

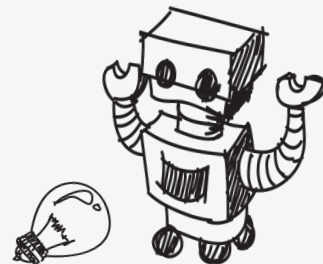
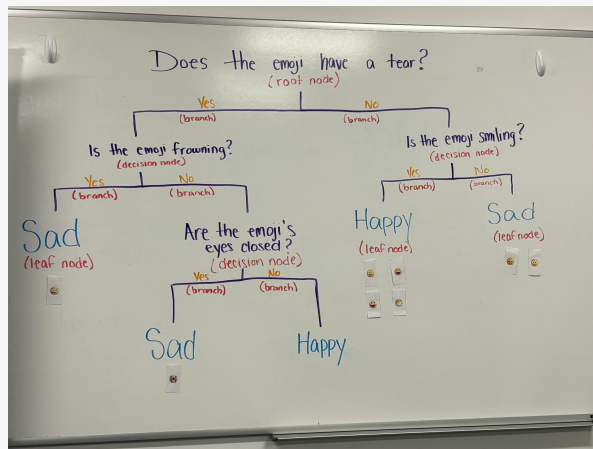
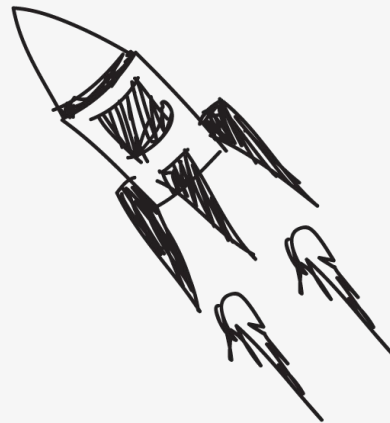


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TRYEngineering



Train Your Tree: How AI Learns to Decide



Sort the Emojis!

With your partner, sort the emoji cards!

- You must have **at least two (2) categories**.
- Write each category name on a separate sticky note.



Source: Canva



Emoji Sort Reflection

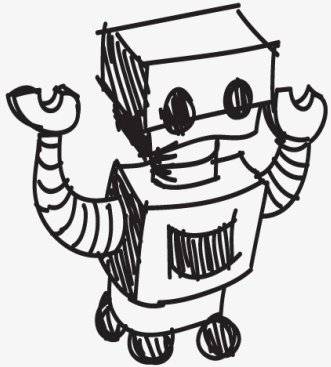
- How did you **sort** your emojis?
- Why did you **categorize** them that way?
- What **features** helped you decide which categories to create?



Source: Big Stock



The Design Challenge



The Design Challenge

You're a junior AI engineer working for EmojiWorks, a company that designs emojis. EmojiWorks wants to add a new feature to their app: a smart AI emoji sorter that helps users quickly find the emoji they are looking for by typing phrases such as "happy emoji," "animal emoji," "red emoji," etc.



Source: Copilot

Your job is to **develop a rule-based decision tree** that sorts emojis into the right categories. You'll look closely at each emoji's features and attributes, collect data, and design the yes/no questions that AI will use to decide which category each emoji belongs to.



Criteria

- Each emoji must have **at least 3** pieces of data and **at least 1** highlighted data
- Decision trees must have **at least 2** yes/no questions (a root node and decision nodes)
- Decision trees must have a **minimum of 2 leaf nodes** (categories)



