Artificial Intelligence (A.I.)

Made Easier

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Over 25 years teaching

FlipRobot Instructor

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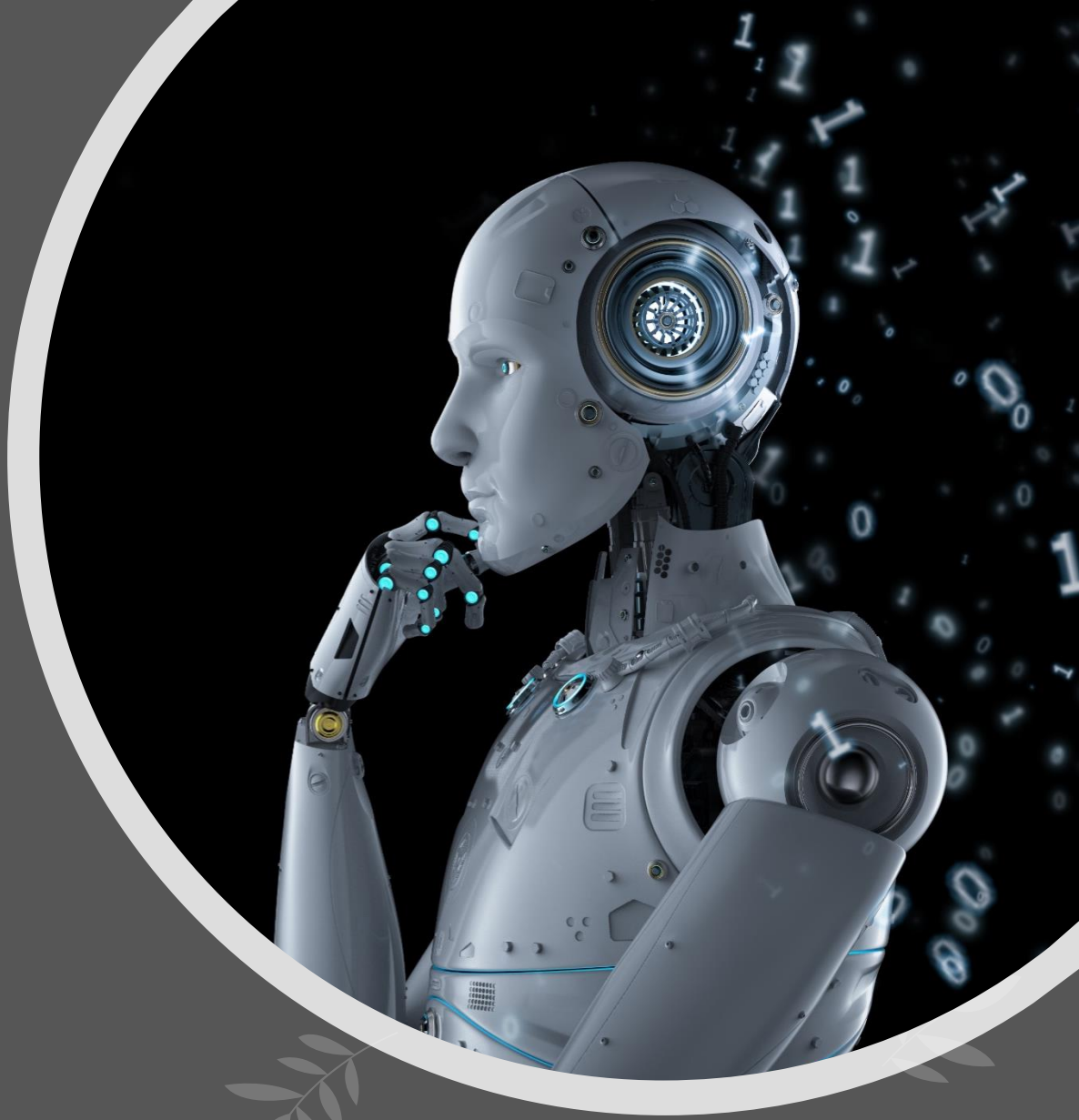
What is AI ?

Artificial Intelligence

... “the field of computer science dedicated to solving cognitive problems commonly associated with human intelligence, such as learning, problem solving, and pattern recognition.”

-Amazon

But what does this mean?
How can a computer learn?



Artificial Intelligence (AI)

- Not all AI are created equal.
- factors when designing AI include:
  - Use-case
  - Current level of technonlogy
  - Processing requirements
  - Cost
  - Size limitations
  - Power needs

'General' AI

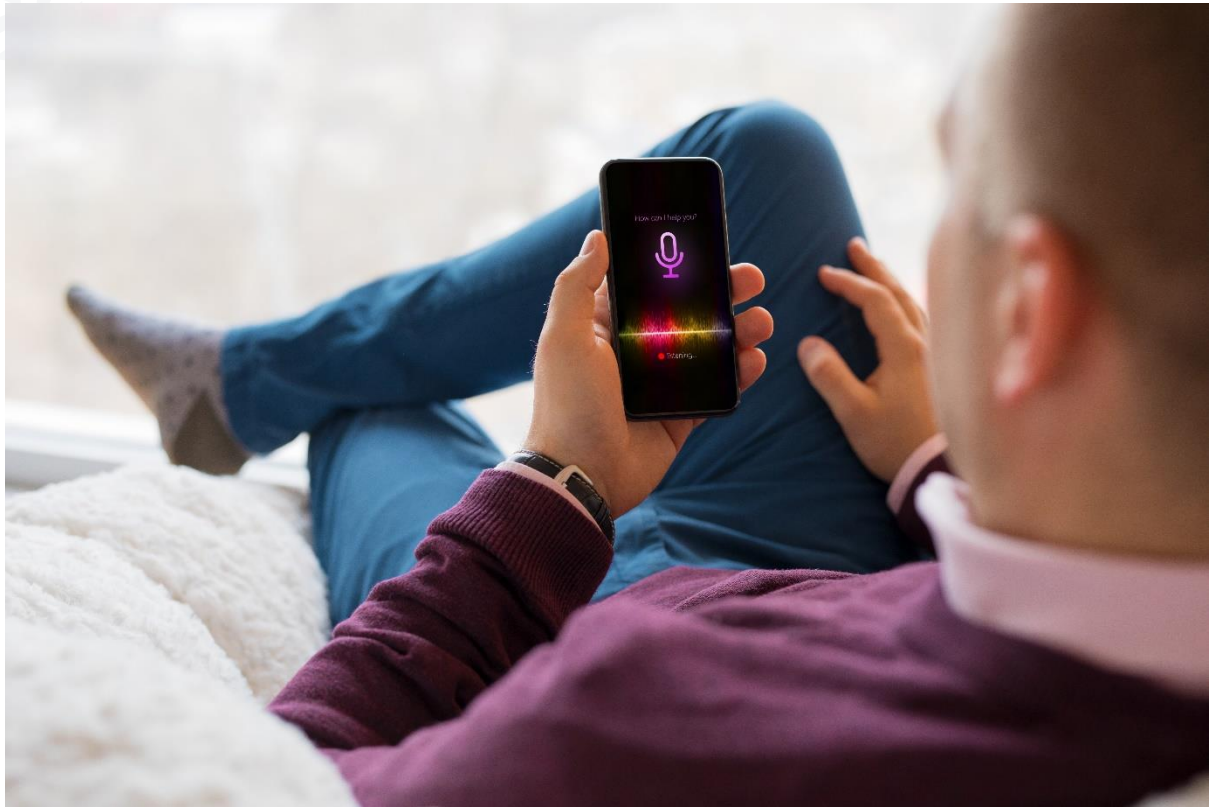
vs.

