web site: https://Calypso.software

AI + ME (AI and Me)

edu.readyai.org/courses/aime/

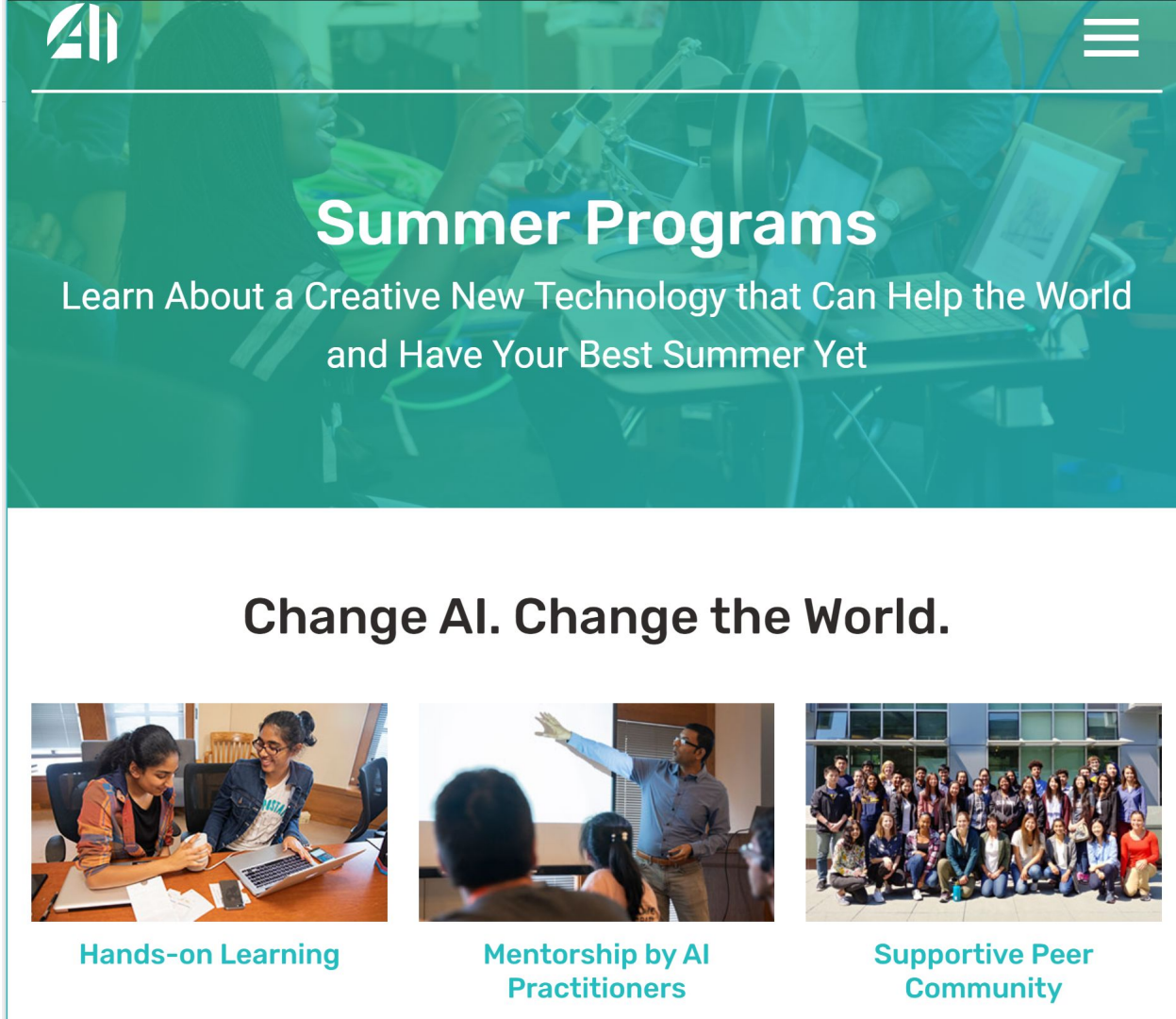
“AI+ME” is an online experience intended to provide young learners with the basics of AI. The lesson takes about one hour to complete. This is the first publicly available course introducing students to the “Five Big Ideas in AI” as defined by the AI4K12 Initiative.

