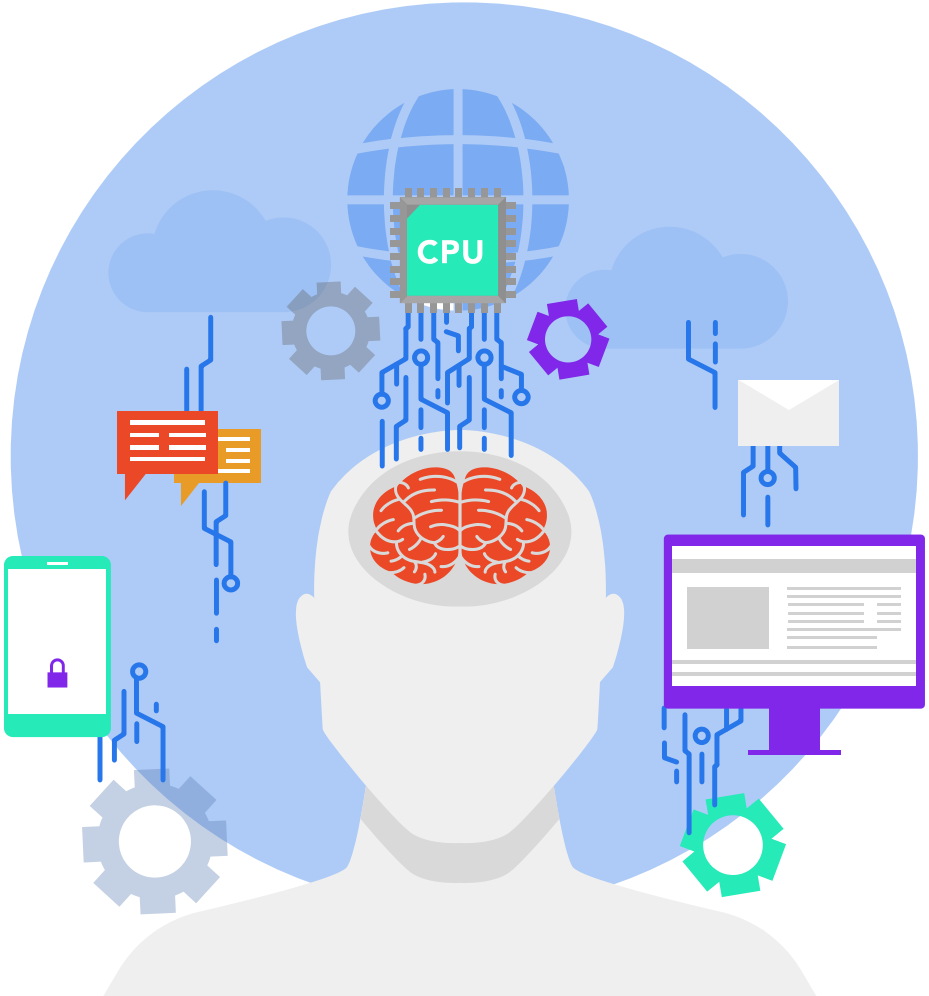
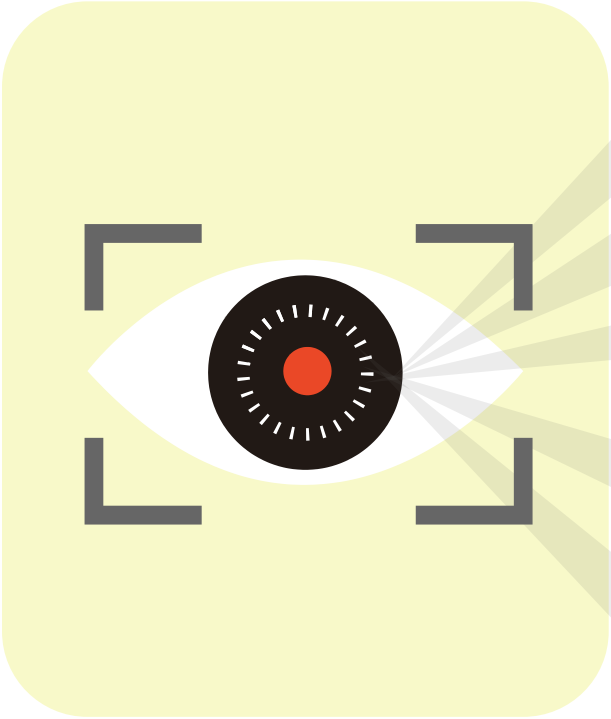


Day 1

Artificial Intelligence & Machine Learning

Speakers:
ZHOU Siyu (Zoe)
ZHONG Licheng (Simon)
DENG Chunwei (Logan)

What Will We Do Today?



- **Ice-breaking** — For Us to Know about Each Other
- **Overview** — Pre-survey, Arrangements, and Quiz
- **Introduction to A.I.** — Introduction to Artificial Intelligence

10-min Break

- **Introduction to M.L.** — Introduction to Machine Learning

10-min Break

- **Application of M.L.** — Application of Machine Learning

Ice-breaking

Ice-breaking

Guess:

Two truths and one lie about each of us

ZHOU Siyu (Zoe):
1. like playing badminton
2. never broken a bone
3. get up 7:30am every day

ZHONG Licheng (Simon):
1. like playing table tennis
2. now study in the fourth year
3. get used to stay up late

DENG Chunwei (Logan):
1. like playing basketball
2. like traveling with friends
3. cannot stay up late

Ice-breaking

Tell us:

Two truths and one lie about each of you

Write on a paper with a pen or
type in the chat box of the Zoom.