'Narrow' AI

Artificial General Intelligence

- AKA. Strong AI, full AI
- it is the intelligence of a machine that has the capacity to understand or learn any intellectual task that a human being can, including:

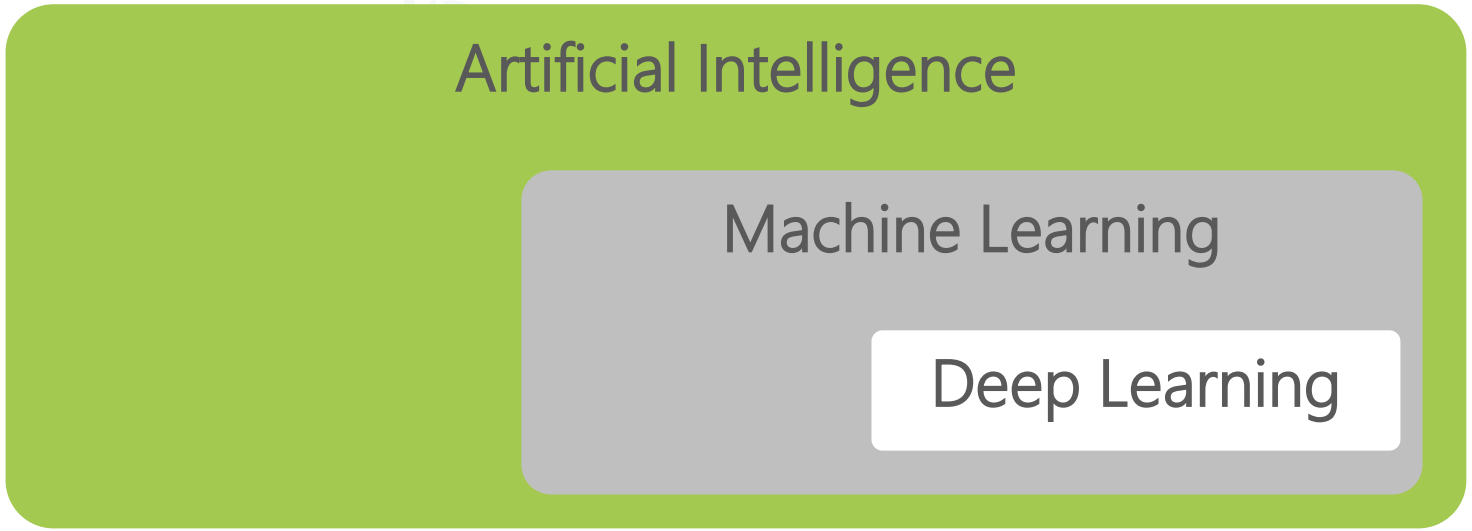
a) reason, use strategy, solve puzzles, and make judgments under uncertainty;
b) represent knowledge, including commonsense knowledge;
c) plan;
d) learn;
e) communicate in natural language;
f) integrate all these skills towards common goals.



Artificial Narrow Intelligence

- Also known as Weak AI, it means that the AI system only deals with a single or a limited number of tasks. It operates within a limited pre-defined range of functions or rules.

So... AI...



AI > ML > DL

Artificial Intelligence

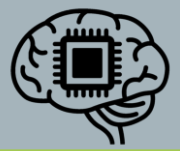
Enables computers to mimic human intelligence and behavior.

- Artificial narrow intelligence
- Artificial general intelligence

Machine Learning

Use large amounts of data and algorithms to analyze the data and "train" the machine to learn how to perform tasks.

- Supervised learning
- Unsupervised learning
- Reinforcement learning



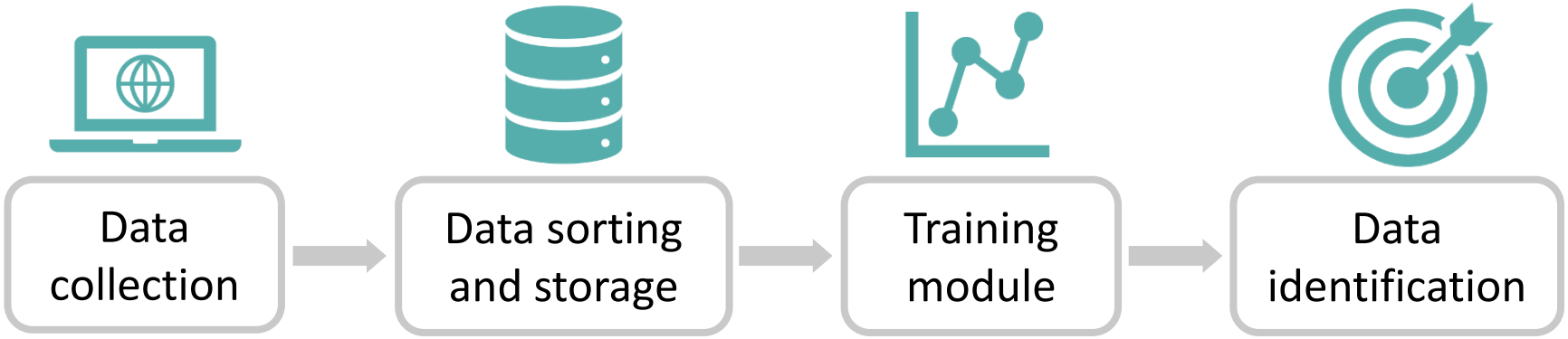
Deep Learning

An AI function that imitates the workings of the human brain in processing data and creating patterns for use in decision making.

- Deep Neural Network
- Feature learning

Machine Learning

Machine Learning Process



Designing computer algorithms that can be automatically improved by training.

