A GUIDE BY

WOZ ED

STEM

SCIENCE TECHNOLOGY ENGINEERING MATH

PATTERN RECOGNITION AND MACHINE LEARNING

ARTIFICIAL INTELLIGENCE | LEVEL IV

60 MINUTES

PATTERN RECOGNITION AND MACHINE LEARNING

OVERVIEW

AI technology is largely based on a machine's ability to study a set of data and make autonomous decisions based on the data. Students will examine sample data and learn to train AI systems to recognize patterns. Students will explore how AI learns to see patterns in the data. AI systems can learn in a variety of ways. One is by using a programmed decision tree or decision forest. Programmers can suggest binary (yes/no) decision pathways for the AI to follow, training it to answer simple questions or provide responses. Users can establish patterns, provide responses, and automate a system that emulates how many human users would respond. In this module, students will examine and build an interface model that resembles the data tree decision making method of AI.

OBJECTIVES

Students will

- Identify basic models of AI learning methodology.
- Explore how the various models are used for specific programmatic advantage.
- Build their own decision tree or decision forest to find results within a dataset.
- Discuss vocabulary to support learning.

NOTE: The decision tree/forest model can be built using a variety of online tools or done with paper and pencil. The concepts will be the same using digital tools or physical tools.

ADVANCED PREPARATION

Notes on what the teacher needs to complete prior to teaching the lesson to be fully prepared for the activities.

- Prior to class, preview Woz ED video, "Machine Learning."
- Prior to class, familiarize yourself with LucidChart: http://wozed.link/AI_L4_M_M2_R1 or Twine: http://wozed.link/AI_L4_M_M2_R2 and set up a free account for the EXPLORE section unless you plan to use pencil/paper to diagram the decision trees.

INTRODUCTION 10 MINUTES

MATERIALS

- computer, tablet, or smartphone with Internet access—1 per student/group
- access to the 20Q website: http://wozed.link/AI_L4_M_M2_R3
- whiteboard
- dry erase marker

PROCEDURE

1. Direct students to the app on their own device or in a web browser.
2. Tell students to play a few rounds.
   a. Ask how this relates to AI and more specifically how this relates to the idea of a decision tree.
   b. Write some of students' answers on the whiteboard.

NOTE: Encourage them to think creatively about the connections to AI without giving them much background knowledge.

ACTIVITY 40 MINUTES

MATERIALS

- computer linked to projector displaying Woz ED video, “Machine Learning”: http://wozed.link/AI_L4_M_M2_R4
- computer with Internet access—1 per group
- access to LucidChart: http://wozed.link/AI_L4_M_M2_R1 or Twine: http://wozed.link/AI_L4_M_M2_R2
- OR paper and pencil – alternative option to draw diagram by hand

PROCEDURE

1. Pose the following questions to prompt a response about machine learning:
   a. Could you tell that the 20Q experience was controlled by an AI system? How could you tell?
   b. The app is a very simple version of an AI. How do you think it works?
   c. The AI behind the app uses a decision tree model of programming. What do you think that means?
   d. In this simple system of machine learning, how is the use of a decision tree apparent in the app?

NOTE: For teachers - more information on decision tree and decision forest models of machine learning for AI can be found here: https://wozed.link/AI_L4_M_M2_R6

2. Play the Woz ED video, “Machine Learning” on Pattern Recognition and Machine Learning.
   The video will give some background knowledge on decision trees and decision forests that will help students in this module’s activity. Challenge students to build their own decision tree data model.
   a. This will be the basis for a chatbot app. A chatbot app is a simple AI program that is based on a series of questions and answers. The bot tries to respond how a human would to a prescribed series of questions or scenarios. These can be remarkably effective. They can also go sideways quickly given the subtlety of human language and nuance.
3. Instruct students to get in groups of two or three students.
4. Tell students to pick a topic, industry, or position where a chatbot might be used. Some examples are:
   - Online banking
   - Website technical support
   - Insurance quotes
   - Search engines
   - Call centers
   - Ordering pizza
   - Product suggestions
   - Weather
   - News
   - Finding a restaurant

5. Task students with diagramming a decision tree that will help build the background AI system.
    a. Students can use a digital resource like lucidchart.com or draw one on paper.
    b. The decision tree will become a data map that the AI will use to answer questions and interact with the online user.
6. Present the following example and explanation to students:
    a. In an online pizza ordering app development project, the first question is, “Pickup or Delivery?” The user then interacts with the AI through the process of ordering a pizza from start to finish.
    b. Humans may have to ‘step in’ at certain points to help solve problems. Students should be aware of this in their diagram and mark it.
7. Instruct students to use proper vocabulary as part of their diagram. Each diagram should contain as much detail as possible when predicting how users will interact with the AI chatbot. Terms to use include:
    - Root node
    - Terminal node
    - Decision node
    - Branch

NOTE: See the following website for terms and more examples of decision trees **http://wozed.link/AI_L4_M_M2_R5**.

8. Diagram the following on the whiteboard as an example.
    a. The pizza ordering chatbot decision tree may start like the first diagram:
9. Encourage students to see how different ‘branches’ of the conversation will change based on user input, suggestions, or regular conversation with a human person..
    a. Demonstrate that by drawing the second diagram on the whiteboard:
10. Ask groups to share their diagram with the class. Encourage feedback between groups as to the logic and organization of their trees.
    a. Notice when and if groups indicated the need for a ‘human handoff.’
    b. Discuss the implications of converting this map to an AI program.
        - Leaf
        - Splitting

Diagram 1

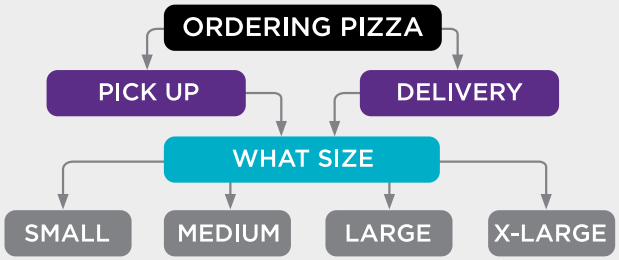
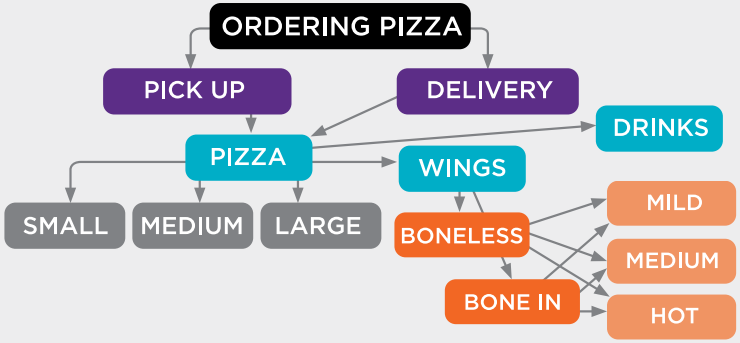


Diagram 2



EVALUATION 10 MINUTES

MATERIALS

- Machine Learning Mindmap—1 per group, created during EXPLORE section
- https://wozed.link/AI_L4_M_M2_H1 —1 per group

PROCEDURE

1. Tell groups that they will evaluate their programming plan against the others in the class.
    a. Each group will start by critiquing their plan as well as evaluating its effectiveness as a program.
2. Distribute Machine Learning Mindmap Discussion Questions handouts and instruct students to discuss within their groups.
3. After group discussion, invite the groups to share some of their answers to the class.

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