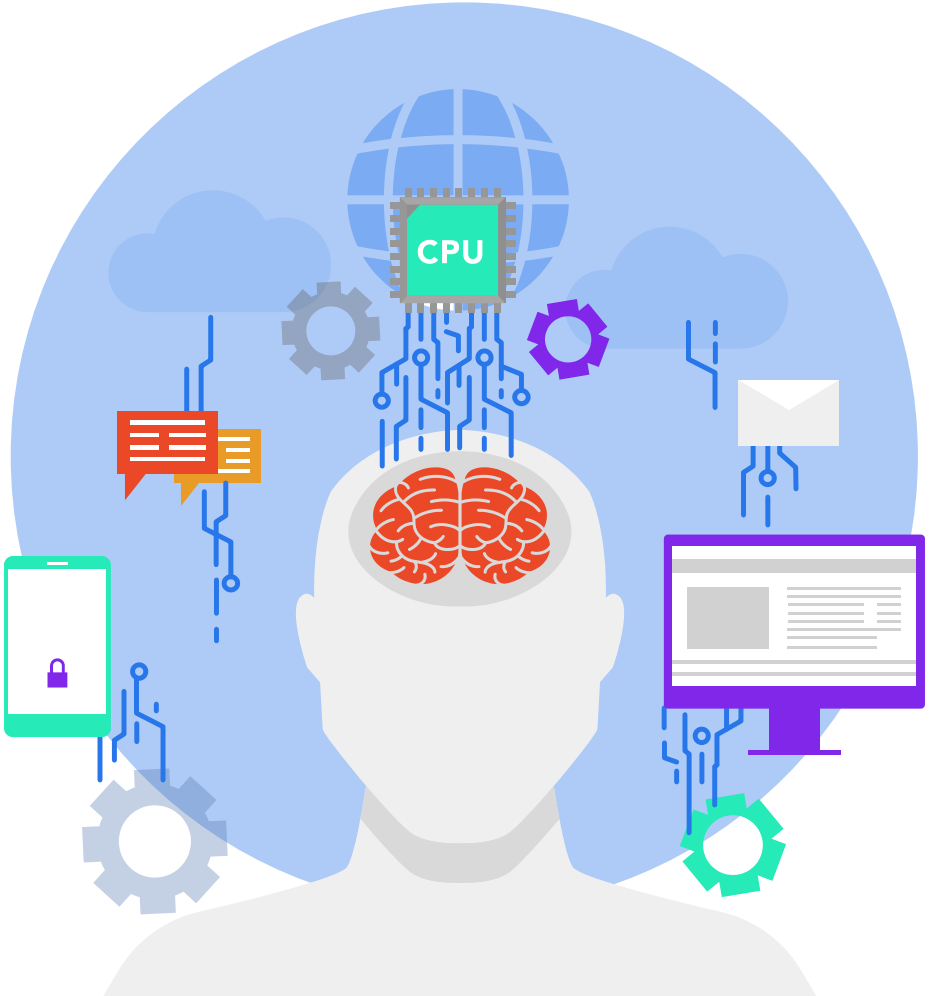
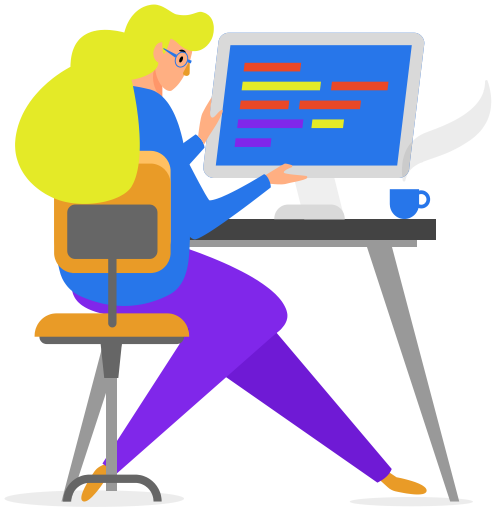


Day 2

Object Recognition, Trig. Functions, and Else...

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

What Will We Do Today?



1. Revision on M.L.
2. Object Recognition

10-min Break

3. Ethical Issues of A.I.
4. A.I. for Social Goods

10-min Break

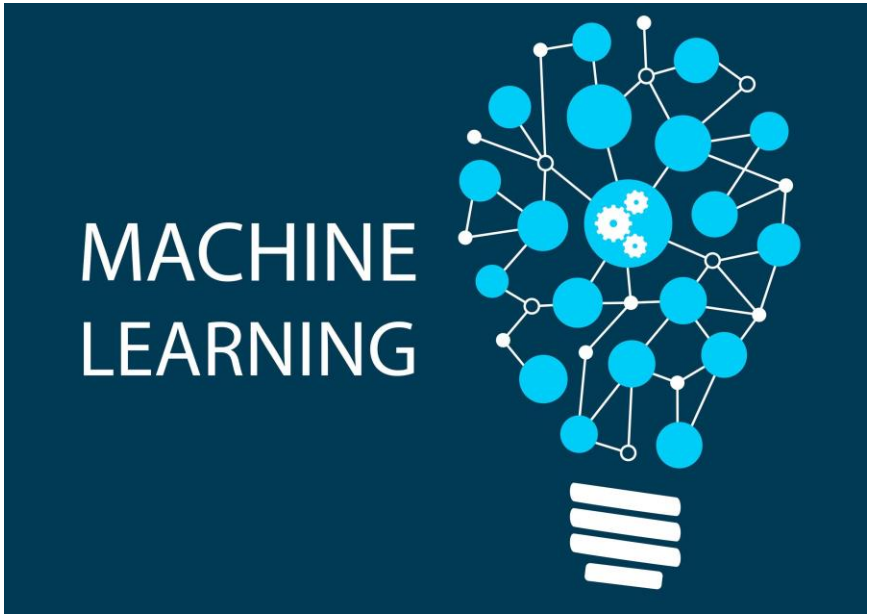
5. Introduction to Presentation
6. Basic Trig. Functions

Revision on M.L.

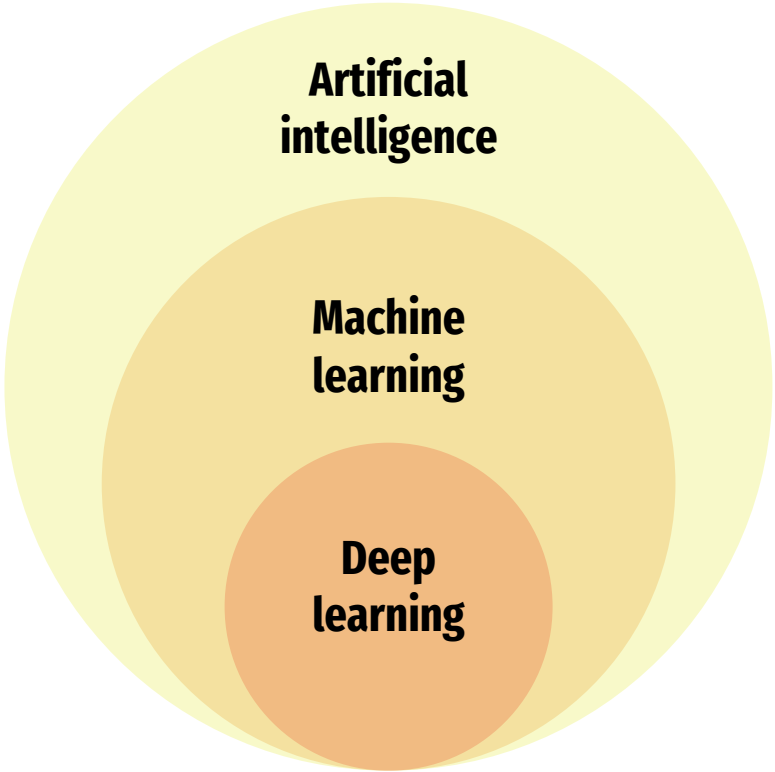
- Relative Concepts and Process of Training Machines to Learn
- Compare Machine Learning
  - and Human Learning
  - and Traditional Programs
- Data Bias

