Unit 7 -Artificial Intelligence and Machine Learning

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AI and Machine Learning Unit

Department of Curriculum and Instruction

Belleville Public Schools

Curriculum Guide

Introduction to Coding, Grades 9-12

AI and Machine Learning Module

Belleville Board of Education

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Unit Overview

This unit is a hands-on introduction to developing a machine learning model with tabular data. Students explore how computers learn from data to make decisions, then develop machine learning projects around real-world data. The unit culminates in designing a machine learning app to solve a personally relevant problem.

Students are introduced to a form of artificial intelligence called machine learning and how they can use the Problem Solving Process to help train a robot to solve problems. They participate in three machine learning activities where a robot - A.I. Bot - is learning how to detect patterns in fish.

The primary objective of this Unit is to introduce the basic principles, techniques, and applications of Artificial Intelligence. Emphasis will be placed on the teaching of these fundamentals, not on providing a mastery of specific software tools or programming environments. Assigned projects promote a 'hands-on' approach for understanding, as well as a challenging avenue for exploration and creativity.

Specifically:

1. Gain a historical perspective of AI and its foundations.

2. Become familiar with basic principles of AI toward problem solving, inference, perception, knowledge representation, and learning.

3. Investigate applications of AI techniques in intelligent agents, expert systems, artificial neural networks and other machine learning models.

4. Experience AI development tools such as an ‘AI language’, expert system shell, and/or data mining tool.

5. Experiment with a machine learning model for simulation and analysis.

6. Explore the current scope, potential, limitations, and implications of intelligent systems.

Enduring Understanding

What Is AI? At a basic level, artificial intelligence is when a computer program mimics the intelligence of a human being. This can appear as solving a problem, engaging in conversations, displaying emotions, and many other forms.

Artificial Intelligence is used in a lot of different places in our lives - from facial recognition in our phones to personal recommendations when we browse the web, and even in driverless cars.

Essential Questions

How can we use the Problem Solving Process to solve a problem with machine learning?

What’s an example of AI either in your personal life or that you’ve seen in a movie or book?

What are different types of machine learning?
Think of a skill you commonly use, like speaking, tying your shoes, cooking, or playing a game. How did you learn this skill?

How are human learning and machine learning similar? How are they different?

Exit Skills

Students understand and can explain AI and Machine Learning concepts

Students will know how to create apps to solve a problem for their own interests

New Jersey Student Learning Standards (NJSLS-S)

8.1.12.AP.1	Design algorithms to solve computational problems using a combination of original and existing algorithms.
8.1.12.AP.8	Evaluate and refine computational artifacts to make them more usable and accessible.
8.2.12.ED.4	Design a product or system that addresses a global problem and document decisions made based on research, constraints, trade-offs, and aesthetic and ethical considerations and share this information with an appropriate audience.
TECH.8.1.12	Educational Technology: All students will use digital tools to access, manage, evaluate, and synthesize information in order to solve problems individually and collaborate and to create and communicate knowledge.
TECH.8.1.12.A	Technology Operations and Concepts: Students demonstrate a sound understanding of technology concepts, systems and operations.
TECH.8.1.12.A.CS1	Understand and use technology systems.
TECH.8.2.12.D.4	Assess the impacts of emerging technologies on developing countries.
TECH.8.2.12.D.5	Explain how material processing impacts the quality of engineered and fabricated products.
TECH.8.2.12.D.6	Synthesize data, analyze trends and draw conclusions regarding the effect of a technology on the individual, society, or the environment and publish conclusions.
TECH.8.2.12.E.1	Demonstrate an understanding of the problem-solving capacity of computers in our world.

TECH.8.2.12.E.3	Use a programming language to solve problems or accomplish a task (e.g., robotic functions, website designs, applications, and games).
TECH.8.2.12.E.4	Use appropriate terms in conversation (e.g., troubleshooting, peripherals, diagnostic software, GUI, abstraction, variables, data types and conditional statements).
TECH.8.2.12.E.CS1	Computational thinking and computer programming as tools used in design and engineering.

Interdisciplinary Connections

CAEP.9.2.12.C.3	Identify transferable career skills and design alternate career plans.
CAEP.9.2.12.C.8	Assess the impact of litigation and court decisions on employment laws and practices.

Suggested Activities & Best Practices

Students are introduced to a form of artificial intelligence called machine learning and how they can use the Problem Solving Process to help train a robot to solve problems. They participate in three machine learning activities where a robot - A.I. Bot - is learning how to detect patterns in fish.

Additionally students will consider how they create “mental” models when learning new concepts, and how those can be similar to a “machine learning” model. They participate in a color pattern activity to simulate building a machine learning model without help, then they play a game called "Green Glass Door" as an example of supervised learning, and finally, they will sort several scenarios into “supervised” or “unsupervised” learning.

