PROFESSIONAL DEVELOPMENT

INTRODUCTION

- Target learners: 6th grade to middle school
- Objectives:
  - Develop integrated curricula in collaboration with middle school STEM teachers on AI
  - Emphasize the importance of visualization and representation with computers
  - Emphasize how computers perceive and learn from data
  - Provide opportunities for students to apply AI concepts to real-world applications and consider the ethical implications of AI
- Two curriculum designs: AI for good and AI for me.

THINGS TO PREPARE BEFORE YOU TEACH

- Knowledge and skills
  - AI
  - Machine Learning
  - Natural language processing
  - Computer vision
- Materials
  - Scratch extension
  - Teachable machine
  - Micro Bit

AI FOR GOOD

- Objectives
  - Explain what AI is and how it works.
  - Describe how AI (ML, NLP, Computer vision) can help our society.
  - Design an AI prototype to solve a daily problem.
- 5 lessons
  - Lesson 1. AI & Machine Learning I
  - Lesson 2. Machine Learning II
  - Lesson 3. Natural Language Processing
  - Lesson 4. Computer Vision
  - Lesson 5. Project Design

AI FOR ME

- Objectives
  - Explain what AI is and how it works.
  - Describe how AI (ML, NLP, Computer vision) can solve problems.
  - Design an AI prototype to address school community's needs.
- 5 lessons
  - Lesson 1. AI & Natural language processing
  - Lesson 2. Machine Learning I
  - Lesson 3. Machine Learning II
  - Lesson 4. Computer Vision
  - Lesson 5. Shark Tank

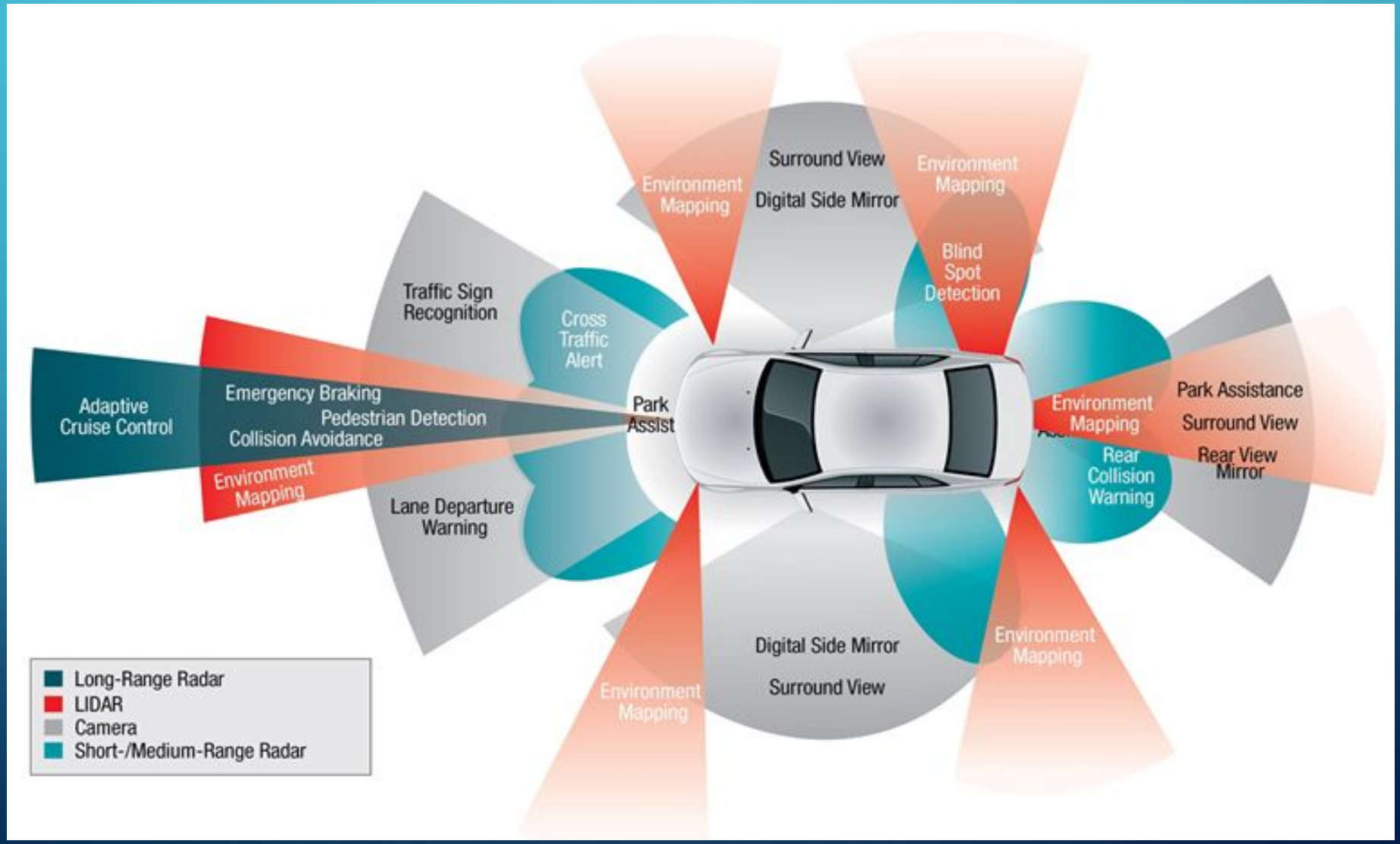
AI VS. NOT AI

TOASTER

SIRI ON IPHONE

BARCODE SCANNER

SMART CAR


Adaptive Cruise Control
Emergency Braking
Pedestrian Detection
Collision Avoidance
Environment Mapping
Traffic Sign Recognition
Cross Traffic Alert
Lane Departure Warning
Park Assist
Environment Mapping
Surround View
Digital Side Mirror
Blind Spot Detection
Environment Mapping
Environment Mapping
Rear Collision Warning
Park Assistance
Surround View
Rear View Mirror
Digital Side Mirror
Surround View
Environment Mapping
Environment Mapping
Long-Range Radar
LIDAR
Camera
Short-/Medium-Range Radar

WASHING MACHINE

NETFLIX

INDUSTRIAL ROBOT

DELIVERY ROBOT

MIXER

TIKTOK FACEFILTER

ELECTRONIC TOLL COLLECTION

WHAT IS AI?
WHAT DOES AI STAND FOR?

WHAT IS ARTIFICIAL?

- Made by humans; produced by human (opposed to natural)
- Example: Artificial flowers

WHAT IS INTELLIGENCE?

- An organism uses data to improve decision making

WHAT IS AI?

- A way for a computer program to work “intelligently”
- The art of teaching computers how to "think."
- A discipline concerned with the designing of computers that make predictions and decisions.

AI INCLUDES MANY CONCEPTS

- Machine Learning
- Natural language processing
- Computer vision

- … And many more.

