Training AI Neural Networks

Teacher: Bianchi & Chukhareva	**Date**:
Class Type: Engineering Foundations	**Grade**: 9th-12th
Time Frame: 2 block lessons - 180 minutes	

Lesson Overview

Unit/ Overarching Focus of Lesson:

Learn how neural networks are structured and use ai models to predict patterns

Objectives/Aims: Students will demonstrate understanding/learning around the following Big Ideas:

- Developing an understanding of key terms in artificial intelligence and machine learning.
- Explaining how neural networks process information.
- Setup an AI model in a Python notebook
- Train an AI model with custom data
- Research AI datasets online to train personalized AI model

Aligned Standards (Common Career Technical Core):

- *Standard 2*: Use technology to acquire, manipulate, analyze, and report data

Key Vocabulary and Concepts:

- Artificial Intelligence- machines that can think and act (virtual assistants)
- Machine Learning - systems that learn from data (recommendation systems on streaming platforms)
- Neural Networks - a type of machine learning model that learns to recognize patterns and makes decisions.
- Neurons: The circles in each layer. They take in information, process it, and pass it on.
- Weights: The lines connecting neurons. Thicker lines represent stronger connections.
- Input Layer: Represents the features of our berries (length and roundness)
- Hidden Layer: Where the network processes information
- Output Layer: The final decision (blueberry or strawberry)

Materials & Resources:

- Computers with
- Phone cameras to take pictures
- Handouts

Preparation for Teaching Diverse Students:

Currently our world is changing rapidly due to the increased use of AI in everyday lives. Even though multiple students use applications like ChatGPT, there is little understanding of how it actually operates behind the scenes. Students use AI to help with their school work, create art and entertainment. This unit allows students to share their experiences with AI and develop an understanding

Cultural context within which the lesson will be grounded, and specific ideas/practices to be included in the lesson:

- Discuss how numbers could be written differently in different cultures and test how well the AI model identifies them

• Incorporate youth culture into our lesson plans - students train their models on things they are interested in (musical instruments, sneakers, skateboards) and test them with their own images
Prior Knowledge: • Experience with AI models like ChatGPT

Prior Lesson:	**Followup Lesson:** Training AI models on Raspberry Pi

Day 1			
Time	**Activity**	**Materials**	**Rationale**
5 mins	**Do Now:** Hugging Face -Doodle Dash Game	cell phones	Quick AI Demo
10 mins	**Discussion: Introduction to Neural Networks** Presentation	Guided Notes	Define and explain AI, ML, and Deep Learning Introduce Neural Networks as building blocks of deep learning
25 mins	**Unplugged Activity**	Strings, peach and strawberry, handouts, neurons	This hands-on, unplugged activity allows students to physically model the process of a neural network.
30 mins	**Blueberry Vs. Strawberry Classification**	Handouts, computers	Another activity to deepen students understanding of neural networks and practice vocabulary
5 mins	**Number Detection Activity**	Internet	Allows students to see a neural network in action, helping to understand how input is processed through layers to produce interface.
5 mins	**Assignment and Instructional Strategies:** Students write one key takeaway and one question they still have.		Identify concepts needed to review

Day 2			
Time	**Activity**	**Materials**	**Rationale**

5 mins	**Do Now:** Students open Colab/Deepnote notebooks and prepare for the activity	Computers	Quick AI Demo
5 mins	**Intro to Python**	Instructions, Computers	The introduction to python programming language, various Learn about Ultralytics AI platform
20 mins	**Tasting an existing Yolo8 Model and training a model with a provided dataset**	Computers	Students learn how to train, validate, and test existing AI models with the help of colab notebook
40 mins	**Training an AI model with data from roboflow**	Handouts, computers	Training an AI model using the roboflow universe dataset. Students choose their own datasets to train the model. After models have been trained, they use images they took to test their models.
5 mins	**Assignment and Instructional Strategies:** Students share the images they used to test their trained model with the class		Students peer review their work

Assessments

Follow-Up Assignment:

Creating an AI model to interact with real-world using Raspberry Pi

Additional Accommodations for Students:

- Use color-coding to distinguish different parts of the AI model during the unplugged activity
- Encourage peer tutoring for coding tasks to support collaborative learning
- Offer a library of common code snippets for reference
- Supplement written materials with hands-on and coding activities
- Provide hands-on manipulatives to represent AI concepts physically
- Allow students to progress through coding exercises at their own pace
- Provide extension activities for fast finishers.
- Provide checklists for multi-step processes in AI model creation and training.
- Use a step-by-step approach for complex concepts, ensuring understanding at each stage.

Methods of Assessment:

- Formative Assessments:
  - **Exit Tickets** (End of Day 1):
    - ➢ Students write one key takeaway and one question they still have about neural networks.
    - ➢ This helps identify concepts that need review at the start of Day 2.
  - **Peer Trained AI models and code Review** (During Day 2 coding activities):

- ➢ Students review each other's test images in pairs, calculating the success rate and giving feedback.
- ➢ This reinforces understanding and introduces basic code review practices.

- Summative Assessments:
  - **AI Model Project**:
    - ➢ Students create, train, and test an AI model using a dataset of their choice.
    - ➢ They document their process, including dataset selection, model training, and testing results.
    - ➢ Assessment criteria:
      - ★ Appropriate dataset selection
      - ★ Correct implementation of model training
      - ★ Thoughtful analysis of model performance
      - ★ Clear documentation of process