Moreover, students explore an application of AI called Seeing AI and examine how it is supporting people with visual impairments. Then, students research other examples of how AI is impacting society, focusing on users who are impacted by the examples they find. Finally, students share their findings with each other.

Assessment Evidence - Checking for Understanding (CFU)

Upon completion of this section, please remove all remaining descriptions, notes, outlines, examples and/or illustrations that are not needed or used.

By identifying the **Evidence of Student Learning with Checking for Understanding (CFU)** techniques used during the lesson and/or for Closure (Madeline Hunter), please list the variety of means used to access students' learning (e.g. quizzes, tests, academic prompts, observations, homework, journals).

- Admit Tickets
- Anticipation Guide
- Common Benchmarks
- Compare & Contrast
- Create a Multimedia Poster
- DBQ's
- Define
- Describe
- Evaluate
- Evaluation rubrics
- Exit Tickets
- Explaining
- Fist- to-Five or Thumb-Ometer
- Illustration
- Journals
- KWL Chart
- Learning Center Activities
- Multimedia Reports
- Newspaper Headline
- Outline
- Question Stems
- Quickwrite
- Quizzes
- Red Light, Green Light
- Self- assessments

- Socratic Seminar
- Study Guide
- Surveys
- Teacher Observation Checklist
- Think, Pair, Share
- Think, Write, Pair, Share
- Top 10 List
- Unit review/Test prep
- Unit tests
- Web-Based Assessments
- Written Reports

Primary Resources & Materials

Learn about Artificial Intelligence (AI) | Code.org

Learn about Artificial Intelligence (AI) | Code.org

https://www.futureoftech.org/assets/documents/FoT_Lesson_Plan-Artificial_Intelligence.pdf

https://www.digitaltechnologieshub.edu.au/teachers/lesson-ideas/ai-lesson-plans

Ancillary Resources

WEBSITE RESOURCES: Scratch Machine Learning for Kids Dr. Scratch Particle Intel TEDtalks 4 Lessons From Robots about Being Human (20 minutes) Don’t fear Intelligent Machines. Work with them (15 minutes) CISCO Morrison Foerster GSMA IoT for all