Overview

Pre-survey

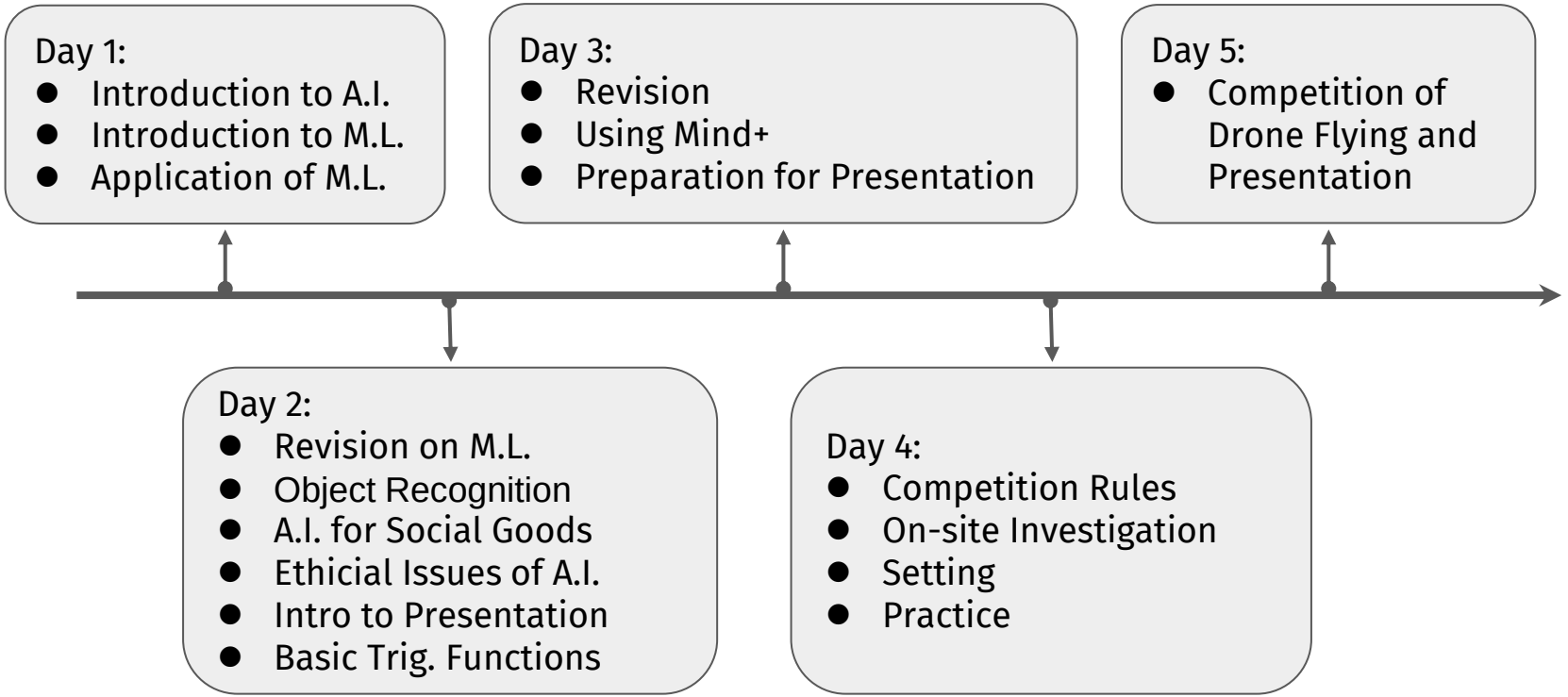
How much do you know about A.I., trigonometry, and programming? Let's check!

You can use the link:

https://quizizz.com/join/quiz/637710021e3411001d4efcfb/start?studentShare=true

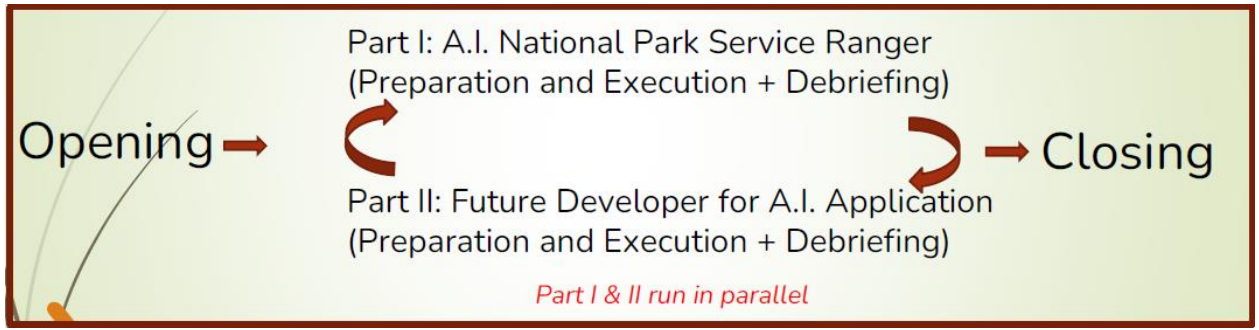
or scan the QR code:

Workshop Schedule From Day 1 to Day 5



Competition Overview

Duration (2.5 hours)	Group A (5 teams)	Group B (5 teams)
5 mins	Opening	
5 mins	Transit	
60 mins	Competition*	15-mins Preparation + 45-mins Presentation*
5 mins	Transit	
60 mins	15-min Preparation + 45-min Presentation*	Competition*
5 mins	Transit	
10 mins	Closing	



Competition Overview

Part I: A.I. National Park Service Ranger (Drone Flying)

- Plan the optimal flying route which includes ONE diagonal line and program your drone to scan a total of 8 objects (including animals, visitors and hunters) in the national park
- Service recipients MUST take off your drone at ONE of the "Start" points and land at anywhere within the competition area upon completion
- Service recipients should NOT fly beyond the competition area
- Duration: 25 minutes (15 minutes preparation and 10 minutes flying time)
- Maximum flying attempts: 3
- Maximum flying height: 2m
- Materials provided: 2 extra batteries and 2 measuring tapes

Part II: Future Developer for A.I. Application (Presentation)

- Service recipients to present an original and creative idea on how A.I. object recognition and drone can be applied for social good in daily life and make a positive impact to the community
- Service recipients are encouraged to incorporate the use of other technologies into your innovative design
- Presentation duration: 3-5 minutes
- Presentation materials: maximum 5 PowerPoint slides
- The presentation is recorded via Zoom

Overview Quiz

Have you understood about the schedules and requirements of competition? Let's check!

You can use the link:

https://quizizz.com/join/quiz/6377b813d95458001e2a1628/start?studentShare=true

or scan the QR code:

Introduction to A.I.