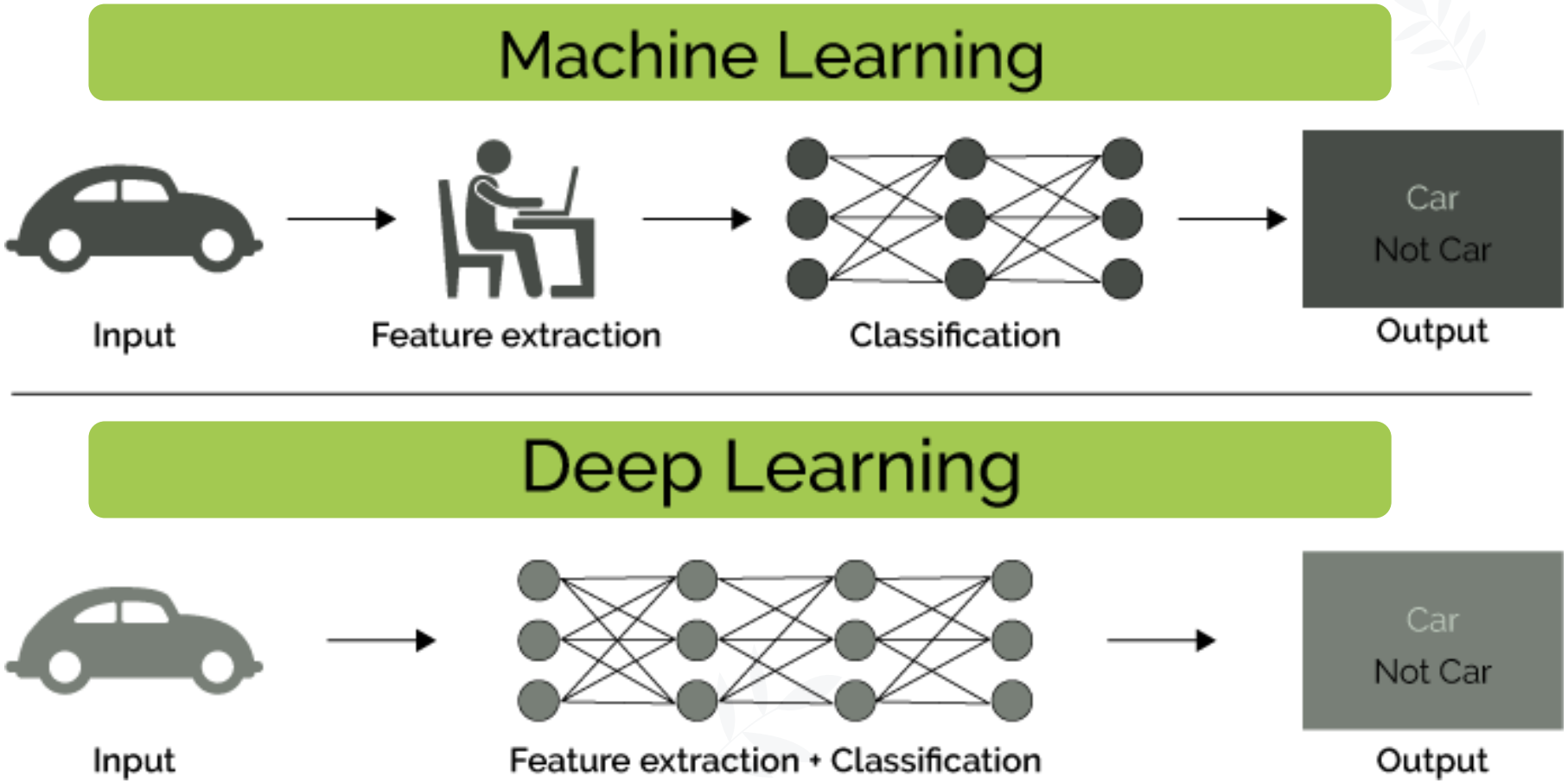
Machine Learning

Machine learning (ML) has the ability to collect, organize, analyze, find relevance in the data, and learn from itself.

Training modules can be used to identify and predict outcome when new data comes in. This is similar to how people learn from reading, communication and experience. Each machine learning module may "learn" from past experiences heuristically through its weighted algorithms, and so can deal with similar events in the future.

Machine Learning

Supervised learning	All data is "labeled" to tell the machine the corresponding value
Unsupervised learning	All data is not labeled. The machine sorts itself by finding the characteristics of the data.
Reinforcement learning	refers to goal-oriented algorithms, which learn how to attain a complex objective (goal) or how to maximize along a particular dimension over many steps.


Machine Learning
Input
Feature extraction
Classification
Car
Not Car
Output
Deep Learning
Input
Feature extraction + Classification
Car
Not Car
Output

Types of A.I. Applications

1. Natural Language Generation
2. Speech Recognition

Semantic Recognition

Types of A.I. Applications

1. Virtual Agents
2. Machine Learning Platforms
3. AI-optimized Hardware
4. Decision Management
5. Deep Learning Platforms
6. Biometrics
7. Robotic Processes Automation
8. Text Analytics and Natural Language Processing
9. Digital Twin/AI Modeling
10. Cyber Defense
11. Compliance
12. Knowledge Worker Aid
13. Content Creation
14. Peer-to-Peer Networks
15. Marketing Automation

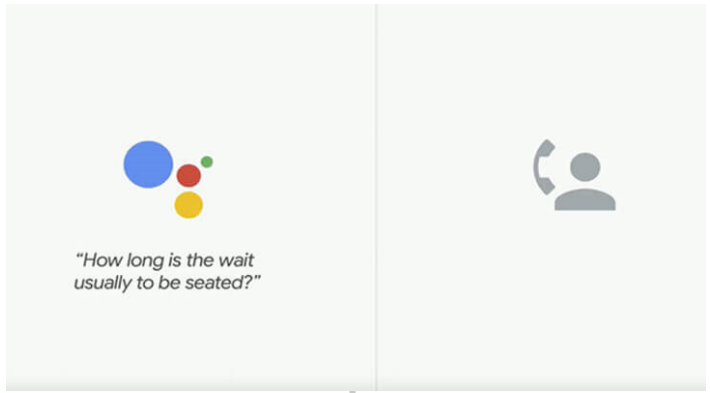
Data Analyzation

Types of A.I. Applications

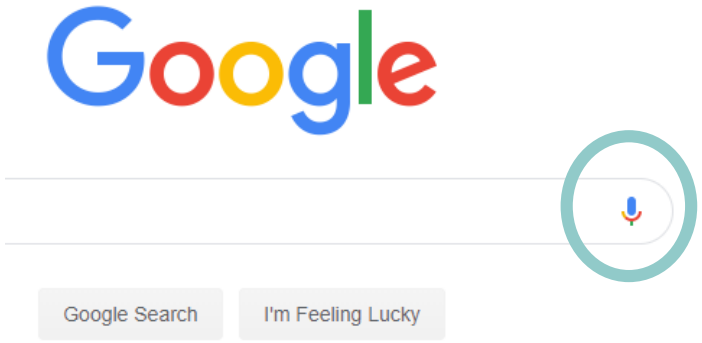
1. Emotion Recognition
2. Image Recognition

Image Recognition

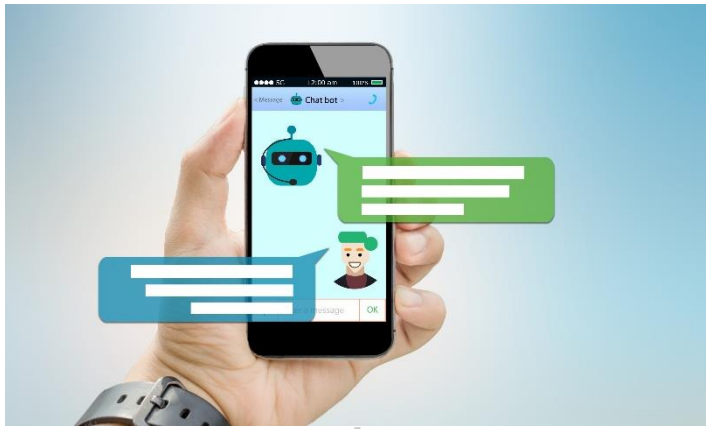
Application of Semantic Recognition



Google Assistant



Google voice search



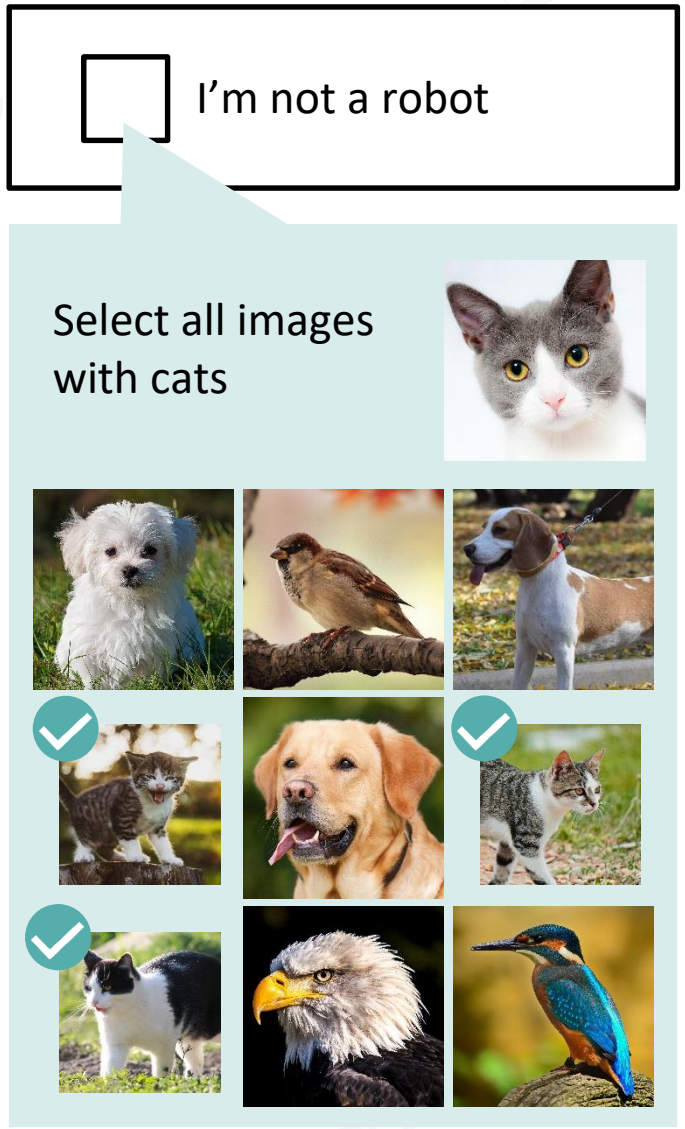
Messenger Chatbot

Application of Image Recognition

Facial recognition system

Self-driving car

Automatic License Plate Recognition System



Completely Automated Public Turing test to tell Computers and Humans Apart (CAPTCHA)

- But... are you a human?
- CAPTCHA is a computer generated and judged question that can only be answered by a human user.
- Bots cannot currently or easily spoof a CAPTCHA.
- Used in website message boards to prevent people from using computer programs to post a large number of advertisements or other spam.

