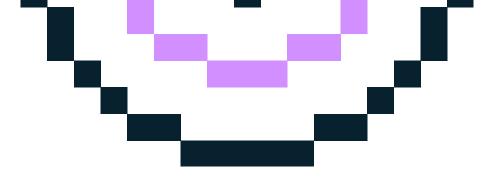


Lesson Plan >

ARTIFICIAL INTELLIGENCE



SNAPSHOT:

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)
Assessment	

TEACHER'S GUIDE:

MATERIALS:

- KWL Worksheet
- Interactive: Facial Recognition
- Artificial Intelligence: Interesting Insights
- Artificial Intelligence Assessment
- Artificial Intelligence Assessment Answer Key

You'll want to refer often to the Future of Tech Website: futureoftech.org

please email Eric Larson at elarson@comptia.org

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.



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.



WRAP-UP:

<u>Claude Shannon</u> 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 <u>Machine Learning using Scratch</u> (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 <u>4 Lessons From Robots about Being Human</u> (20 minutes) Don't fear Intelligent Machines. Work with them (15 minutes) CISCO Morrison Foerster GSMA IoT for all



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.



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: facial recognition

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.



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?



Sample Answer Sheet for Part One

	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
Саре	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%	

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.



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.



Avengers Tally Sheet Part One

Name:

Record your response in the table below.

	Α.	В.	с.	D.	Ε.	F.	Unnamed
Hair							
Skin							
Hair length							
Mask/ Helmet							
Саре							
Holding Something							
Similarity Score							
Likelihood							



Avengers Tally Sheet Part Two

Name:

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 Envelope							

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.

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.

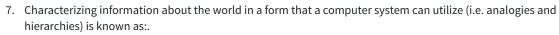
- 1.
- 2.
- 3.
- 4.
- 5.

artificial intelligence 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



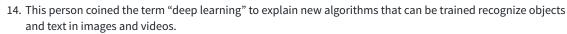
- a. Heuristics
- b. Planning
- c. Knowledge Representation
- d. Deep Learning
- 8. Below is a list of various algorithms. Classify each one as supervised learning (S), unsupervised learning (U) or reinforcement learning (R): (*Each correct label is worth half a point.*)

Anomaly Detection	K-Nearest Neighbor
Clustering	Linear Regression
Decision Trees	Principal Component Analysis
Deep Deterministic Policy Gradient	Support Vector Machines
Deep Q Learning	State-Action-Reward-State-Action

- 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



- 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)