Teaching Artificial Intelligence in K-12

ISAST
Hal Speed
2021.09.13
Feuermachine des Autors
durch die Expansion das
Wasser zuheben
in Profil

Fig. 11.

Hydraulik p. 2.
Artificial Intelligence is powering our lives, economy, and workforce
AI is ubiquitous in our everyday lives
AI is a Part of Our Everyday Lives - Seen & Unseen
AI is an *economic driver* for our economy
AI in Manufacturing & Warehouses
AI in Logistics & Shipping

By 2035
AI in Agriculture
AI in Ocean & Coastal Sensing

- Hurricane Modeling
- Detect Harmful Algae Blooms
AI in Maritime Weather, Situational Awareness & Security
AI in Fashion & Shopping

VIRTUAL GLASSES
TRY ON APP

What should I wear?
Get outfit suggestions based on your location and weather

How do I look?
Upload a photo to get instant style tips, right on your phone
Healthcare

Nurse Grace
Health-care humanoid

Mobile Medical Diagnosis

Rapid DNA Sequencing & Rare Disease Diagnosis
AI in Investment & Stock prediction

Identifying Trends & Evaluating Risks

Relationship Management

Chatbots
## AI in Banking

### Uses of AI in Banking

<table>
<thead>
<tr>
<th>Channel</th>
<th>Front office</th>
<th>Middle office</th>
<th>Back office</th>
</tr>
</thead>
<tbody>
<tr>
<td>Size of cost savings opportunity</td>
<td>$199B</td>
<td>$217B</td>
<td>$31B</td>
</tr>
</tbody>
</table>

### Key use cases

<table>
<thead>
<tr>
<th>Conversational banking</th>
<th>Anti-fraud &amp; risk</th>
<th>Credit underwriting</th>
</tr>
</thead>
<tbody>
<tr>
<td>AI biometrics technology</td>
<td>Personalized insights</td>
<td>Anti-money laundering/Know-your-customer</td>
</tr>
<tr>
<td>Smart contracts infrastructure</td>
<td></td>
<td></td>
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</tbody>
</table>

Source: Business Insider Intelligence, Autonomous NEXT, 2019
Training an AI-Ready Workforce

- Align education to future workforce needs
- Prioritize AI within existing Federal fellowship and service programs
- Leverage research to improve educational quality and opportunity

American AI Initiative: Year One Annual Report, Feb 2020
AI-Enabled Workforce

AI End Users
AI Power Users
AI Professionals & Researchers

AI End Users have fundamental knowledge and skills required to be end users of AI:

- Comfortable using AI-enabled technologies
- Understand the current uses of AI and the limitations
- Understanding how AI affects privacy and security,
- Understand and evaluate the social impacts of AI
- Comfort evaluating how AI is used to make decisions about you or others

All of us are AI End Users
AI-Enabled Workforce

AI Power Users

have fundamental knowledge and skills required to be power AI users and AI professionals:

- Understand the types problems AI tools can solve
- Use AI tools and applications to solve real-world problems
- Evaluate and purchase appropriate AI tools to address business needs
- Build models and systems that leverage data to make decisions
- Data Science skills (e.g., data set identification, data management (cleaning, labeling, etc), selection)
- Evaluate societal impact of AI systems and technologies
- Use and promote ethical and responsible decision making and accountability in the use of AI
AI-Enabled Workforce

AI End Users
AI Power Users
AI Professionals & Researchers

AI Professionals & Researchers have fundamental knowledge and skills required to be power AI users and AI professionals:

- Design AI Algorithms
- Collect & curate datasets and optimize the models
- Programming, deployment, and maintenance of AI systems
- Systems-thinking and human-centered design skills,
- Evaluate societal impact of AI systems and technologies
- Use and promote ethical and responsible decision making and accountability in the use of AI
- Research & Develop AI innovations
AI is an economic driver for our economy. Nearly every sector of the economy and society has been affected by the capabilities and potential of AI.

**Equity of Access**
- Geographic
- Socio-economic
- Racial and Ethnic Groups
- Differently-Abled Learners
- High and Low Resourced Schools & Communities
- Formal & Informal Learning

AI Education is a mechanism for economic advancement for all people.
AI is an economic driver for our economy. Nearly every sector of the economy and society has been affected by the capabilities and potential of AI.