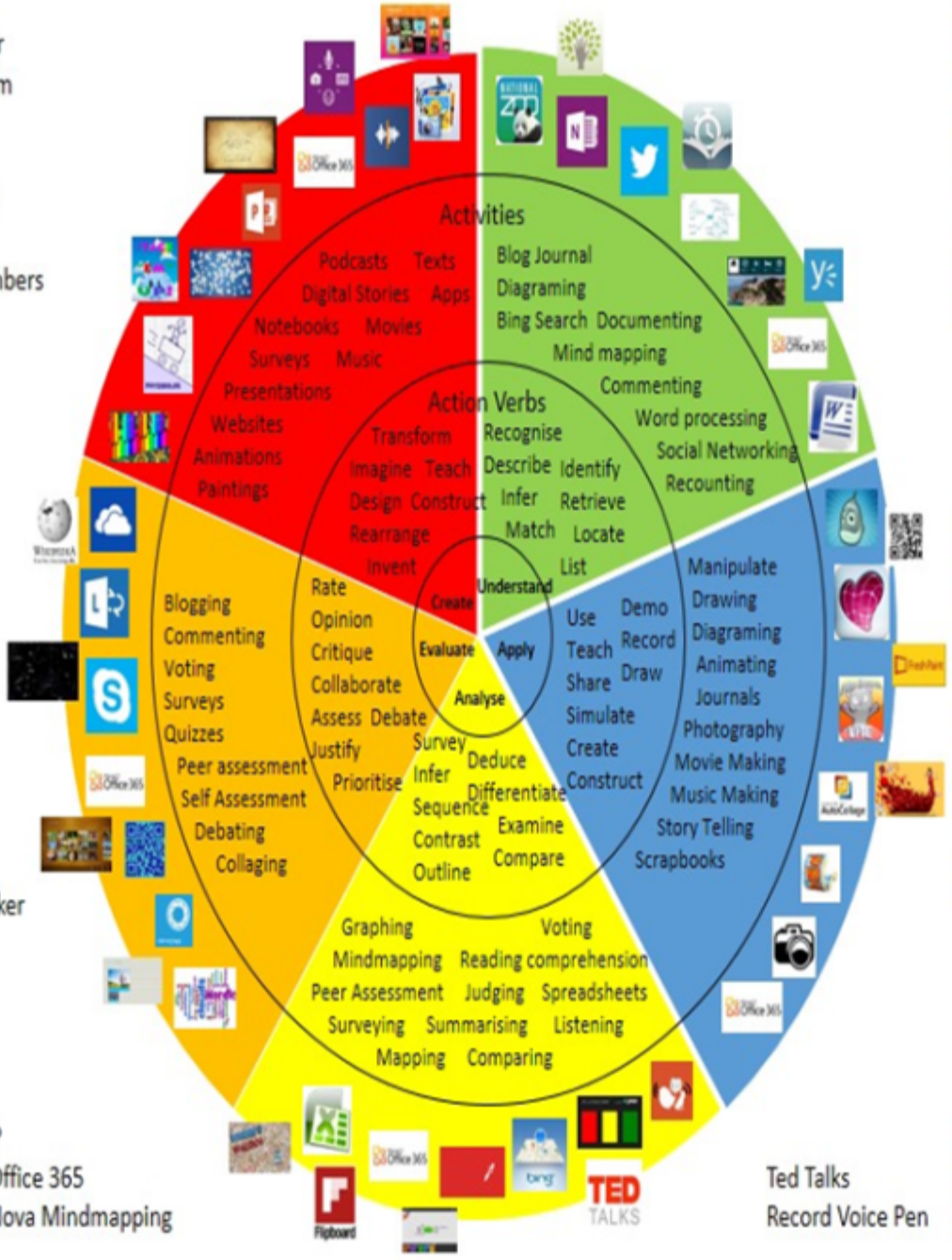
Technology Infusion

Technnology is infused in lesson as it is on the computer learning about computer science concepts

Win 8.1 Apps/Tools Pedagogy Wheel

Podcasts
Photostory 3
Kid Story Builder
Music Maker Jam
Paint A Story
Office 365
MS PowerPoint
Stack 'Em Up
NqSquared Numbers
Physamajig
Xylophone 8

Wikipedia
Skydrive
Lync
SkyMap
Skype
Office 365
Puzzle Touch
Easy QR
Memorylage
Life Moments
Word Cloud Maker



Where's Waldo?
MS Excel Office 365
Flipboard Nova Mindmapping

Ted Talks
Record Voice Pen

Originally taken from http://www.coetail.com/vzimmer/files/2013/02/iPadagogy-Wheel.001.jpg
And adapted for Windows 8.1 devices by Charlotte Beckhurst @CharBeckhurst

Differentiation

Technology Resources • Teacher Tutoring • Peer Tutoring • Cooperative Learning Groups • Differentiated Instruction • Follow all IEP Modifications/504 Plan

Differentiations:

- Small group instruction
- Small group assignments
- Extra time to complete assignments
- Pairing oral instruction with visuals
- Repeat directions
- Use manipulatives
- Center-based instruction
- Token economy
- Study guides
- Teacher reads assessments allowed
- Scheduled breaks
- Rephrase written directions
- Multisensory approaches
- Additional time
- Preview vocabulary
- Preview content & concepts
- Story guides
- Behavior management plan
- Highlight text
- Student(s) work with assigned partner
- Visual presentation
- Assistive technology
- Auditory presentations
- Large print edition
- Dictation to scribe
- Small group setting

Hi-Prep Differentiations:

- Alternative formative and summative assessments
- Choice boards
- Games and tournaments
- Group investigations
- Guided Reading
- Independent research and projects
- Interest groups
- Learning contracts
- Leveled rubrics
- Literature circles
- Multiple intelligence options

- Multiple texts
- Personal agendas
- Project-based learning
- Problem-based learning
- Stations/centers
- Think-Tac-Toes
- Tiered activities/assignments
- Tiered products
- Varying organizers for instructions

Lo-Prep Differentiations

- Choice of books or activities
- Cubing activities
- Exploration by interest
- Flexible grouping
- Goal setting with students
- Jigsaw
- Mini workshops to re-teach or extend skills
- Open-ended activities
- Think-Pair-Share
- Reading buddies
- Varied journal prompts
- Varied supplemental materials

Special Education Learning (IEP's & 504's)

Please identify the **Special Education Learning** adaptations that will be employed in the unit, using the ones identified below.

Adapting existing materials, simplifying or supplementing materials for Special Education Learning other options are below.

Adjust the method of presentation or content.

- **Develop** supplemental material.
- **Develop** simple study guides to complement required materials.

Providing extra material such as videos or an interactive way to learn the material is best, You Tube or a smaller scaffolding exercise where they understand one or two parts of the whole concept.