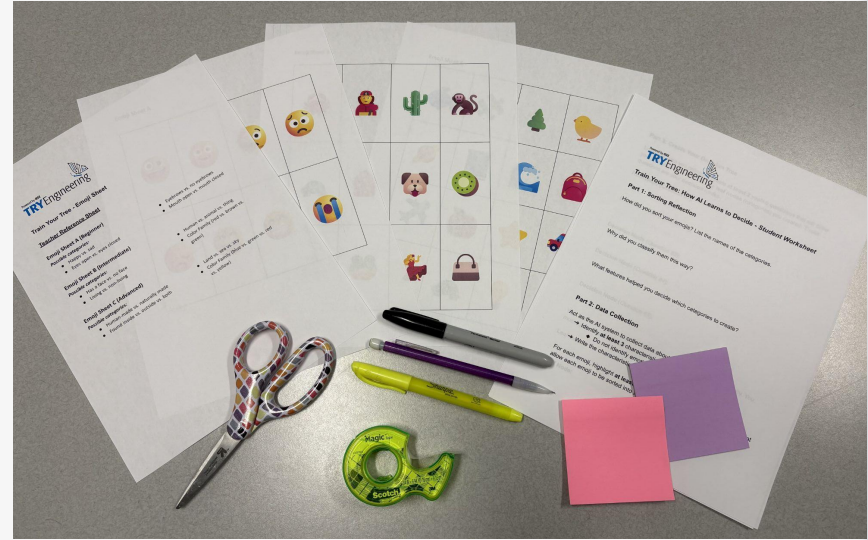
Constraints

- Use only the materials provided
- Complete in the allotted time



Materials

- Printed [emoji cards](#) (1 sheet per team)
- Desk space, wall, or whiteboard to create decision tree
- Pencil, pen, or marker
- Highlighter
- 2 different colored sticky notes for writing questions
- Tape for attaching emoji cards to surface
- [Student Worksheet](#)



What is a Decision Tree?

A **decision tree** is a **supervised learning algorithm** for classification, meaning that it learns from labelled data. Every input has a corresponding output.

*An **AI decision tree** is labelled like an upside down tree. It starts with a **root node** and ends with **leaf nodes**.*

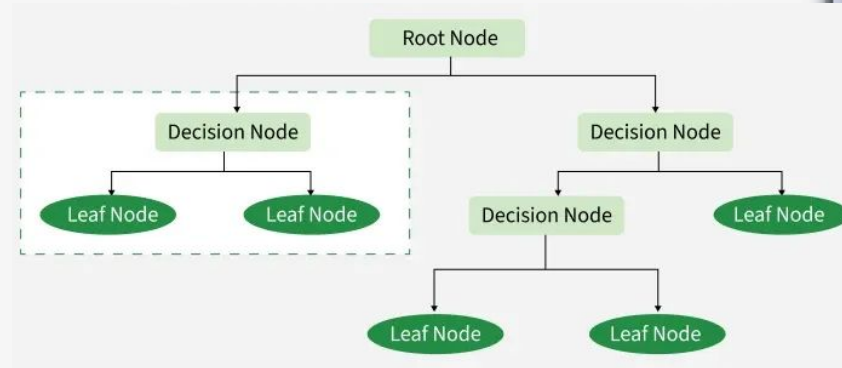
The decision tree starts with a **root node** and splits data into branches. These branches lead **decision nodes** and eventually, **leaf nodes**, that represent the AI's final decision.



Decision Tree Terminology

Decision trees have **four main components**:

- The **root node** is the starting point of the tree. It represents the entire dataset before any splits are made.
- The **decision nodes** are internal nodes where the tree tests a feature (attribute) and splits the data into groups.
- **Branches** are the paths that connect nodes. Each branch represents the outcome of a decision or test.
- The **leaf nodes** are the endpoints of the tree. Each leaf represents the final classification or decision.



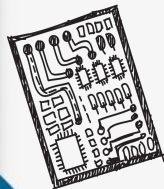
*Your **leaf nodes** are the categories from your sort!*



Failure is Part of the Process

- **Failure is part of the process!** Engineers test, fail, troubleshoot, and redesign until they reach the best solution.
- **Iterate again and again:** test, fail, redesign– each cycle brings you closer to success.
- **Document your journey:** sketch ideas, record iterations, and note measurements or calculations.
- **Celebrate multiple solutions:** there's no single “right” answer– creativity leads to diverse possibilities.

