



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

The background is a dark blue gradient. In the corners, there are decorative white and light blue circuit-like patterns consisting of lines and circles, resembling a PCB or neural network connections.

AI VS. NOT AI

TOASTER



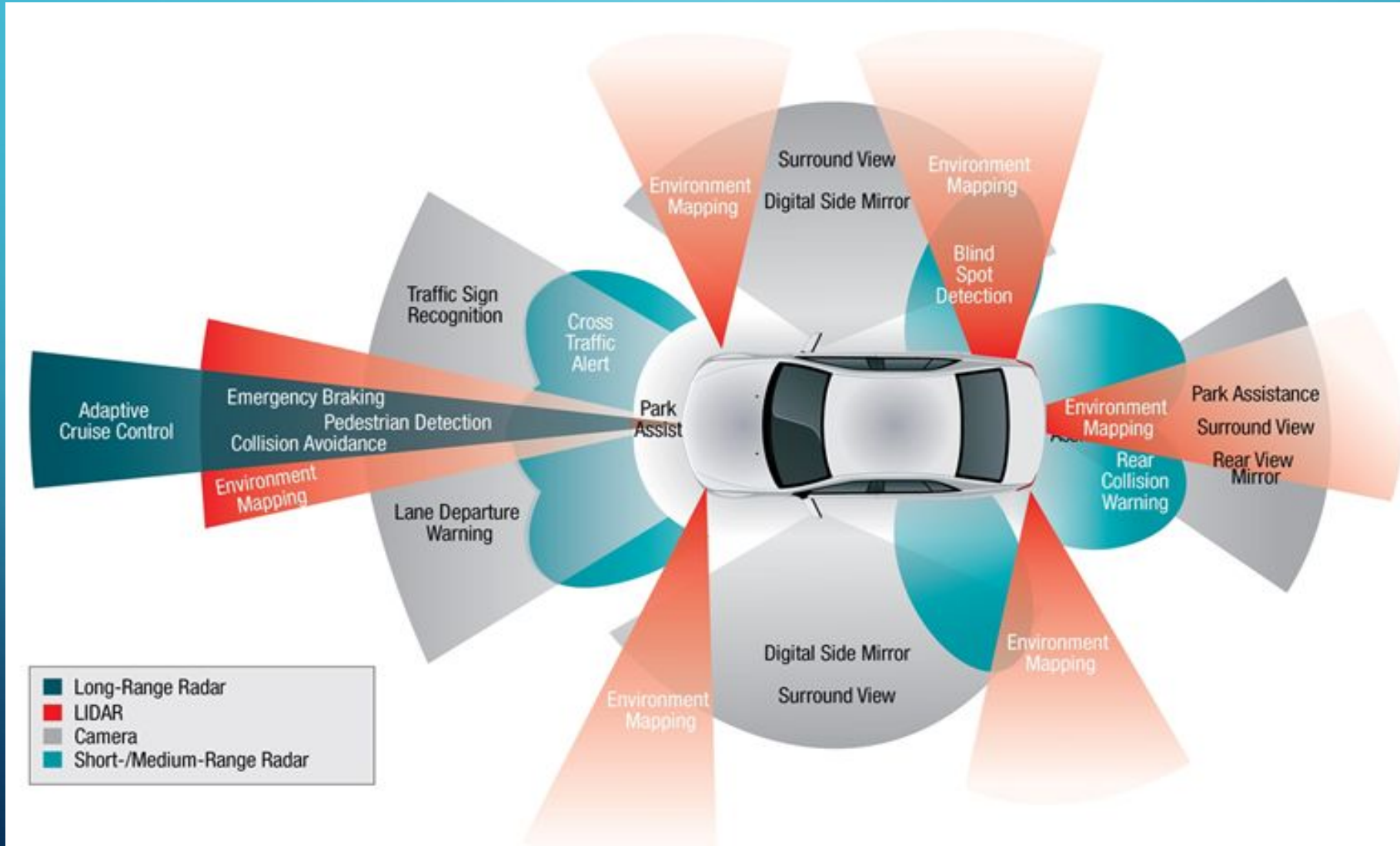
SIRI ON IPHONE



BARCODE SCANNER



SMART CAR



WASHING MACHINE



NETFLIX

NETFLIX

INDUSTRIAL ROBOT



DELIVERY ROBOT



MIXER



TIKTOK FACEFILTER



ELECTRONIC TOLL COLLECTION



The background is a solid teal color with a subtle gradient. In the corners, there are decorative white line-art elements resembling circuit traces or neural network connections. These elements consist of straight lines of varying lengths and angles, ending in small circles. The lines are more densely packed in the corners and become sparser towards the center.