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- printed copy of board work/notes provided

- additional time for skill mastery
- assistive technology
- behavior management plan
- Center-Based Instruction
- check work frequently for understanding
- computer or electronic device utilizes
- extended time on tests/ quizzes
- have student repeat directions to check for understanding
- highlighted text visual presentation
- modified assignment format
- modified test content
- modified test format
- modified test length
- multi-sensory presentation
- multiple test sessions
- preferential seating
- preview of content, concepts, and vocabulary
- Provide modifications as dictated in the student's IEP/504 plan
- reduced/shortened reading assignments
- Reduced/shortened written assignments
- secure attention before giving instruction/directions
- shortened assignments
- student working with an assigned partner
- teacher initiated weekly assignment sheet
- Use open book, study guides, test prototypes

English Language Learning (ELL)

Advance notes

One way that we can make things easier is by preparing and distributing advance notes. This gives ELLs the opportunity to preview what will be taught and, in turn, aids in comprehension of the material.

eDictionaries

When used correctly, technology never fails to transform a classroom. Allow your students to use eDictionaries in your classroom to look up unknown words. Any regular dictionary will do, but eDictionaries allow students to hear the pronunciations of words. As you might imagine, this is extremely helpful for anyone learning a second language. If students encounter an unknown word, they can type it into an eDictionary, hear the word pronounced and either read or listen to the definition. Also, if they aren't sure how to to spell a word, many eDictionaries will allow them to speak the word to have the correct spelling displayed.

Please identify the **English Language Learning** adaptations that will be employed in the unit, using the ones identified below.

- teaching key aspects of a topic. Eliminate nonessential information
- using videos, illustrations, pictures, and drawings to explain or clarif
- allowing products (projects, timelines, demonstrations, models, drawings, dioramas, poster boards, charts, graphs, slide shows, videos, etc.) to demonstrate student's learning;
- allowing students to correct errors (looking for understanding)
- allowing the use of note cards or open-book during testing
- decreasing the amount of workpresented or required
- having peers take notes or providing a copy of the teacher's notes
- modifying tests to reflect selected objectives
- providing study guides
- reducing or omitting lengthy outside reading assignments
- reducing the number of answer choices on a multiple choice test
- tutoring by peers
- using computer word processing spell check and grammar check features
- using true/false, matching, or fill in the blank tests in lieu of essay tests

At Risk

Directions or Instructions

Make sure directions and/or instructions are given in limited numbers. Give directions/instructions verbally and in simple written format. Ask students to repeat the instructions or directions to ensure understanding occurs. Check back with the student to ensure he/she hasn't forgotten. It is a rare event for students at risk to be able to remember more than 3 things at once. Chunk your information, when 2 things are done, move to the next two.

A Strategy Summary

Planned interventions are far superior to remediation approaches. Always plan to address students at risk in your learning tasks, instructions, and directions. Try to anticipate where the needs will be and then address them. Intervene as much as possible to support students at risk. If your intervention strategies are working, continue to use them. If they're not working, plan for new interventions that will help students succeed.

Intervention Strategies that will be employed in the unit, using the ones identified below.

- allowing students to correct errors (looking for understanding)

- teaching key aspects of a topic. Eliminate nonessential information
- allowing products (projects, timelines, demonstrations, models, drawings, dioramas, poster boards, charts, graphs, slide shows, videos, etc.) to demonstrate student's learning
- allowing students to select from given choices
- allowing the use of note cards or open-book during testing
- collaborating (general education teacher and specialist) to modify vocabulary, omit or modify items to reflect objectives for the student, eliminate sections of the test, and determine how the grade will be determined prior to giving the test.
- decreasing the amount of workpresented or required
- having peers take notes or providing a copy of the teacher's notes
- marking students' correct and acceptable work, not the mistakes
- modifying tests to reflect selected objectives
- providing study guides
- reducing or omitting lengthy outside reading assignments
- reducing the number of answer choices on a multiple choice test
- tutoring by peers
- using authentic assessments with real-life problem-solving
- using true/false, matching, or fill in the blank tests in lieu of essay tests
- using videos, illustrations, pictures, and drawings to explain or clarify

Talented and Gifted Learning (T&G)

http://www.grandviewlibrary.org/CurriculumAdaptations/General_Gifted.pdf

Grouping • Group gifted students with other gifted students or higher-level learners. • Refrain from grouping gifted students with lower-level students for remediation.

Talented and Gifted adaptations that will be employed in the unit, using the ones identified below.