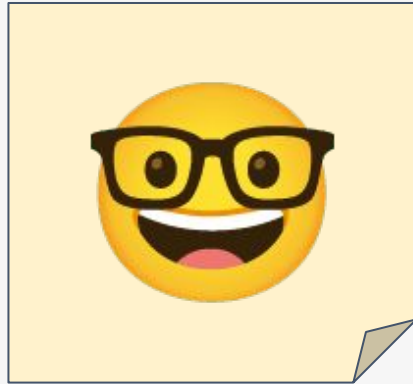
Ready, Set, Let's Engineer!



Data Collection Pt. 1

Act as the AI system and collect data about each emoji in your set!

- Identify **at least 3** characteristics or features of each emoji.
 - ◆ Do not identify emotion (e.g., happy, sad, angry)
- Write the characteristic/feature on the back of each emoji card.



- Yellow
- Smiling
- Open Mouth
- Glasses
- Round eyes
- Open Eyes
- One tooth



Data Collection Pt. 2

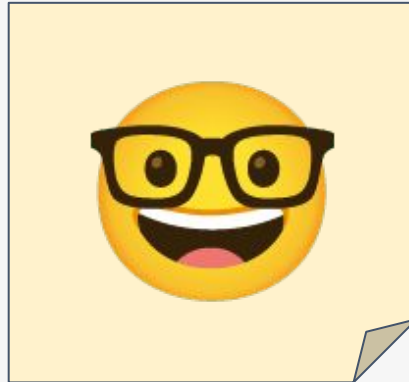
If I wanted to sort my emojis **exactly** as you did, what **data** would I use?

→ For each emoji, highlight **at least 1 piece of data** that allow each emoji to be sorted into the categories you created.

If my two categories are **Happy** and **Sad**, I would highlight:

- Smiling
- Open Mouth
- Open Eyes

These pieces of data will help me create questions that will properly sort my emojis.



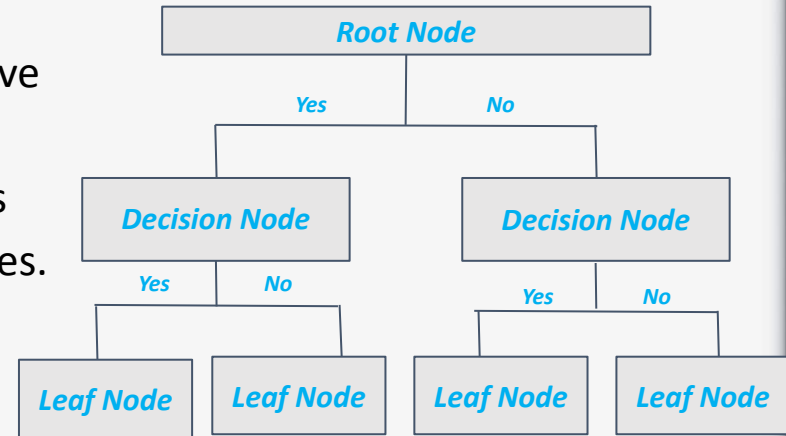
- Yellow
- Smiling
- Open Mouth
- Glasses
- Round eyes
- Open Eyes
- One tooth



Build Your Decision Tree

Using the data you collected about each emoji, build your decision tree. Your tree must have **at least 2 questions—a root node and decision nodes**.

- Create your **root node** (*first question*).
- Draw your **branches**. Your branches should have two paths: *Yes* or *No*.
- Create your **decision node(s)**. These questions split the data further until they reach leaf nodes.
- **Leaf node(s)** are the final categories, the decision that the AI has made. ***These are the categories you created during the sorting activity.***



Testing

Test your decision tree!

- Place all your emojis cards at the top of the decision tree (*above the root node*).
- Run each emoji through each decision node and follow the branches until every emoji ends up under a leaf node (**category**).

The decision tree is successful if each emoji falls under the leaf node (category) you assigned it to during the sorting process.

Did any of your emojis end up under the wrong leaf node? This is called a **misclassification**. Leave it for now. You will have time to redesign.



Reflect

- Were any emojis misclassified? If so, why were they misclassified?
- What feature(s) (*root node, decision nodes, leaf nodes*) of the decision tree can be changed or added to improve its accuracy or make it better?