AI Education is a mechanism for economic advancement for all people.

Diversity & Inclusion of Voices and Representation. Ensuring Everyone has:

- a seat at the table (e.g., student, teachers, community, administrators, parents, decision-makers)
- skills to develop AI-enabled technologies
- empowerment to evaluate and make decisions about the use of AI-enabled technologies for personal, educational, professional, and decision-making purposes.
Overview of the AI4K12 Initiative
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)
Steering Committee

Dave Touretzky
Carnegie Mellon
AI for K-12 Working Group Chair

Christina Gardner-McCune
University of Florida
AI For K-12 Working Group Co-Chair

Deborah Seehorn
Co-Chair of CSTA
Standards Committee
Academia/Industry Working Group Members

Hal Abelson
MIT

Cynthia Breazeal
MIT

Emily Reid
AI4ALL

Matthijs Spaan
TU Delft
AAAI

Fred Martin
UMass Lowell
Former:
CSTA Chair of Board of Directors
Mission

● Develop national guidelines for teaching AI in K-12
  ○ Modeled after the *K-12 CS Framework* 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
AI4K12 Guidelines, Not Standards

We aim to provide

- 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

Guidelines define:

- What students should know (Enduring Understanding - Knowledge)
- What students should do (Learning Objective - Skill)
**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)
Advisory Board

Miles Berry, Roehampton University, UK
Amy Eguchi, UC San Diego, CA
Morgan Grimes, Amazon, Cincinnati OH
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Wells Santo, Oakland, CA
Laura Schmidt, Milwaukee Tech Hub Coalition, WI
Joseph South, ISTE, Portland, OR
Tom Vander Ark, Getting Smart, Federal Way, WA
Karon Weber, Microsoft, Seattle, WA
Joyce D. Williams, National Geospatial-Intelligence Agency, VA
Five Big Ideas in AI

- Organizing framework for the K-12 guidelines
- 5 big ideas are enough to cover the richness of the field, but small enough to be manageable by teachers
- Not necessarily the way AI practitioners view their field, but appropriate for the needs of the K-12 audience
Big Idea #1: Perception

Computers perceive the world using sensors

Perception is the extraction of meaning from sensory signals using knowledge.

- Human senses vs. computer sensors
- Types of perception: vision, speech, recognition, etc.
- How perception works: algorithms
Big Idea #1: Perception - Concept List

1-A: Sensing
● 1-A-i: Living Things
● 1-A-ii: Computer Sensors
● 1-A-iii: Digital Encoding

1-B: Processing
● 1-B-i: Sensing vs. Perception
● 1-B-ii: Feature Extraction
● 1-B-iii: Abstraction Pipeline: Language
● 1-B-iv: Abstraction Pipeline: Vision

1-C: Domain Knowledge
● 1-C-i: Types of Domain Knowledge
● 1-C-ii: Inclusivity
Big Idea #2: Representation and Reasoning

Agents maintain representations of the world and use them for reasoning

- Types of representations
- Families of algorithms and the work they do
- Representation supports reasoning: algorithms operate on representations
Big Idea #2: Representation & Reasoning - Concept List

1-A: Representation
- 1-A-i: Abstraction
- 1-A-ii: Symbolic Representation
- 1-A-iii: Data Structures
- 1-A-iv: Feature Vectors

1-B: Search
- 1-B-i: State Spaces and Operators
- 1-B-ii: Combination Search

1-C: Reasoning
- 1-C-i: Types of Reasoning Problems
- 1-C-ii: Reasoning Algorithms
Big Idea #3: Learning

Computers can learn from data

- Nature of learning
- Fundamentals of neural networks
- Datasets
Big Idea #3: Learning - Concept List

1-A: Nature of Learning
- 1-A-i: Humans vs. Machines
- 1-A-ii: Finding Patterns in Data
- 1-A-iii: Training a Model
- 1-A-iv: Constructing a Reasoner
- 1-A-v: Adjusting Parameters
- 1-A-vi: Learning from Experience