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

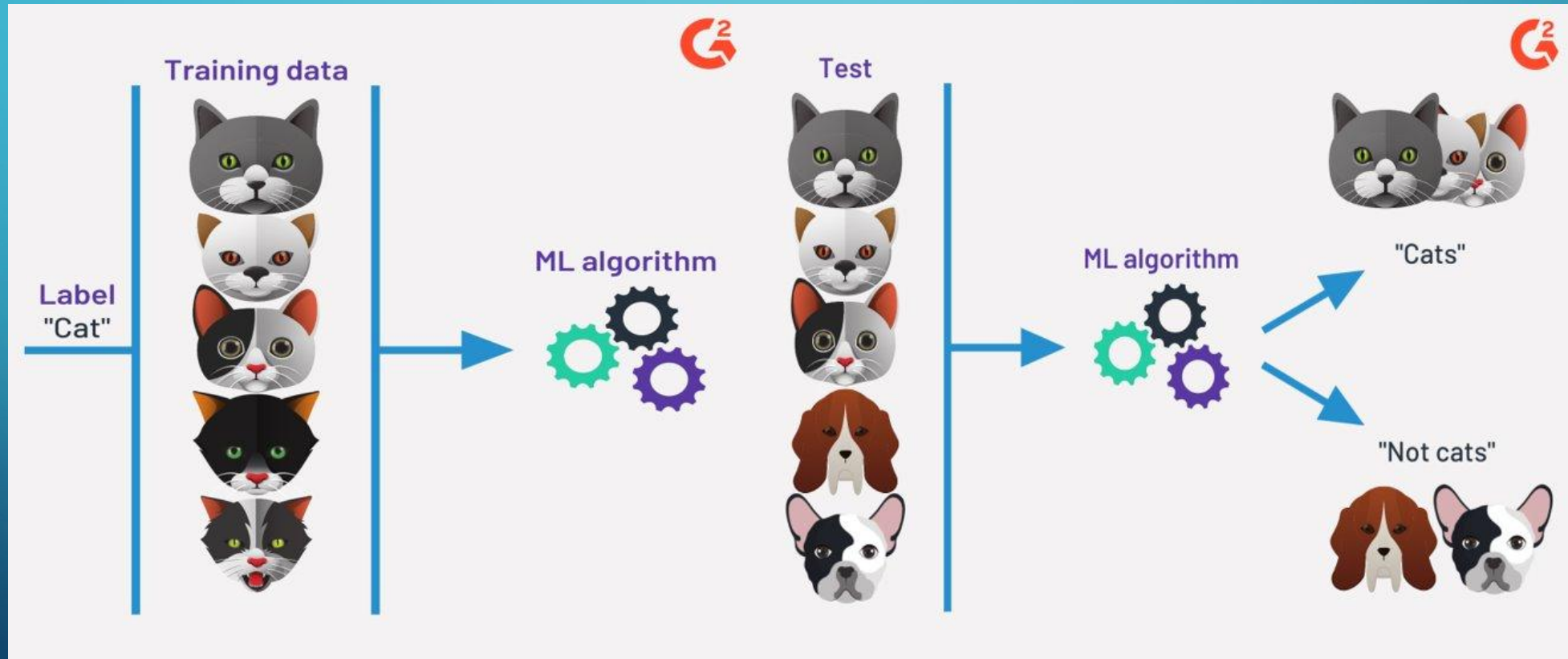
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1. MACHINE LEARNING