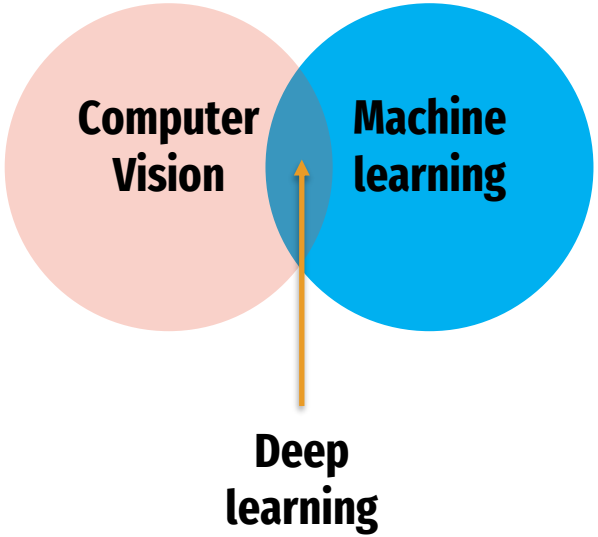
Machine Learning

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

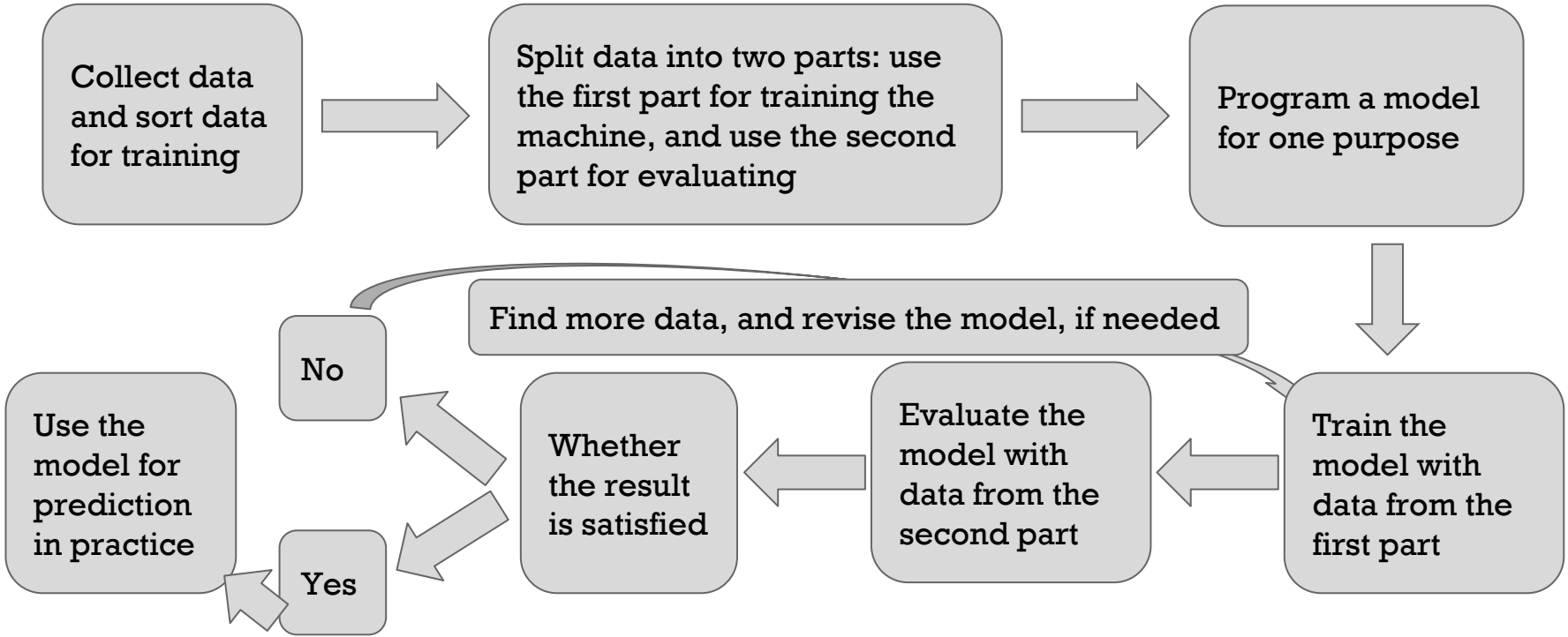


Compare Concepts





Process of Training Machines to Learn

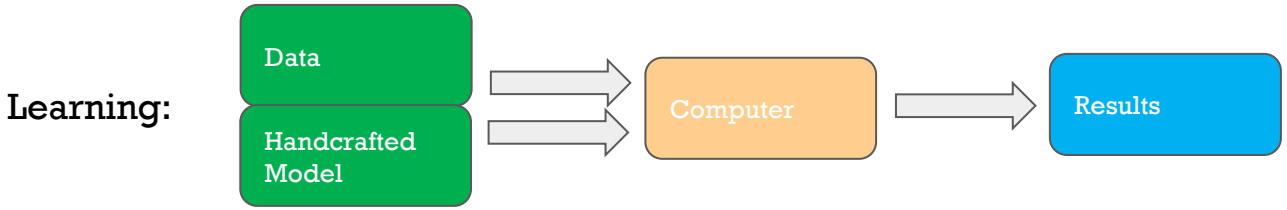


Compare Machine Learning and Human Learning

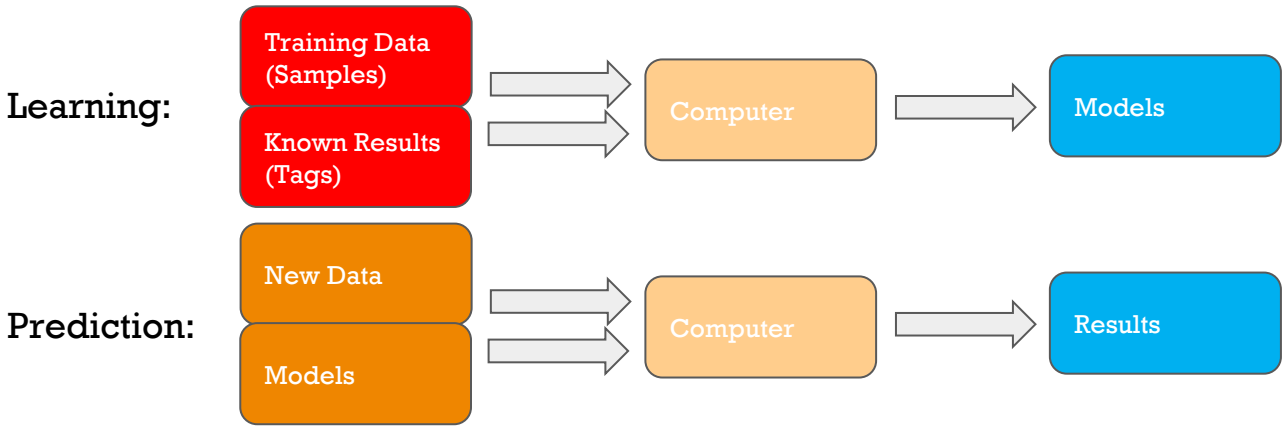
		human	machines
learn	① input -	definitions + examples	tags + samples
	② generalize -	common traits (elements) for similar things and different traits (elements) for different ones by human (machines)	
analyze – compare and contrast		extract traits (elements) of new examples (samples), and try to match 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	

Compare Machine Learning and Traditional Programs

Traditional Programs:



Machines Learning:



Compare Machine Learning and Traditional Programs

The core difference:
Unlike those of traditional programs, the models of machine learning are not constructed by human calculation; Instead, they are obtained by computer programming.

Main advantages of machine learning:

1. Researchers do not need to develop a specific model for each real problem.
2. With changing data in real world, the models can be quickly adjusted to adapt the change.

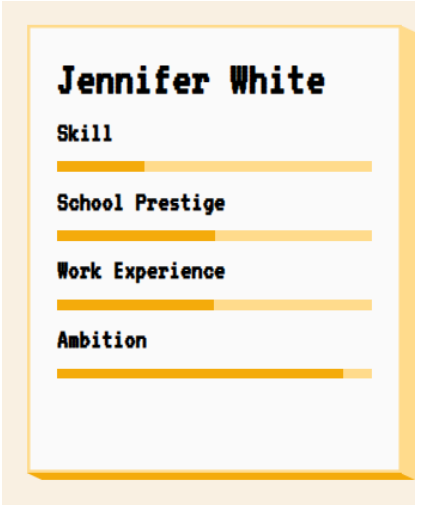
However, there are also requirements:
(1) The training data should be large enough and various enough, and (2) new data should be related with training data. -- objective laws

Data Bias

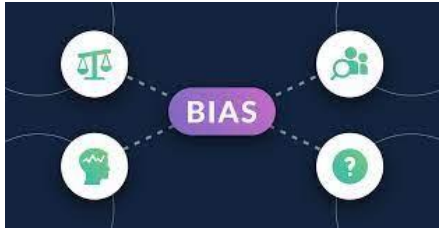
Models in traditional programs are deterministic, but models in machine learning are probabilistic. Nonetheless, both need to face rapid changes in real world, and both may make data bias.

Data bias favors some things or excludes others, depending on when, where, and how training data is collected, and who collected them.

After data bias happens, models in traditional program will require constant manual effort in updating the rules, while models in machine learning will directly learn from new data when retrained.



Data Bias



Ways to reduce data bias:

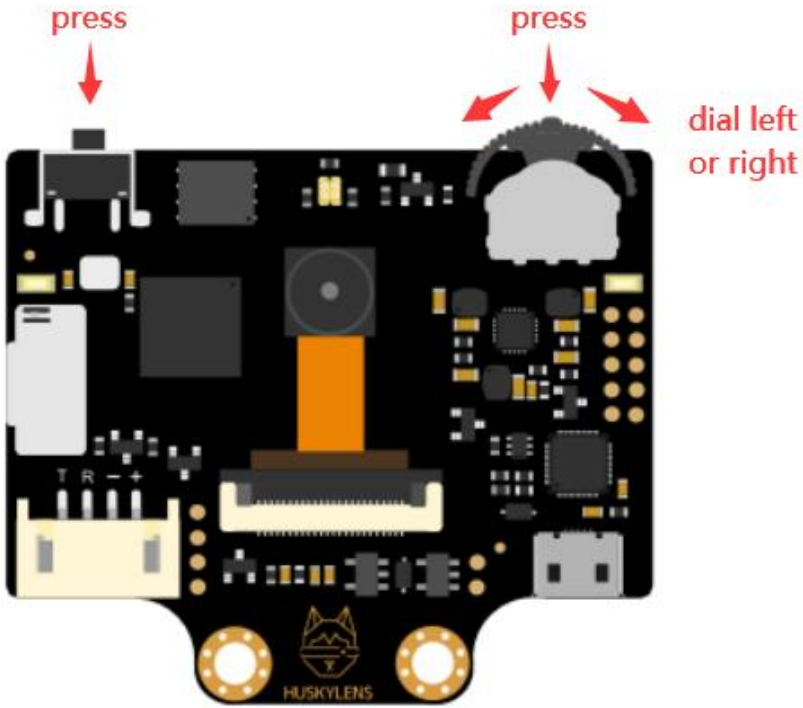
1. Training data should come from reliable sources without intentional bias, and its amount should be large enough to represent scenarios as various as possible.