EXAMPLE ACTIVITIES

MACHINE LEARNING

NATURAL LANGUAGE PROCESSING

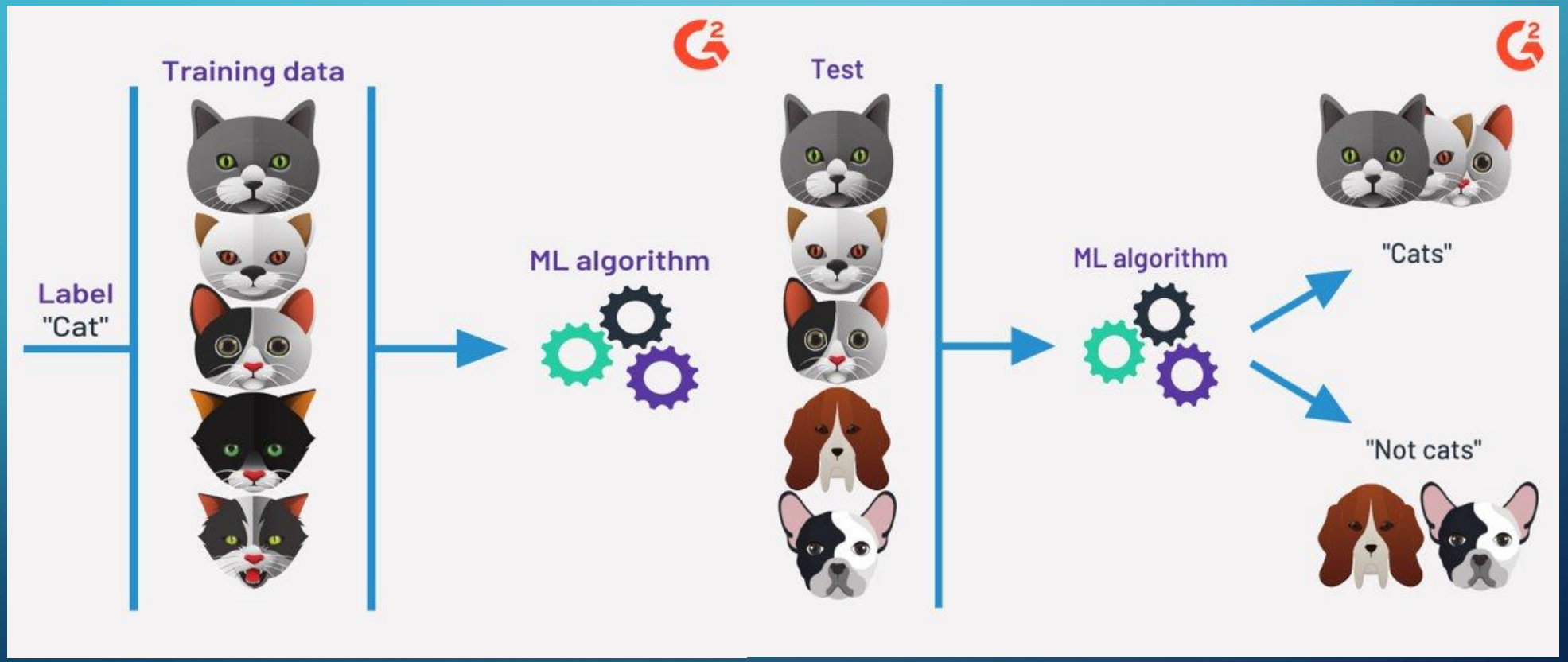
COMPUTER VISION

1. MACHINE LEARNING

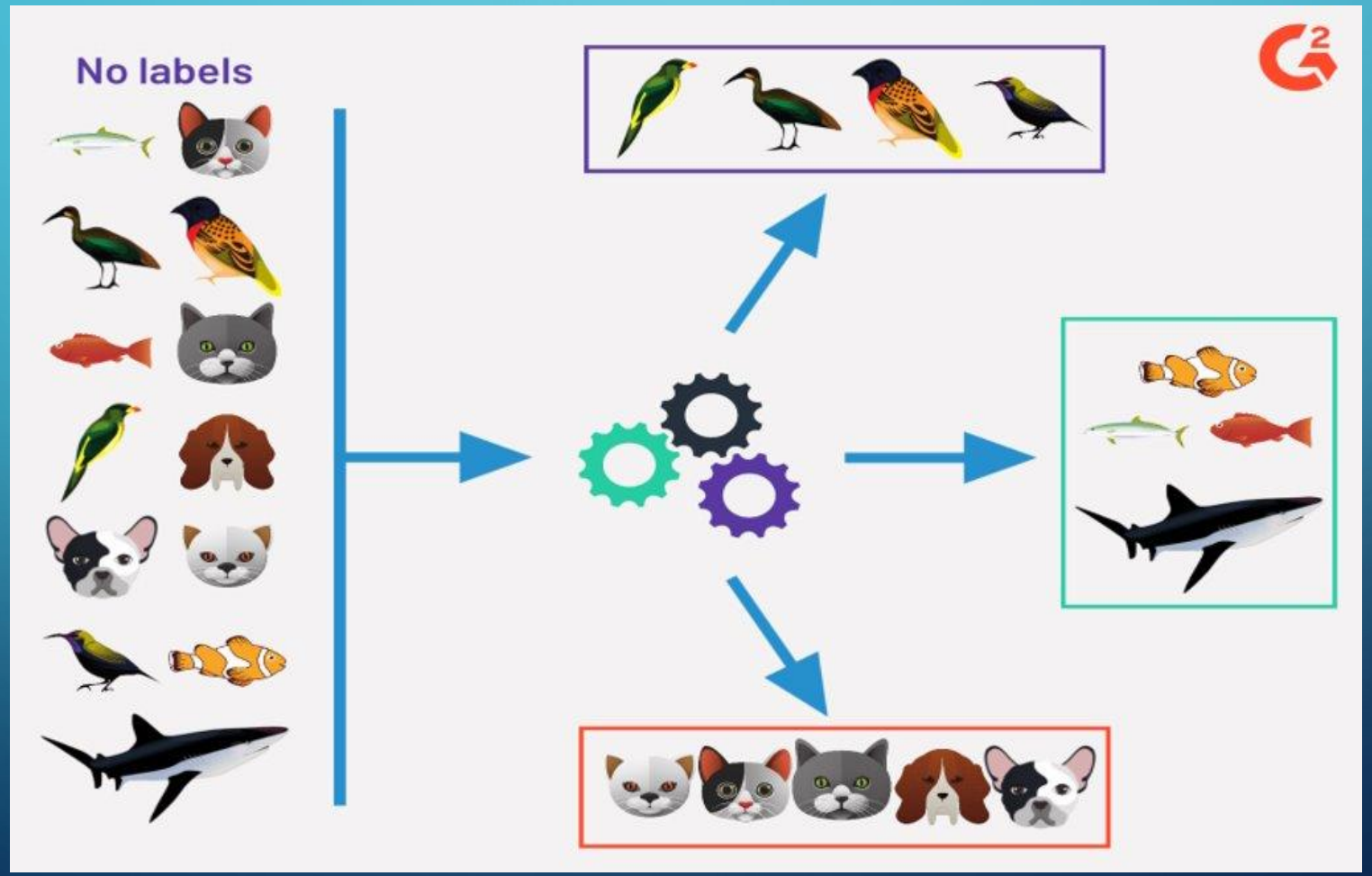
WHAT IS MACHINE LEARNING?