Target Audience: Elementary School

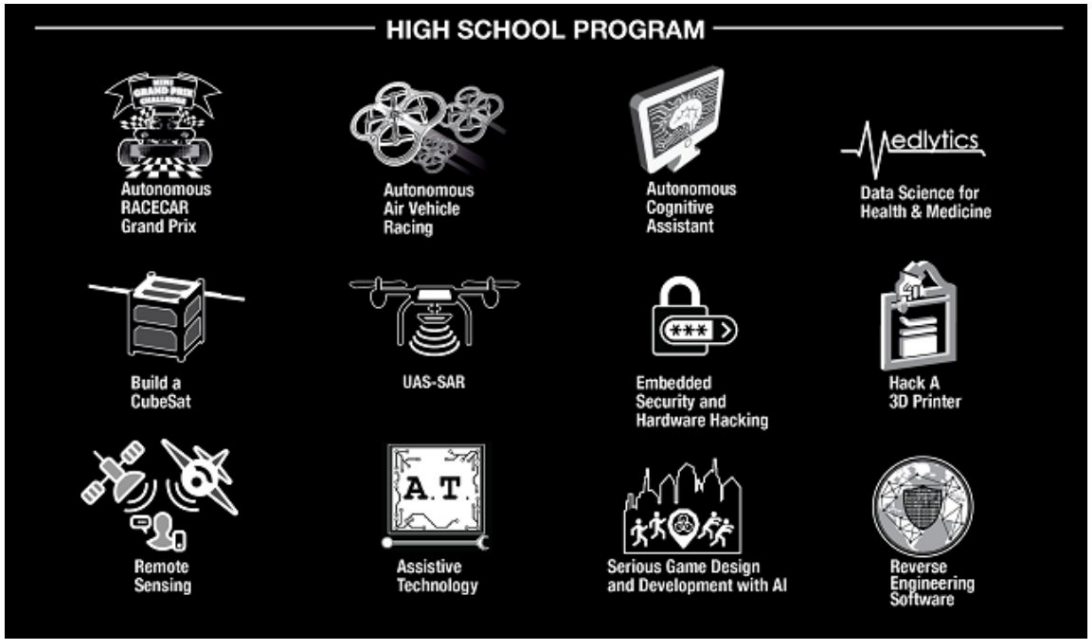


Summer Camps

- National organizations
- Local districts & universities



Summer Camp



Beaverworks

The MIT Beaver Works Summer Institute (BWSI) is a rigorous, world-class STEM program for talented students who will be entering their senior year in high school. The four-week program, hosted at MIT, teaches STEM skills through project-based, workshop-style courses.

Team

Robert Shin
MIT Lincoln Lab

Joel Grimm
MIT Lincoln Lab

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WAICY: World Artificial Intelligence Competition for Youth

"S.T.E.A.M.-Powered A.I."

- 50/50 Rubric
- Winning Project

https://www.waicy.org/

Next Steps

Suggested Next Steps

- Seek out Professional learning opportunities & bring a friend
- Develop cross-curricular project with colleagues
- Review the draft AI4K12 Big Idea #1 & 3 Grade band progression charts
- Help us build a community
- Find out what is happening in your state
- Join our mailing list

Our Next Steps

- The State of AI Education in Your State Workshop (11 states)
- Issuing a report in Summer 2021
- Release Big Ideas #2, 4, & 5

It’s time for all of us to think about AI in K-12.

Visit us:

http://AI4K12.org

Join the mailing list:

https://aaai.org/Organization/mailing-lists.php

#AI4K12