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.

Object Recognition

Overview of Huskylens



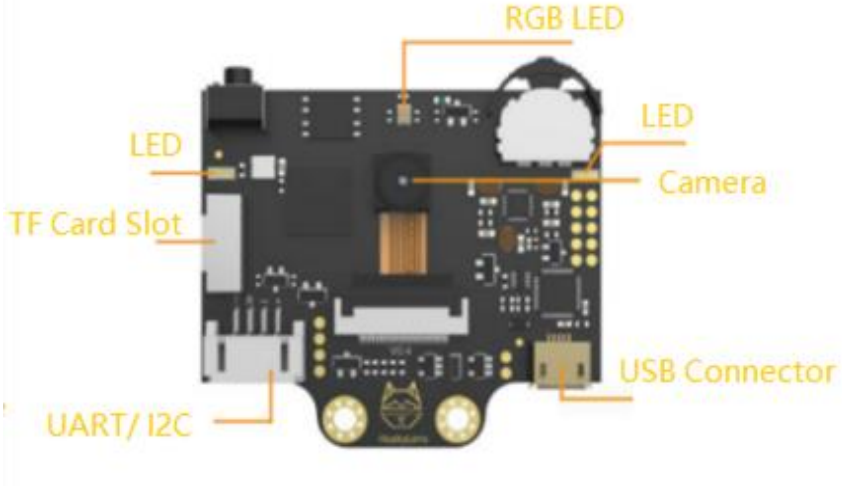
Overview of Huskylens

Function button

Dial the button to left/right to switch different functions

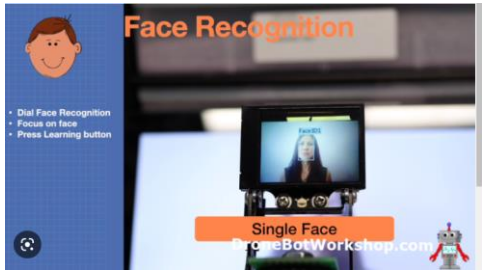
Learning button

Press to confirm



Functions of Huskylens

Face recognition



Object recognition

Color recognition

Object tracking

Line tracking

Tag recognition

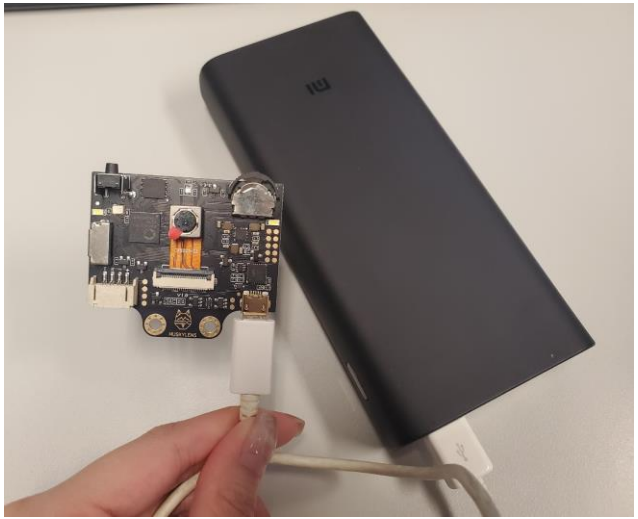
Functions of Huskylens

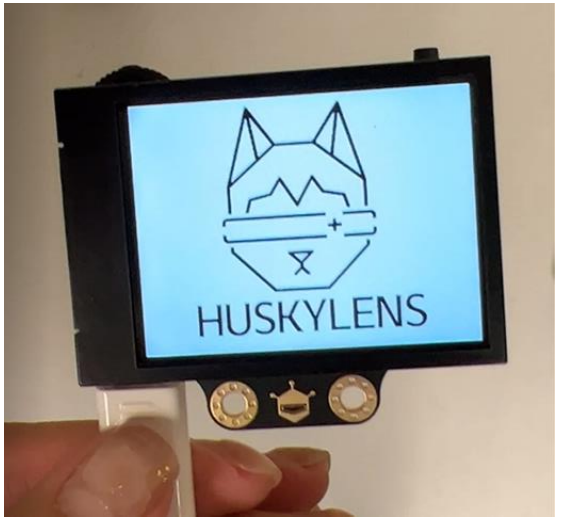
In the workshop, we will only focus on "object classification" function.

Need to train the data yourself for detection.

How to Train Huskylens to Learn

- Step 1: Connect Huskylens to a power bank using micro-USB cable

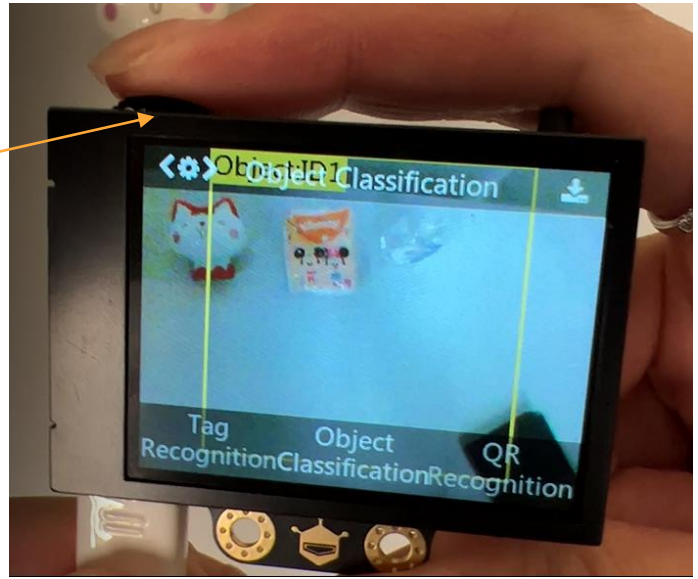




How to Train Huskylens to Learn

- Step 2: Dial the Function Button to the right to switch to “Object Classification” function

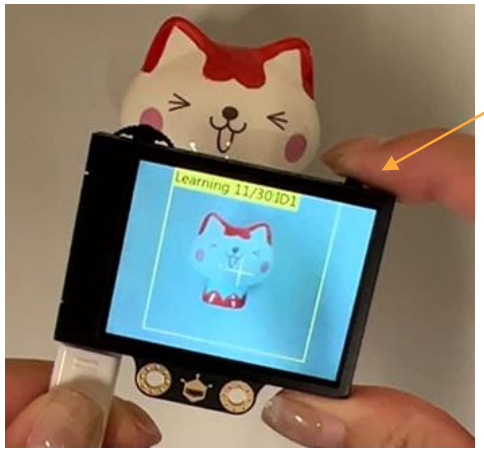
Function Button



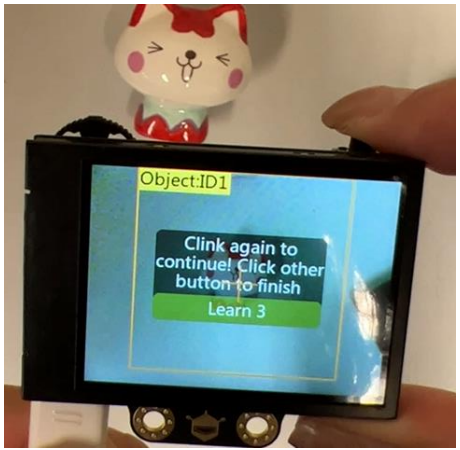
How to Train Huskylens to Learn

Step 3: Long press the Learning Button to capture the images of the object from different angles and distances

(Make sure the object falls within the yellow box on screen)