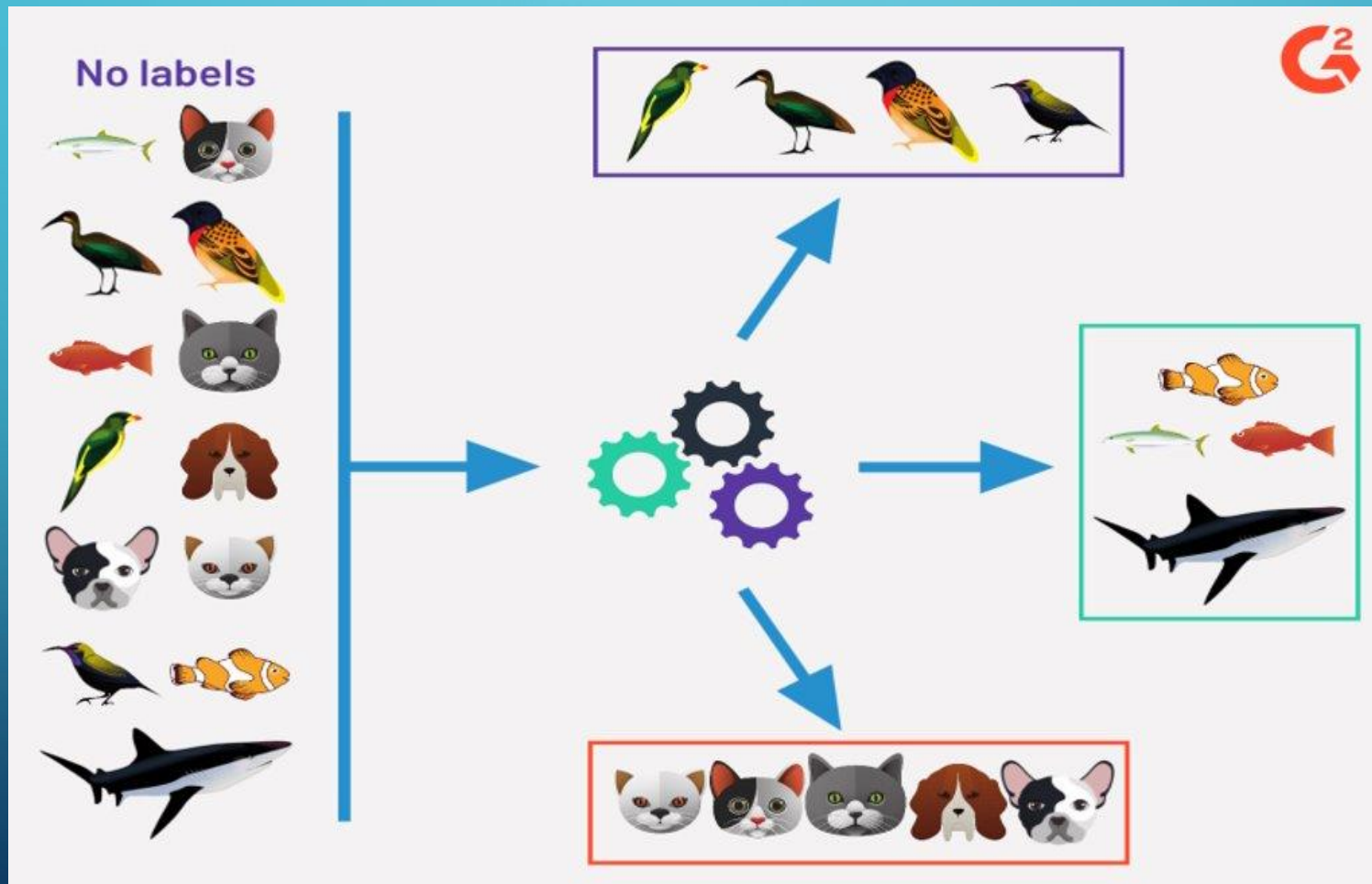
WHAT IS MACHINE LEARNING?

- 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?



The background is a dark blue gradient. In the corners, there are decorative white and light blue circuit-like patterns consisting of lines and circles, resembling a printed circuit board or neural network connections.

SUPERVISED AI EXAMPLE

CODE.ORG - AI FOR OCEANS

AI FOR OCEANS

- [AI for Oceans](#)
- How can we help protect the oceans using ML?

Dive into machine learning with
AI for Oceans



AI FOR OCEANS

These were the most important fish parts:

- body
- color
- dorsal fin
- tail
- mouth

Click individual fish to see their information.

Train More

Continue

These were the most important fish parts in determining whether this fish was "circular" or "not circular".

- body
- color
- tail
- mouth

Train More

Continue

These were the most important fish parts in determining whether this fish was "circular" or "not circular".

- body
- color
- dorsal fin
- mouth

Train More

Continue

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?