- Above grade level placement option for qualified students
- Advanced problem-solving
- Allow students to work at a faster pace
- Cluster grouping
- Complete activities aligned with above grade level text using Benchmark results
- Create a blog or social media page about their unit
- Create a plan to solve an issue presented in the class or in a text
- Debate issues with research to support arguments
- Flexible skill grouping within a class or across grade level for rigor
- Higher order, critical & creative thinking skills, and discovery
- Multi-disciplinary unit and/or project
- Teacher-selected instructional strategies that are focused to provide challenge, engagement, and growth opportunities
- Utilize exploratory connections to higher-grade concepts

- Utilize project-based learning for greater depth of knowledge

Sample Lesson

https://www.futureoftech.org/assets/documents/FoT_Lesson_Plan-Artificial_Intelligence.pdf

https://skyteach.ru/wp-content/uploads/2019/01/Artificial-intelligence-a-worksheet.pdf

https://www.liveworksheets.com/bd40059vg

FoT_Lesson_Plan-Artificial_Intelligence.pdf (futureoftech.org)

Artificial Intelligence (AI) is not a new term, but defining it isn't that easy. What does intelligence mean in the context of computers and software? Machine learning is the term for technology that trains computers to interpret data and dynamic environments. This lesson introduces students to artificial intelligence through the application of facial recognition. Extended learning opportunities allow students to construct robots and create scenarios in which machine learning can be applied. STUDENT LEARNING OBJECTIVES: Students will be able to: • Provide examples of artificial intelligence • Describe how artificial intelligence works • Know how AI technologies could affect employment and education • Discuss the legal, moral and ethical questions implications of artificial intelligence • Explain the evolution of artificial intelligence • Examine various career options related to artificial intelligence SYNOPSIS: Introduction (5 minutes) Interactive: Facial Recognition (20 minutes) Teacher Input (15 minutes) Wrap Up (5 minutes) Assessmentlesson plan > artificial intelligence 3 TEACHER'S GUIDE: MATERIALS: • KWL Worksheet • Interactive: Facial Recognition • Artificial Intelligence: Interesting Insights • Artificial Intelligence Assessment • Artificial Intelligence Assessment Answer Key For Facial Recognition • Print images and questions found in link. • Internet INTRODUCTION: Reality or Fiction?: As artificial intelligence (AI) develops, there is the promise of exciting developments, from facial recognition to self driving cars to robots as personal assistants. With this promise, there are also worrisome implications. Ask the students what comes to their minds when they think about artificial intelligence? Record their responses on the board. Distribute the KWL Worksheet. Have the students complete the first column and write down what they know about artificial intelligence. Briefly discuss their responses. Ask the students what AI devices they envision in their homes and communities one day. Record their responses on the board. Ask the students to consider the positive and negative implications of the various devices. With this in mind, have the students complete the second column of the KWL Worksheet - "What do you want to learn about artificial intelligence?" Allow the students to share what they want to learn about artificial intelligence. INTERACTIVE: Introduce the activity "Interactive: Facial Recognition" by explaining how facial recognition impacts artificial intelligence. Have the students work through Part One and Part Two of Interactive: Facial Recognition. TEACHER INPUT: Facial recognition is a form of supervised learning, which is the process of taking labeled inputs and outputs, then feeding them through an algorithm until the AI learns the relationship well enough to be able to recognize it again in a new, unknown dataset. The goal is to predict the unknown as accurately as possible. // You'll want to refer often to the Future of Tech Website: futureoftech.org To receive the answer key to the assessment, please email Eric Larson at elarson@comptia.orglesson plan > artificial intelligence 4 Say you want to train your algorithm to recognize cats. Supply your algorithm with a sufficient number of labeled images—typically in the millions—and the algorithm will learn the difference between photos that are labeled as having cats, and those that are labeled as not containing a cat. But then the real test begins. After being exposed to enough photos that do contain cats, it must now analyze new, unlabeled images to make a determination about its contents. Throw a photo with a dog in the mix, and your AI might be in trouble. If it misinterprets the dog image as that of a cat, that's an error known as a false positive. By the same token, if the AI rejects the photo of a Maine Coon cat (because Maine Coons look somewhat different from other cat breeds), that's also a problem. That error would be called a false negative. (Note: False positives and false negatives can happen when medical tests are performed, too.) Some facial recognition systems are able to pick out distinctive details of faces. For example, the computer can measure the distances between facial features and determine ratios to compare to other

