Index & Lesson Names	Activity Names	Standards and Guidelines	Objectives	Description	Prep Time	Total Lesson Time	Number of Days	Total Time Per Lesson	
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0.1 - What is AI		**AI4K12 1-B-i (Grade 6-8):** Give examples of different types of computer perception that can extract meaning from sensory signals.	Identify the three basic components of most types of AI. Identify everyday technologies that use AI. Distinguish between technologies that use AI and do not use AI.	This introductory lesson introduces students to what AI is and what it is not. They will learn about three basic components of most types of AI.	20	45	1	65	
	Explore AI Journal			In this activity, students explore various online tools that use artificial intelligence.					
	AI Matching Game			Students play a game where they have to match an AI technology with the prediction that it is trying to make.					
	AI or Not?			In this lesson, students learn about AI as three parts; a dataset, algorithm and prediction. From this definition, they practice identifying types of AI in their everyday lives.					
0.2 - Algorithms as Opinions		**CSTA 2-AP-13 (Grade 6-8):** Decompose problems and subproblems into parts to facilitate the design, implementation, and review of programs.	Write a simple algorithm Create a list of goals for an algorithm Create a list of stakeholders for an algorithm	This lesson introduces students to what an algorithm is, using the making of peanut butter jelly sandwiches as an example. Students will learn that an algorithm is like a recipe and that different people tend to prefer different algorithms based on their varied interests and goals.	20	50	1	70	
	Best PB&J			Students learn that algorithms, like recipes, are a set of instructions that modify an input to produce an output. Students are then asked to write an algorithm to make the "best" peanut butter and jelly sandwich. Students then explore what it means to be "best" and see how their opinions are reflected in their algorithms.					
0.3 - Ethical Matrix		**AI4K12 3-C-i (Grade 6-8):** The choice of features to include, and the best encoding to use for these features, depends on the particular reasoning problem we are trying to solve. **NGSS Practice 1 (Grade 6-8):** - Asking questions and defining problems: Specifying relationships between variables, and clarifying arguments and models. - Define a design problem that can be solved through the development of an object, tool, process or system and includes multiple criteria and constraints, including scientific knowledge that may limit possible solutions.	Write a goal for a specific algorithm List stakeholders for a specific algorithm Explain what makes these entities stakeholders Why are they concerned about this technology or the larger system it is a part of? Label a stakeholder by their values What goals should the system hold in order to meet the needs of this user? Map stakeholders and their values in an ethical matrix Identify stakeholders for which an algorithm is optimized and not optimized	This lesson further shows students that different algorithms can have different purposes for different stakeholders and that such relationships can be visually represented using an ethical matrix. Students will create their own ethical matrices for their best PB&J sandwich algorithms.	20	45	1	65	
	PB&J Ethical Matrix			Building on the algorithms as opinions lesson, students identify the stakeholders who care about their peanut butter and jelly sandwich algorithm and the values those stakeholders have in the algorithm. They then fill out an ethical matrix to see where those values overlap or conflict.					
0.4 - Decision Trees		**AI4K12 2-A-iii (Grade 6–8):** Describe the parts of a graph and how those parts are related. **AI4K12 3-A-i (Grade 6–8):** Contrast the unique characteristics of human learning with the ways machine learning systems operate.	- Build a decision tree - Use test data to evaluate the design of a decision tree - Explain that training data make decision trees specific to a purpose - Draw connections between the structure of a decision tree (e.g., content of a node) and the background knowledge of the person who made it to show how their prior experience influenced the design of the decision tree - Explain that a creator's understandings, experiences, background, and assumptions in a decision tree are called biases.	This lesson introduces students to how decision trees, a basic form of neural networks, can be designed in multiple ways to classify a complex dataset. Students will create their own decision trees that can be used to classify various types of pastas.	30	45	3	225	
	PastaLand			Students learn how decision trees can be used to classify a set of data. They gain experience building their own decision trees by sorting types of pasta based on various characteristics that they choose.					
	Is it Winter?								
0.5 - Investigating Bias		**CSTA 2-IC-21 (Grade 6-8):** Discuss issues of bias and accessibility in the design of existing technologies. **AI4K12 1-C-ii (Grade 6-8):** Describe how a vision system might exhibit cultural bias if it lacked knowledge of objects not found in the culture of the people who created it. **AI4K12 3-C-iii (Grade 6-8):** Explain how the choice of training data shapes the behavior of the classifier, and how bias can be introduced if the training set is not properly balanced.	Describe what it means to be fair Identify and describe bias from a given classification example	This lesson shows students that unfairly trained AI systems can be far from objective and neutral. Students will recognize that AI systems can be unfairly trained and that there are several strategies that AI designers can use to mitigate biases in AIs.	20	45	1	65	
	Exploring AI Bias			Students investigate how bias is present in common technologies that use AI.					