The background is a solid teal color with a gradient. In the corners, there are decorative white line-art patterns resembling circuit boards or neural networks, with lines and small circles.

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.

N

Natural

L

Language

P

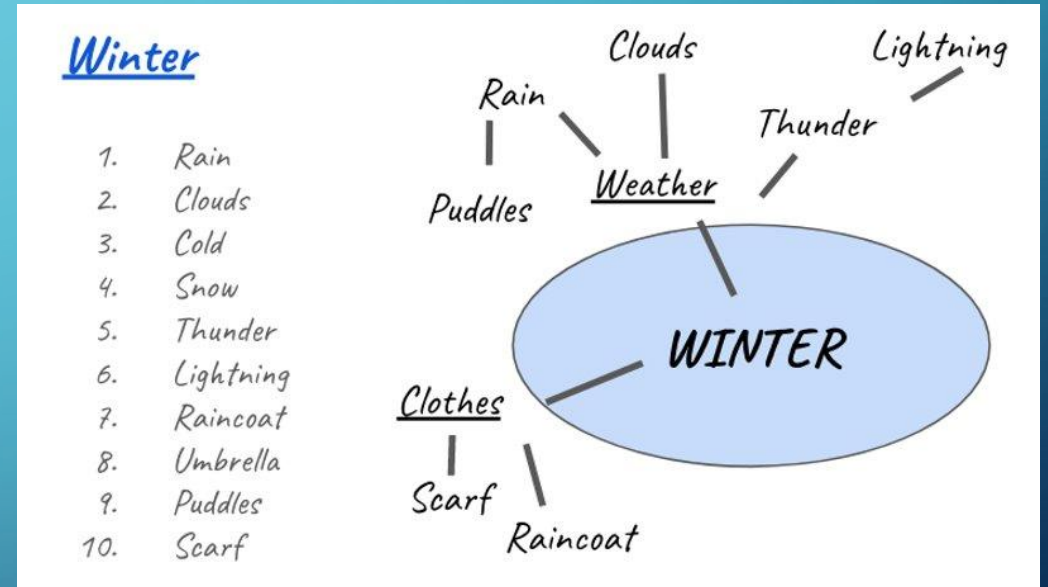
Processing

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”

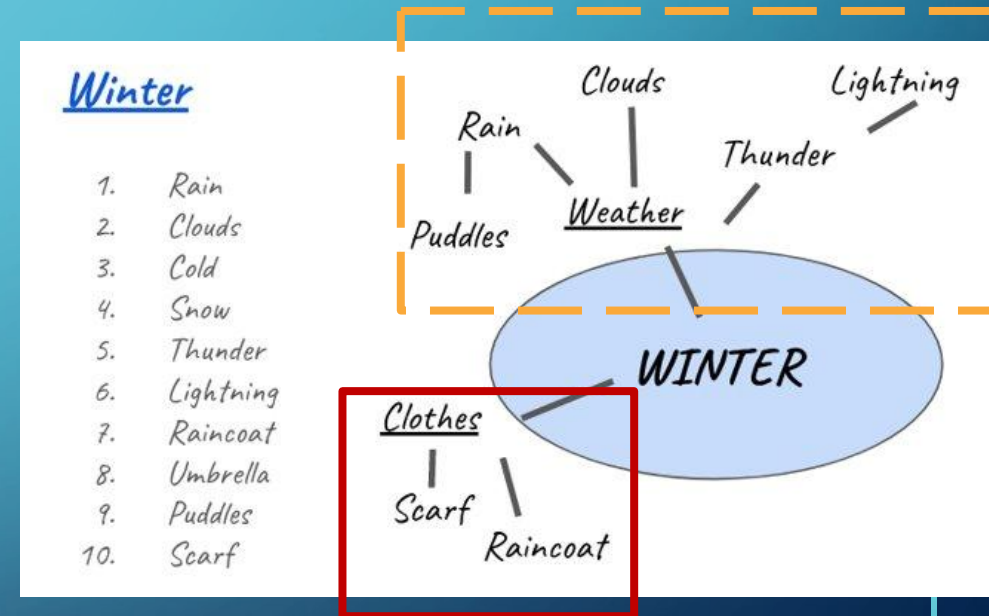
HOW DOES NLP WORK?