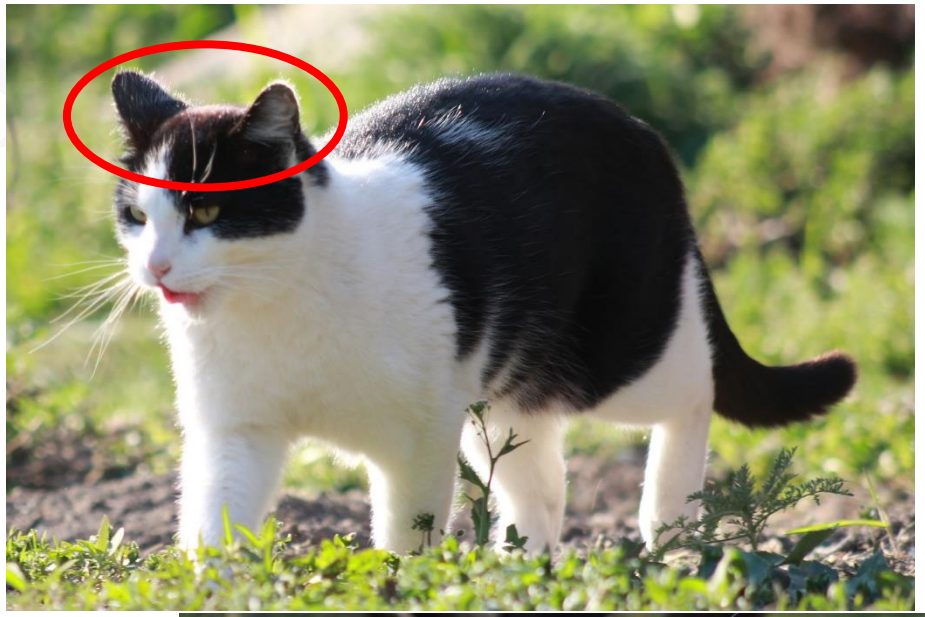
Image Recognition

Feature, Specific Feature

- **Looking closely at the photos, what are the features that cats have in common?**

- **feature**：ear, leg, tail…
- **Specific feature**：「sharp」ear,「four」legs,「one」tail.

- **Looking closely at the photos, cats and dogs have ears, but what's the difference in the shape of the ears?**



Feature, Specific Feature

- We can find: Cats are sharp ears, dogs are round ears.
- If the "shape of the ear" is feature, the " sharp" and "round" are the specific feature.
- We found that choosing "the shape of the ear" as the view to identify whether it is cat or dog in the photo was a "feature choice".
- Selecting the right "feature" can identify the animal species

Training Module Process：Feature Selection

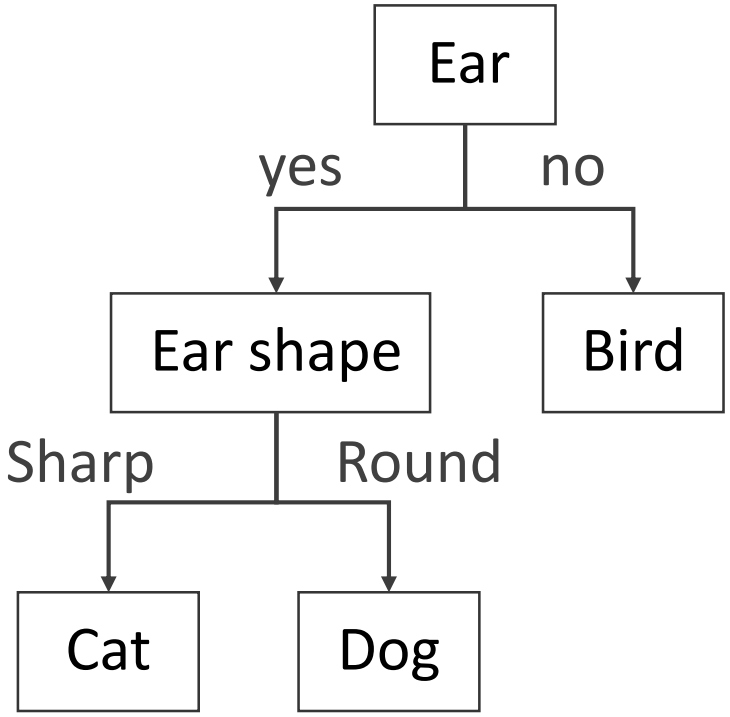
- But in fact, all dogs are not "round" ears, and the way to identify cats and dogs may require observing "the shape of the ear" and "the shape of the face"... and so on, not all data can be identified by observation.
- So how to select the appropriate "features", you can calculate the feature by statistical method.

Training Module Process：
Data Classification

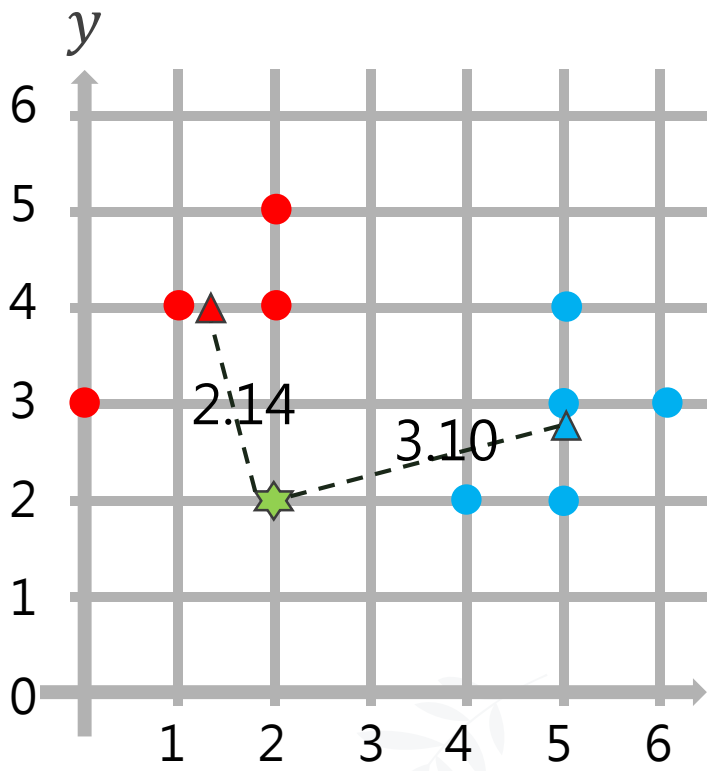
- This is the data classification, first determine the features and how to determine the standard of specific feature, so that similar specific feature can be divided into the same category, is through the classification algorithm to know.