- Machine Learning (ML) is a process when AI learns for itself through data and experience
- Enable AI systems to come up with their own solutions
- Complete certain tasks at great speed and scale
- When you think of ML, who or what do you think of?

WHAT IS SUPERVISED ML?



WHAT IS UNSUPERVISED ML?



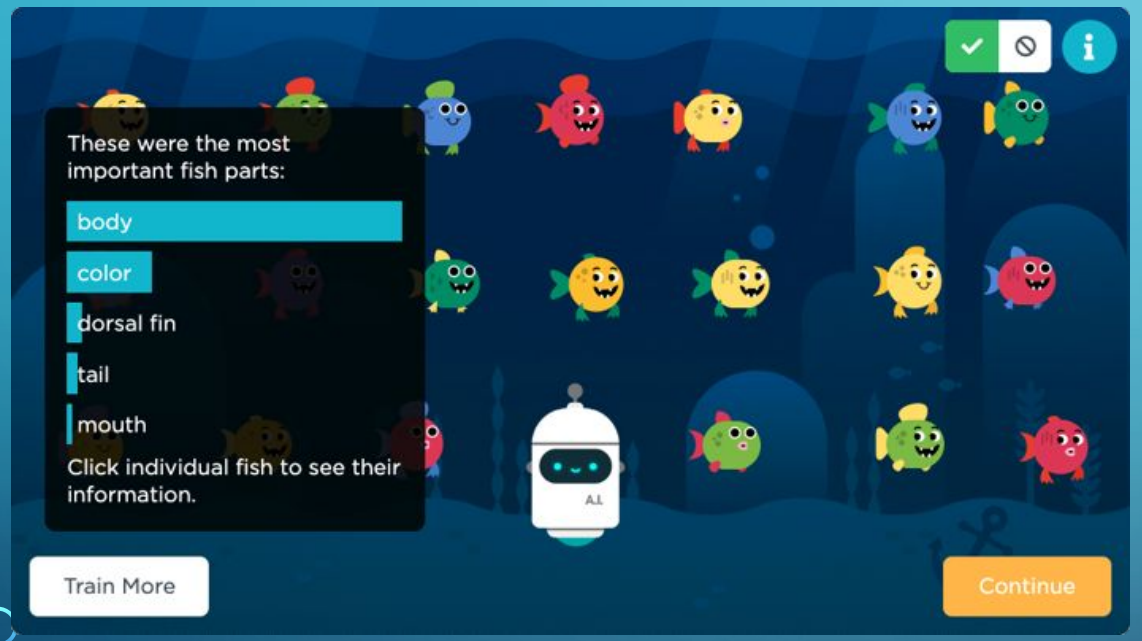
SUPERVISED AI EXAMPLE

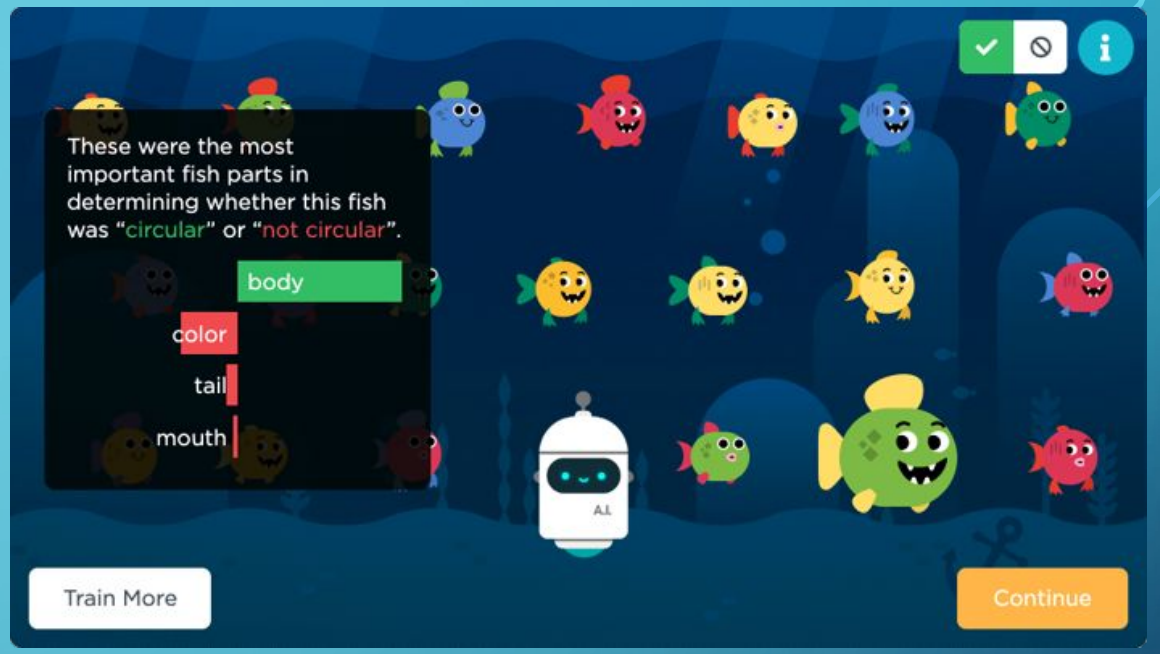
CODE.ORG - AI FOR OCEANS

AI FOR OCEANS

- AI for Oceans
- How can we help protect the oceans using ML?

AI FOR OCEANS





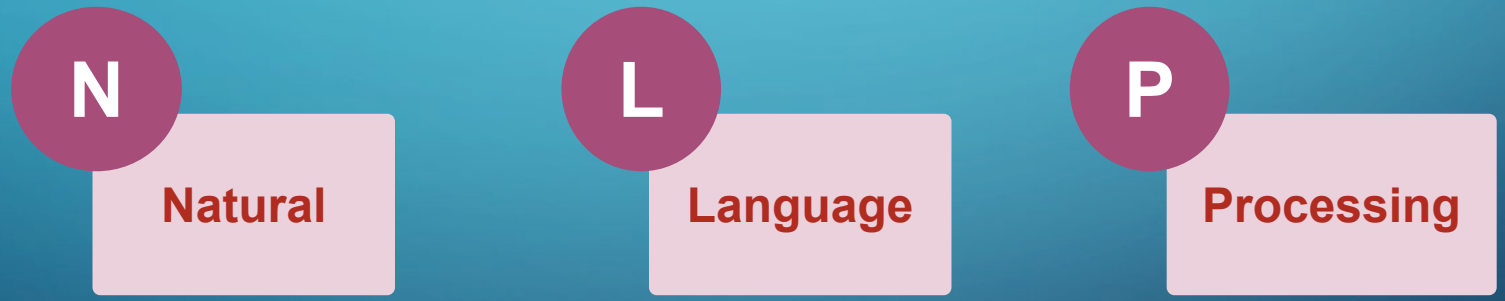
AI FOR OCEANS

- How do AI know what a “fish” may look like?
- Why did we need to label and distinguish different objects in “AI for Oceans” activity (e.g., “fish” versus “not fish”)? How do you call this step?
- How important this step was for machine learning?

