Artificial Intelligence Neural Networks Activity Guide

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micron

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Whole slide deck or whole document Description: User uses the whole slide deck or whole document AS IS, without any modification	No additional citation required
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This activity is an adaption from an activity originally developed by AI4ALL, and used with their permission
https://ai-4-all.org/

The accompanying presentation is available on the Micron Educator Hub in the K-12 STEM section. Direct link: micron-k12stem-ai-neural-network-presentation

Artificial Intelligence Neural Networks Activity

Goal

Grow 6-12 grade student understanding of:

- Artificial Intelligence (AI)

- Machine Learning (ML)

- Neural Networks

Objectives

In this activity students will:

- learn the definition and some uses of Artificial Intelligence and Machine Learning

- gain a basic understanding of how Computer Science enables Artificial Intelligence

- learn the elements of a Neural Network and how a Neural Network works

- experience a hands-on practice of Neural Network concepts and relate it to human vision

- develop teamwork and communication skills in the Human Neural Network Game

Standards – NGSS & CCSS

This activity aligns with the following Next Generation Science Standards (NGSS) and Common Core State Standards (CCSS) on this and the following page.

NEXT GENERATION SCIENCE STANDARDS
For States, By States

Middle School Standards

AI Concept	NGSS Practice/Standard	Example Activity
Neural Networks	MS-SEP2, MS-ETS1-4	Model human vision with neural nets
Machine Learning	MS-SEP4, MS-LS4-1	Analyze data to classify objects
Problem Solving	MS-SEP1, MS-ETS1-1	Define AI solutions for real problems
Patterns	MS-CCC1	Find patterns in data with AI
Cause & Effect	MS-CCC2	Explore algorithmic decision-making
Systems Modeling	MS-CCC4	Simulate systems with neural networks

High School Standards

AI Concept	NGSS Practice/Standard	Example Activity
Neural Networks	HS-ETS1-4	Simulate solutions with neural nets
Machine Learning	HS-PS3-4, HS-LS4-6	Analyze scientific data with AI
Problem Solving	HS-ETS1-1, HS-ETS1-2	Define/design AI solutions for challenges
Patterns	HS-CCC1	Discover data patterns with AI
Cause & Effect	HS-CCC2	Explore algorithmic decision-making
Systems Modeling	HS-CCC4	Model complex systems with AI

Standards

This activity aligns with the following Common Core State Standards (CCSS):

The Common Core State Standards are designed to prepare students for college, career, and life, emphasizing real-world skills such as problem-solving, critical thinking, and collaboration.

- Common Core Math Standards most relevant to AI, machine learning, and neural networks include:
  - Mathematical Practice Standards:
    - MP1: Make sense of problems and persevere in solving them
    - MP4: Model with mathematics
    - MP7: Look for and make use of structure
  - Statistics & Probability:
    - 6.SP, 7.SP, 8.SP: Analyze and interpret data
    - High School S-ID: Summarize, represent, and interpret data

- Common Core ELA/Literacy Standards support AI by emphasizing:
  - Reading and analyzing technical texts (RI 6-12)
  - Writing explanations and arguments (W 6-12)
  - Presenting findings and engaging in discussions (SL 6-12)

Artificial Intelligence Neural Networks Activity Guide

Artificial Intelligence Neural Networks Activity

Materials Needed:

• Artificial Intelligence Neural Networks Presentation (from Micron Educator Hub)

• 3-4 printed color copies of images for Human Neural Network Game
  − Found at the end of this file and as a stand-alone file

• Printed or written name badges to assign roles for Human Neural Network Game
  − 3-5 Input Neurons per team of students
  − 3-4 Hidden Neurons per team of students
  − One Output Neuron per team of students

• Many standard sticky-note pads or note cards for Input and Hidden Neurons

• Note pad for Output Neurons

• Pen for each student

Recommended: 2-3 assistants to help with activity

Throughout this guide, black text indicates optional talking points, blue text indicates actions/tasks for the instructor.

Overview

This activity guide provides structure for the Human Neural Network Activity. The instructor/teacher should use the slide deck to present the content to students. This activity starts with an overview of Artificial Intelligence, Computer Science, Machine Learning and Neural Networks. It is not necessary for students (or the teacher) to have a background or any prior experience with Artificial Intelligence.