Source: Big Stock



Why Misclassifications Matter?



Sometimes AI makes mistakes—called **misclassifications**. This happens when there's not enough data.

Misclassifications matter because they can lead to:

- **wrong decisions** — the AI system chooses the wrong category, action, or response
- **loss of trust** — people stop relying on the system if it keeps getting things wrong

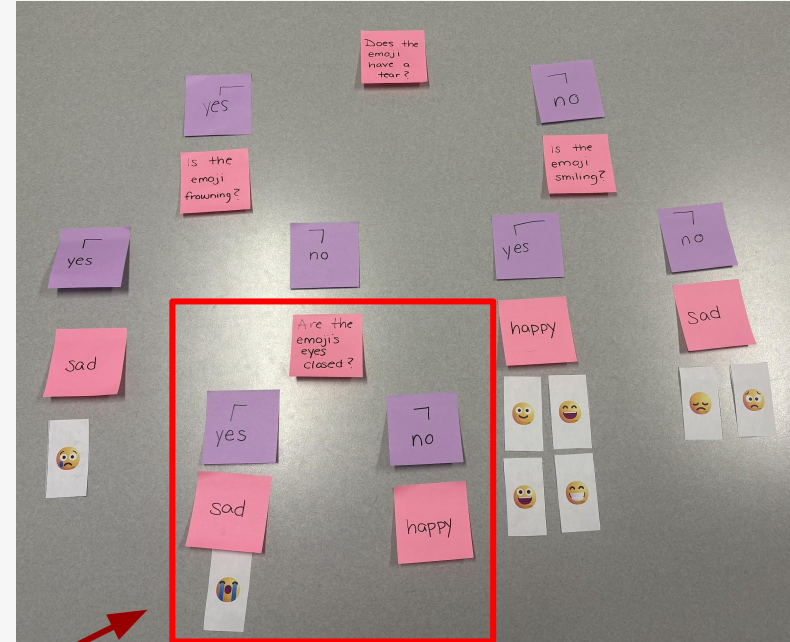
Engineers fix this by testing, analyzing errors, and redesigning the system so it becomes more accurate and fair.



Redesign & Optimize

Redesign your decision tree by:

- Adding new **decision nodes** (questions) that allow for more accurate classification **OR**
- Create new **leaf nodes** and redesign the entire decision tree with a new **root node** and **decision nodes**.



Added decision node



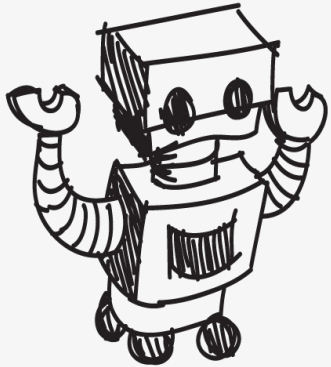
Reflect



- What feature(s) of the decision tree did you change or add? The root node? The decision nodes? The leaf nodes?
- After redesigning, did your decision tree become more accurate? Were there any misclassifications? What could you do to improve your decision tree?
- What did you learn about how AI uses decision trees to make decisions?



Background Concepts



What is Artificial Intelligence?