1-B: Neural Networks
- 1-B-i: Structure of a Neural Network
- 1-B-ii: Weight Adjustments

1-C: Datasets
- 1-C-i: Feature Sets
- 1-C-ii: Large Datasets
- 1-C-iii: Bias
Big Idea #4: Natural Interaction

Intelligent agents require many kinds of knowledge to interact naturally with humans

- Natural language understanding
- Common sense reasoning
- Affective computing & interaction (e.g. with robots or speech agents)
- Consciousness and philosophy of mind
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: Societal Impact

Artificial Intelligence can impact society in both positive and negative ways

- Ethics of AI making decisions about people
  - Fairness, bias, transparency, explainability, accountability
- Economic impacts of AI
- Cultural impacts of AI
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)
Overview of the AI4K12 Initiative Work

Year 1 - 2018-2019
- Release Big Ideas Wheel
- Developing Gradeband guidelines
- Release example guidelines, activities, and resources
- Community Building: CSTA Kick-off (2018), AAAI Fall 2018 Symposia

Year 2 - 2019-2020
- Refining guidelines and developing grade band progression charts
- Released K-12 Progression for Big Idea #1 Perception (Open for public feedback)
- Community Building: ISTE, CSTA, SIGCSE, AAAI, EAAI presentations, workshops, panels; AAAI Fall 2019 Symposia

Year 3 - 2020-2021
- Released K-12 Progression for Big Idea #2 - Representation & Reasoning and Big Idea #3 Learning (Open for public feedback)
- Release all 5 Big Ideas in AI Progression Chart & revise based on public feedback
- Community Building: The State of AI Education in Your State, EAAI 2021 - Special Track - AI Demos, Resources, Curriculum
- Community Building (ongoing): Webinars, Twitter Chats, Workshops

Learn more at AI4K12.org
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 explain 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 ....
Five Big Ideas in Artificial Intelligence

1. Perception
   Computers perceive the world using sensors. Perception is the process of extracting meaning from sensory signals. Making computers “see” and “hear” well enough for practical use is one of the most significant achievements of AI to date.

2. Representation & Reasoning
   Agents maintain representations of the world and use them for reasoning. Representation is one of the fundamental problems of intelligence, both natural and artificial. Computers construct representations using data structures, and these representations support reasoning algorithms that derive new information from what is already known. While AI agents can reason about very complex problems, they do not think the way a human does.

3. Learning
   Computers can learn from data. Machine learning is a kind of statistical inference that finds patterns in data. Many areas of AI have progressed significantly in recent years thanks to learning algorithms that create new representations. For the approach to succeed, tremendous amounts of data are required. This “training data” must usually be supplied by people, but is sometimes acquired by the machine itself.

4. Natural Interaction
   Intelligent agents require many kinds of knowledge to interact naturally with humans. Agents must be able to converse in human languages, recognize facial expressions and emotions, and draw upon knowledge of culture and social conventions to infer intentions from observed behavior. All of these are difficult problems. Today’s AI systems can use language to a limited extent, but lack the general reasoning and conversational capabilities of even a child.

5. Societal Impact
   AI can impact society in both positive and negative ways. AI technologies are changing the ways we work, travel, communicate, and care for each other. But we must be mindful of the harms that can potentially occur. For example, biases in the data used to train an AI system could lead to some people being less well served than others. Thus, it is important to discuss the impacts that AI is having on our society and develop criteria for the ethical design and deployment of AI-based systems.

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11” x 14” poster available for free download at AI4K12.org

The AI for K-12 Initiative is a joint project of the Association for the Advancement of Artificial Intelligence (AAAI) and the Computer Science Teachers Association (CSTA). Funded by National Science Foundation award DRL-1546473.

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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, Portuguese, Turkish, Tamil, and Thai.
AI4K12 State Workshop
Workshop Objectives

To provide an opportunity for states to...

- learn about national & state efforts K-12 AI Education & Resources
- learn from and network with other states
- collaboratively work within your state team to develop
  - AI Vision & Implementation Implications
  - A draft AI Implementation plan (3, 6, 12 mo goals)
  - Formation of an initial leadership team
- Identify *Immediate Next Steps* for your state group and each team member
- Develop a *Work and Communication Plan* (e.g., Action Plan)
The State of K-12 AI Education in Your State: A Planning Workshop
David Touretzky, CMU & Christina Gardner-McCune, UF
Funded by National Science Foundation award DRL-1846073.