0.6 - Career Daydream	Career Daydream	TBD	Come up with a dream job that they want to do in the future that matches their values, strengths and interests. Imagine how AI is going to play a role in that job and affect their daily routine.	In this activity students will daydream about what a typical work day is going to be like in 30 years. The instructor will read a pre-written script to help students meditate and guide them to share their answers.	10	30	1	40	

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1.1 - Intro to Supervised Machine Learning		**CSTA 2-DA-08 (Grade 6-8):** Collect data using computational tools and transform the data to make it more useful and reliable. **CSTA 2-AP-17 (Grade 6-8):** Systematically test and refine programs using a range of test cases. **AI4K12 2-C-ii (Grade 6-8):** Compare several algorithms that could be used to solve a specific type of reasoning problem. **AI4K12 3-C-iii (Grade 6-8):** Explain how the choice of training data shapes the behavior of the classifier, and how bias can be introduced if the training set is not properly balanced. **NGSS Practice 1 (Grade 6-8):** Ask questions to clarify and/or refine a model, an explanation, or an engineering problem. **NGSS Practice 2 (Grade 6-8):** - Develop or modify a model— based on evidence – to match what happens if a variable or component of a system is changed. - Develop and/or use a model to predict and/or describe phenomena."	Describe a prediction made by an AI technology Give an example of algorithmic bias from everyday life Explain why a) certain items in a dataset, b) the size of the dataset, and c) the diversity of items in the dataset might introduce algorithmic bias Justify a method of re-curating a dataset to solve a algorithmic bias problem	This lesson introduces students to how supervised machine learning can be trained to classify complex datasets based on labelled data. Students will train their teachable machine models and learn that AI can learn from labeled data. They will also revisit the idea that training AI systems with an increasing amount of data does not necessarily mitigate bias if there's not enough diversity in the data.	30	45	3	225	
	Teachable Machine Activities			Students answer questions about what they learned while learning about Teachable Machines.					
	Teachable Machine Projects			Students are introduced to the concept of classification. By exploring Google's Teachable Machine tool, students learn about supervised machine learning. Then students are asked to build a cat-dog classifier but are unknowingly given a biased dataset. When the classifier works better on cats than dogs, students have the opportunity to retrain their classifiers with their own new datasets.					
1.2 - Neural Networks		**AI4K12 1-C-i (Grade 6-8):** Classify a given image (e.g., "traffic scene", "nature scene", "social gathering", etc.) and then describe the kinds of knowledge a computer would need in order to understand scenes of this type. **AI4K12 3-A-i (Grade 6-8):** Contrast the unique characteristics of human learning with the ways machine learning systems operate. **AI4K12 3-A-iv (Grade 6-8):** Explain the difference between training and using a reasoning model. **AI4K12 3-A-v (Grade 6-8):** Compare how a decision tree learning algorithm works vs. how a neural network learning algorithm works. **AI4K12 3-B-i (Grade 6-8):** Illustrate the structure of a neural network and describe how its parts form a set of functions that compute an output. **AI4K12 3-B-ii (Grade 6-8):** Demonstrate how a learning rule can be used to adjust the weights in a one-layer nural network.	Label a diagram of each step in the training process of a neural network to identify feedforward, evaluation, and backpropagation. Describe where the "learning" occurs in the process of training a neural network. Explain that training data makes a neural network specific to a purpose	This lesson introduces students to a specific type of supervised learning called neural networks. Students will learn how neural networks work from a game in which they role-play different components of a neural network.	20	45	2	130	
	NN Game			Students learn about a type of algorithm called a neural network by playing the role of nodes training a network. Students caption a mystery image by passing on information through different "layers" of the class.					
1.3 - Classifying AI vs. Generating AI		**AI4K12 3-B-ii (Grade 3-5):** The behavior of a neural network can be altered by adjusting its weights. **AI4K12 3-C-iii (Grade 6-8):** During training, weights are adjusted in response to errors in the network's output, so that an error will be less likely when the input is seen again.	Describe the process of "classification" and "generation" in their own words Give original examples of "classification" and "generation" from their lives Contrast the process of classifying to the process of generating (i.e., how are they different?)	In this lesson students experience the process of generation and classification as they mix colors on an online platform and observe that they can create a varied palette of colors with a few input colors. Students will learn about examples of AI systems that perform classification and generation and practice distinguishing between generating and classifying AIs.	15-20min	45	1	45	
	Color Matching Game			Students will classify colors against a color wheel and color chart.					