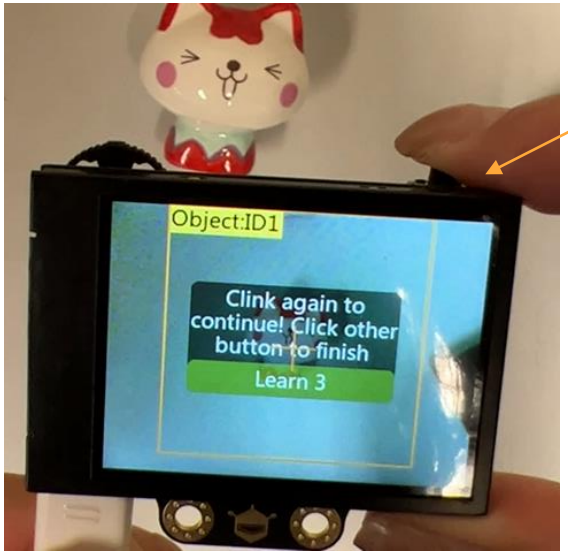


Learnin
g button



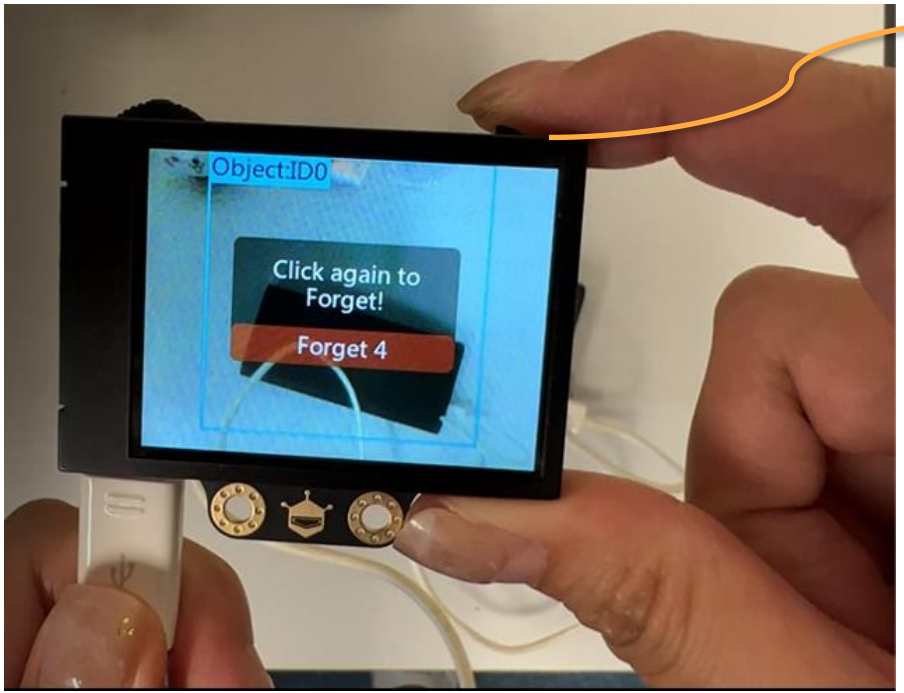
How to Train Huskylens to Learn

- Step 4: Short press the Learning Button again if you want to continue scanning other object(s)



Learning button

What if You Want to Erase the Training Data?



- Short press the Learning button to prompt the forget window
- Short press the Learning button again to make it forget

The whole set of data will ALL be erased!

You can't specify what to delete!

It’s your turn now!

- Find two object and use the Huskylens to scan.

Controller

- Connect Huskylens to open source controller

- Program it to flash LED light using Mind+

Let’s Break!
5 min

Ethical Issues of A.I.

One Example - The Trolley Problem

A galloping train runs on the track. On the way that the train is moving, **five** people are tied up on the track and unable to move. The train is going to run over them. Now, you stand next to a switch that can change the train to running on another track. If this switch is pulled, the train will be switched to another track, and on this way, **one stranger** are tied up on the track. Now, you have two options:

(1) Do nothing, and let the train run over those five people.

(2) Pull the switch down to change the train into another track, causing the train to run over **the stranger**.

What would you choose?

One Example - The Trolley Problem

A galloping train runs on the track. On the way that the train is moving, **five** people are tied up on the track and unable to move. The train is going to run over them. Now, you stand next to a switch that can change the train to running on another track. If this switch is pulled, the train will be switched to another track, and on this way, **one of your friends** is tied up on the track. Now, you have two options:

(1) Do nothing, and let the train run over those five people.

(2) Pull the switch down to change the train into another track, causing the train to run over **your friend**.

What would you choose?

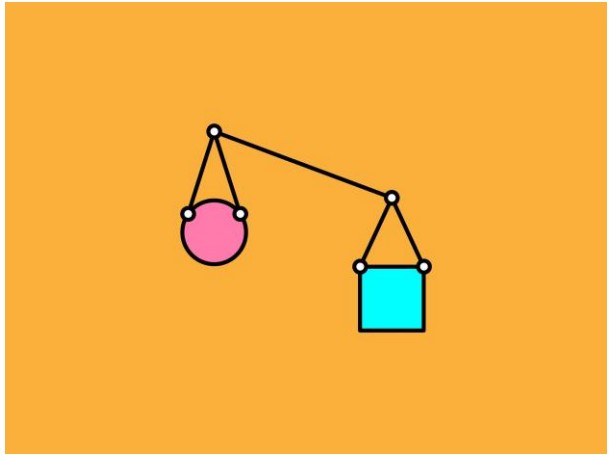
One Example - The Trolley Problem

Link:
https://www.youtube.com/watch?v=yg16u_bzjPE

Decision-Making about Ethical Issues

What is ethical issues of A.I.?

A set of guidelines that advise on the design and outcomes of artificial intelligence. (IBM)



Decision-Making about Ethical Issues

After watching the video, think about these three questions:

(1) What factors may lead you to choosing you option?

(2) What factors may lead A.I.to choosing its option?

(3) What are differences between decision-making processes on such problems from you and A.I.?

Decision-Making about Ethical Issues

(1) What factors may lead you to choosing you option?

To minimize the number of casualties

To save the vulnerable (e.g., the old and children)

To save those having closed relationship with you

……

(2) What factors may lead A.I.to choosing its option?

Researchers collected existed decision samples from human and then trained A.I.. Thus, A.I. makes decision by learning from large amount of various inputted data and analyzing how the majority react when facing different scenarios. This means A.I. will make decision as closely as the majority.

Decision-Making about Ethical Issues

(3) What are differences between decision-making processes on such problems from you and A.I.?

Human consider problems not only based on the logics, but also based on the ethics (e.g., intuitive judgements, personal emotions, and moral restrictions).

By contrast, A.I. analyzes problems only based on the logics -- the program written in it, and A.I. will not feel guilty on any emotional or moral problems.

Decision-Making about Ethical Issues

Now, lets' think about three more questions:

(1) After such accidents happen, who should take charges of the responsibility? (Who is the responsible subjects?)

(2) When facing totally new accidents (different scenarios from the past), how will A.I. make decisions?

(3) Should A.I. be used to make decisions about ethical issues?

Decision-Making about Ethical Issues

(1) After such accidents happen, who should take charges of the responsibility? (Who is the responsible subjects?)

A.I. ?

Researchers / Programmers ?

(Individuals)

Company / Manufacturer ?

(Organization)

You ?

(Users)

This question does not have a standard answer.

Decision-Making about Ethical Issues

(2) When facing totally new accidents (different scenarios from the past), how will A.I. make decisions?

A.I. will make decisions based on existed training data, and as a result, will not act similarly with the majority as usual.
Nonetheless, A.I. will still try to analyze problems and make decisions according to all inputted information, which is still based on the logics.

Decision-Making about Ethical Issues

(3) Should A.I. be used to make decisions about ethical issues?

Pro: A.I. now has learned enough data and can make decisions like human. Furthermore, A.I. is developing rapidly and may be able to treat new scenarios independently.

Con: The answer to the question of responsible subjects is still ambiguous. In addition, it is difficult to supervise and check whether there is any human-made interference from researchers / programmers or company / manufacturer inside the programmed codes, which may cause extra legal issues.

Another Example - Autonomous Vehicles

Recalling the video at the beginning of this section. It describe a case of an accident triggered by self-driving cars.

Think about this question: who should take charges of the responsibility? (Who is the responsible subjects?)

Another Example - Autonomous Vehicles

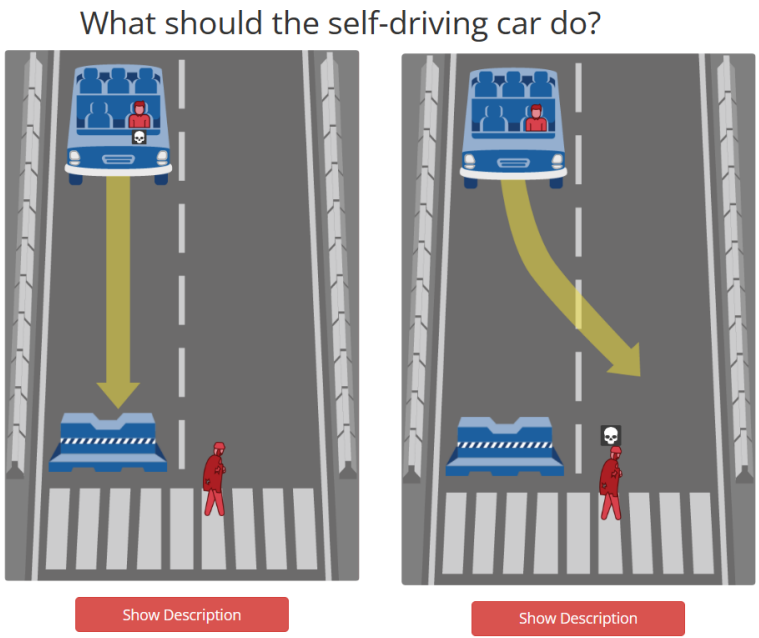
Nowadays, in some districts, self-driving-car projects has been schemed as experimental works on the street, and governments have passed laws on self-driving cars.

Up to now, relative laws claim that the responsible subjects can be more than one, the people sitting on the car (users) and developer / manufacturer (organization). This means both subjects need to share the whole responsibility on accidents (100%). For example, the police may affirm that users in the car take 20% responsibility and organization making the car take 80% responsibility.

Although laws in different districts may differ a little, but this information give you some updated reference on self-driving cars.