Two Ways to Classify and Identify Data

Decision Tree

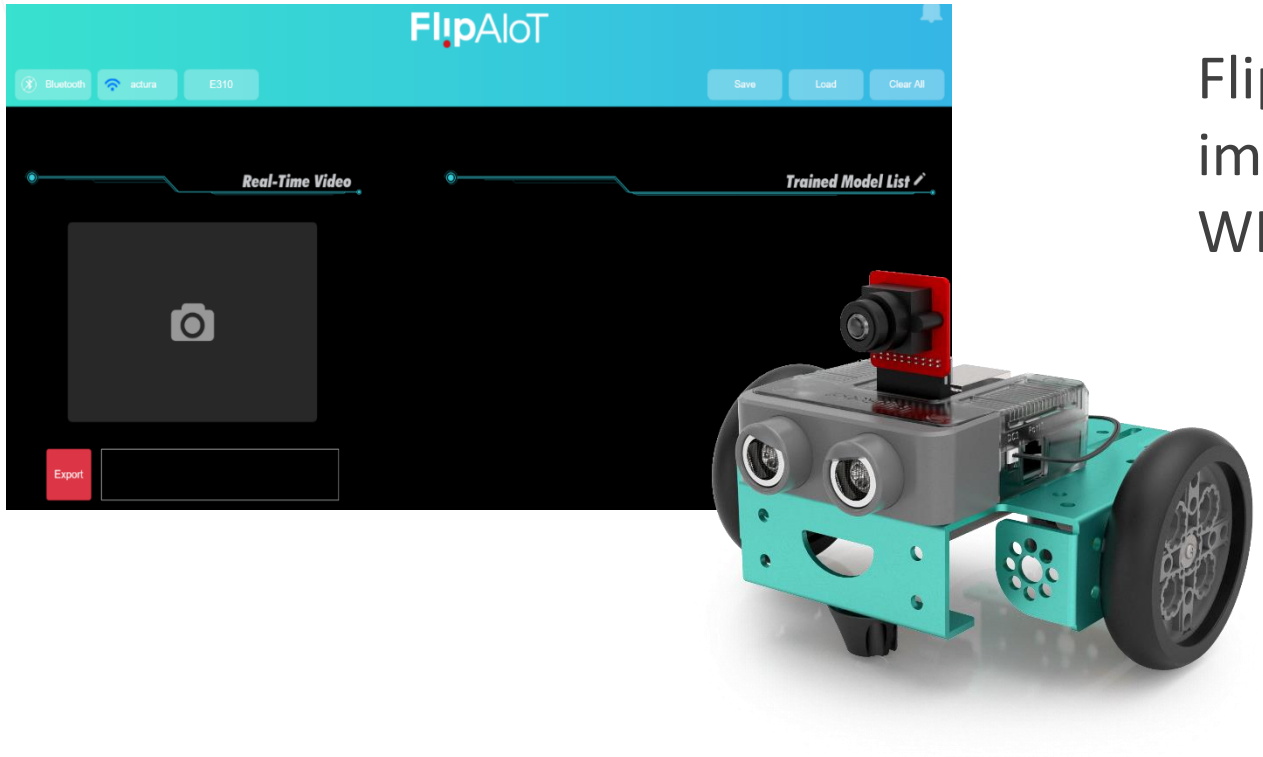


Nearest Neighbors Algorithm



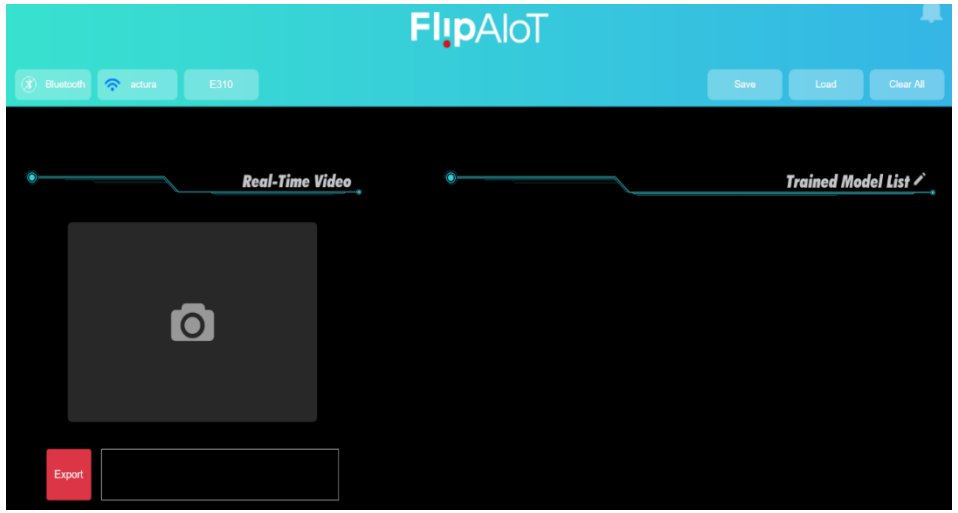
FlipAIoT

FlipAIoT–Image Module Training and Image Recognition Tool



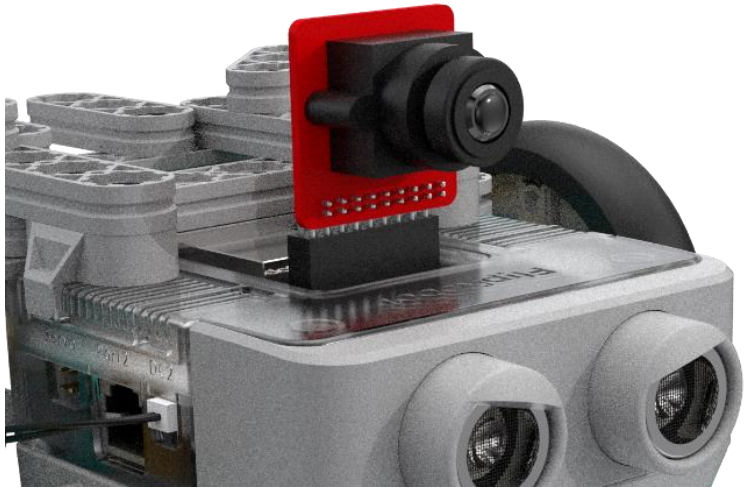
FlipAIoT is a software for analyzing images which taken from robot's WIFICamera by WiFi.

FlipAIoT–Image Module Training and Image Recognition Tool



- Image modules can be trained by taking a large number of photos of an item or environment through camera.
- When new images are received after the image module training, FlipAIoT can identify which image module the image belongs to immediately and execute different instructions.

WIFI Camera



- WIFICamera consists of WIFICamera Receiver and WIFIBoard.
- The chip on the robot can't quickly analyze large amounts of data, so it is needed to transmit images back to FlipAIoT on computer for analysis by WIFI wireless transmission.

Bluetooth and WiFi?

Yes, both WiFi and Bluetooth are used at the same time on the robot. Can you see why?

	Bluetooth	WiFi
Frequency	2.4 GHz	2.4, 3.6, 5 Ghz
Bandwidth	800 Kbps	11 Mbps
Range	5-30 meters	32 meters indoors, 95 meters outdoor
Power	Low	High
Latency	200ms	150ms
Bit-Rate	2.1Mbps	600Mbps

WiFi can send larger volumes of data faster with less delay than Bluetooth.

FlipAIoT is an application of Machine Learning.