2. NATURAL LANGUAGE PROCESSING

WHAT IS NATURAL LANGUAGE PROCESSING (NLP)?

- NLP is the branch of AI that helps computers detect, understand, interpret, and manipulate human language in ways that are context aware.

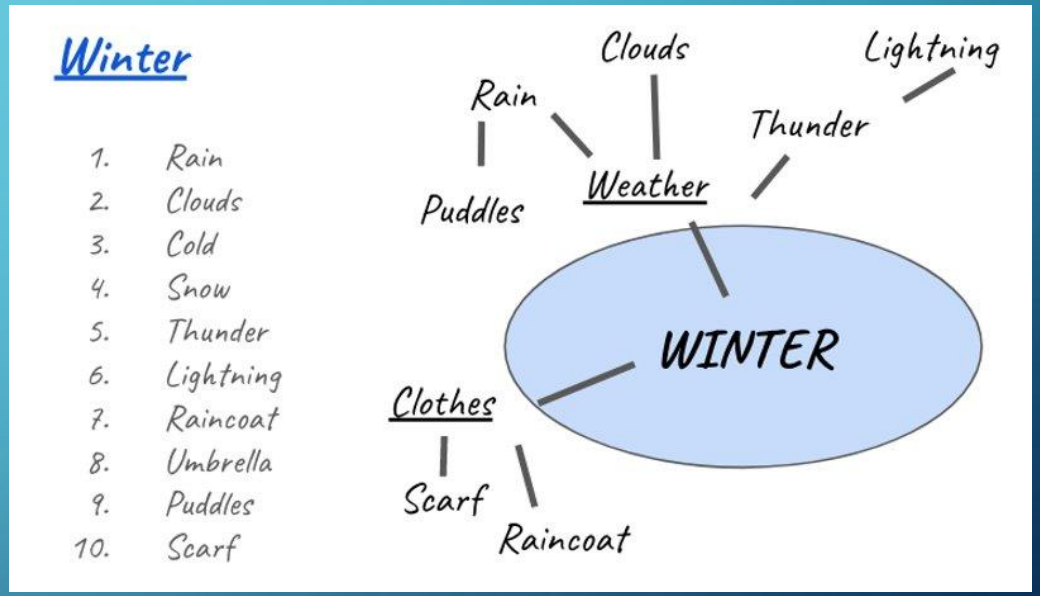


HOW DOES NLP WORK?

- Different forms of analysis based on…
  - Data (example: words)
  - Structures (example: grammar)
  - Meaning
- What does it mean?
  - “It’s only 68 degrees in here”

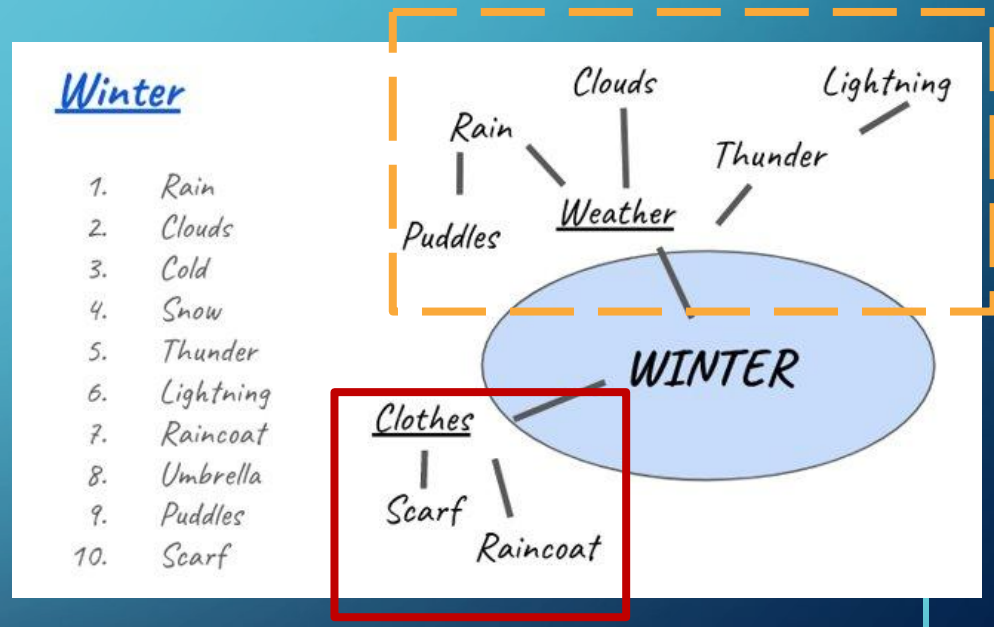
HOW DOES NLP WORK?

- Language is Data.
- Word association
  - the relationship between sentences, words or signs and their meaning



TRY TO BUILD YOUR WORD ASSOCIATION MAP

- Talk about your target word and the different meanings
- After you receive your word, begin building your word association map
- Make a cluster:
  - Draw lines to link words together if they are related
- Border your clusters:
  - When you are finished, draw a shape around clusters t hat are not related to other clusters



HOW DOES NLP WORK?

- Each cluster has a boundary
- Each boundary has been defined by us
- Boundaries can change. But…how?
  - Context (restaurant versus school cafeteria)
  - Location (school versus home)
  - Culture (Korea versus US)
  - Trends (1990 versus 2023)
  - Audience (middle schooler versus old timer)

[Fun fact: this is how algorithms are made!]

HOW DOES NLP WORK?