- 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 that 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

is used to



[some] uses of the models we trained

- Make Word Predictions to Generate Text Responses (ChatGPT; autocomplete)
- Determine Meanings of Text (language translation)

HOW DOES AUTOCOMPLETE WORK ON DIFFERENT USERS?

how to make

how to make **money**

how to make **friends**

how to make **water run uphill**

how to make **a decision**

how to make **a questionnaire**

how to make **our ideas clear**

how to make **telehealth app**

how to make **strategic alliances work**

how to make **soap**

how to make **a good presentation**

🔍 how to make

🔍 how to make - Google Search

🔍 how to make **kelly green**

🔍 how to make **a paper airplane**

🔍 how to make **kelly green icing**

🔍 how to make **money**

🔍 how to make **kelly green frosting**

🔍 how to make|

🔍 how to make **french toast**

🔍 how to make **a paper airplane**

🔍 how to make **buttermilk**

🔍 how to make **slime**

🔍 how to make **money fast**

🔍 how to make **money online**

🔍 how to make **deviled eggs**

WHAT'S THE ALGORITHM PAYING ATTENTION TO?

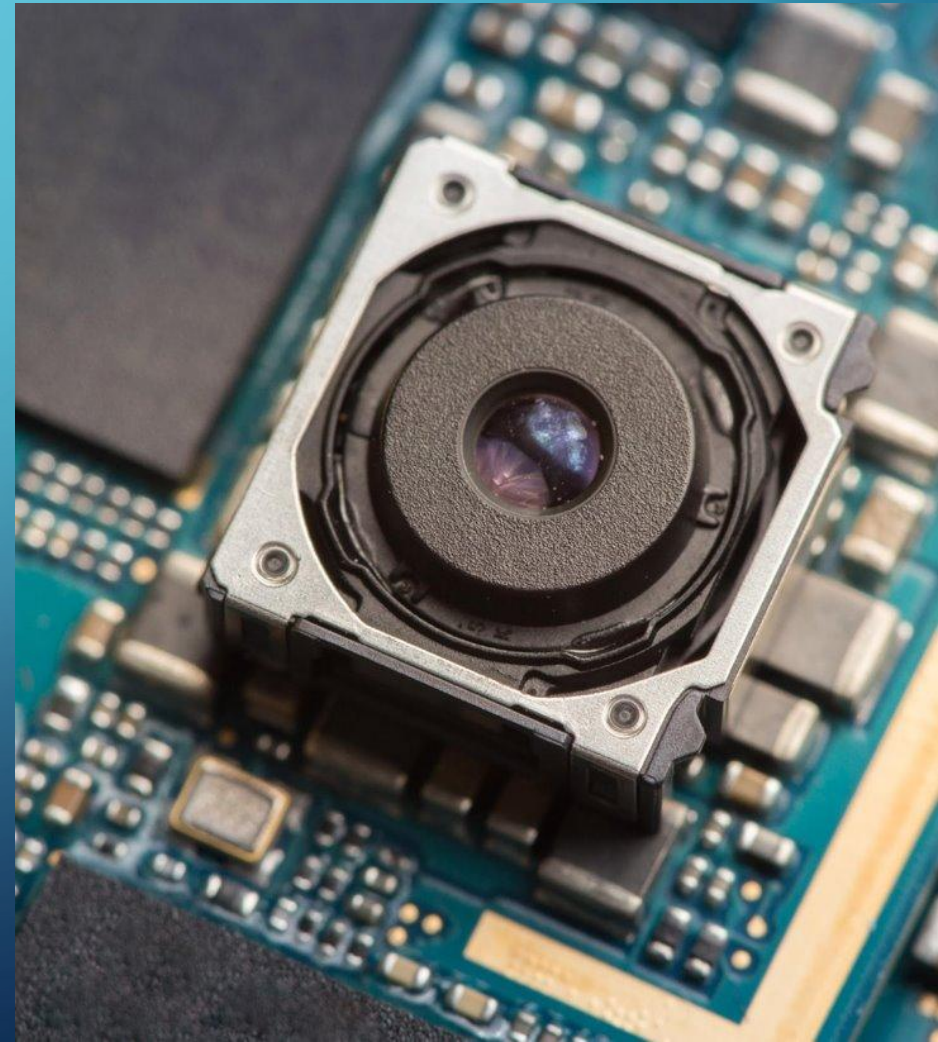
- Google profile
- Social media activity
- Recent searches
- Search history
- Location / zip code
- Date / time
- Other immediate searches in your proximity
- Browser cookies
- Other....?