141 Participants

27 States
3 Territories

Focused Breakout Groups (15):
CA, CT, FL, GA, HI, IL, IN, MD, MA, MS, NC, OH, PA, SC, TX, Puerto Rico, Virgin Islands (no docs)
On-Going Support of State Teams

Quarterly Webinars & Check-ins & Community Building

- 1 month Check-in
- 3 month Goal Check-in & Small-Group Work (targeted at areas of interest)
- 6 month Goal Check-in
- 9 month Goal Check-in

Slack Group - Community Building & Resource Sharing

- Coordination across roles
- Reduce duplication of work
- Collaboration to build capacity
Highlights from States working to integrate AI into their K-12 Plan
## Texas

<table>
<thead>
<tr>
<th>Name</th>
<th>Institution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dan Blier</td>
<td>Plano ISD</td>
</tr>
<tr>
<td>Joy Schwartz</td>
<td>TACC</td>
</tr>
<tr>
<td>Dara Betz</td>
<td>Del Mar College</td>
</tr>
<tr>
<td>Philip Davis</td>
<td>Del Mar College</td>
</tr>
</tbody>
</table>
Texas

- Texas is in the beginning stages of looking into AI for our K-12 schools.
- No courses have been approved by our State Board of Education.
- There is a legislative passed requirement to develop a K-12 CS Strategic Plan. This hasn’t started being built yet. This opens an opportunity to bring AI into the process.
CS Updates

- **CS funding returned**! $5M Educator Workforce Investment Grant, $5M supporting teachers to get CS Supplementary Authorization, $250K/year 1.0 FTE CA CS Coordinator
- New Code.org AI/ML CS Discoveries Unit 7
- ISTE is releasing a fifth AI guide this fall, which will focus on ethics + AI and aligns with the five big ideas.

### Awareness

- ✔ 2 AI workshops at CSTA Code ‘n Play (Machine Learning for Kids for Grades 3-8 and Teachable Machine/p5.js for Grades 6-12.)
- ✔ Teachable Machine for 4-12 workshop at the May CSTA-SV meeting.
- ✔ Regional industry advisory committee meeting: AI and the implications of automation on the Ag, Advanced Manufacturing, and ICT sectors.
- ✞ Reach out to CA state level math, science, language arts, organizations to present the AI literacy & Five Big Ideas.

### Community

- ✔ Scheduled monthly AI team meetings.
- ✔ Created Google Drive repository of AI resources.
- ✔ Created #aiforca channel on CSforCA Slack.
- ✞ CSTA chapter outreach: document AI teaching and learning in our state, offer to present on AI at chapter meetings.
- ✞ Identify what we need from future industry partners, and reach out to potential industry partners.

### Accessibility

- ✔ AI summer camp (Virtual SDUSD High School AI Camp) @ UC San Diego (CREATE) for the San Diego Unified high school students.
- ✔ NSF grant proposal for AI4K12 research projects to support the initiative.
- ✞ Create crosswalk among the Five Big Ideas in AI, CA CS standards, and other core subject areas.
- ✞ UCSD AI Literacy course
To Date:

● Stakeholder meetings (FLDOE, UF, school districts, economic development agencies, state workforce boards, philanthropic foundations, state colleges, technical colleges, SUS and industry)
● Developed industry AI workforce survey, collected and analyzed responses
● Piloted Summer ‘21 camp with support from UF, CareerSource Central Florida and OCPS
● Developed 4 course CTE framework for high school students (Under review by FL DOE)

Next Steps (in progress):

● Secure funding to ensure smooth implementation of the AI Foundations CTE Framework in Fall 22
● Strategic planning and implementation for curriculum development and capacity building opportunities for teacher professional development are underway in partnership with FLDOE, districts and UF (this effort will begin in fall 2021)
● Develop feedback mechanism to connect industry, the academy and K-12 educators around AI Education
● Develop framework at elementary and middle school level
BCPS CTE Artificial Intelligence/Machine Learning Advisory Committee met bi-weekly

AI Symposium that included K12, community college and 4-year higher ed had 50+ attendees.