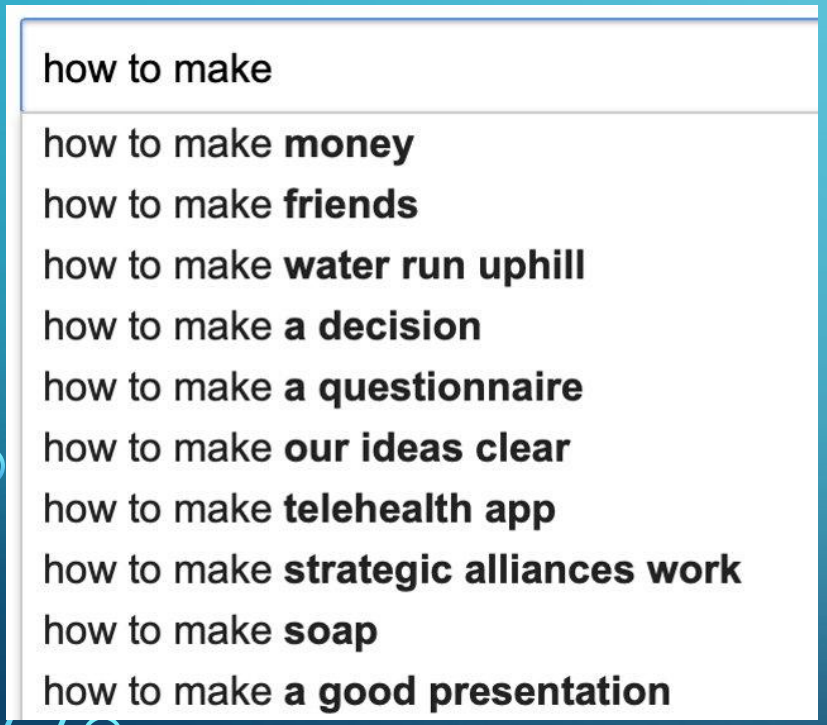
[some] techniques to train a model

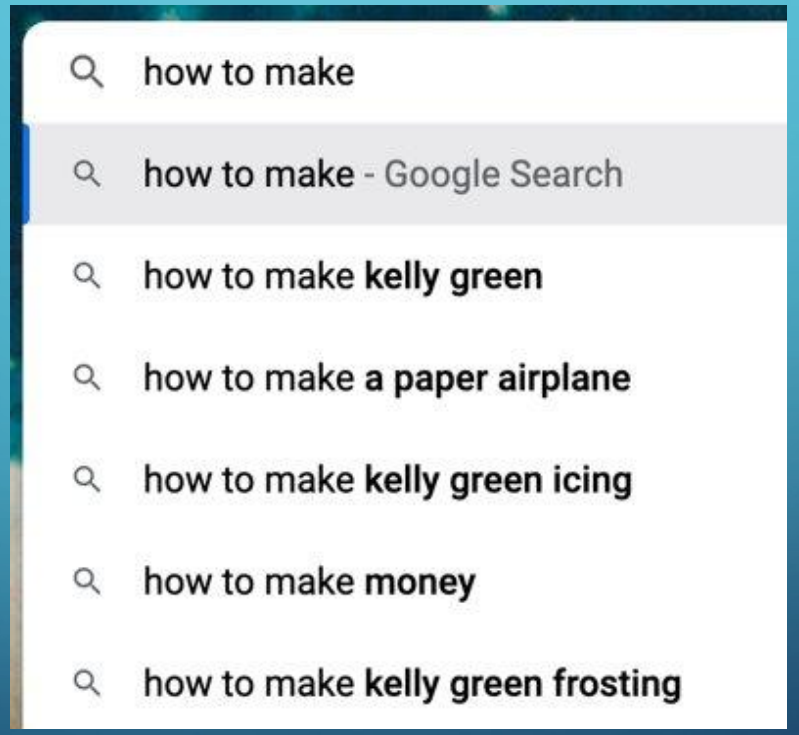
- Cluster analysis
- Keyword extraction
- Sentiment analysis

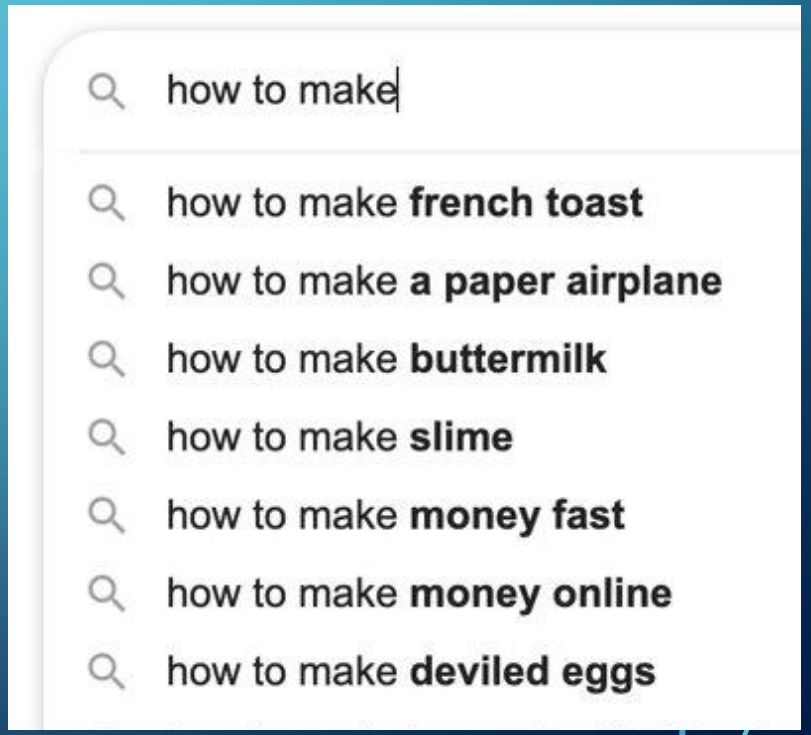
[some] uses of the models we trained

- Make Word Predictions to Gene rate Text Responses (ChatGPT; autocomplete)
- Determine Meanings of Text (lan guage translation)

HOW DOES AUTOCOMPLETE WORK ON DIFFERENT USERS?







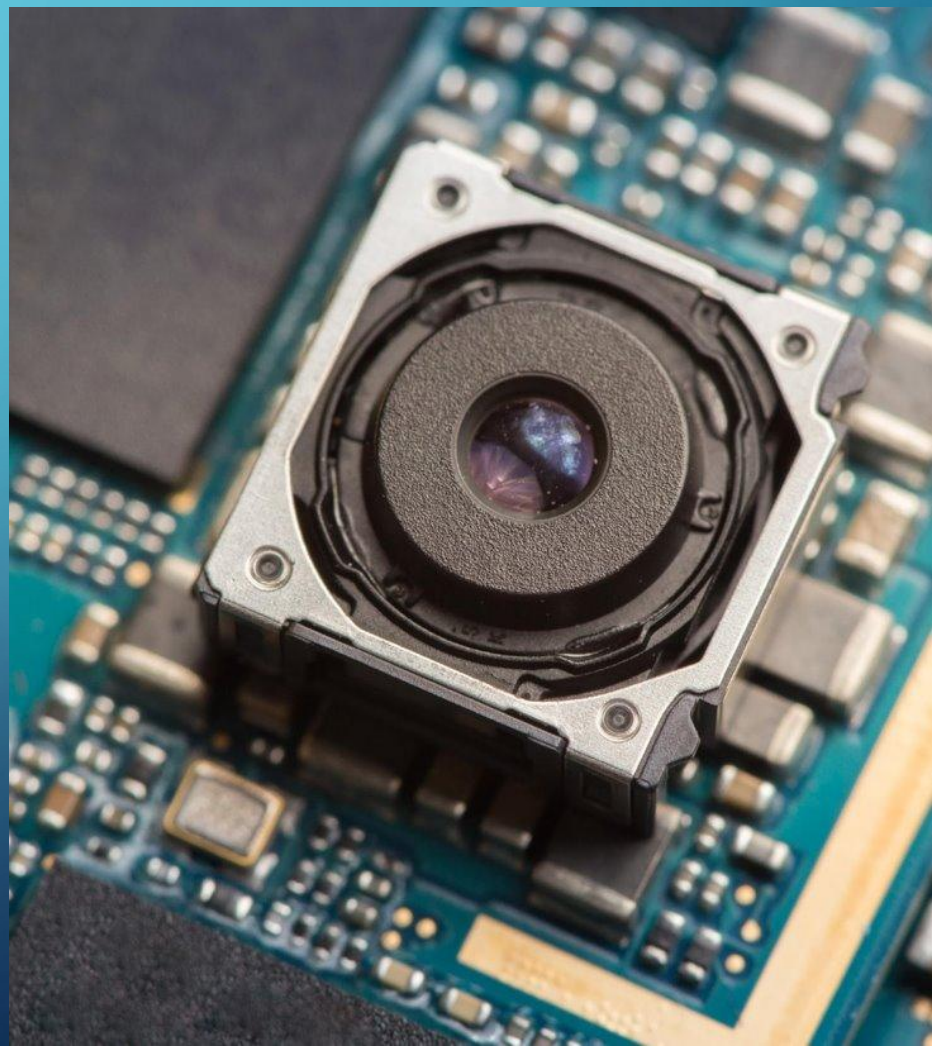
WHAT'S THE ALGORITHM PAYING ATTENTION TO?