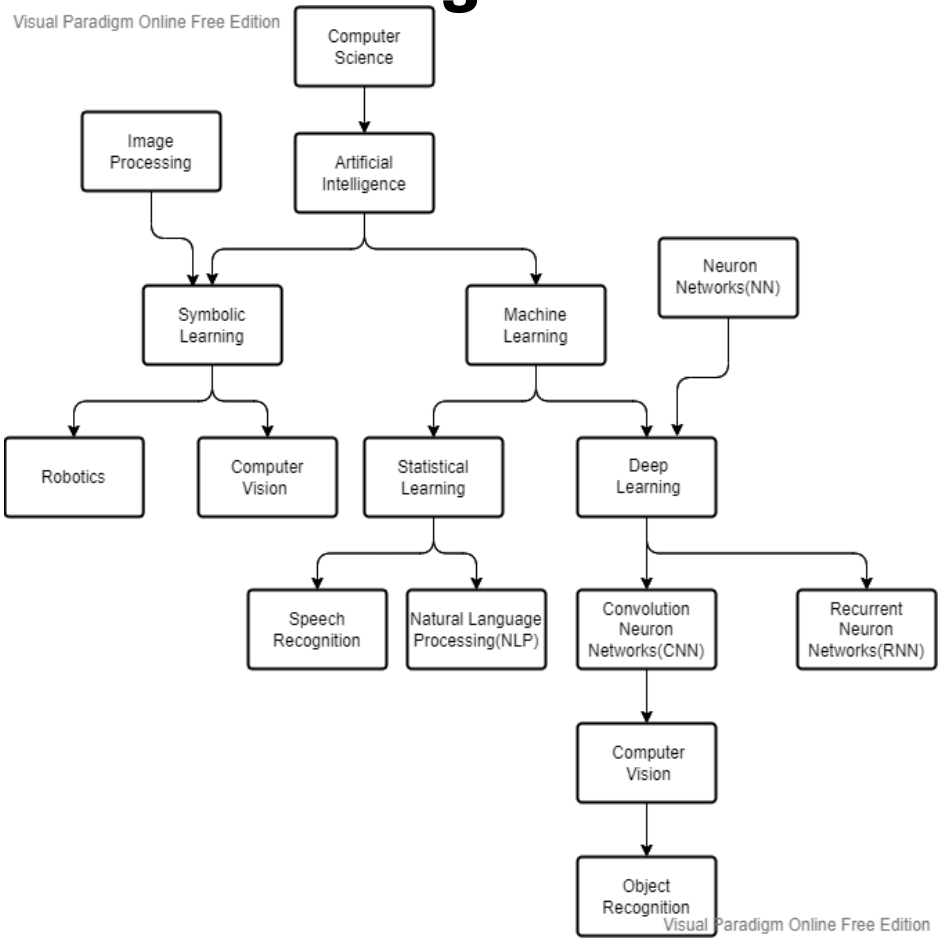
What is Artificial Intelligence?

Link: https://youtu.be/2ePf9rue1Ao

What is Artificial Intelligence?

Summary of the Video

- Classification
- Prediction



What is Artificial Intelligence?

Artificial Intelligence (A.I.)

- uses computers and machines to mimic the problem-solving and decision-making skills of a human.(IBM)
- combines computer science and robust dataset.
- learns how to sense, learn, reason, and act.
- need a lot of data input, and then output as one human react.

Pattern Recognition

Image Processing

Decision-making

Reasoning

Problem-solving

Learning

Speech Recogntion

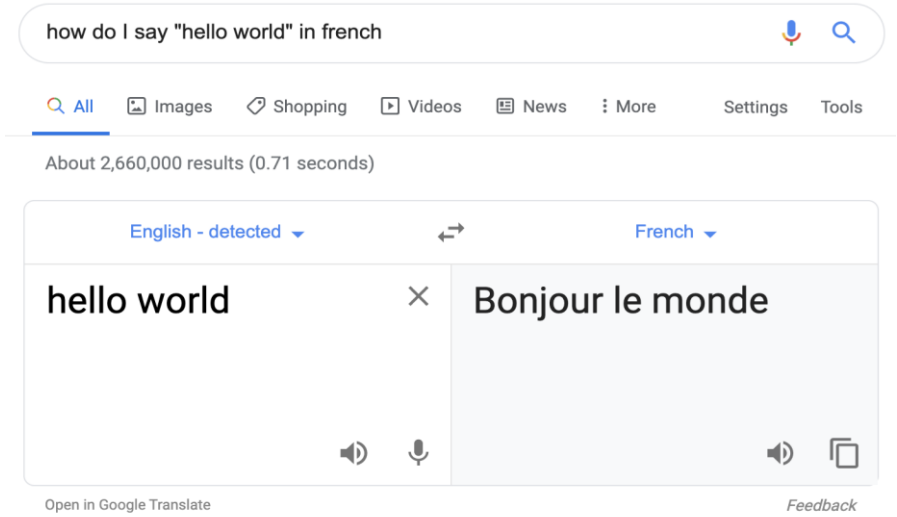
Object Recogntion

Robotics

Language Processing

Application of A.I.

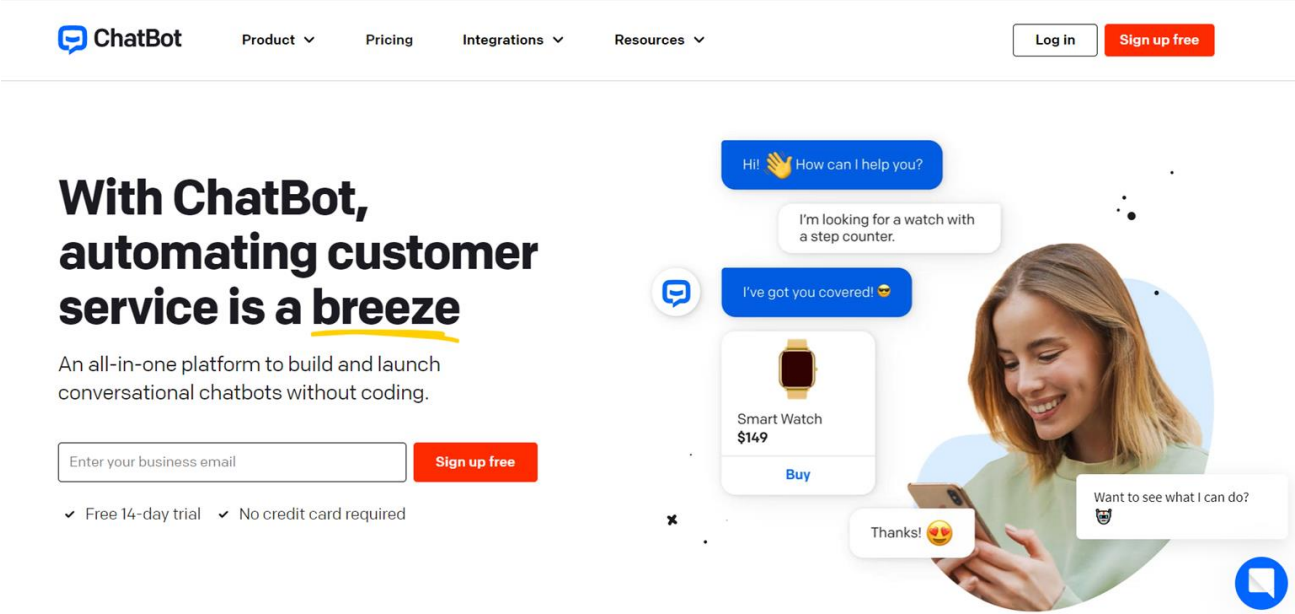
- Intelligent search engines and personalized result pages language processing, reasoning
- Translator function language processing



Application of A.I.

- ChatBot (chat robot) in service industry

  language processing, prediction



Application of A.I.

- Recommendation of ADs, posts, videos, music, and movies in which users possibly interest on different kinds Internet source platform

Classification for marketing

Application of A.I.