Another Example - Autonomous Vehicles

A simulative game: https://www.moralmachine.net/



A.I. for Social Goods (Presentation Topic)

AI application for Social Goods - PeopleLens

Link: https://www.microsoft.com/en-us/research/blog/peoplelens-using-ai-to-support-social-interaction-between-children-who-are-blind-and-their-peers/

AI application for Social Goods - PeopleLens

Read the whole article in the link. (about 4 minutes)

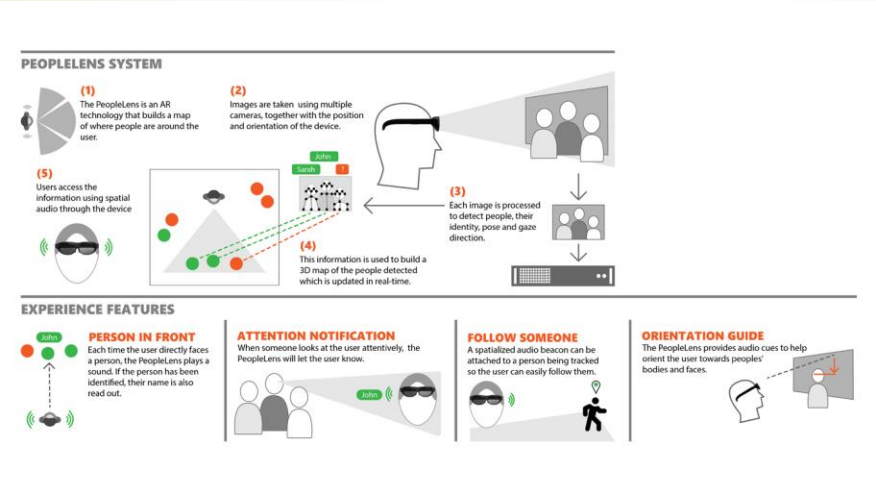
Think about the following question:

If your friends do not hear about PeopleLens and want to know about it, how to give them an introduction about PeopleLens through a presentation based on this article in the theme of A.I. for social goods?

Next, we will take this as an example to show you how to do a mini presentation.

PeopleLens (presentation example)

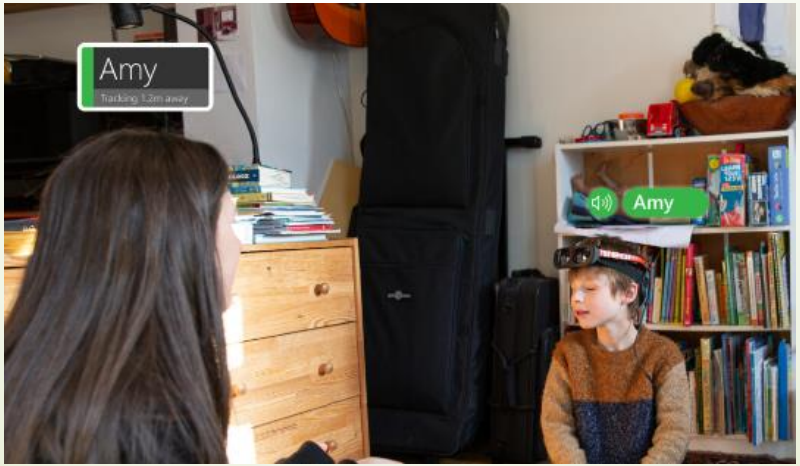
- an open-ended A.I. system helping blind people engage in social life



Presenters:
XXX XXX

What is PeopleLens?

- Head-worn device
- Achieve easier interaction between young blind people/learner and their peers
- Reads the known people's name aloud in **spatialized audio**(sound comes from the direction of the person)
- Assisting the learner to know position and distance of their peers.



How Does PeopleLens Work?

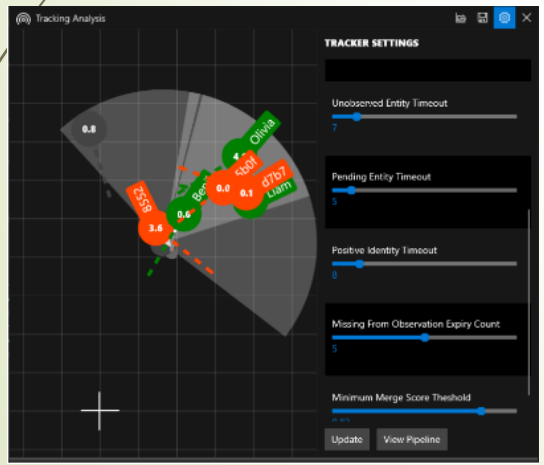
How does PeopleLens reminds the wearer?

- Combine 4 advanced algorithm to: **locate, identify, track, and capture** the gaze directions of people nearby.
- Present this information to the wearer **through sound**

How Does PeopleLens Work? (con't)

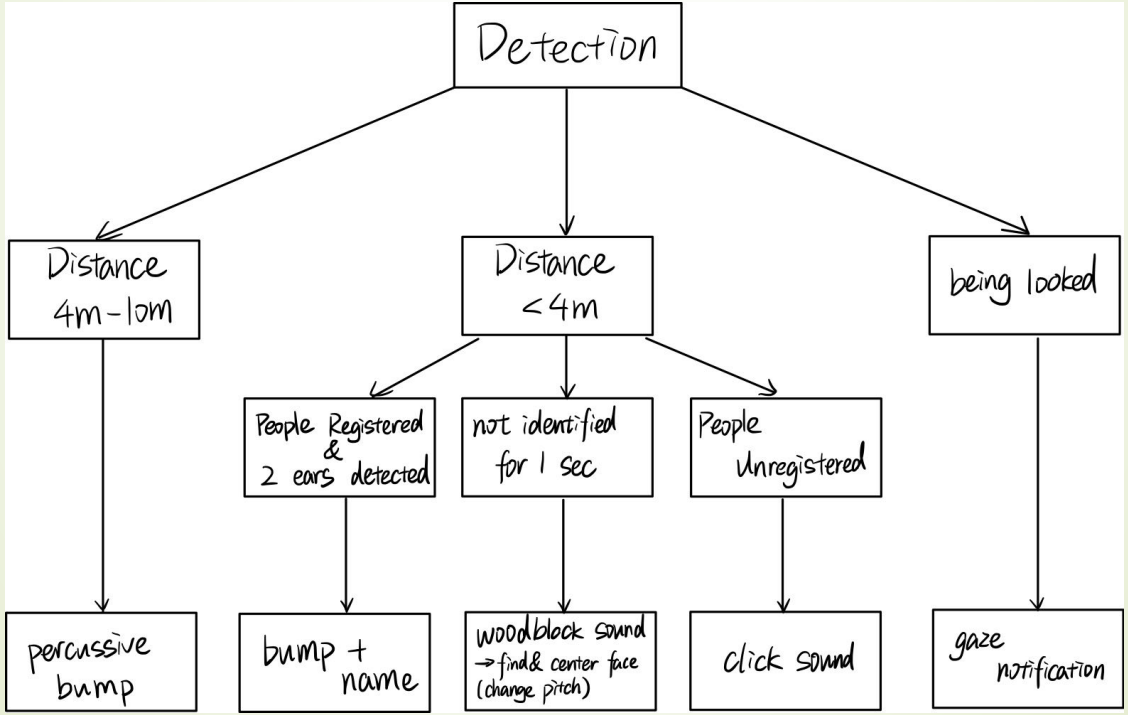
How does PeopleLens protect privacy?

- Take photos on a person's face
- Convert into a vector of numbers.
- Different vector from other systems
- No identifying information is captured by the system



How Does PeopleLens Work? (con't)

How does PeopleLens alert wearer know who is he watching?

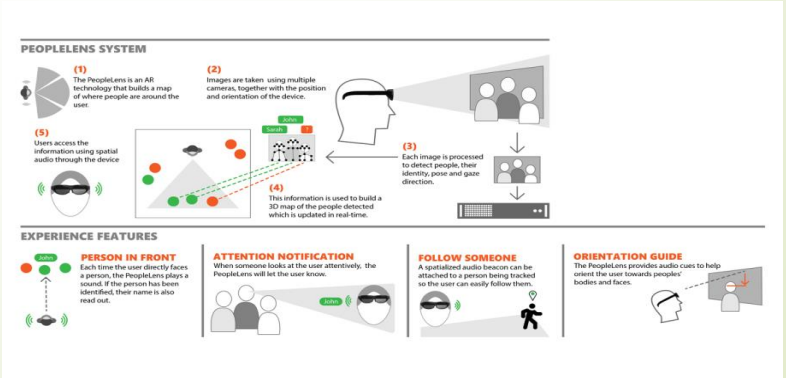


Why Does PeopleLens Make Us Better?

For learners(children and young people who are blind):
- build a social network/ find more friends
- effectively signal communicative intent

For learner's peer:
- know when the peers have been "seen" and can interact with
- replace the eye contact

For teachers and parents:
- learner develop competence and confidence in social interaction.



One Example for Social Goods - PeopleLens

The previous presentation (about 5 minutes) is an example presentation for your reference. You can try to conclude the process of delivering a presentation.