- Google profile
- Social media activity
- Recent searches
- Search history
- Location / zip code
- Date / time
- Other immediate searches in your proximity
- Browser cookies
- Other….?

2. COMPUTER VISION

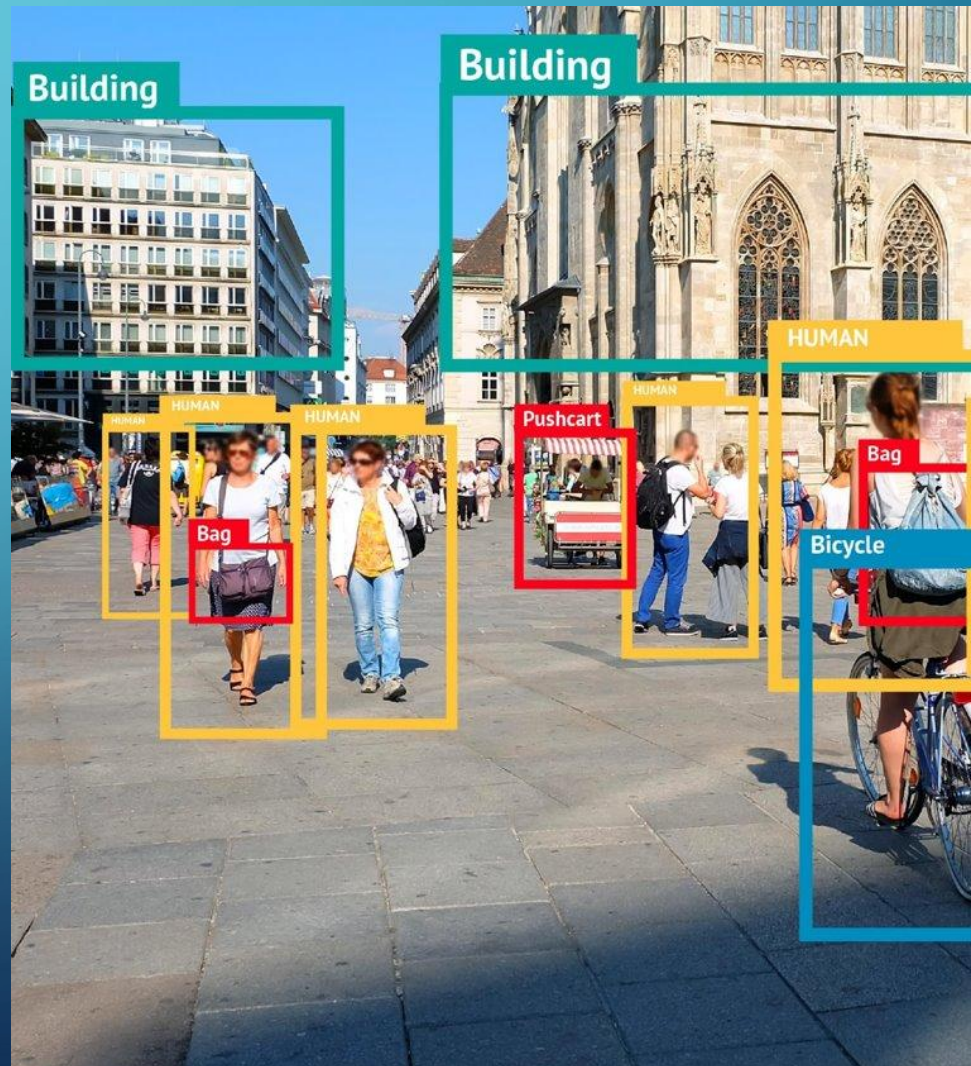
WHAT IS COMPUTER VISION (CV)?

- It is used to know what an image contains.
- The goal of CV is to understand the content of digital images by extracting useful/ meaningful information from the image.



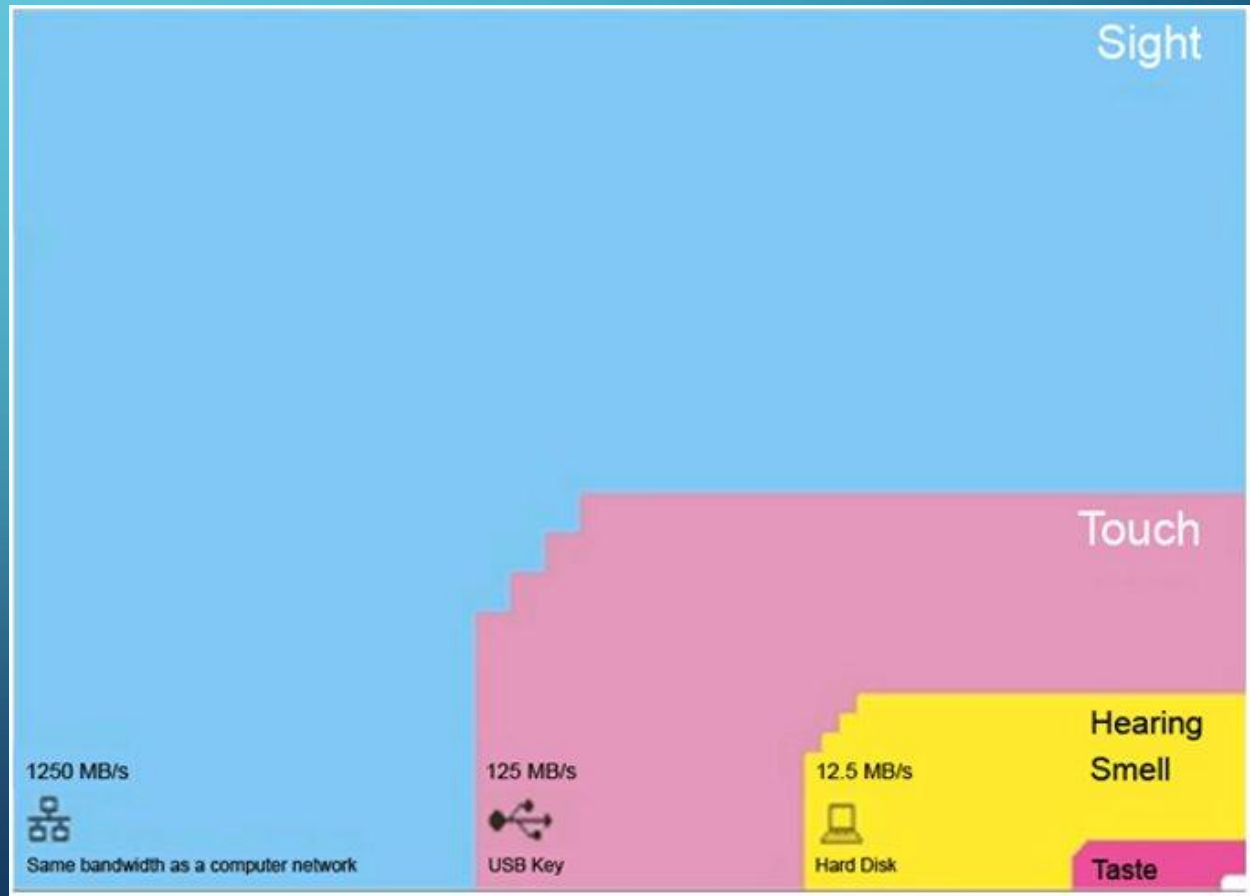
WHAT IS USEFUL/MEANINGFUL DATA?