The background is a dark blue gradient. In the corners, there are decorative white line-art patterns resembling circuit boards or neural networks, with lines and small circles connecting them.

2. COMPUTER VISION

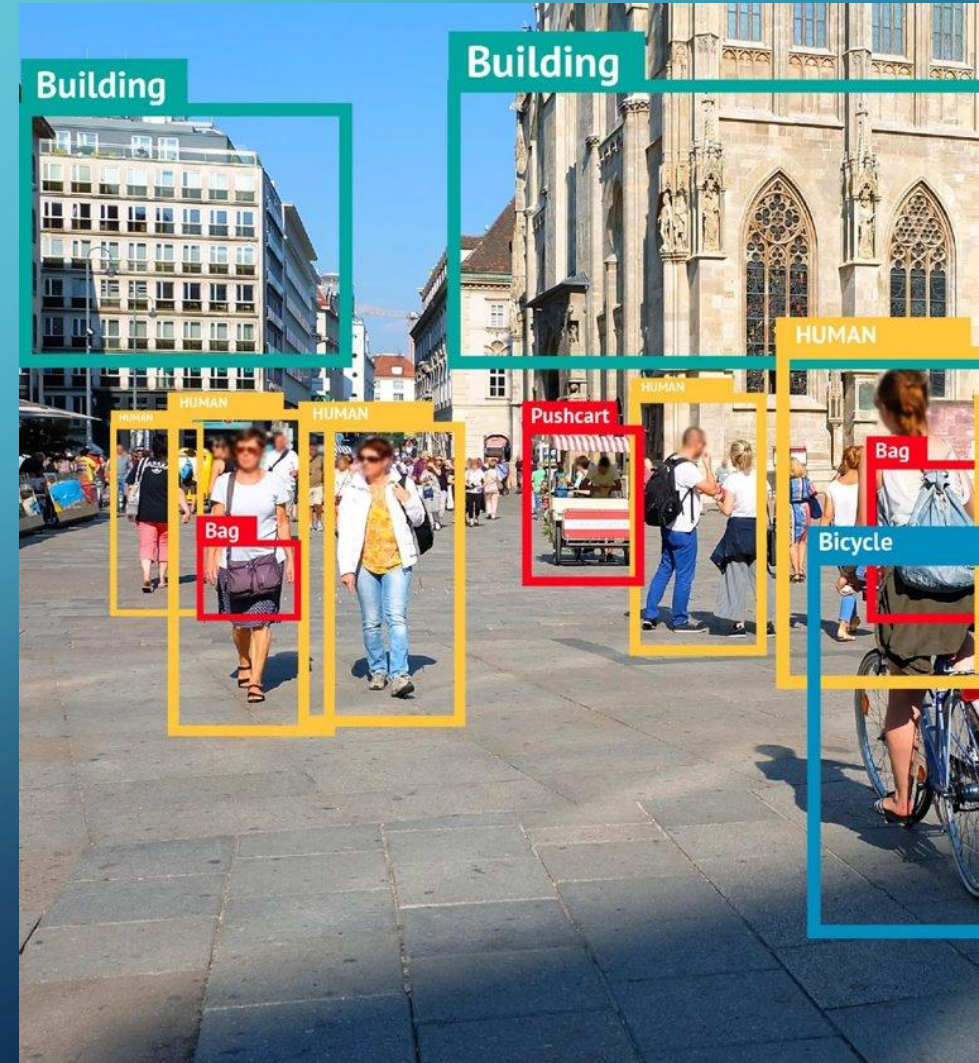
WHAT IS COMPUTER VISION (CV)?

- 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.