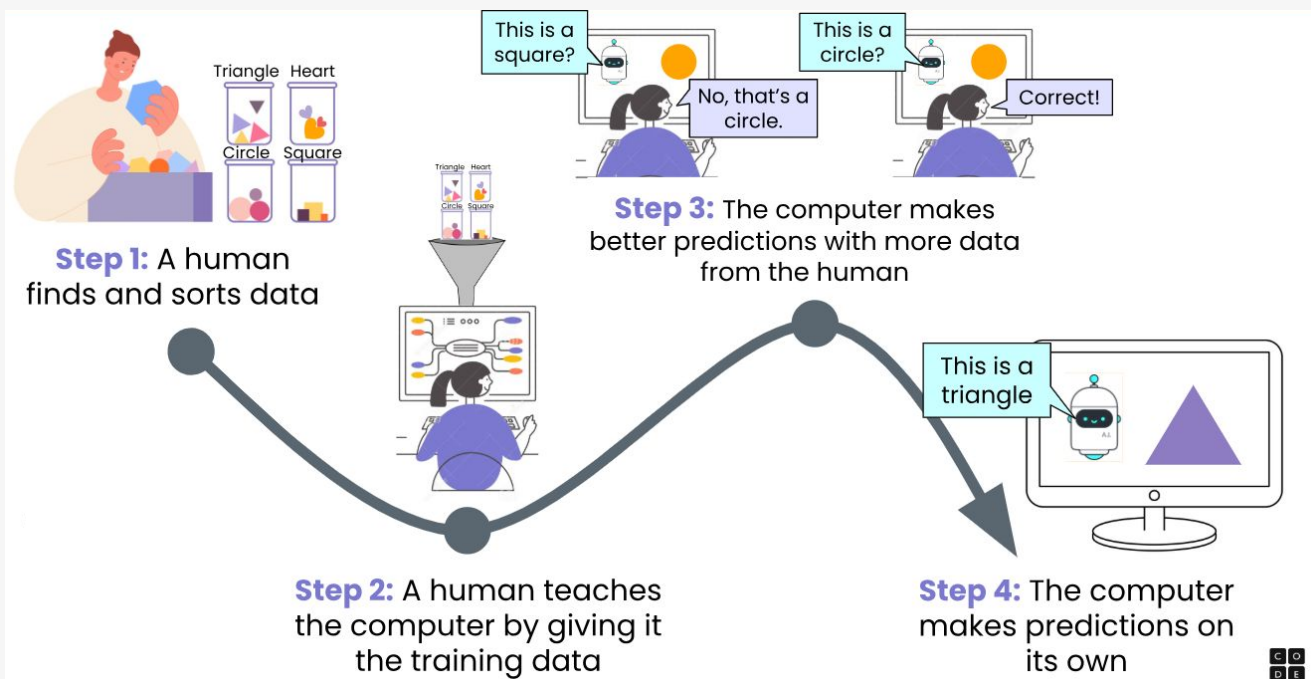
Artificial Intelligence (AI) is a technology that makes machines seem smart, letting them “think” and solve problems as people do.

AI systems follow **patterns**, **rules**, and **data** to make decisions.

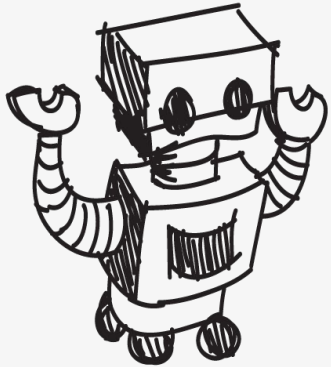
Examples of AI tools: ChatGPT, Voice Assistants (*Amazon Alexa*), and Self Driving Cars.



How do Computers Learn? - From code.org



Dig Deeper



Dig Deeper with Code.org

Visit code.org's [How AI Makes Decisions](https://code.org/ai-lesson) for a virtual version of this lesson on similar topics.

[Lesson 1: Making Predictions](https://code.org/ai-lesson) introduces students to the fundamentals of AI and machine learning with an emphasis on **data categorization**.

[Code.org](https://code.org)'s lesson builds on the sorting activity in this *TryEngineering* lesson plan.

GRADES 3-5

How AI Makes Decisions



Introduce young students to AI and machine learning with hands-on activities using predictive data models. Students will practice making their own predictions and learn about data categorization and sorting.

Explore curriculum

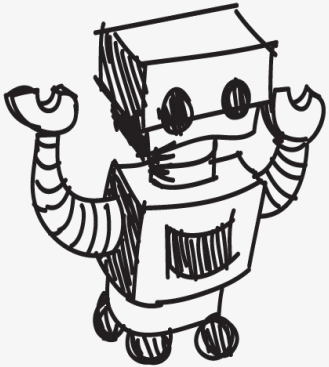


Dig Deeper (Extension Activities)