Setup for the activity

• Two rooms is ideal, but one large room will work

• Store printed images in a location the students cannot access

• Have printed Neuron name badges with roles ready to assign to students

• Have sticky notes or note cards and pens for all students
  − Standard sticky notes or note cards for input neurons & hidden neurons
  − Large sticky notes or note pad for output neurons

• Be sure you have previewed the slides

Presentation talking points

Slides #4-6

This activity is about Artificial Intelligence. Who has heard of Artificial Intelligence, or 'AI'?

Today we will learn about and play an activity related to these concepts. We have an engineer from Micron, Eliza Stack that will guide us through the activity.

Ask questions like: who has experience programming? who has heard about Machine Learning? who knows about how the human brain works? Etc.

Slide #7

Artificial Intelligence is all around us today.

These are some important details about AI.

Throughout the slide deck, cover the information, but avoid simply reading the slides to the students. Allow the students to read and then ask the students if they have questions and to share their experience with the topic.

Slide #8

Computer Science is related to AI.

Knowing how to program is a good foundation to help you understand AI.

Slide #9

Here are some examples of AI. What are some other examples?

- AI has evolved significantly in recent years, tapping into the vast pool of global knowledge, on the internet and specialized data sets
- In healthcare, AI enhances diagnostic precision in scans and accelerates new drug discoveries

Just like our brains need memory to function, AI needs memory and storage to store and process information.

Slide #10

Machine Learning is part of many AI systems

Slide #11

Raise your hand (again) if you have done some computer programming. If you did Hour of Code or Code.org, using block language, that is a great example of the step-by-step instructions you give to the computer.

Machine Learning is different, because the computer doesn't get those step-by-step instructions.

Presentation talking points

Slide #12

Are you surprised to hear that Machines don't learn?

Machines "learn" by adjusting numbers, not by thinking or understanding. Humans learn through experience, reasoning, and awareness. AI "learning" is about pattern recognition, not comprehension.

Notes for the instructor:

Machines don't "learn" like humans do. The word "learn" is an analogy. Machines don't have understanding, awareness, or experiences. Instead, they adjust mathematical parameters (like weights in a neural network) based on data and feedback.

What actually happens: AI systems, especially those using machine learning, are programmed to find patterns in data. They use algorithms to adjust their internal settings so they can make better predictions or decisions over time. This process is called "training," not true learning in the human sense.

Why the confusion? The term "machine learning" comes from the fact that, after being exposed to lots of examples, AI can improve its performance on a task—much like a person might improve at a skill with practice. But the machine doesn't "understand" or "know" anything; it's just following mathematical rules.

Slide #13

Today's activity is based on Neural Networks.

Has anyone studied the brain and how it works?

Slide #14

When AI Neural Networks were developed it was based on lots of research into how the human brain functions.

Help students understand that computers/AI are very different than humans AND that all digital data (including AI) comes down to Zeros & Ones.

Slide #15

Here are some example of where Neural Networks can be used. What are some other examples?

Presentation talking points

Slide #16

Artificial Intelligence has been around for many decades. The term 'Artificial Intelligence' was first used at a conference in 1956. It has grown significantly starting in the early 2000s due to increasingly powerful computing systems, availability of data and improved algorithms.

Slide #17

Now, let's learn about the Neural Network Game!

Slides #18-20

First, let's review how the brain processes Human Vision through the neurons

Next, let's compare the brain process to the AI Neural Network

Slide #21

This can be skimmed over (even skipped) for younger students that are below grade 10.

Computer neural networks are math based. When started, the network isn't very accurate. The AI network makes use of training to judge the results, adjust the math, and try again. This approach is repeated MANY times! Each time make the model more accurate.

Slide #22-25

At this time, identify the teams and assign the roles to each student. You can do this earlier, but it must be done by slide 22, so students can focus on understanding their role

We will split into teams and each of you will be assigned the role of Input, Hidden or Output Neurons. Pay attention to the description of your role (on your neuron name badge).