CV might be used to classify, identify, verify, detect, and/or recognize objects in an image.



UNDERSTANDING IMAGES IS NOT TRIVIAL

- Images contain a lot of data!
- The problem for computers is that data is not easily transformed into something they can understand. Computers don't see colors and shapes.



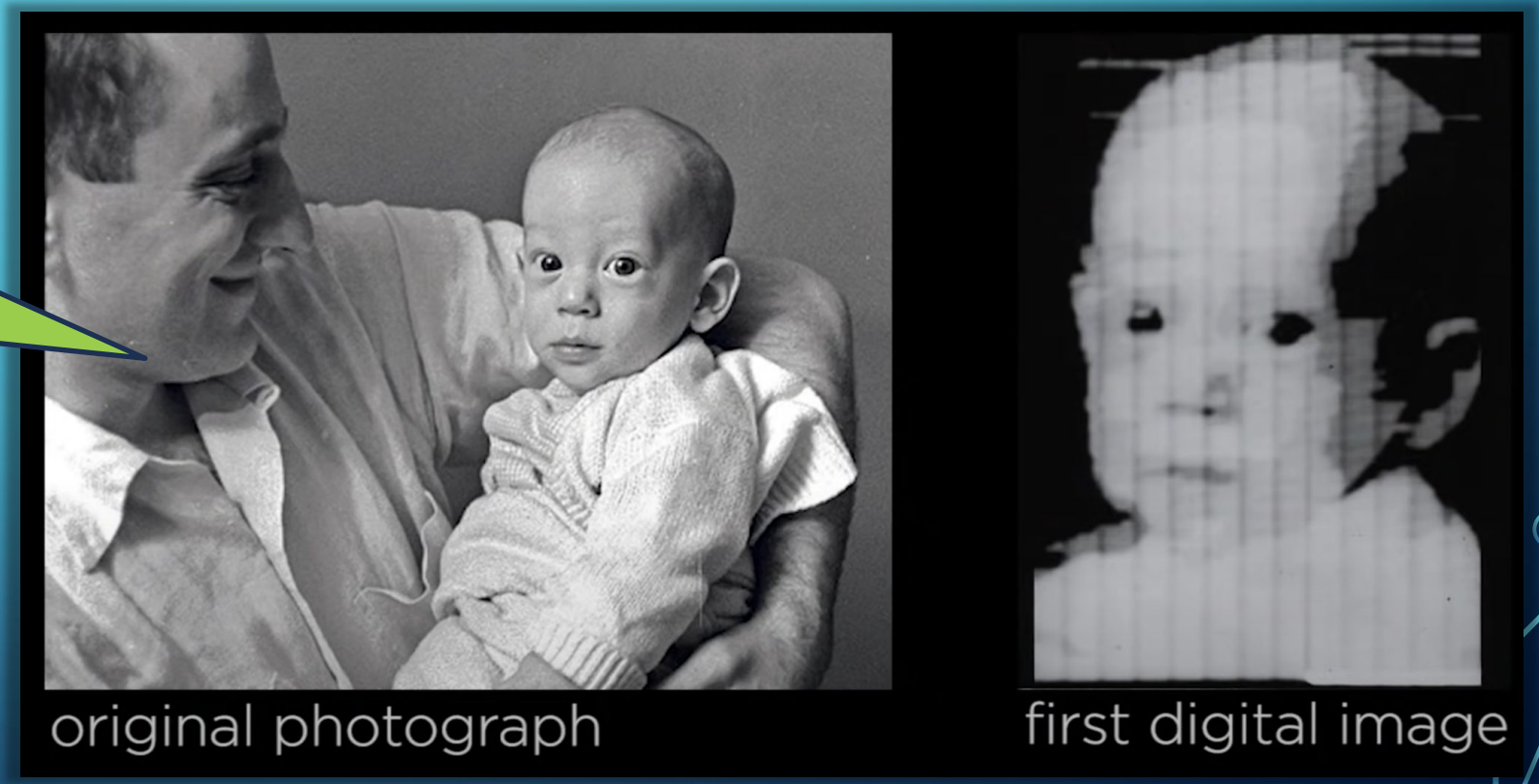
THE PROBLEM OF UNDERSTANDING IMAGES

To address the problem of a computer extracting meaningful information from an image, the problem was decomposed into smaller more manageable problems:

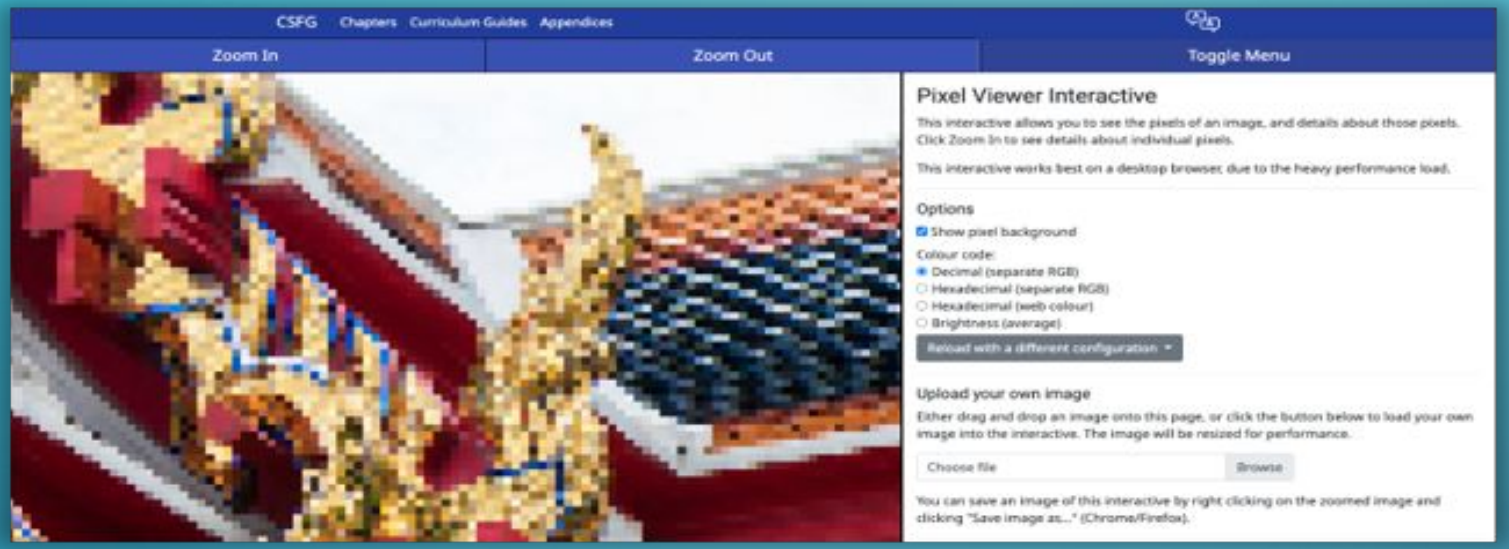
- Pixel/Color Identification
- Edge Detection
- Shape Detection