Continuing to develop AI learning pathway for teachers

1. Introduction to AI 1 credit
2. Follow up to AI topics 1 credit
3. AI careers ½ credit
4. AI and equity 1 credit
5. Teaching advanced AI in high school 1 cr.

What about looking at ways to implement CS standards across K-12 using AI as the context?

60 more educators registered for summer 2021 intro, 7 for advanced with Python, 27 for MS AI, 10 for follow up
Georgia State Updates

- High School AI pathway out for public review
  (Scroll to bottom)

- AI4GA grant was funded by NSF to create curriculum and PD for middle school AI instruction
  - Exploring existing curriculum to include in project

- AI task force plans to meet again after the semester ends/transitions
AI4K12 Community
Next Steps

New States
1. Build a team
2. Setup a meeting to work through the resources to create your state implementation

Continuing Delegations
1. Continue to expand your team
2. Meet with your team
3. Work your implementation plan
4. Let us know if you have questions or need help moving forward

Low Hanging Fruit
1. Add AI PD into CS State Summit
2. Create a landscape survey to see what grassroots activities are going on in your state (districts, industry, teachers, libraries, nonprofits/community partners)
3. Connect with your local CSTA chapter
4. Informal networks and community supports
5. ISTE PLN informal - virtual field trips - NC traveling AI exhibits, girl scouts/boys scouts, John Deere
It’s Not Too Late to Get Involved

● Review and use workshop resources
  ○ shared workshop folder

● Next State Webinar - 2021 October 6
It’s time for all of us to think about AI in K-12.

Email us: info@ai4k12.org

Visit us: https://AI4K12.org

Join the mailing list: https://aaai.org/Organization/mailing-lists.php

Follow Us & Join the Twitter Chats

#AI4K12
Machine Learning Primer
What is Machine Learning?

- Machine Learning is a subfield of Artificial Intelligence focused on developing algorithms that learn to solve problems by analyzing data for patterns.
- Deep Learning is a type of Machine Learning that leverages Neural Networks and Big Data.

Source: HarvardX tinyML course
What is Machine Learning?

Human Programming

Input Data (ingredients) → Computer → Output (cake)
Human Program (recipe)

Machine Learning

Input Data (ingredients) → Computer → Program (recipe) or Model
Desired Output (cake)
What is Machine Learning?

**Human Programming**

- Input Data (2,2)
- Human Program (x+y)

**Computer** → Output (4)

**Machine Learning**

- Input Data (2,2)
- Desired Output (4)

**Computer** → Program (x+y, x*y, x², y², ?) or Model
Once We Have A Trained Model

Unlabeled or Unclassified Data → Trained Model → Inferences or Classifications (guesses with a degree of confidence)
Machine Learning Workflow

Data Engineering or Data Science

Model Engineering

Model Deployment

Usage

Collect Data  Preprocess Data  Design a Model  Train a Model  Evaluate Optimize  Convert Model  Deploy Model  Make Inferences

Source: HarvardX tinyML and Google TensorFlow
How Do ML Models “See” and “Hear”? 

- Vertical edges
- Horizontal edges

spectrogram
AI4K12 Resource Directory

https://ai4k12.org/resources/list-of-resources/

Includes:

- Books and Reports (Adults)
- Children’s Books
- Competitions
- Curriculum Materials
- Demos

- Online Professional Development Courses
- Online Courses for K-12 Students
- Reference Sources & Tutorials
- Resource Directories
- Software Tools & IDEs
- Videos
Additional Resource Lists

https://aiforteachers.org/

https://raise.mit.edu/resources.html

https://tinymlx.org/4D/K12

https://www.actua.ca/ai/

https://code.org/ai
AI and Machine Learning Module

- ~ 5 week curriculum
- Standalone or optional unit in CS

Discoveries

AI for Oceans Classifier

How AI Works Videos

AI and Ethics

Code.org Resources

https://code.org/ai
Intended to be an alternative unit to either unit 5 or 6 of the ECS course
AI in Education

https://iste.org/areas-of-focus/AI-in-education

AI Course on ISTE U
Fall 2021 starts Oct 4
Spring 2022 starts Feb 7
Summer 2022 starts July 11
$224/299