- **Extension Activity:** Allow students to create their own emoji sheets. Blank templates can be found on the “Emoji Sheet” document.
 - TryEngineering suggests you complete the lesson as a whole-group activity so students understand what is expected, and then have students create their own emoji sheet and decision tree. Follow this [link](#) to an emoji website that also includes an emoji generator!
- Read [*AI Adventures: Exploring the World of Artificial Intelligence*](#) by TryEngineering
- Explore the [TryEngineering Artificial Intelligence Collection](#) page for more resources on AI.
- Watch the [Artificial Intelligence video](#) by BrainPOP
- Watch [What is Artificial Intelligence](#) by AI for Kids



Vocabulary



Vocabulary

Accuracy - how many items the model gets right

Algorithm - a set of steps a computer follows to solve a problem

Artificial Intelligence (AI) - a technology that makes machines seem smart, letting them “think” and solve problems as people do

Branch - the path taken after answering a rule

Classification: sorting items into categories

Data - information that we collect; AI uses data to learn

Decision Node - the internal nodes that test an attribute

Decision Tree - a supervised learning algorithm for classification, meaning that it learns from labelled data. Every input has a corresponding output.

Feature - something that an item has or is; a characteristic used to describe something

Leaf Node - represents a classification or decision; they do not split

Misclassification - when the AI makes a wrong prediction

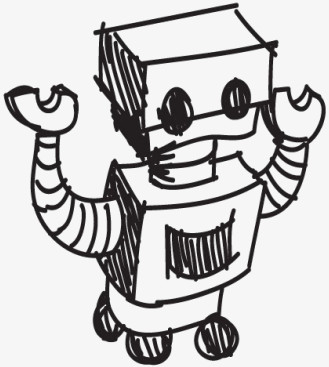
Root node - the starting point of a decision tree; represents the entire data set, which gets divided into two or more sets

Sort - to put items into groups based on their features

Supervised Learning Algorithm - a type of machine learn where a model learns from labeled data—meaning every input has a corresponding correct output.



Engineering Fields



What is Engineering?



Learn about engineering and how engineers are creative problem solvers and innovators who work to make the world a better place.

(Video 3:43)



Source: TeachEngineering YouTube Channel - <http://www.youtube.com/watch?v=H9VDkvaGmVo>

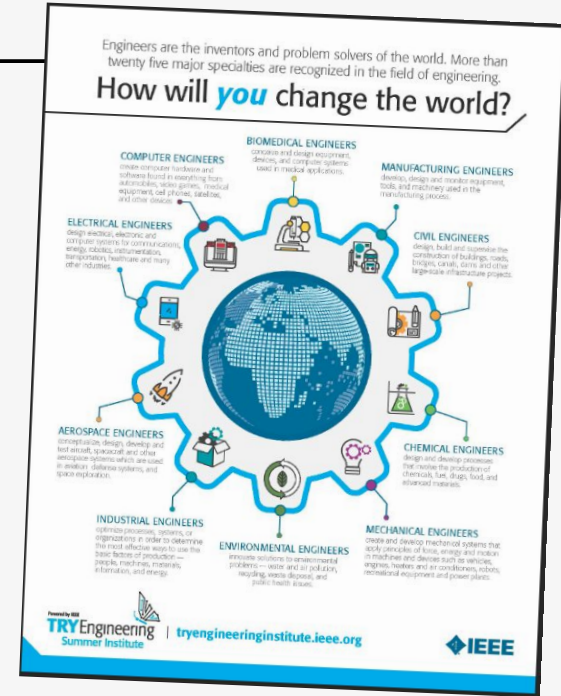
Related Engineering Fields

- There are several types of engineering fields that are involved with artificial intelligence. Here are just some of the related engineering fields.

- [Computer Engineering](#)
- [Software Engineering](#)
- [Computer Information Technology](#)

- Explore the Engineering Fields Infographic - How will **YOU** change the world?

Engineers are the inventors and problem solvers of the world! More than twenty five major specialties are recognized in the field of engineering. **Engineers make the world a better place!**



For more engineering lesson plans and
resources like games, engineering careers,
and STEM opportunities visit IEEE's
[TryEngineering.org](https://www.tryengineering.org)

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