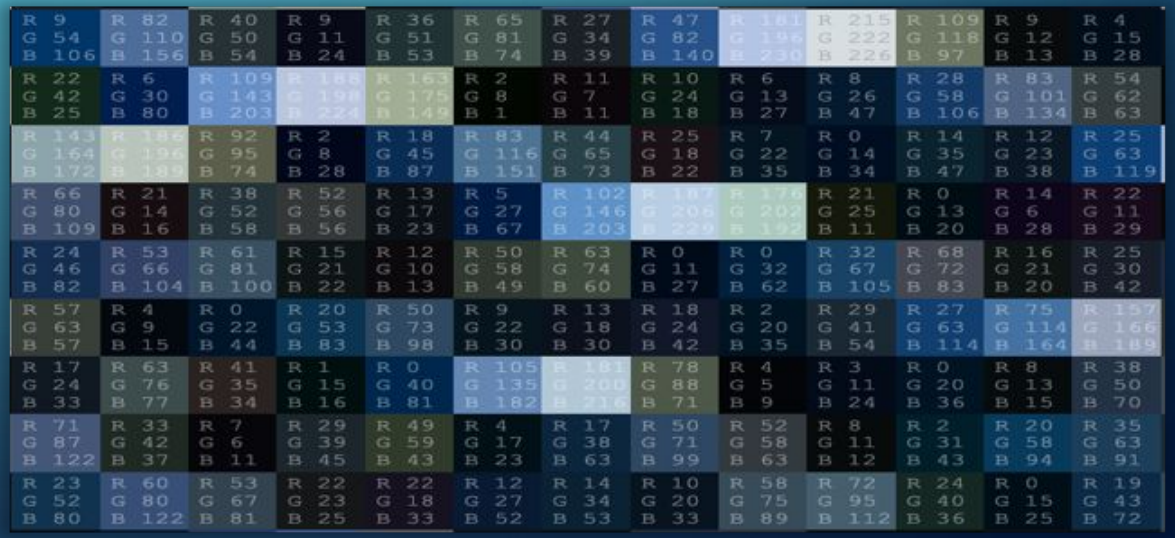
PIXEL/COLOR IDENTIFICATION

What would happen if computers could look at pictures? - Russell Kirsch



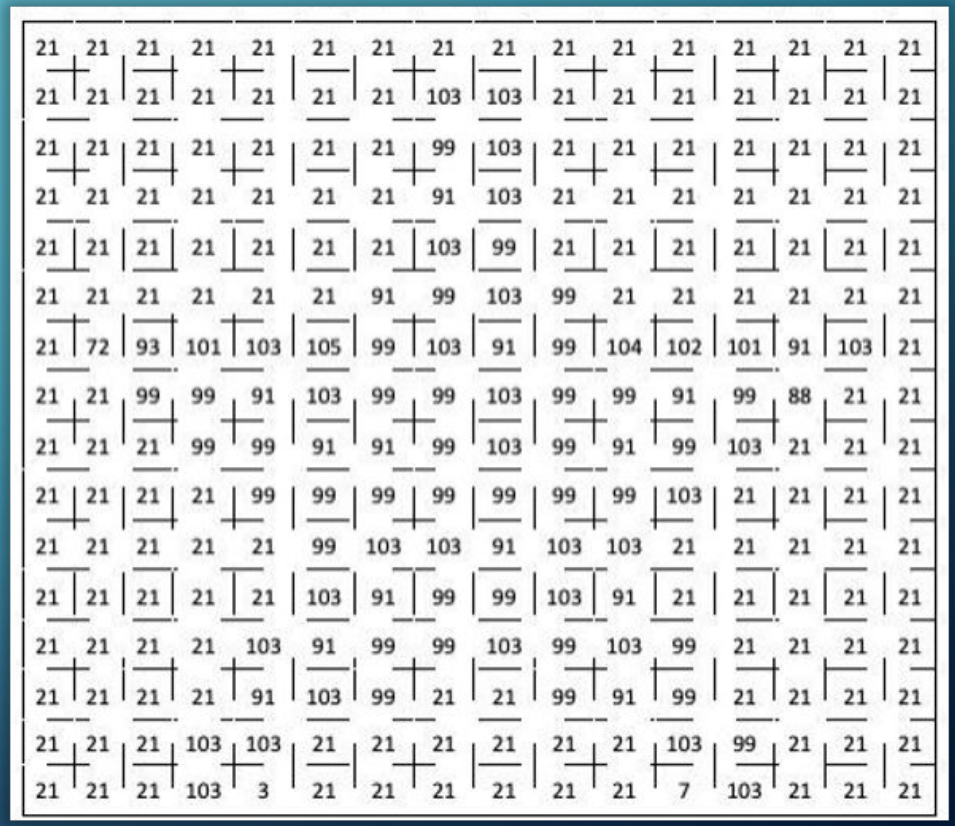
EXPLORE THE PIXEL ACTIVITY PROGRAM





EDGE DETECTION - UNPLUGGED

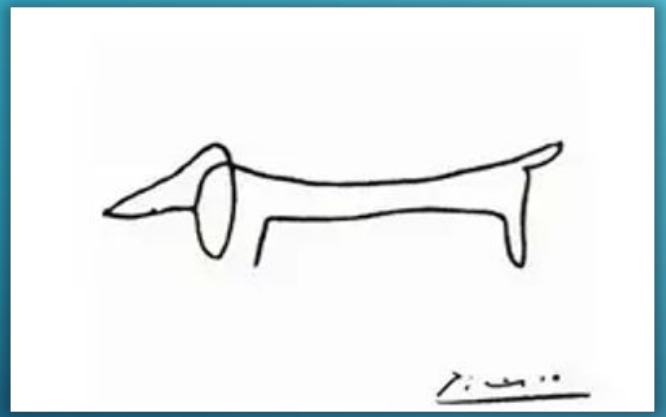
- Here are the pixel values for a gray-scale image.
- What do you think is in the image?



EDGE DETECTION - UNPLUGGED

A Star

SHAPE DETECTION – WHAT DO YOU SEE?



EDGE DETECTION TO SHAPE DETECTION

Google Quick Draw

DISCUSSION QUESTIONS

- How can we connect CS with AI?
- Do you think that collecting more data always leads to better decisions? Why or why not?
- How can poor quality data affect AI?
- How can we ensure that the data we collect is accurate and reliable?