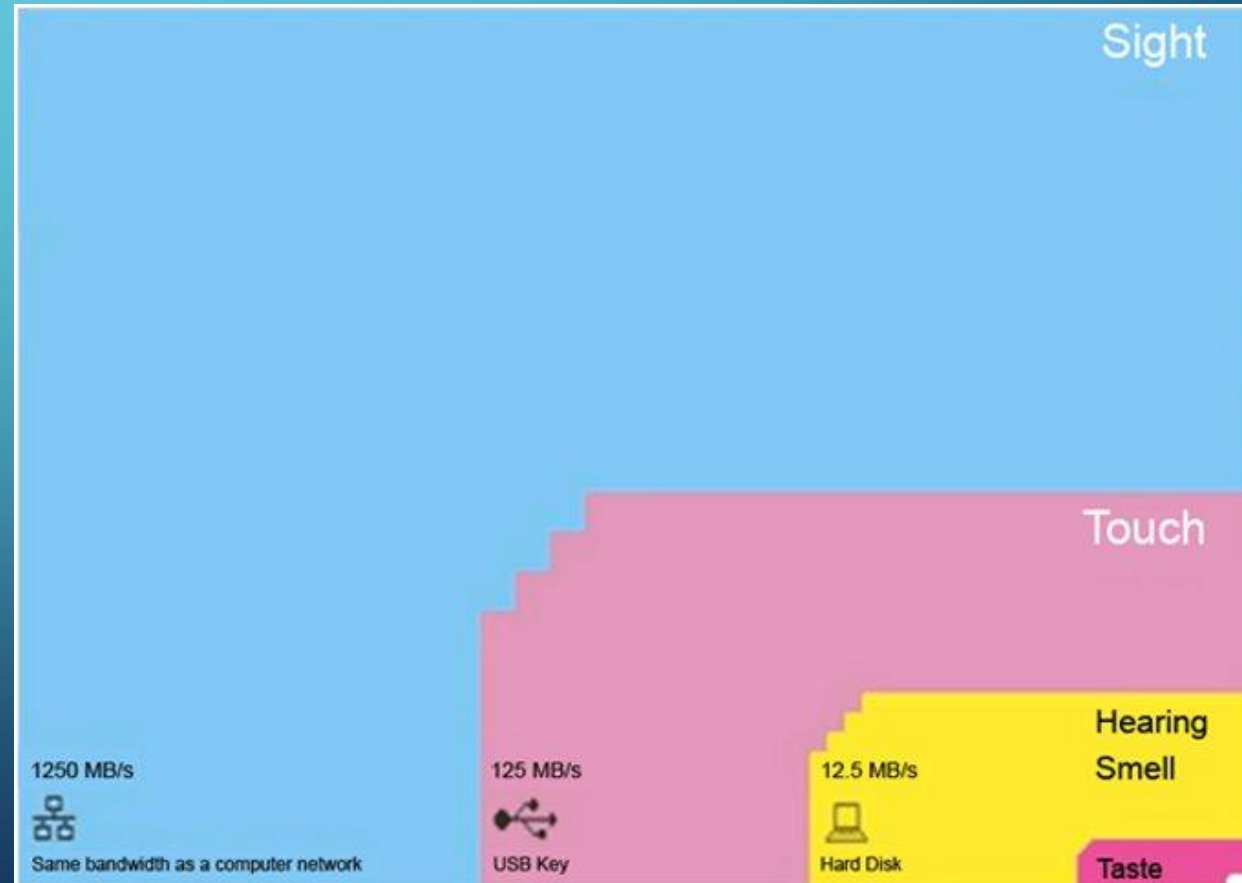
WHAT IS USEFUL/MEANINGFUL DATA?

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



original photograph




first digital image

EXPLORE THE PIXEL ACTIVITY PROGRAM

CSFG Chapters Curriculum Guides Appendices

Zoom In Zoom Out Toggle Menu



Pixel Viewer Interactive

This interactive allows you to see the pixels of an image, and details about those pixels. Click Zoom In to see details about individual pixels.

This interactive works best on a desktop browser due to the heavy performance load.

Options

- Show pixel background

Colour code:

- Decimal (separate RGB)
- Hexadecimal (separate RGB)
- Hexadecimal (web colour)
- Brightness (average)

Reload with a different configuration

Upload your own image

Either drag and drop an image onto this page, or click the button below to load your own image into the interactive. The image will be resized for performance.

Choose file

You can save an image of this interactive by right clicking on the zoomed image and clicking "Save Image as..." (Chrome/Firefox).