Other Applications:

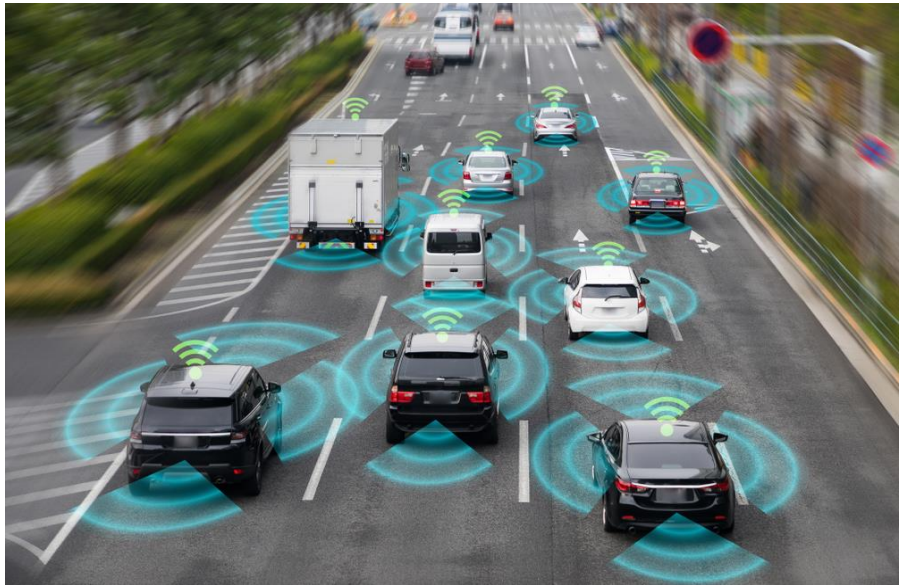
- Intelligent security robots for guarded and surveillant purposes
- Intelligent grading systems for assessing assignment purposes
- Intelligent medical systems for diagnosing diseases
- Guided machines for visually disadvantaged people
- ……

Application of A.I. - True or False Practice

Write answers on a paper with a pen or type them in the chat box of the Zoom.

- Autonomous/self-driving vehicles: automatically calculating driving path and controlling vehicles

problem-solving, decision making, a lot of data input for training model…



Application of A.I. - True or False Practice

Write answers on a paper with a pen or type them in the chat box of the Zoom.

- Unlocking a phone or a door with your fingerprint

problem-solving, decision making, a lot of data input for training model…

Application of A.I. - True or False Practice

Write answers on a paper with a pen or type them in the chat box of the Zoom.

Pattern-recognizing, and analyze what does article discuss about

- Intelligent social media data monitoring and analysis system

Link: https://www.mentionlytics.com/

Application of A.I. - True or False Practice

Write answers on a paper with a pen or type them in the chat box of the Zoom.

- Dust collector

No data input

Application of A.I. - True or False Practice

Write answers on a paper with a pen or type them in the chat box of the Zoom.

-

Automatic music generation machines

For different mood, different genre

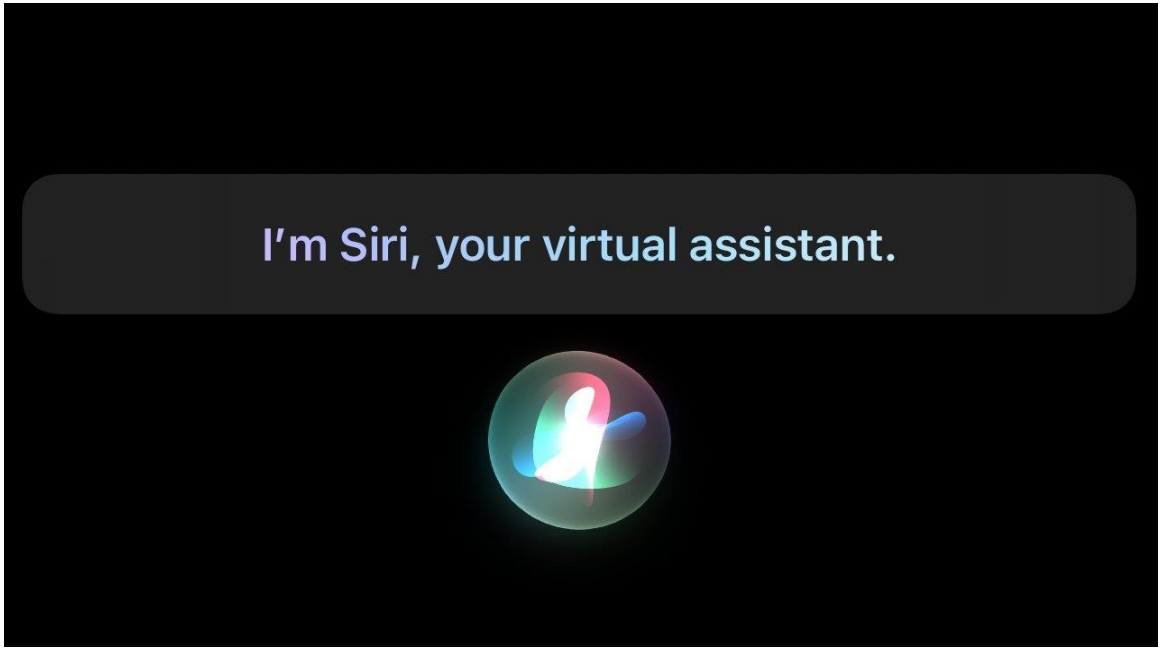
Link: https://soundraw.io/

Pattern-recognizing with a lot of data input

Application of A.I. - True or False Practice

Write answers on a paper with a pen or type them in the chat box of the Zoom.

- Intelligent voice assistance software



- Language processing, speech recognition with a lot of data input

✅

Application of A.I. – Challenging Question

Write answers on a paper with a pen or type them in the chat box of the Zoom.

Which one of the following is the best example of A.I.?

A. A smart toothbrush reminds you to brush your teeth every day at 7a.m..

B. A smart toothbrush that has a camera in it and connect to a smartphone so you can see your teeth when you brush them.

C. A smart toothbrush that tells you where you need to brush better and gives you a rating on how well you brush.

Application of A.I. – Challenging Question

Explanations for the three choices:

A. Pre-setting reminding time to brush teeth can be achieved by programming, not involving problems.

B. A toothbrush with a camera and connected to a smartphone is only an electronic equipment combining two functions, not involving problems.

C. A toothbrush telling better places to brush and giving rating, needs to collect data about teeth, analyzing data, and giving advices with rating, involving a completed problem-solving process.

One More Example - Improvement to A.I.

Link: https://youtu.be/-RHG5DFAjp8

One More Example - Improvement to A.I.

Problem-solving, speech recognition, language processing, …

In the video, Google Assistant (A.I. machine) made a complex phone call to make a reservation. The conversation **didn't go as planned**, but the Google Assistant **responded in a normal way**.

Now: growing up rapidly but should be used to serve humans.

Future: smarter & being **applied in more occasions**, may cause mistakes (misunderstanding of A.I.) and illegal use.