Notes for the instructor:

The number of teams is dependent on the number of students. The ideal team size is 8, with 3 input neurons, 4 hidden neurons and 1 output neuron. There is always only one output neuron. If there are not enough students for at least 2 teams of 8, then a team of 7 can have 3 input and 3 hidden neurons. If the number of students is too many for 2 teams of 8, but not enough for 3 teams of 8, just be sure that the number of hidden neurons is not less than the number of input neurons. Here are some guidelines:

  - Teams of 9: 3 input / 5 hidden / 1 output
  - Teams of 10: 4 input / 5 hidden / 1 output
  - Teams of 6: 2 input / 3 hidden / 1 output

Human Neural Network Activity

This section walks through the activity

Explain to the students that they cannot speak during each activity round, but they will be able to discuss and strategize between rounds.

Arrange students, so they are sitting with their teammates, and the teams are somewhat divided. Give the following materials to each student, based on their role:
  - Input neurons: pen, a stack of sticky notes (or note cards)
  - Hidden neurons: pen, one sticky note (or note card)
  - Output neuron: pen, large sticky note or piece of paper

This is where assistants are necessary. Hidden & Output neurons should stay in the main room; one instructor can show videos or engage in a discussion with the Hidden & Output neurons about AI while all the Input neurons are out of the room.

The following steps are taken for each 'round':

INPUT NEURONS
  - Take the students assigned as input neurons out to a separate room or space.
  - Show each input neuron the same image. Remind them that they cannot speak.
  - Instruct each input neuron to:
    - use the same number of sticky notes as there are hidden neurons.
    - look at the image (do not take it back into the room)
    - write one word about the image on each sticky note – can be the same word or a different word on each sticky note
  - When they return to the room, each input neuron will deliver one sticky note to each hidden neuron on their team

HIDDEN NEURONS
  - All students remain in the same room. Remind all students there is no talking.
  - Instruct each hidden neuron to:
    - review all sticky notes from the input neurons on their team
    - write two words on one sticky note, based on the words from the input neurons
    - deliver their one sticky note to the output neuron on their team

OUTPUT NEURONS
  - Instruct each output neuron to:
    - gather and review the sticky notes from the hidden neurons on their team
    - write a descriptive phrase based on the words from the hidden neurons
  - Be ready to read their phrase when called upon

Human Neural Network Activity

This section walks through the activity - continued

Once all Output Neurons have their 'Descriptive Phrase' ready, engage students as a full group. Again, remind students that there is no talking until each output neuron has shared their 'descriptive phrase'.

As a full group, with students sitting with their teammates, each output neuron will read their 'Descriptive Phrase'. Avoid acknowledging if the phrase is or is not accurate until all teams have completed.

Instructor shows the image on the screen and asks the students to comment on the process and how close the output neuron description was to the actual image. Allow for discussion to flow for a few minutes, then ask the students the following questions:

1. How could the Input Neurons provide more useful information to the Hidden Neurons?
    - Should each Input Neuron write the same word on every stick note?
    - What if each Input Neuron had a specific aspect of the image to review?
    - For example: One person writes the word of the main object in the image; one person writes a word related any action taking place; one person writes a word related to the location, etc.
2. How could the Hidden Neurons provide more useful information to the Output Neurons?
    - What is a method to take a bunch of random words and consolidate to two words?
    - Do the two words have to be related?
3. Instructor: consider other questions…

Before starting another round, allow each team to discuss their strategy for the next image. Keeping everyone in their same roles, have the Input Neurons leave the room with an instructor. Walk through the same process with a new picture and remind everyone they cannot speak.

Continue with additional rounds, each with a new picture. After round three consider changing the roles of the students. Instructor decides if the students should switch roles. Before changing roles, ask students the following questions.
  - What is the benefit to keeping people in the same roles?
  - Are each of you getting better at the role you are in?
  - If we change roles, how would that impact the output of the game?

After the 'final' round, wrap up with a discussion of how the students think that Machines / Computers Learn. Ask students to think of other examples of where Machine Learning and Neural Networks may be applicable.

Glossary

Term or acronym	Definition/description
Artificial Intelligence (AI)	Field of computer science creating systems that perform tasks needing human-like intelligence such as learning and reasoning.
Machine Learning (ML)	A type of AI that uses data to teach computers how to learn to make predictions and decisions. Computer learning takes place through recognition of patterns from data, similar to how humans learn from examples.
Neural Network	A type of ML inspired by the human brain. Uses a collection of connected nodes to make predictions and update themselves as data is introduced to the system.
Computer Science (CS)	Computer science is the study of how computers work and how we can use them to solve problems. Computer science involves studying algorithms, data structures, programming languages, and hardware architecture.
Programming	Providing the computer with step-by-step instructions of exactly what to do.