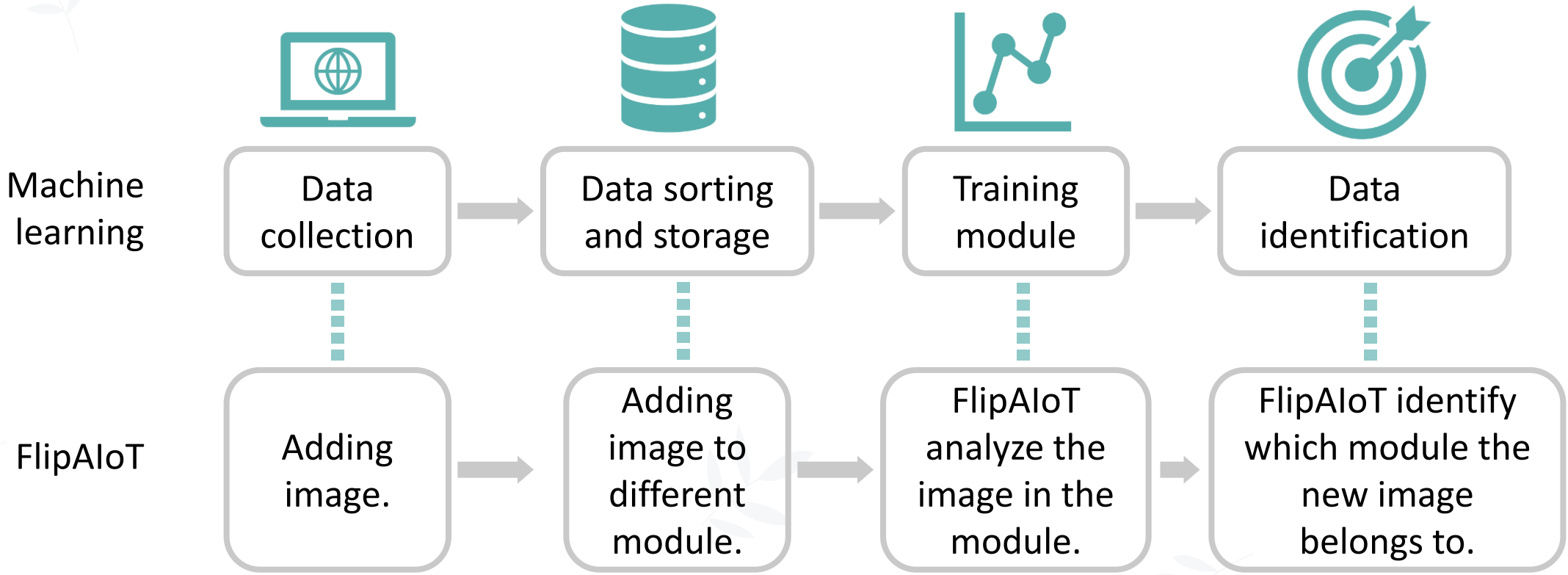
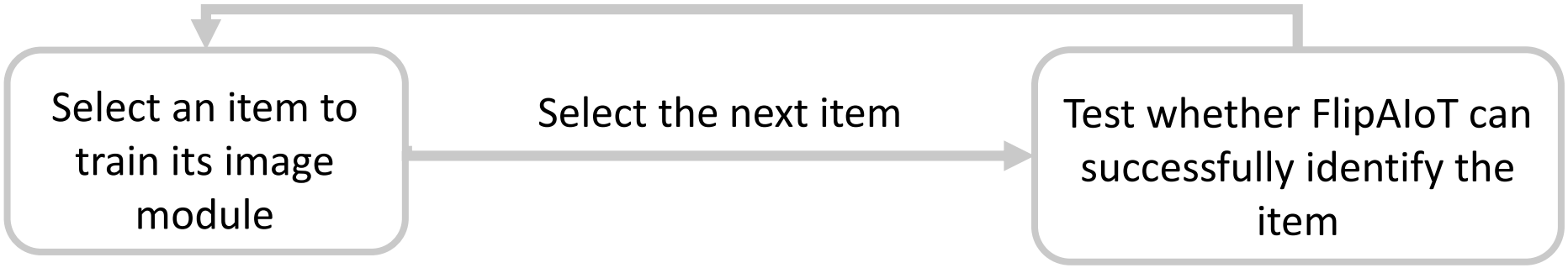


Image Module Training Process



TIPS

- Keep the same background during the training
- Take multiple pictures of the same item.
- Vary the distance, angle and location of the item in the picture.

TIPS

- Can the item be identified?
- Is the similarity to other items in the category high?
- If images are not easily be identified, take more pictures at different distances, different positions, and different angles.

Internet of Things (IoT)

Simply...

Connecting all the things in the world to the internet.

- Collecting and sending info
  Examples: sensors for motion, moisture, air quality, water levels, light, temperature etc.
- Receiving and action on info
  Examples: printers receiving and printing documents or 3D models, a car responding to a KeyFOB.
- Both collecting, sending, receiving, and acting
  Examples: irrigation control on a farm based on data from many sensors, and most things in a smart home.

QUIZ 1

1. Which application is using the technology of image recognition?

a) self-driving car

b) Face ID

c) License plate recognition

d) All above are correct. V

QUIZ 2

2. Which technology is not the common application of AI ?

a) Semantic recognition

b) IoT V

c) Data collection.

d) Image recognition

QUIZ 3

3. Which of AI functions does the voice assistant mainly apply?

a) Semantic recognition ✓

b) IoT.

c) Data analysis.

d) Image recognition.

QUIZ 4

4. Which test is the famous for examining the robot or the human?

a) Newton test.

b) Turing test V

c) Picasso test.

d) Galilei test.

QUIZ 5

5. Which statement about the relationship of AI, machine learning and deep learning is correct?

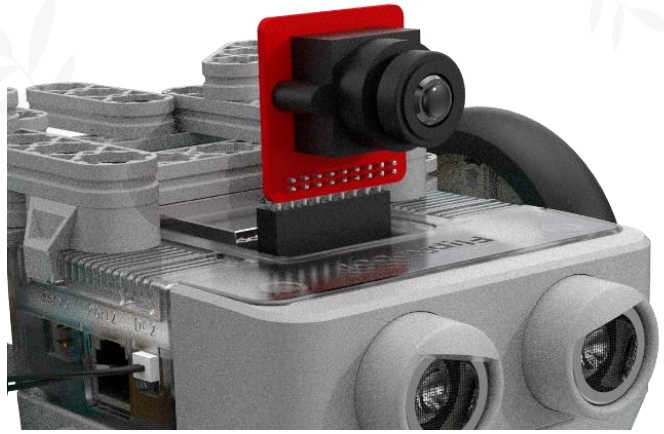
a) AI is part of technology of machine learning