	Classifier or Generator			Students review the difference between classifiers and generators by identifying whether various entities are classifiers or generators.					
1.4 - Inventory of Me	Inventory of Me	**CSTA 2-IC-20 (Grades 6–8)** Compare tradeoffs associated with computing technologies that affect people's everyday activities and career options.	Describe the meaning of Holland's 6 work personality types. Predict and confirm their own work personalities. Find a list of jobs that people of their work personalities usually enjoy doing.	In this activity students will learn about Holland's work personality types and examples of jobs favored by people with each type.	10	45	1	55	
1.5 - Planting the Seeds of STEM Jobs	Planting the Seeds of STEM Jobs	**AI4K12 5** AI can impact society in both positive and negative ways. **CSTA 2-IC-20 (Grades 6–8)** Compare tradeoffs associated with computing technologies that affect people's everyday activities and career options.	Describe what STEM jobs are. Name the benefits of choosing STEM jobs. Recognize the importance of diversity in the STEM workforce.	In this activity students will learn about what STEM jobs are, why they should consider STEM jobs, and why it is important for everyone to participate in STEM jobs.	10	45	1	55	
2.1 - What are GANs?		TBD	1. what classifying and generating means for AI systems 2. examples of classifying and generating based AI systems 3. to differentiate between GANs generated art and human generated art	Students will learn that GANs can generate art such as photographs, paintings, handwritten poetry, music, and jokes (that are kind of funny! Maybe.)	20	30	1	50	
	Exploring GANs			Students explore a variety of GANs and complete questions or activities for the GANs they explore.					
	GANs or Not?			Students identify whether or not various entities were generated by a GAN.					
2.2 - How do GANs work?		TBD	Given a word bank, students will describe the characteristics of the main components of a GAN: a discriminator and a generator Describe the relationship between a generator and discriminator in a GAN in their own words	This lesson introduces students to how GANs work as a result of the interplay between the generator and the discriminator. Students will learn how the generator and discriminator compete with one another to generate text, images, videos, and more.	20	45	1	65	

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	GAN Game			Students engage in an unplugged activity in pairs, when one of them tries to guess what image the other one has within a pixel map. The guessing student makes multiple attempts and gets feedback from their partner in order to try to reach the target image. We use these roles as analogies for Generator and Discriminator - the two competing parts of a GAN.					
2.3 - Unanticipated Consequences of Technology		AI4K12 5: AI can impact society in both positive and negative ways. CSTA 2-IC-20 (Grade 6–8): Compare tradeoffs associated with computing technologies that affect people's everyday activities and career options.	List one or more positive and negative consequence of GANs on a) their everyday lives, b) their community, and c) the larger world	This lesson introduces students to consequences of AI technologies and shows them that such consequences may or may not be the ones we intended or anticipated. Students will learn that AI technologies can have unanticipated effects on other seemingly unrelated systems (e.g., social, cultural, economic, political, etc.)	20	50	1	70	
	Unanticipated Consequences Activity			In this activity, students learn that technologies can have consequences that their creators didn't plan for. They work in small groups to brainstorm the consequences of various technologies.					
2.4 - AI Generated Art		National Core Arts Standards MA:Cn110.1.6.b (Grade 6-7): Analyze and interact appropriately with media arts tools and environments, considering fair use and copyright, ethics, and media literacy. AI4K12 3-A-i (Grade 6–8): Contrast the unique characteristics of human learning with the ways machine learning systems operate.	Justify their opinion as to whether AI can create art based on their concept of what art is and b) their understanding of how AI works Justify their opinion as to who is responsible for (who is the owner of) art made by a GAN (e.g., the generator NN, the discriminator NN, the person who curated the dataset, the person who wrote the algorithm, the person who input the seed drawing.) Propose a rule for determining who is responsible for (who owns) a piece of GAN generated art.	In this lesson students will explore various forms of AI generated art.	20	50	1	70	
	Art or Not?			Students identify whether or not various entities are art.					
	GANs Art			Students make art using GAN tools and share it in slides.					
2.5 - What are Deepfakes?		TBD	Identify the source and reference data for a given GAN generated image Describe and give examples for each of the 7 clues for identifying deepfakes: hair, eyes, side profile, emotions, teeth, background, asymmetry Describe a negative consequence and positive consequence of deepfakes in their own words Compose a set of rules for how deepfakes should be created or designed.	In this lesson students will explore what deepfakes are, how realistic they can look, and ways to identify them. Students will learn how deepfakes are made and several strategies to identify them.	20	45	2	130	
	Face Art			Students explore two face generating AI tools.					