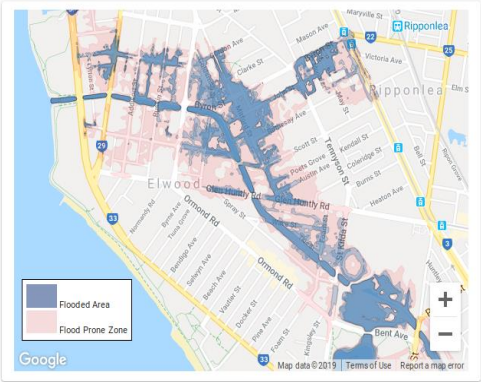
We will lead you to think about how to deliver a presentation in the next section.

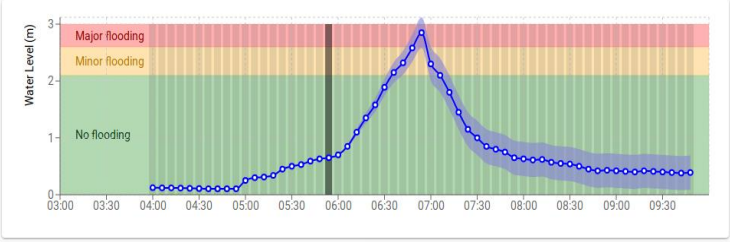
Before that, let’s finish our discussion about social goods!

Other Examples for Social Goods

Forecasting Floods

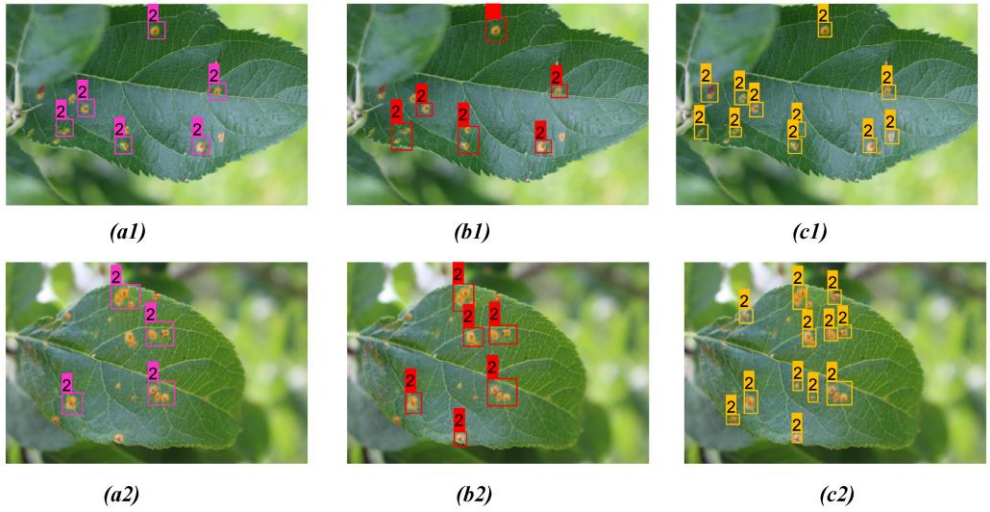
- Estimate magnitude of flooding based on river base
- Prevent damages...





Detect plant disease

- Prevent bacterial illnesses on plants
- stop reducing yield



Open Questions

In your perspective, what areas will possibly A.I. be used in the future, and how it will be used?

Do you know any literature works about A.I. being using in the future? (e.g., some science fictions or movies)? How does the “future pictures” be conceived and described in these literature works?

Let’s Break!
5 min

Introduction to Presentation

- Structure of a Presentation
- Presentation Information

Structure of a Presentation

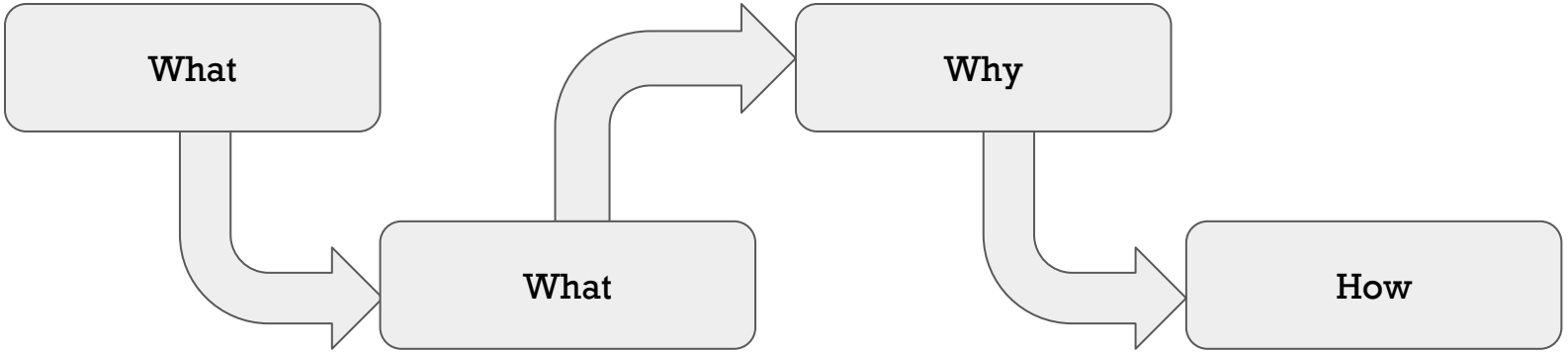
We have shown you how to deliver a presentation step by step with the example of PeopleLens.

Could you conclude the structure of this sample presentation?

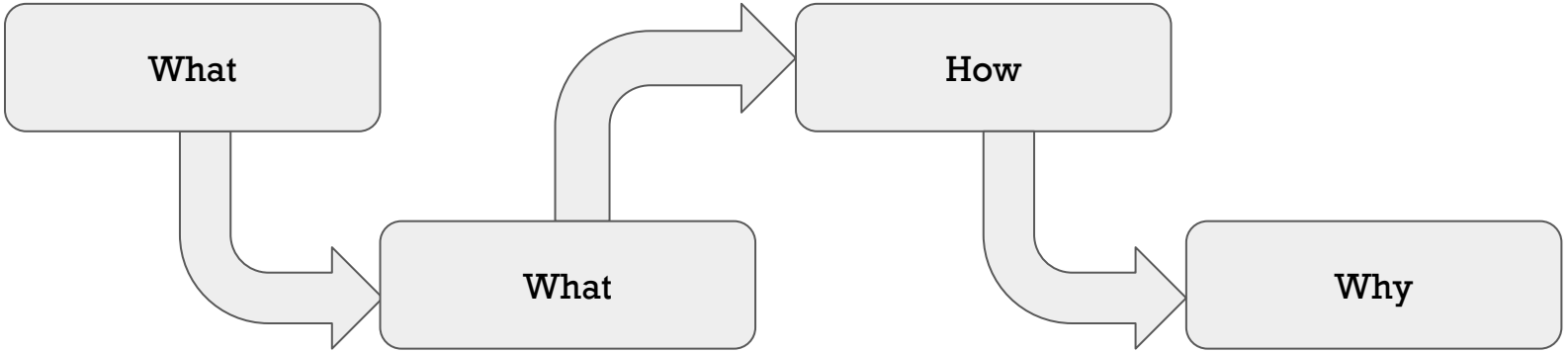
Did you hear any other ideas about the structure of delivering a presentation before?

Structure of a Presentation

Common structure:



It can also be:



Structure of a Presentation

Use "what-why-how" or "what-how-why" structure to describe things or analyze things in presentations, essays, or other formal occasions:

What:
What is the meaning of sth (definition: connotation + extension)?

Why:
Why does sth. work/happen (causes)?
Why is sth. good for sb. (pros)? / why is sth. bad to sb. (cons)?
Why is sth. significant (functions)? / why is sth. inadequate (flaws)?

How:
How can sth. be used for sb. (application)?
How does sb. take advantages of sth.? / how does sb. avoid disadvantages of sth.?
How does sb. learn from sth.? / how does sb. make improvement for sth.?

Presentation Information

Recall that we introduced the overview of two parts of competition in Day 1 workshop. Now let's focus on Part II "Future Developer for A.I. Application". The following information is extracted from the competition rules:

Present an original and creative idea on how A.I. object recognition and drone can be applied for social goods in daily life and make a positive impact to the community.

You can incorporate the use of other technologies into your innovative design

Presentation duration: 3-5 minutes

Presentation material: max. 5 slides

Presentation will be recorded via Zoom

Presentation in Round III

Presentation Information

Key words: “A.I. for social goods”

Link: https://www.microsoft.com/en-us/ai/ai-for-good

Time (recommended): 4-5 minutes

PPT (recommended): 4-5 slides

Structure (recommended): what-how-why

Cover (1): Title, picture, presenter names, (and any other words if needed).

What (1): What is it? What is its connection with object recognition and drone?

How (1-2): How can it be applied for social goods in daily life?

Why (1): Why does it make a positive impact to the community?