b) Machine learning is part of technology of deep learning

c) Machine learning is part of technology of AI. V

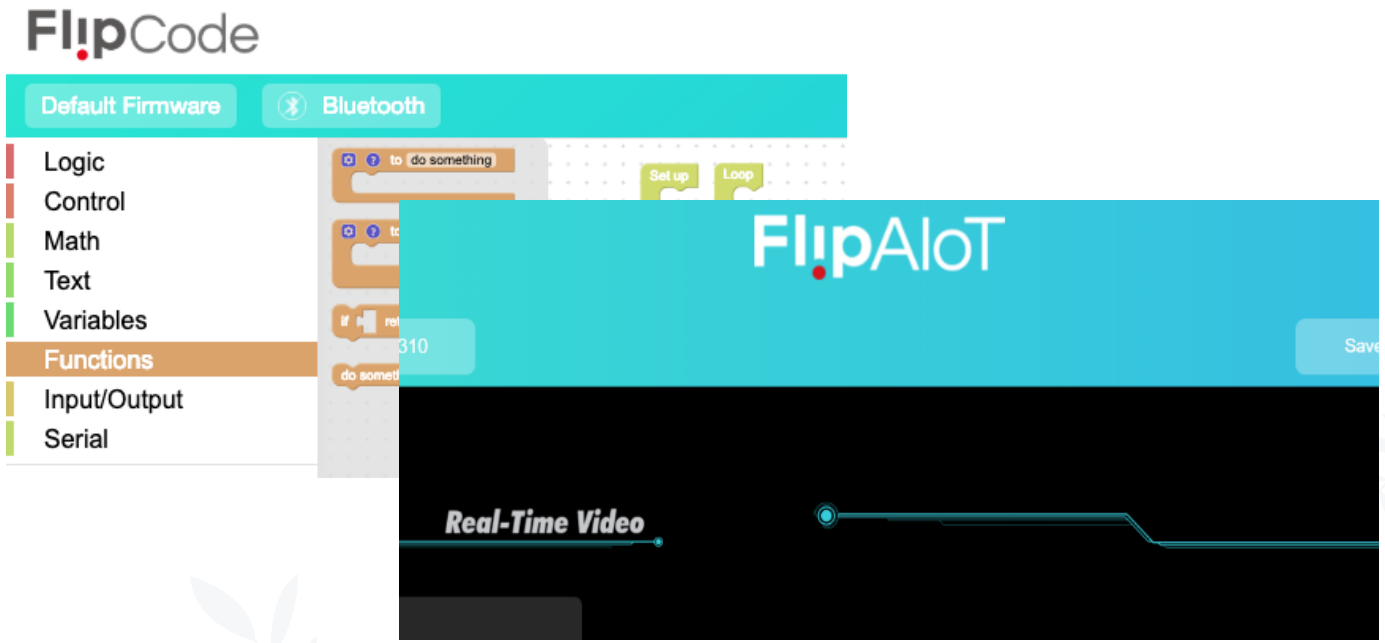
d) All three concepts are the same

Demo...



We are using:

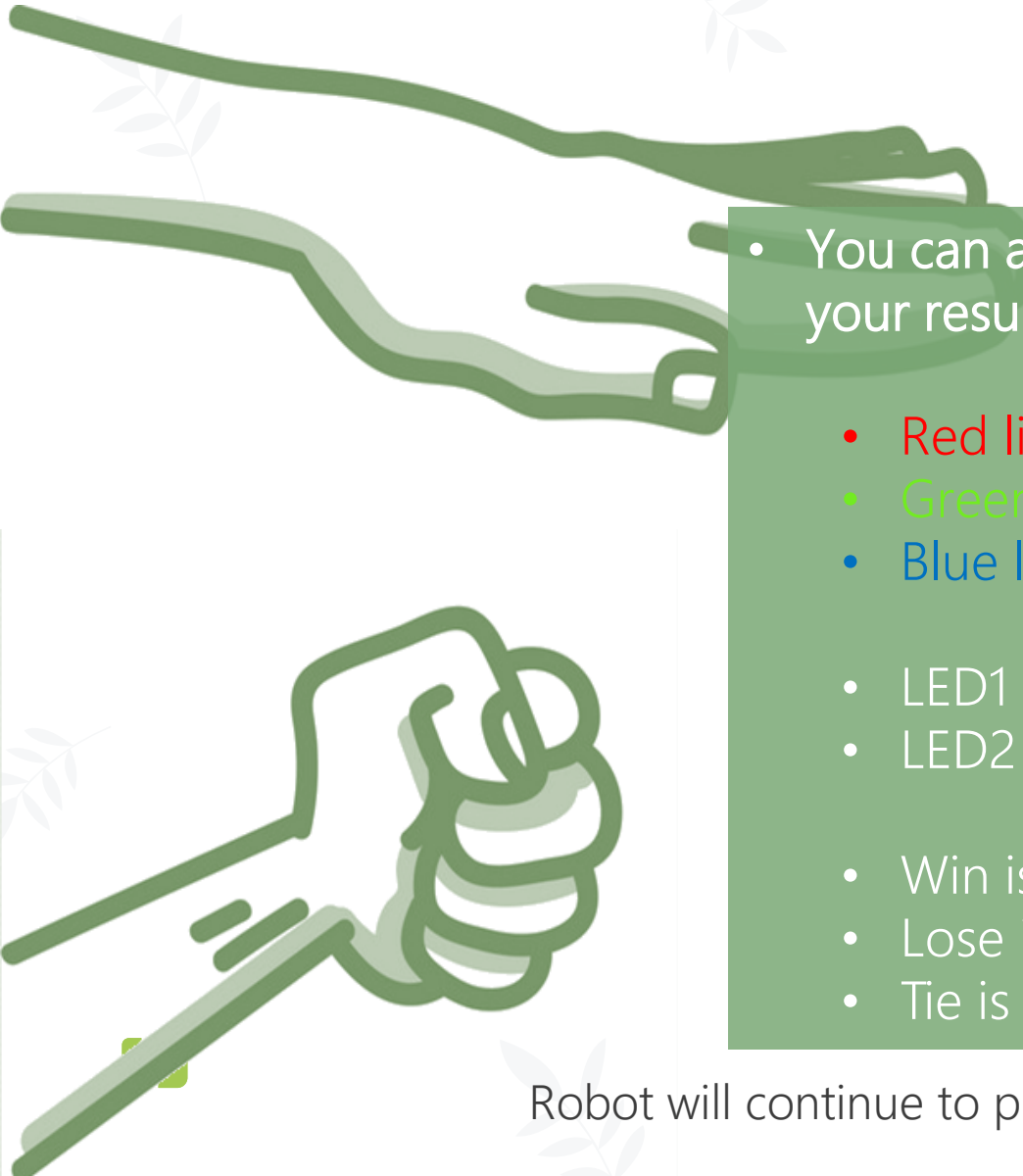
- FlipRobot and it's built in microprocessor,
- WIFICamera and Bluetooth dongle (add on kit)
- FlipAIot (paid) software
- FlipCode (free) software



Live Demo...FlipRobot Paper Scissors Stone

- Turn on and connect all software and hardware.
- Hold your hand in front of the robot for it to sense you.
- Listen to the beep count and the white lights.
- Play your hand (paper scissors stone) in front of the camera.
- The computer will make a random play and will tell you if you win or lose.

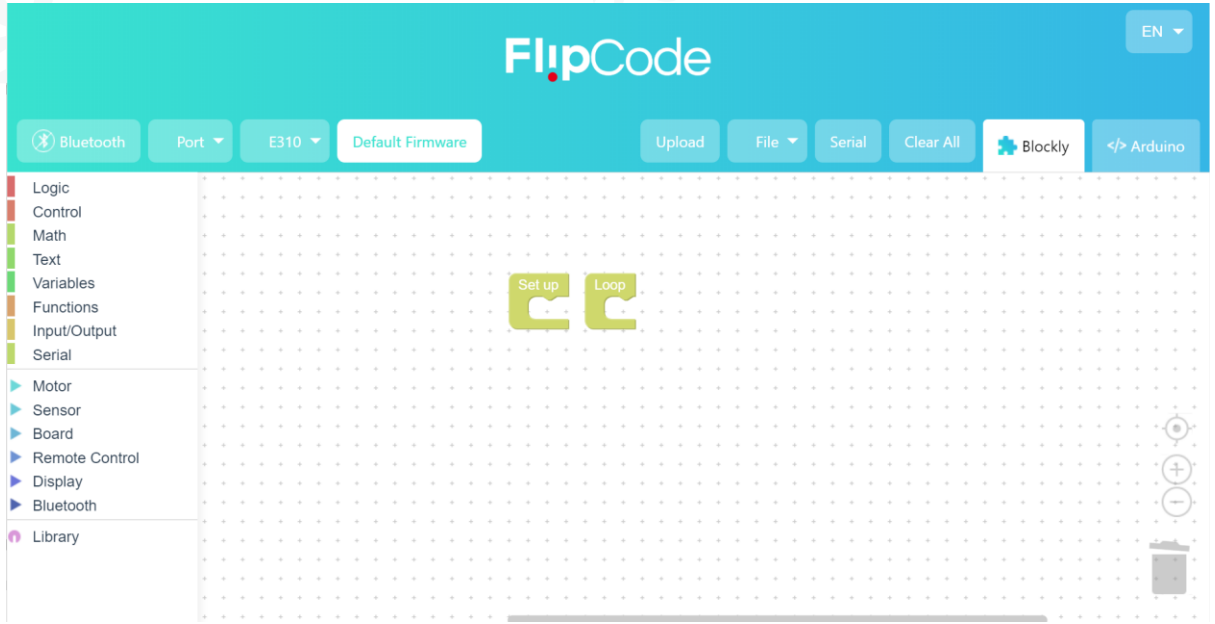
Live Demo...FlipRobot Paper Scissors Stone



- You can also see both the Robot and your results of play on the robot.
  - Red light = Paper
  - Green light = Scissors
  - Blue light = Stone
  - LED1 is your play
  - LED2 is the Robot
  - Win is high tone
  - Lose is low tone
  - Tie is silent.