R 9	R 82	R 40	R 9	R 36	R 65	R 27	R 47	R 181	R 215	R 109	R 9	R 4
G 54	G 110	G 50	G 11	G 51	G 81	G 34	G 82	G 196	G 222	G 118	G 12	G 15
B 106	B 156	B 54	B 24	B 53	B 74	B 39	B 140	B 230	B 226	B 97	B 13	B 28
R 22	R 6	R 109	R 188	R 163	R 2	R 11	R 10	R 6	R 8	R 28	R 83	R 54
G 42	G 30	G 143	G 198	G 175	G 8	G 7	G 24	G 13	G 26	G 58	G 101	G 62
B 25	B 80	B 203	B 224	B 148	B 1	B 11	B 18	B 27	B 47	B 106	B 134	B 63
R 143	R 186	R 92	R 2	R 18	R 83	R 44	R 25	R 7	R 0	R 14	R 12	R 25
G 164	G 196	G 95	G 8	G 45	G 116	G 65	G 18	G 22	G 14	G 35	G 23	G 63
B 172	B 189	B 74	B 28	B 87	B 151	B 73	B 22	B 35	B 34	B 47	B 38	B 119
R 66	R 21	R 38	R 52	R 13	R 5	R 102	R 187	R 176	R 21	R 0	R 14	R 22
G 80	G 14	G 52	G 56	G 17	G 27	G 146	G 208	G 202	G 25	G 13	G 6	G 11
B 109	B 16	B 58	B 56	B 23	B 67	B 203	B 228	B 192	B 11	B 20	B 28	B 29
R 24	R 53	R 61	R 15	R 12	R 50	R 63	R 0	R 0	R 32	R 68	R 16	R 25
G 46	G 66	G 81	G 21	G 10	G 58	G 74	G 11	G 32	G 67	G 72	G 21	G 30
B 82	B 104	B 100	B 22	B 13	B 49	B 60	B 27	B 62	B 105	B 83	B 20	B 42
R 57	R 4	R 0	R 20	R 50	R 9	R 13	R 18	R 2	R 29	R 27	R 75	R 17
G 63	G 9	G 22	G 53	G 73	G 22	G 18	G 24	G 20	G 41	G 63	G 114	G 166
B 57	B 15	B 44	B 83	B 98	B 30	B 30	B 42	B 35	B 54	B 114	B 164	B 189
R 17	R 63	R 41	R 1	R 0	R 105	R 181	R 78	R 4	R 3	R 0	R 8	R 38
G 24	G 76	G 35	G 15	G 40	G 135	G 200	G 88	G 5	G 11	G 20	G 13	G 50
B 33	B 77	B 34	B 16	B 81	B 182	B 216	B 71	B 9	B 24	B 36	B 15	B 70
R 71	R 33	R 7	R 29	R 49	R 4	R 17	R 50	R 52	R 8	R 2	R 20	R 35
G 87	G 42	G 6	G 39	G 59	G 17	G 38	G 71	G 58	G 11	G 31	G 58	G 63
B 122	B 37	B 11	B 45	B 43	B 23	B 63	B 99	B 63	B 12	B 43	B 94	B 91
R 23	R 60	R 53	R 22	R 22	R 12	R 14	R 10	R 58	R 72	R 24	R 0	R 19
G 52	G 80	G 67	G 23	G 18	G 27	G 34	G 20	G 75	G 95	G 40	G 15	G 43
B 80	B 122	B 81	B 25	B 33	B 52	B 53	B 33	B 89	B 112	B 36	B 25	B 72

EDGE DETECTION - UNPLUGGED

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

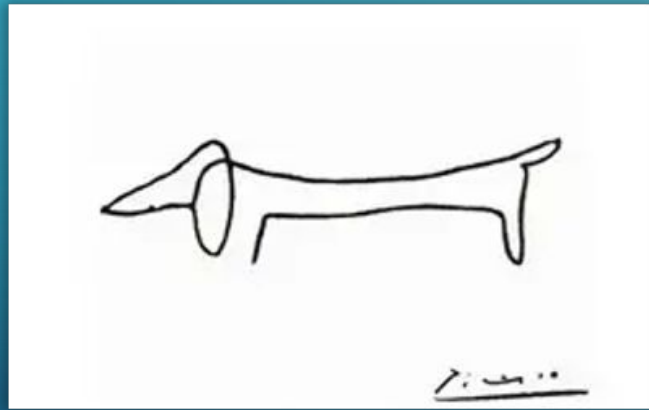
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21	21	21	21	91	103	99	21	21	99	91	99	21	21	21	21	21	21	21	21
21	21	21	103	103	21	21	21	21	21	21	21	103	99	21	21	21	21	21	21
21	21	21	103	3	21	21	21	21	21	21	21	7	103	21	21	21	21	21	21

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?