Teaching AI

Free AI Course
15-hour, self-paced
High School Level
AI4ALL Open Learning empowers high school teachers of all subjects to bring AI education to their classrooms through a free, adaptable AI curriculum and teacher resources.
ReadyAI Resources

- Self-paced Courses
- Lesson Plans
- Unplugged Lessons
- Teacher Training

AI Picture Books

AI Teaching & Learning Kits

https://www.readyai.org/
Other Books for Young Students

https://tinkertoddlers.com/
● Introduction to ML: Image Classification
● Personal Image Classifier: PICaboo
● Personal Audio Classifier
● Voice Calculator Tutorial
● Therapist Bot Tutorial
● Awesome Dancing with AI Tutorial
● Facemesh Filter Camera
● Rock Paper Scissors Tutorial

https://appinventor.mit.edu/explore/ai-with-mit-app-inventor
Microsoft Farm Beats for Students

https://aka.ms/farmbeatsforstudents

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/

Do-it-yourself artificial intelligence

With our maker kits, build intelligent systems that see, speak, and understand. Then start tinkering. Take things apart, make things better. See what problems you can solve.
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/](https://aieducation.mit.edu/)

01. AI Literacy in K-12

02. AI for Vocational-Technical and Adult Education.

03. AI and Personalized Learning in the Classroom

04. Inclusivity and Creativity in the Era of AI
DAILY AI Curriculum

DAILY is a middle school AI curriculum focusing 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.
Computing and AI Education Programs

**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.
Browser-based Tools
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!

https://quickdraw.withgoogle.com/

You were asked to draw snake

You draw this, and the neural net recognized it.

It also thought your drawing looked like these:

- COLD DRINKS
- snake
- The Great Wall of China
- roller coaster

How does it know what snake looks like?
It learned by looking at these examples drawn by other people.
Teachable Machine

https://teachablemachine.withgoogle.com/

1. **Gather**
   Gather and group your examples into classes, or categories, that you want the computer to learn.

2. **Train**
   Train your model, then instantly test it out to see whether it can correctly classify new examples.

3. **Export**
   Export your model for your projects: sites, apps, and more. You can download your model or host it online for free.
Label, Train, Use

Lobe simplifies the process of machine learning into three easy steps. Collect and label your images. Train your model and understand your results. Then play, improve, and export your model.
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
Cognimates offers AI extensions for Scratch, such as:

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

https://lab.scratch.mit.edu/face/

Make a sprite follow your nose

Does it see you?
Other Scratch-based Editors w/ML

https://scratch.techpark.jp/

https://stretch3.github.io/

https://mblock.makeblock.com/
Wio Terminal

Wio Terminal is your complete AI platform to get started with TinyML and IoT - Built around the ATSAMD51P19 and ARM Cortex-M4F at 120MHz for high compatibility with various ML frameworks for microcontrollers.

Hardware

Software

Learning Resources

Codecraft

Codecraft is a graphical programming environment based on Scratch 3.0 that supports a great variety of hardware devices and programming languages such as Arduino, Python, C or JavaScript etc. Now it supports TinyML in collaboration with Edge Impulse!

TinyML with Wio Terminal Free Course for Beginners

Begin your first step into the world of TinyML and Wio Terminal with detailed lessons and step-by-step projects to guide you! Now, simple hardware can also solve complex problems.
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
TensorFlow Playground

https://playground.tensorflow.org

Other AI Activities
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

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HIGH SCHOOL STUDENTS & PARENTS

JOIN A BOOTCAMP

With no prior experience or knowledge required, any 9th - 12th grader can learn the basics of Artificial Intelligence by participating in one of our Intro to AI Bootcamps. Click below to be notified when we're hosting a Bootcamp in your area!

https://www.markcubanai.org/
World AI Competition for Youth

https://www.waicy.org/

- For students ages 6-18
- 2021 November 20
- Registration opens soon
It’s time for all of us to think about AI in K-12.

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