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Sample Name Badges for Human Neural Network Game

Print and hand out to students as described at the bottom of page12

Human Neural Network

INPUT NEURON

- No talking while you look at the Image
- The number of sticky notes must match the number of hidden neurons on your team
- Write ONE word on each sticky note
- Deliver one sticky note to each hidden neuron on your team

Human Neural Network

HIDDEN NEURON

- No talking while you look at the sticky notes
- Write two words on one sticky note, based on the words on the sticky notes from the input neurons on your team
- Deliver one sticky note to the output neuron on your team

Human Neural Network

OUTPUT NEURON

- No talking while you look at the sticky notes
- Review the words on all sticky notes from the hidden neurons on your team
- Write a descriptive phrase on your note paper based on the words on the sticky notes from the hidden neurons on your team

The following 5 slides provide unique images for the Neural Network Game

- Use one image per round and ONLY show the images to the students in the Input Neuron role.

- Do NOT show these slides to the full group of students until the end of each round

- Educators can use their own pre-existing images or create their own AI images
  - Start with simpler images, with only one or two items
  - As the students progress in the game, consider unique scenes with a variety of interesting aspects
  - Consider changing the type of image to more artistic or more futuristic
  - Include characters that are not familiar to the students

  All five images were created for Micron by Copilot AI

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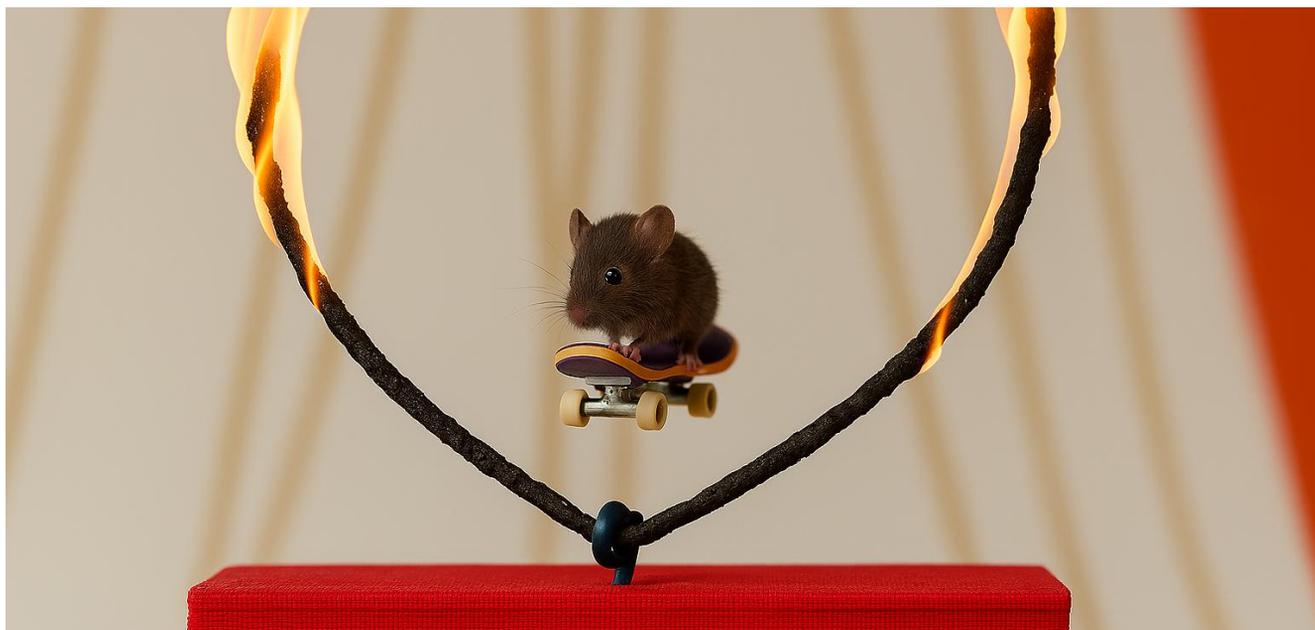
Image for Round #1

Created for Micron by Copilot

Image for Round #2

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Image for Round #3

Created for Micron by Copilot

Image for Round #4

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Image for Round #5

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