Let’s Break!
10 min

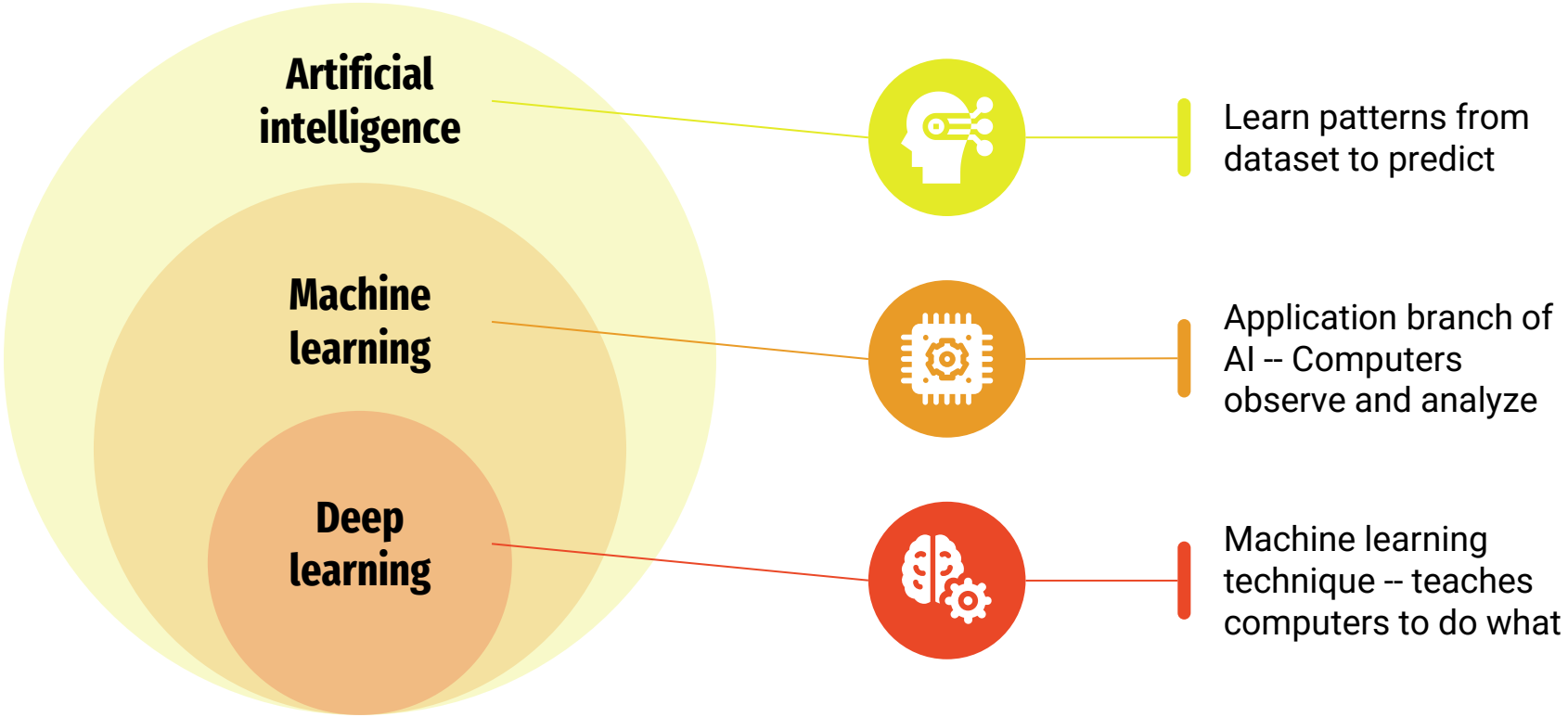
Introduction to M.L.

- What is Machine Learning
- How do Machines Learn, and How do Human Learn
  - Quick Draw
  - Manual Recognition
  - Summary
- How to Train Machines to Learn
  - Google Teachable Machine
  - Summary

What is Machine Learning?

Link: https://youtu.be/f_uwKZIAeM0

What is Machine Learning?



Compare Artificial Intelligence and Machine Learning

Artificial Intelligence

- Computers act on their own
- They act according to environment
- Systems display cognitive ability
- Computers make decisions

VS

Machine learning

- It’s an application of AI
- Computers observe and analyze
- Predict based on previous patterns
- Pre-programmed algorithms

How Do Machines Lean?

How Do Human Lean?

How Do Machines Recognize Object?

How Do Human Recognize Object?

Let's think about these questions through two activities!

(1) Quick Draw

(2) Manual Recognition

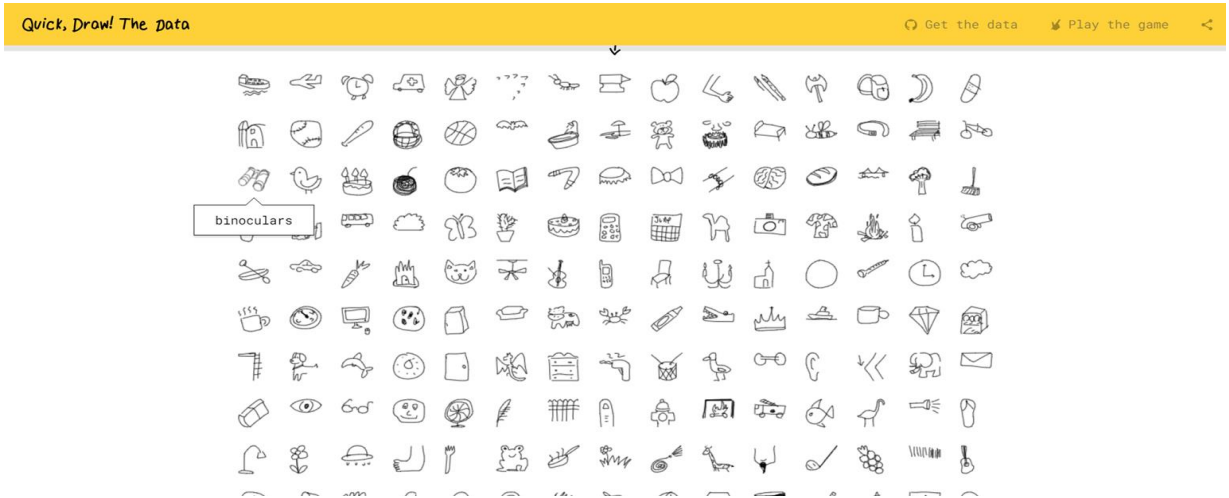
Quick Draw

It uses neutral network to recognize your artwork.

https://quickdraw.withgoogle.com

Quick Draw

- Dataset



Quick Draw

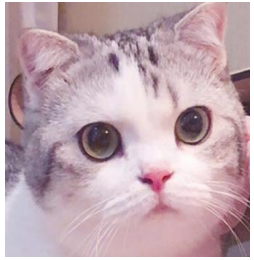
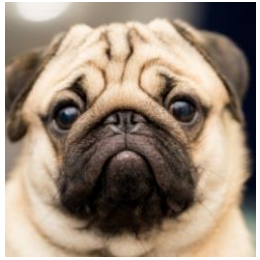
- Think about this question:
- In addition to the large dataset having constructed, what else things are needed for the machine to recognize objects?