Presentation Information

Presentation Criteria:

(1) Originality and Creativity

(2) Adherence to the theme

(3) Presentation Clarity

Criteria	Description	Marks
(1) Originality and Creativity	Show imagination and originality, able to give audience surprises	30
(2) Adherence to the Theme	Highly correlates to the theme "A.I. for social good" and demonstrate impact to the community	30
(3) Presentation Clarity	Well-structured, speaks confidently, materials are clear with good use of visual aids	20

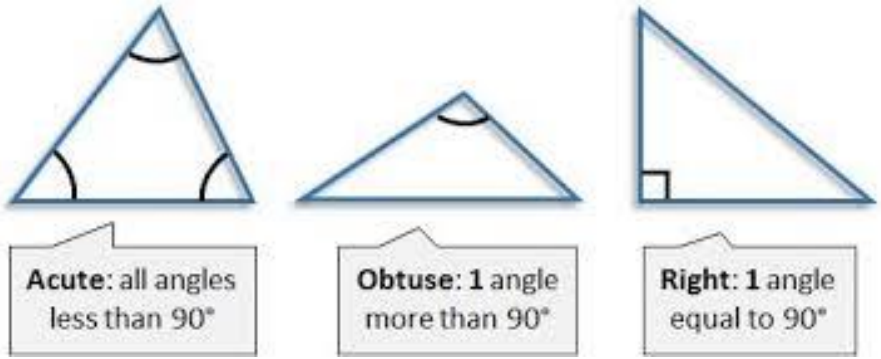
Basic Trigonometric Functions

Basic information about triangle (optional if they know)

Acute angle: less than 90°

Obtuse angle: more than 90°

Right angle: equal to 90°



Acute triangle: all angles are less than 90°

Obtuse triangle: one angle is more than 90°

Right triangle: one angle is equal to 90°

Important rule in triangle: sum of all angles = 180°.

Right triangle: one angle = 90°, sum of another two angle = 90°

know degree of one acute angle → degree of left one acute angle

Otherwise(acute/obtuse triangle):

know degrees of two angles → degree of left one angle

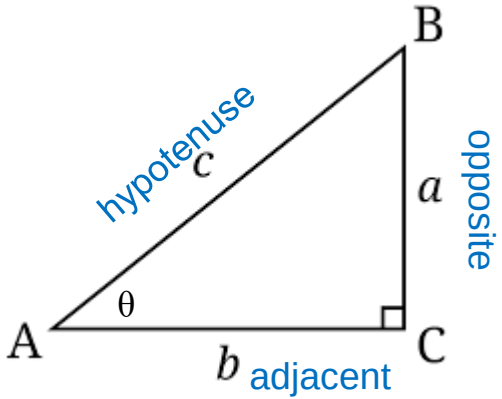
Basic information about triangle

In a right triangle, we specially define:

The right triangle: ∠C

∠C opposite side: c or AB hypotenuse

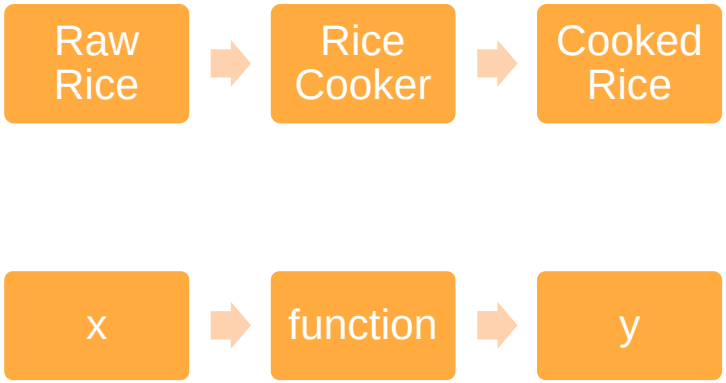
Note: hypotenuse can only be used in right triangles



Why should we study right triangles? Because trigonometric functions are defined with concepts of right triangles. What is the trigonometric function? Before studying this, let's talk about what is the function.

What is Functions?

An analogy with usual things:



If we replace raw rice as input “x”, replace cooked rice as output “y”, then the rice cooker is a “function”.

What is Functions?

Definition of the function:

an expression or a rule that defines a relationship between two variable (input/independent variable and output/dependent variable).

Example:

x is input / independent variable,

y is output / dependent variable

$y = 2x$ is a function between y and x.

Similarly, $y = \frac{3}{2}x$ $y = \frac{3}{2}x + 5$ $y = x^2$ $y = x^2 - 5$ $y = x^3$ $y = x^3 - 5$

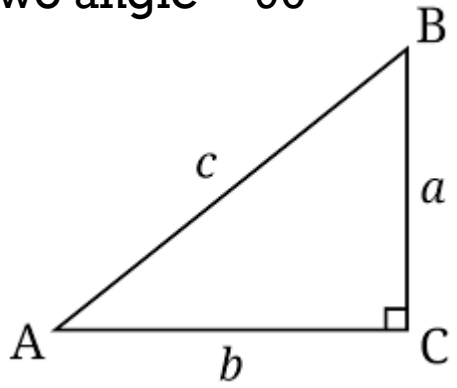
$y = x^{\frac{3}{2}}$ $y = x^{\frac{3}{2}} + 5$ $y = 6x^{\frac{3}{2}} + 10$, these are all functions.

Functions about triangle

In mathematics, there are many kinds of function, but in this workshop, we only focus on trigonometric functions.

Trigonometric functions represent the relationship between three sides and three angles in a right triangle.

Right triangle: one angle = 90°, sum of another two angle = 90°
know degree of one acute angle
→ degree of left one acute angle
→ All of three angles will be determined.
→ Shape of the triangle is fixed.
→ The ratio of three sides is also determined.

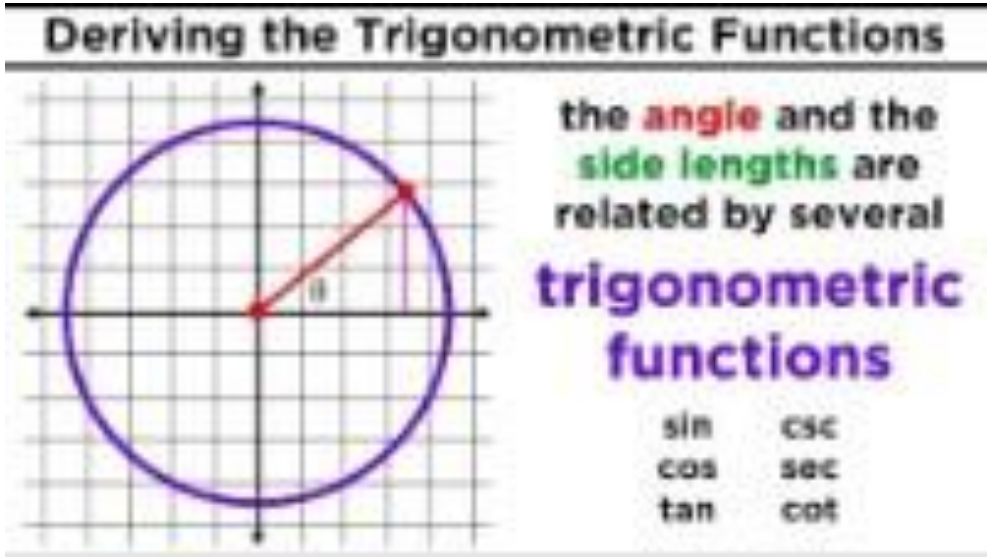


So, inversely we can know angle using two sides because it is triangle

Trigonometry Calculator:

https://www.omnicalculator.com/math/trigonometry

Optional Video for trigonometric function

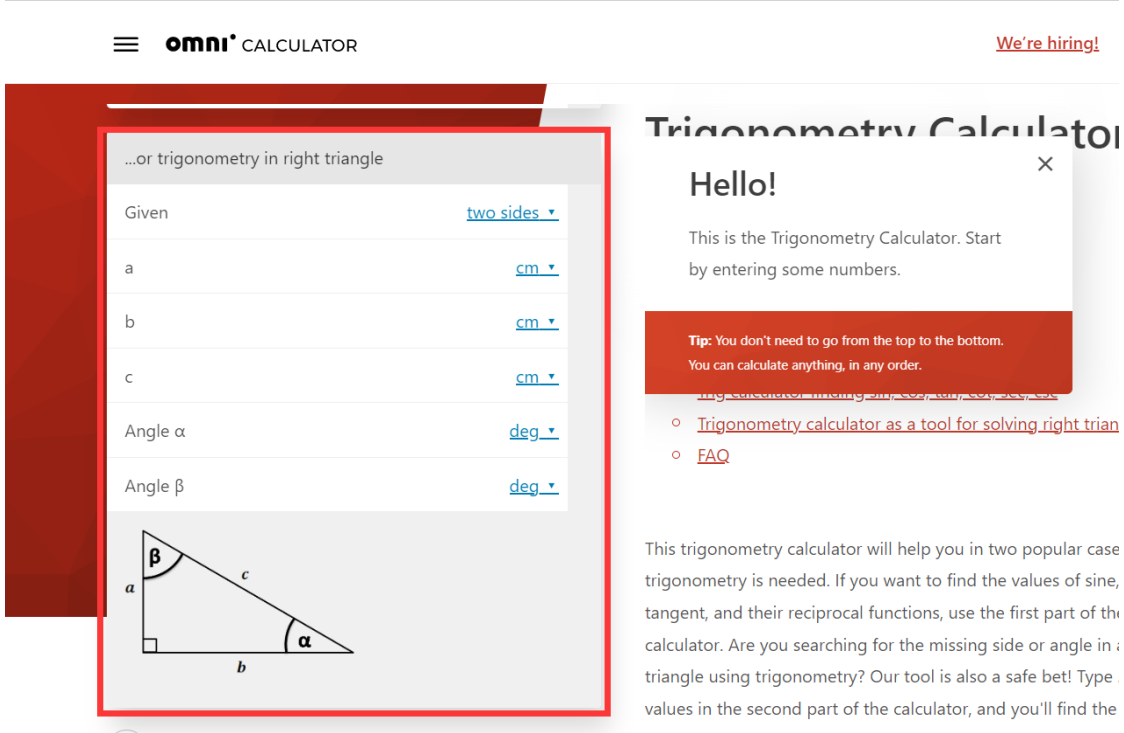


Link: https://www.youtube.com/watch?v=cqIZue-plBI

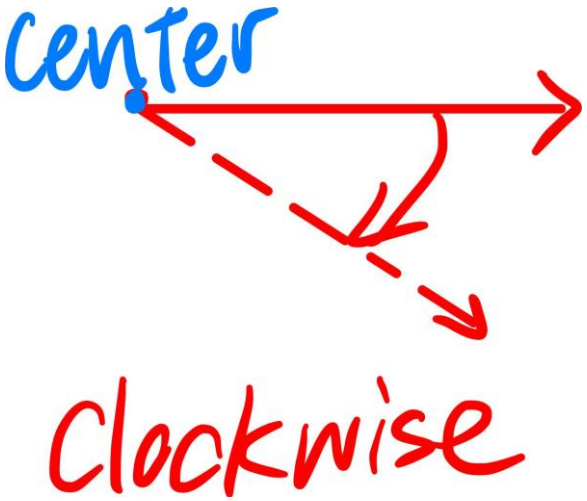
How to Calculate right triangles' degree?