	Spotting Deepfakes			Students take a pre-test to try and figure out which examples are deepfakes and which are not. After learning more about how to detect deepfakes, students will take the post-test to see if they can better detect deepfakes.					
2.6 - Spread of Misinformation	Mediacity Chatroom	Core Standards Social Studies 6-8.6 (Grade 6–8): Identify aspects of a text that reveal an author's point of view or purpose (e.g., loaded language, inclusion or avoidance of particular facts). Core Standards Social Studies 6-8.8 (Grade 6–8):	Compare misinformation to neutral information to describe a) distinguishing characteristics and b) effects or consequences. Evaluate a given list of facts to identify which are likely to be misinformation Explain whether the rapid spread of misinformation is the result of AI or human behavior	In this lesson students will experience the spread of misinformation. Students will learn what misinformation is and understand that it spreads faster than authentic news.	30	45	2	150	
2.7 - Generate a Story	Storytelling with AI	CSTA 2-DA-09 (Grade 6-8): Refine computational models based on the data they have generated. National Core Arts Standards MA:Pr5.1.6.c (Grade 6): Demonstrate adaptability using tools and techniques in standard and experimental ways in constructing media artworks. National Core Arts Standards MA:Cr3.1.7.b (Grade 7): Improve and refine media artworks by intentionally emphasizing particular expressive elements to reflect an understanding of purpose, audience, or place. NGSS Practice 2 (Grade 6–8): Modeling: Developing, using, and revising models to describe, test, and predict more abstract phenomena and design systems. - Evaluate limitations of a model for a proposed object or tool. - Develop or modify a model— based on evidence – to match what happens if a variable or component of a system is changed. - Use and/or develop a model of simple systems with uncertain and less predictable factors."	Develop an original story using GAN-based generation tools to generate texts and pictures Compare the process of writing a story with a text generator to the traditional writing process to identify strategies and limitations for writing with a text generator	In this lesson students will create stories of their own with GANs generated text and art. Students will learn to use GAN-based generation tools to generate texts and pictures and form them into stories.	20	55	1	75	
2.8 - AI's Impact on My Future Jobs	AI's Impact on My Future Jobs	AI4K12 5 AI can impact society in both positive and negative ways. CSTA 2-IC-20 (Grades 6–8) Compare tradeoffs associated with computing technologies that affect people's everyday activities and career options.	Recognize that new opportunities will increasingly arise as humans find new ways to integrate AI in their jobs. Describe in detail how such integration can happen for at least one job that they are interested in.	In this activity students will explore the interaction between AI and their future jobs.	20	45	1	65	
3.1 - Environmental Impact of AI	Calculate Your Carbon Footprint	AI4K12 5: AI can impact society in both positive and negative ways. CSTA 2-IC-20 (Grade 6–8): Compare tradeoffs associated with computing technologies that affect people's everyday activities and career options.	Explain how training AI contributes to global warming. Identify strategies for lessening the environmental impact of AI. Describe at least one way AI algorithms can be optimized to save some training time.	In this lesson, students will explore the environmental impact of training AI models. Students will learn that the design of AI algorithms can have consequences for the environment.	15	30	1	45	

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3.2 - Redesign YouTube		**AI4K12 5:** AI can impact society in both positive and negative ways. **CSTA 2-AP-10 (Grade 6–8):** Use flowcharts and/or pseudocode to address complex problems as algorithms. **CSTA 2-AP-15 (Grade 6–8):** Seek and incorporate feedback from team members and users to refine a solution that meets user needs. **CSTA 2-IC-21 (Grade 6–8):** Discuss issues of bias and accessibility in the design of existing technologies. **NGSS Practice 1 (Grade 6–8):** Define a design problem that can be solved through the development of an object, tool, process or system and includes multiple criteria and constraints, including scientific knowledge that may limit possible solutions.	create an ethical matrix for their YouTube recommendation algorithm describe a goal of their new algorithms describe how they will reduce bias with their new algorithm Identify three types of datasets they will use to meet their goals	In this lesson students will redesign the YouTube recommendation algorithm to meet their needs and reduce bias. This is a culminating project that can span several days of work and spark student reflection on lessons learned from the curriculum.	20	45	1	65	
3.3 Personal Roadmap to My Dream Jobs	Personal Roadmap to My Dream Jobs	**AI4K12 5** AI can impact society in both positive and negative ways. **CSTA 2-IC-20 (Grades 6–8)** Compare tradeoffs associated with computing technologies that affect people's everyday activities and career options.	Create tables that summarize their work personalities, their top matched jobs, what they need to get those jobs, and how those jobs may be impacted by AI.	In this activity students will create their personal roadmaps to their dream jobs using what they have learned in the career sessions.	20	50	1	70	