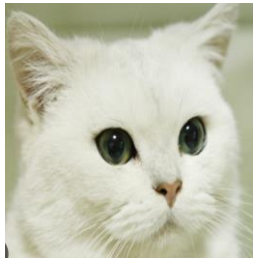
Manual Recognition

For each picture, it is a cat or a dog?

Let's recognize them!




Write your answers on a paper with a pen or type your answers in the chat box of the Zoom.

Manual Recognition

For each picture, it is a cat or a dog?
More Pictures:

Think about this question: What's the difference of cats and dogs?

1

2

3

4

Write your answers on a paper with a pen or type your answers in the chat box of the Zoom.

How do we human learn differences between cats and dogs?

- We need to observe; but before this, the definitions of cats and dogs have been made by predecessors.
- We generalize some key traits that only cats commonly share and key traits that only dogs commonly share.

How do machines learn differences between cats and dogs?

- Machines need to observe; but before that, the tags of cats and dogs have been made by humans.
- Machines find some key elements that only cats commonly share and key elements that only dogs commonly share.

When meeting similar but new things, how do we human recognize cats and dogs?

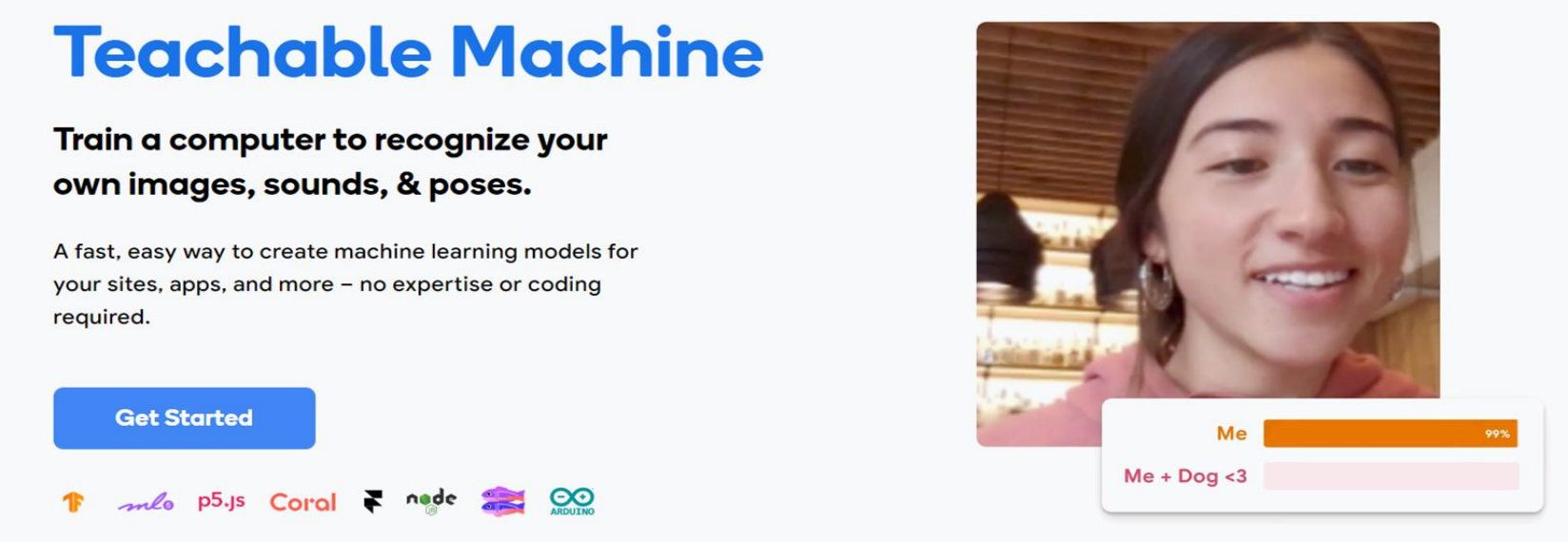
- We recall our experiences (memories stored)
- We compare unknown new things and known things with generalized traits and match them.

When meeting similar but new things, how do machines recognize cats and dogs?

- Machine recall their “experiences” (data stored)
- Machines compare unknown new things and known things with generalized elements and match them.

How to Train Machines to Learn

Let's start from "Google Teachable Machine"!



Link: https://teachablemachine.withgoogle.com/train/image

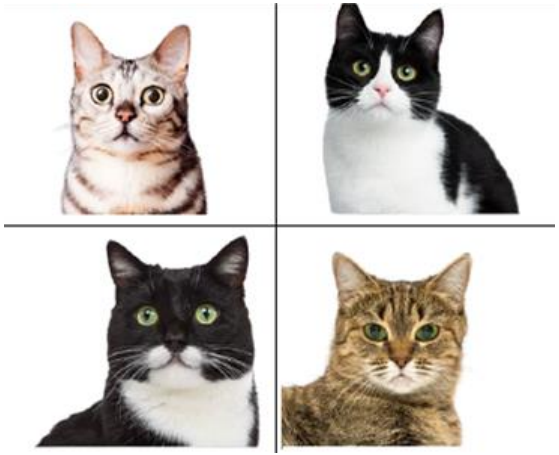
Google Teachable Machine

1. Download digital pictures of animals.
2. Open the website, and name “Class 1” and “Class 2” into cats and dogs.
3. Upload images of cats to the class of cats.
4. Upload images of dogs to the class of dogs.
5. Click the button “train model”.
6. Upload new samples and use your trained model to them.

Google Teachable Machine

Images of dogs:

Images of cats:



Google Teachable Machine

Images of dogs:




Images of cats:




Google Teachable Machine

Use trained model to test these new samples. Write your answers on a paper with a pen or type your answers in the chat box of the Zoom.