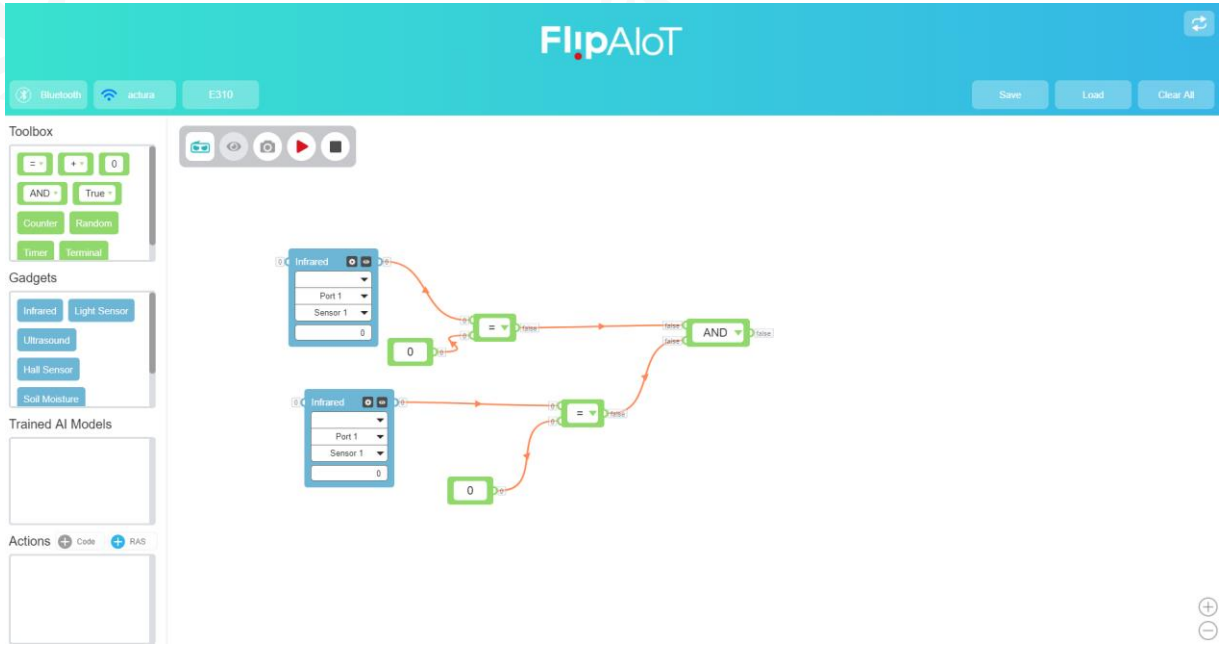
Robot will continue to play whenever a hand in front of the camera

Hmmm...



- Think of a game
- Set up FlipAIoT, FlipCode and connect FlipRobot with WiFi Camera and USB Bluetooth Dongle. (confirm connection in upper left of FlipAIot)
- Train the FlipAIoT (export it)
- Write the FlipCode functions (save it) (Only simple code!)

Hmmm...



- FlipAIoT >>> Programing Page
- Click the camera icon to see the camera POV
- Add (+) Action (Select FlipCode file)
- Drag the program blocks and connect them like a flow chart
- Press the Play button
- Debug and fine tune your code and keep training your models until you get it working!

Week 5 Student of the Week Contest

Topic: AI Robot Image Recognition Solution

Project Description

Find a problem in daily life, try to use image recognition to create solution.

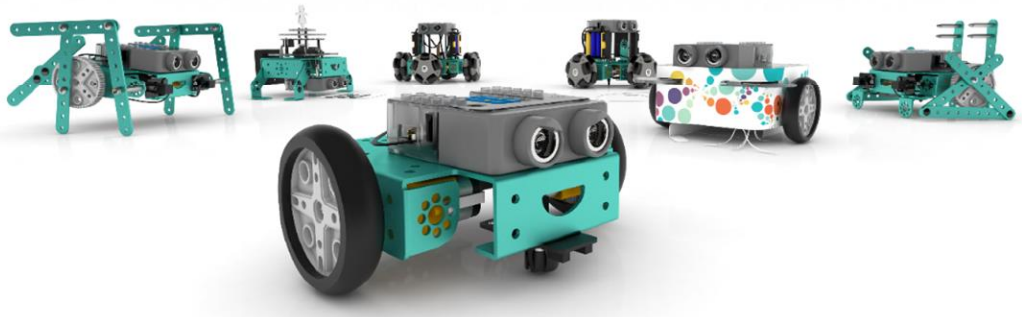
Deadline

Aug 13th, 14:00PM (GMT+8)

3 hours before our Aug 13th class begins

Project Format

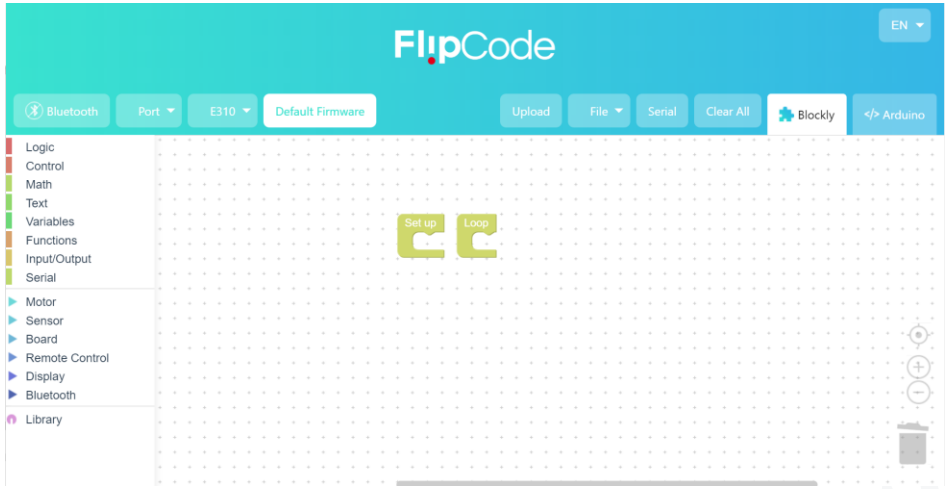
Problem description + Solution (explain which kind of images need to be collected, and what action will be activated when robot recognize specific images) + Hashtag #STEAMup #Studentoftheweek



3 winners will be announced on the 2nd class and will receive our Fliprobot Kit!

Preparation for next lesson

FlipCode



https://code.fliprobot.com/blockly/apps/blocklyMain/

Thank You !

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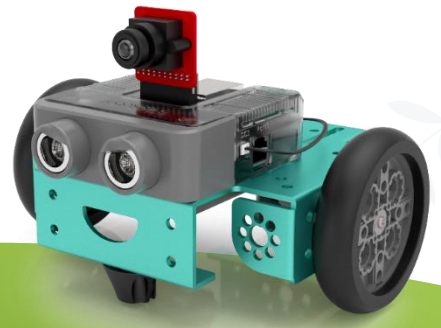
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