photos in a database. Because of the sensitive nature of matching faces to, say, a criminal database, an AI may be programmed to offer up a probability score of a match. Challenges to a high probability match include poor lighting, grainy video, make-up, facial hair, time between photos, and the fact that some people really do look a lot like other people. Hopefully your Doppelganger hasn't gotten in trouble with the law! (Adapted from the Future of Tech website.) Reinforce how the Interactive: Facial Recognition provided them with opportunities to test these same strategies through active learning and critical thinking. Ask the students to consider other ways in which facial/feature recognition will impact their schools, communities and lives in the next 5 years. Discuss their responses. Direct the students to the The Future of Tech website. The Future of Tech website provides a deeper look at artificial intelligence. Divide the students into pairs. Utilizing the Future of Tech website, ask each group to identify five interesting insights related to one of the following categories under the Artificial Intelligence Learning Unit: • What Is AI? • How May AI Technologies Affect Employment and Education? • What are the Legal, Moral and Ethical Questions Technologists Are Asking About AI? • What's Next For AI In The Next Decades? • What are Career Options Related to AI? Have the students record their insights on the Artificial Intelligence: Interesting Insights worksheet and report their insights to the class. //lesson plan > artificial intelligence 5 // WRAP-UP: Claude Shannon envisions "a time when we (humans) will be to robots what dogs are to humans" and says he is "rooting for the machines." Ask the students if they agree or disagree with the statement and explain why. ASSESSMENT: Have the students complete column 3 on their KWL Worksheet – What did you learn about artificial intelligence? EXTENDED LEARNING OPPORTUNITIES: • Interactive: Robotic Hand (45 minutes) • Interactive - Machine Learning using Scratch (45 - 60 minutes) • Have students construct their own autonomous robot using one of the various robotics platforms • Lego • Textrix • VEX • Have students complete a Career Interest Survey to see where their interest lies and discuss how their interests may align with career opportunities associated with artificial intelligence. • Invite guest speakers from the field to your class to discuss the role that the artificial intelligence plays in factories, industries, personal life and communities. WEBSITE RESOURCES: Scratch Machine Learning for Kids Dr. Scratch Particle Intel TEDtalks 4 Lessons From Robots about Being Human (20 minutes) Don't fear Intelligent Machines. Work with them (15 minutes) CISCO Morrison Foerster GSMA IoT for alllesson plan > artificial intelligence 6 // STANDARDS ALIGNMENT: CSTA K-12 Computer Science Standards (2017) • 1A-IC-16 Compare how people live and work before and after the implementation or adoption of new computing technology. • 1B-NI-04 Model how information is broken down into smaller pieces, transmitted as packets through multiple devices over networks and the Internet, and reassembled at the destination. • 1B-IC-18 Discuss computing technologies that have changed the world, and express how those technologies influence, and are influenced by, cultural practices. • 1B-IC-20 Seek diverse perspectives for the purpose of improving computational artifacts. • 2-NI-04 Model the role of protocols in transmitting data across networks and the Internet. • 2-IC-20 Compare tradeoffs associated with computing technologies that affect people's everyday activities and career options. • 2-IC-23 Describe tradeoffs between allowing information to be public and keeping information private and secure. • 3A-CS-01 Explain how abstractions hide the underlying implementation details of computing systems embedded in everyday objects. • 3A-NI-04 Evaluate the scalability and reliability of networks, by describing the relationship between routers, switches, servers, topology, and addressing. • 3A-IC-24 Evaluate the ways computing impacts personal, ethical, social, economic, and cultural practices. • 3B-AP-18 Explain security issues that might lead to compromised computer programs. • 3B-IC-26 Evaluate the impact of equity, access, and influence on the distribution of computing resources in a global society. • 3B-IC-27 Predict how computational innovations that have revolutionized aspects of our culture might evolve. Next Generation Science Standards • MS-ETS1-1. Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions. • MS-ETS1-2. Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem. • MS-ETS1-3. Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success. • MS-ETS1-4. Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved. • HS-ETS1-1. Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and