Now test the following pictures

1

Dog: __%
Cat: __%

2

Dog: __%
Cat: __%

3

Dog: __%
Cat: __%

4

Dog: __%
Cat: __%

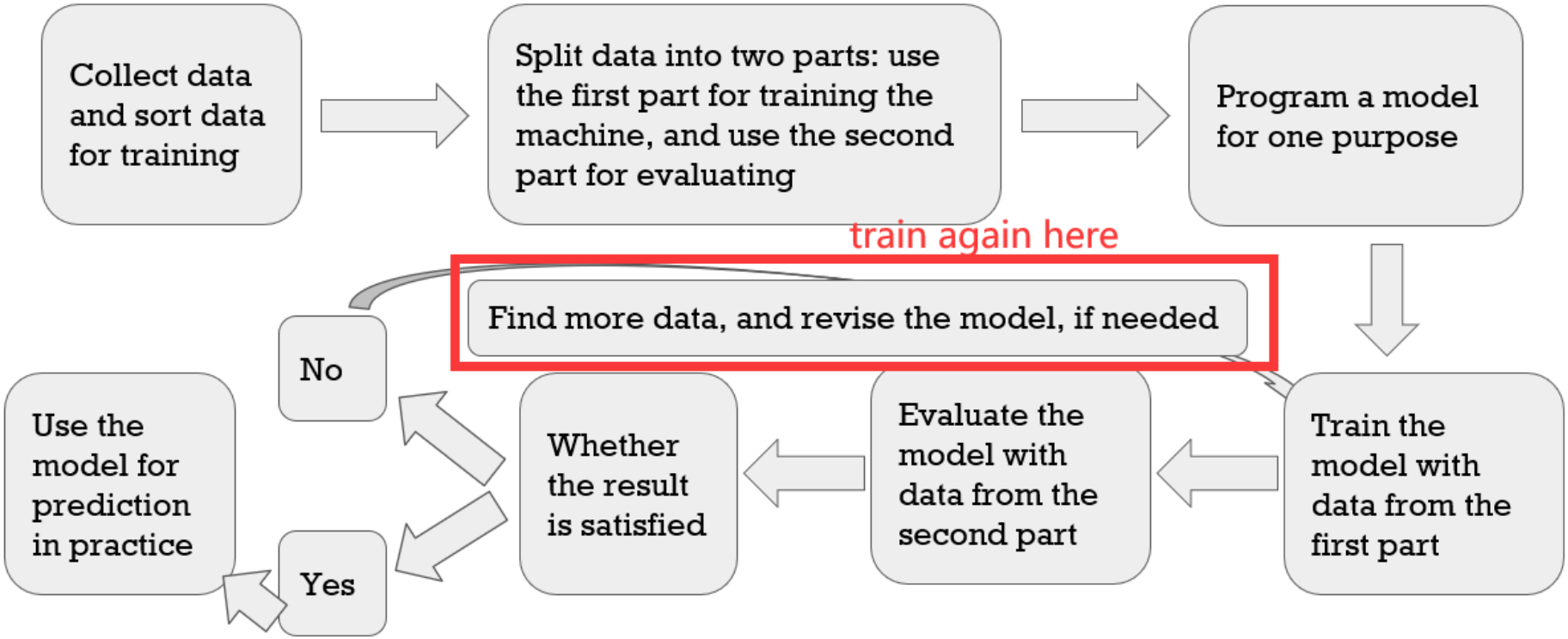
How to Train Machines to Learn

Take “Google Teachable Machine” as an example. Think about the following questions:

1. From the first-three test pictures, could you say how the machine successfully recognize them (could you generalize the steps of training machines to learn)?

2. For the last test picture, could you say why the recognitive rate of the last test picture is unstable (combined with your manual recognition)?

Process of Training Machines to Learn



How to Train Machines to Learn

From the example “Google Teachable Machine”, we can conclude:

1. With collected and sorted pictures (16 ones, 8 cats and 8 dogs) as inputs (tags + examples), the machine will be trained to “learn” new things.

2. However, in the stage of evaluating, the machine may not always give stable and correct answers under the given input. This phenomenon is called “data bias” and will be further discussed in the next section.

Compare Machine Learning and Human Learning

		human	machines
learn	① input -	definitions + examples	tags + samples
	② generalize -	common traits (elements) for similar things and different traits (elements) for different ones by human (machines)	
analyze – compare and contrast		extract traits (elements) of new examples (samples), and try to match them with constructed model stored in memories	
evaluate the ability		we use worked examples (samples) to test them, and see whether they can get satisfied results	

Let’s Break!
10 min

Application of M.L.

- Application of Machine Learning
  - Detailed Illustration with an Example
- Experience “Data Bias” from a Game
- What is Data Bias
  - Summary

Application of Machine Learning

Link: https://youtu.be/HKcO3-6TYr0

Application of Machine Learning

1. Virtual Personal Assistant (Google Assistant, Alexa)
2. Traffic Prediction
3. Social Media Personalization
4. Email spam filter
5. Online fraud detection
6. Stock market trading
7. Assistive medical technology

Detailed Illustration with an Example

Example: "**email spam filter**"
- difference between machine learning and traditional programs.

Traditional programs detect spam by checking an email against a fixed set of rules. For example:
· Did it come from known spammer domain/IP addresses?
· Does the email contain free, lottery, or gift several times?

In addition, as spammers change tactics, researchers need to continuously **update these rules**.

Detailed Illustration with an Example

By contrast, for developing the **machine learning**, researchers will:

· Prepare a data set: numerous emails labeled manually as spam or not-spam.
· Train and adjust models, also select the best one.
· During practical usage, apply the model to decide whether to keep an email in the inbox or in the spam folder.

If the user moves an email from inbox to spam or vice versa, add this feedback to the training data, and retrain the model to be up-to-date with the spam trends.

Train again with new input

Detailed Illustration with an Example

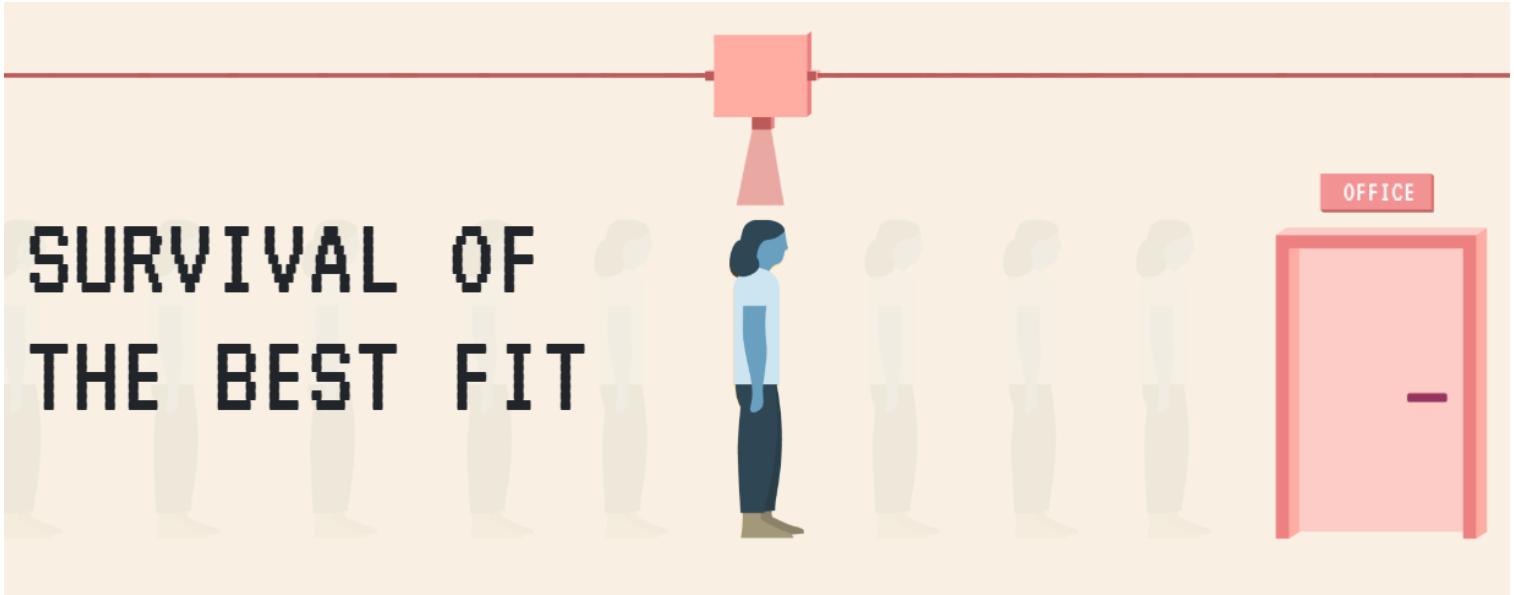
Traditional programs: deterministic
Models in machine learning: probabilistic.
Both may make mistakes.

After mistake:
Traditional program: update rules manually
Machine Learning program: directly learn from retrained data…

*This involves the phenomenon "data bias". Now we will talk about what brings about data bias, and how to improve it.

Experience “Data Bias” from a Game

Let’s start from a game - “Survival of the Best Fit”!



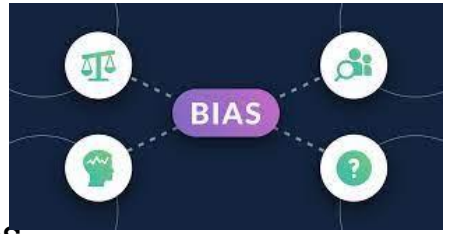
Link: https://www.survivalofthebestfit.com/

Experience “Data Bias” from a Game

1. According to instructions, choose candidates’ CV you prefer.
2. Machine will then automatically choose candidates’ CV and give the experimental results.
3. Analyze the results and reflect why these happened.

(Tips: Recall the process of data being collected in this game, and recall the process of machine learning from data, which we have discussed)

Why does progress of machine learning cause “data bias”?



Possible factors:

1. The amount of training data is not large enough and causes relatively large randomness.

2. The training data source may be different from evaluating data source, which respectively belongs to different sorts.

3. The algorithm of the model is not perfect -- it focus on some extra elements which are nontrivial for filtering CV.

……

Experience “Data Bias” from a Game

With the experience of this game, let’s think about the following questions:

1. Could you generalize why the machine may operate as unexpected? (what is data bias?)

2. Could you say what can we do to maximize the accuracy (to reduce data bias)?

If you feel not easy to answer these questions, don’t worry. Let’s watch the following video and try to find answers.

What is Data Bias

Link: https://youtu.be/x2mRoFNm22g

What is Data Bias

Concepts:

Two ways of collecting data:

1. The devices directly collect from your daily use.
2. The devices ask you for help to recognize what are the objects.

Biased data favors some things, and de-prioritizes or excludes others, depending on when, where, and how training data is collected, and who collected them.

What is Data Bias

By learning from biased data, computers may make biased predictions, whether the people training the computer are aware of it.

E.g., for the training data of A.I. diagnostic model, if X-ray data is only collected from one gender, then the computer's predictions may only work for that gender.

Now we have found the answer to the first question. What about the second question?

1. Could you generalize why the machine may operate as unexpected? (what is data bias?)

2. Could you say what can we do to maximize the accuracy (to reduce data bias)?

What is Data Bias

1. The amount of training data is not large enough and causes relatively large randomness.

2. The training data source may be different from evaluating data source, which respectively belongs to different sorts.

3. The algorithm of the model is not perfect -- it focus on some extra elements which are nontrivial for filtering CV.

Ways to reduce data bias:

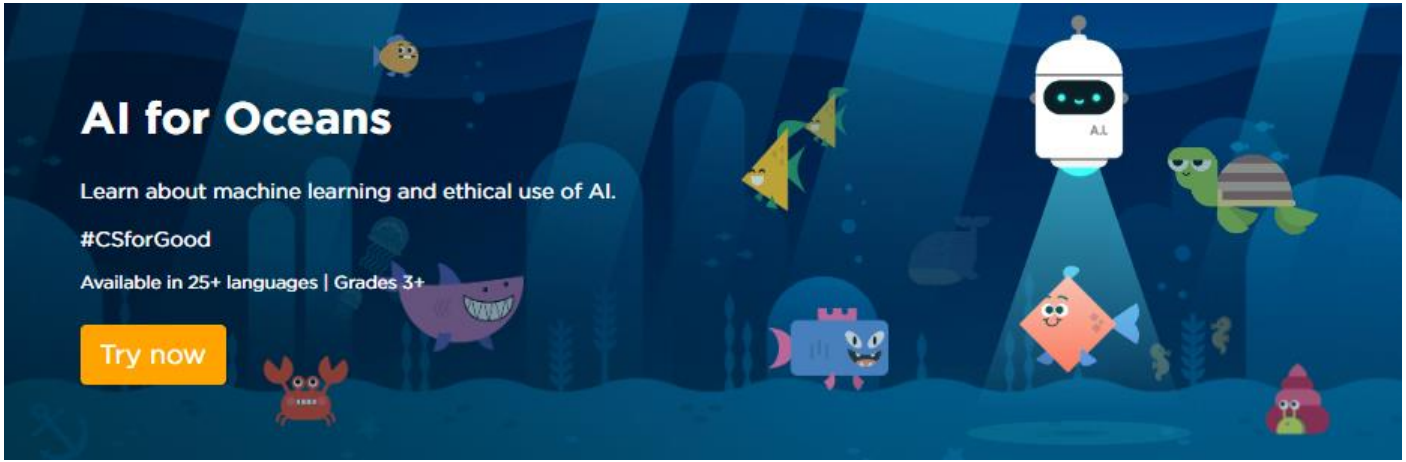
1. Training data should come from reliable sources without intentional bias, and its amount should be large enough to represent scenarios as various as possible.

2. In practice, the data is not all traceable and its amount is not unlimited, and no machine is perfect. We need to make sure sources of training and evaluating data are the same if we lack other sorts of data, to ensure working environment in usage and training stages are similar.

3. We may also tune the algorithm of the model to manually "help" machine correct bias if the existed data able to use includes flaws which are not easy to remove.

Optional Resource

Link: https://code.org/oceans



Thank you for listening!