wants. • HS-ETS1-2. Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering. • HS-ETS1-3. Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics as well as possible social, cultural, and environmental impacts. artificial intelligence > k-w-l chart WHAT I KNOW OR THINK I KNOW ABOUT ARTIFICIAL INTELLIGENCE WHAT I WANT TO LEARN ABOUT ARTIFICIAL INTELLIGENCE WHAT I LEARNED ABOUT ARTIFICIAL INTELLIGENCE artificial intelligence > K-W-L CHARTartificial intelligence > facial recognition 1 This lesson consists of multiple parts. Each part addresses pattern recognition and image processing, but on different levels. Part One focuses on simple pattern recognition while Part Two allows the students to dive deeper and examine specific patterns and features that enable machines to process faces and images. Part One Preparation: Using Google, search for a cartoon image of the following Avengers: • Iron Man Marvel Cartoon • Captain America Marvel Cartoon • Thor Marvel Cartoon • Doctor Strange Marvel Cartoon • Black Widow Marvel Cartoon • Hulk Marvel Cartoon Find a high quality printable image of each Avenger. Print the Avenger characters in color on separate sheets of paper. Place each picture in a manilla envelope. Print the Questions for Your Avenger (located on page 2) on a separate sheet of paper and adhere to the front of each envelope. Label the envelopes A, B, C, D, E and F. You don't want to give away which Avenger is in which envelope. Print the Part One Avenger Tally Sheet for each student in the class. Now print a different but similar image of one of the Avengers identified above. For example, if the picture of Thor in the envelope has him standing with a hammer, perhaps print a close-up of Thor's face. Place the similar image in another manilla envelope. Label it "Unnamed Avenger." Print the Questions for Your Avenger (located on page 3) on a separate sheet of paper and adhere to the front of the envelope. Set this envelope aside. Activity: Select six students. Allow the students to select one of the envelopes labelled A through F. Have the student open the envelope and look at the image. Instruct the student not to show the image to anyone else. Ask the students to answer the Questions for Your Avenger on the front of the envelope. Once they have answered the questions, ask the students to place the image back inside the envelope and return the envelope to you. artificial intelligence: facial recognitionartificial intelligence > facial recognition 2 Explain to the students that the physical images of each Avengers can be described as a series of patterns that represent each Avenger's various characteristics. Remind the students that a computer cannot "see" a photo like a human eye can, but it can compare a list of features very well. By translating a photo into a series of features, a computer can "recognize" people and/or objects in various photos. Open the "Unnamed Avenger" envelope. Show the Avenger to the class. Ask the class to answer the following questions: What is the Avenger's hair color? Is the Avenger's skin color light? Does the Avenger have long hair? Does the Avenger wear a mask or helmet? What color is the Avenger's mask or helmet? Does the Avenger wear a cape? Is the Avenger holding something? Have the students record their responses on the Part One Avenger Tally Sheet on page 5. As the students answer the questions, explain that the list of physical characteristics help us determine if the other images in the envelopes are similar. This is known as the similarity score. Once the students have answered the questions, share the responses on the front of the other envelopes with the class. Have the students record their response on their tally sheet. Explain to the students if we divide the number of similarities by number of questions it will help the students determine the likelihood of the facial recognition. Have the students calculate the likelihood of facial recognition. After all six Avengers have been compared, ask the class to tally their results. Which envelope has the highest similarity score? Which image had the highest likelihood score? Open each envelope. The image inside the envelope with highest score should match the "Unnamed Avenger." Using a process that a computer can go through, they matched images without relying purely on sight. Questions for Your Avenger What is the Avenger's hair color? Is the Avenger's skin color light? Does the Avenger have long hair? Does the Avenger wear a mask or helmet? What color is the Avenger's mask or helmet? Does the Avenger wear a cape? Is the Avenger holding something? //artificial intelligence > facial recognition 3 Sample Answer Sheet for Part One Part Two In groups of five, have the students choose one of the Avenger characters below: • Hulk • Thor • Captain America • Black Widow • Doctor Strange • Iron Man Using Google, search for different versions of the character. For example, Thor: • Chris Hemsworth as Thor • Comic Book Thor • Mythology Thor • Viking Thor • Etc. Find a high quality printable image of the Avenger. Copy and paste the image on a blank document. Print the Avenger characters in color on separate sheets of paper. Place the picture in a manilla envelope. Label the envelopes A, B, C, D, E

and F. // A . Dr. Strange B. Iron Man C. Captain America D. Hulk E. Black Widow F. Thor Unnamed Hair black black blonde black red blonde blonde Skin yes yes yes no yes yes yes Hair length no no no no yes yes yes Mask/ Helmet no yes yes no no yes yes Cape yes no no no no yes yes Holding Something yes no yes no yes yes yes Similarity Score 3 2 4 0 3 7 7 Likelihood 43% 29% 57% 0 43% 100%artificial intelligence > facial recognition 4 // Identify 5-7 characteristics about the Avenger that can be extracted from the images. Write the characteristics as yes/no questions on the front of each manilla envelope. Use the previous Questions for Your Avenger as a reference. Print one of the Avenger images identified above again. This will be the "matching unnamed" Image. Write the same questions from above on the back of the image. Have the students seal the envelopes. Collect the envelopes from each group. Redistribute each set of envelopes to another group. Have the students open their envelope, view their image and answer the questions on the front of the envelope. Place the image back into the envelope. Ask each group calculate the similarity score and determine the likelihood of their image matching the unnamed image on the Avenger Tally Sheet - Activity Two. Have the students share their results. Ask the students the following questions: How did they determine what questions to ask? Was it harder for the student to identify the matching image during the extension activity? If so, have them explain why. Were there key features that helped the student identify the matching image? Have the students identify ways that pattern recognition and image processing can have positive and negative implications on an individual.artificial intelligence > facial recognition 5 // Avengers Tally Sheet Part One Name: Record your response in the table below. A . B. C. D. E. F. Unnamed Hair Skin Hair length Mask/ Helmet Cape Holding Something Similarity Score Likelihood artificial intelligence > facial recognition 6 Avengers Tally Sheet Part Two Name: Which envelope matched the unnamed envelope? Did the questions that you asked help your team make a correct match? What were the key features that helped your team identify the matching image? In what ways can pattern recognition and image processing have positive and negative implications on an individual or industry. // Record your response in the table below. Envelope A Envelope B Envelope C Envelope D Envelope E Envelope F Envelope Unnamed Similarity Score Likelihood of Matching the Unnamed Envelopeartificial intelligence > interesting insights Group Members: In groups, select one of the following sections of the Artificial Intelligence learning unit on the Future of Tech website (futureoftech.org) to review. • What Is AI? • How Does AI Work, From Simple To Cutting-Edge? • How AI Technologies May Affect Employment And Education • The Legal, Moral And Ethical Questions Technologists Are Asking About AI • What's Next For AI? • Career Options Related To AI Section our group chose: Provide a brief overview of the section in two or three sentences: List five interesting insights that your group learned while reviewing the section. 1. 2. 3. 4. 5. artificial intelligence > INTERESTING INSIGHTSartificial intelligence assessment Name:

_____

Select the best response. A top score on this assessment is 25 points: 1. Systems or processes designed to focus on and solve one defined task are known as: a. Narrow intelligence. b. Artificial General intelligence. c. Artificial superintelligence. d. Artificial intelligence 2. Systems or processes designed to tackle multiple complex problems independent of outside guidance or training are known as: a. Narrow intelligence. b. Artificial General intelligence. c. Artificial superintelligence. d. Artificial intelligence 3. Systems or processes that have surpassed human capacity are known as: a. Narrow intelligence. b. Artificial General intelligence. c. Artificial superintelligence. d. Artificial intelligence 4. The type of AI that is in use in autonomous vehicles, computer vision, fastest-route mapping, ridesharing apps, prevention of banking fraud, and e-mail spam filters is known as: a. Symbolic AI b. Machine Learning c. Deep Learning d. Supervised Learning 5. Narrowing down possible solutions by eliminating incorrect options is known as: a. Heuristics b. Planning c. Knowledge Representation d. Deep Learning 6. Deriving a sequence of actions for achieving a goal is known as: a. Heuristics b. Planning c. Knowledge Representation d. Deep Learning artificial intelligence assessment >artificial intelligence assessment 7. Characterizing information about the world in a form that a computer system can utilize (i.e. analogies and hierarchies) is known as:. a. Heuristics b. Planning c. Knowledge Representation d. Deep Learning 8. Below is a list of various algorithms. Classify each one as supervised learning (S), unsupervised learning (U) or reinforcement learning (R): (Each correct label is worth half a point.) ____ Anomaly Detection ____ Clustering ____ Decision Trees ____ Deep Deterministic Policy Gradient ____ Deep Q Learning 9. This person said that computer programs could be taught to think like humans, and developed a hypothetical test to determine whether a machine could imitate a human well enough

to fool another human: a. Arthur Samuel b. Alan Turing c. Frank Rosenblatt d. Mark Zuckerberg 10. This person coined the term “artificial intelligence”. a. John McCarthy b. Alan Turing c. Elon Musk d. Mark Zuckerberg 11. This person designed the first neural network for computers, which simulates the thought processes of the brain. a. Alan Turing b. Frank Rosenblatt c. Arthur Samuel d. Geoffrey Hinton 12. This person coined the term “machine learning.” a. Frank Rosenblatt b. Arthur Samuel c. Geoffrey Hinton d. Alan Turing 13. This person created ELIZA, an early natural language processing system. a. Frank Rosenblatt b. Arthur Samuel c. Joseph Weizenbaum d. Geoffrey Hinton // ____ K-Nearest Neighbor ____ Linear Regression ____ Principal Component Analysis ____ Support Vector Machines ____ State-Action-Reward-State-Actionartificial intelligence assessment 14. This person coined the term “deep learning” to explain new algorithms that can be trained recognize objects and text in images and videos. a. Frank Rosenblatt b. Arthur Samuel c. Joseph Weizenbaum d. Geoffrey Hinton 15. This company was the first to introduce a virtual assistant that uses voice-activated queries and a natural language interface to answer questions, make recommendations, and perform administrative tasks using the phone’s on-board apps and access to the internet. a. Apple b. Google c. Amazon d. Microsoft 16. What is the name of the advanced humanoid robot designed by Boston Dynamics for various search and rescue tasks? a. Voyager b. Atlas c. Watson d. Garvis Short Answer: 17. Provide two examples of how AI technologies will affect the workforce. 18. Identify one legal, one moral and one ethical implication of Artificial Intelligence. (worth 3 points