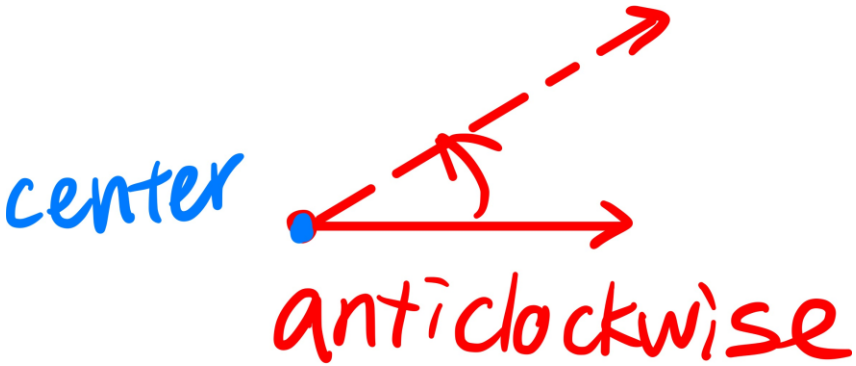
know the ratio of two sides → get degree of an angle

Side Length & Angle Calculator: https://www.omnicalculator.com/math/trigonometry

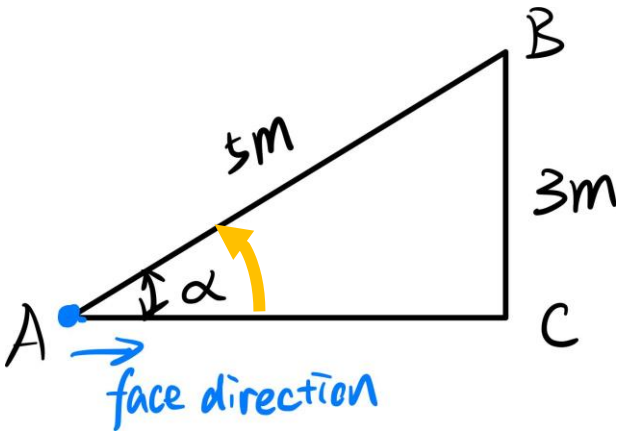


Drone's Rotating Direction





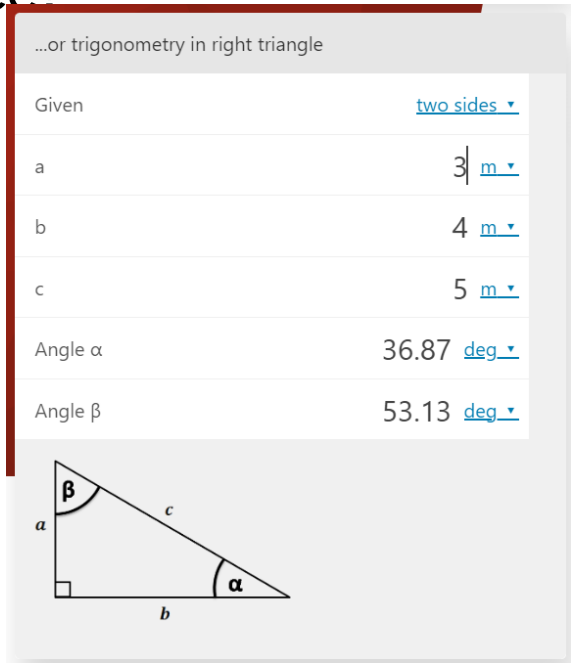
Calculation example



Given AB = 5m and BC = 3m. Drone is on the point A, and face to C. How does drone fly from A to B?

1. Rotate clockwise or anti-clockwise?
2. Rotate in how many degree?
3. Fly how many meters?

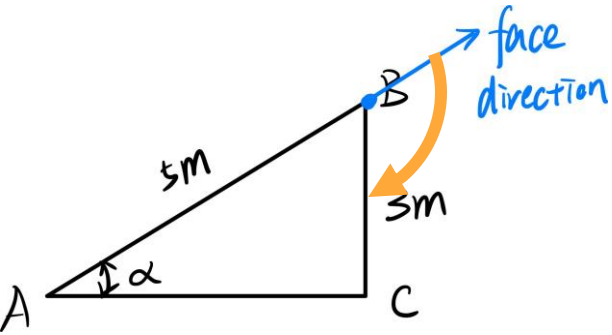
Rotate anti-clockwise
Rotate 36.87°(angle α in calculator in the picture)
Fly 5 meters



Trigonometry Calculator:

https://www.omnicalculator.com/math/trigonometry

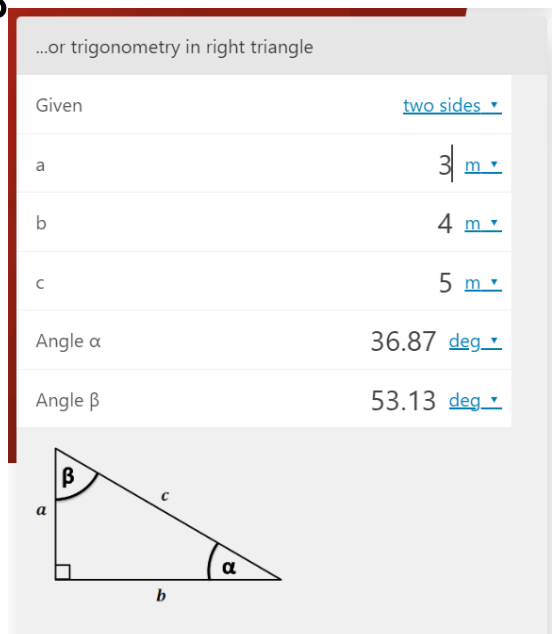
Calculation example



Given AB = 5m and BC = 3m. Drone is on the point B, and face to the original flying direction. How does drone fly from B to C?

1. Rotate clockwise or anti-clockwise?
2. Rotate in how many degree?
3. Fly how many meters?

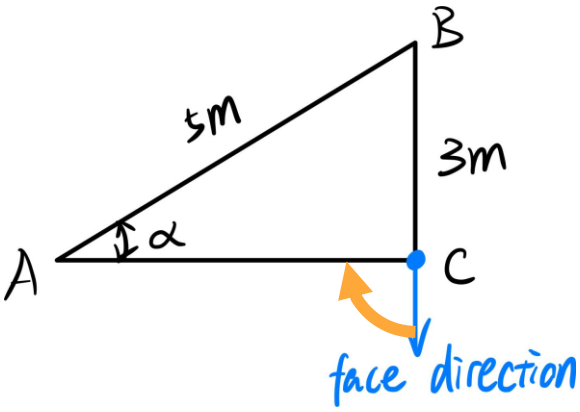
Rotate clockwise
Rotate 126.87°
180° – 53.13°(angle β in calculator) = 126.87°
Fly 3 meters



Trigonometry Calculator:

https://www.omnicalculator.com/math/trigonometry

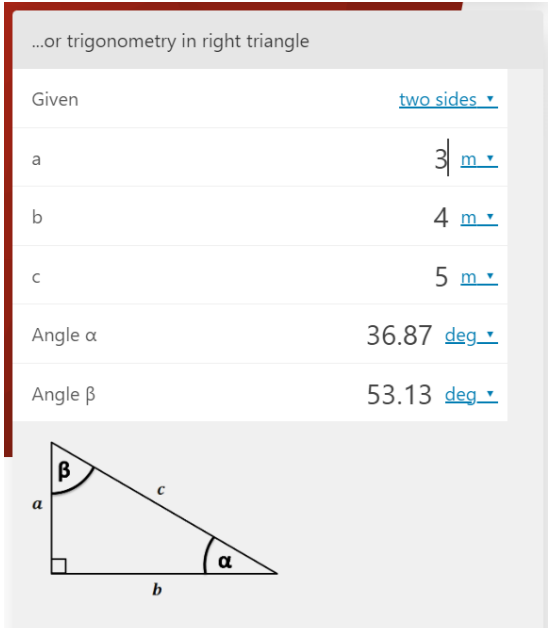
Calculation example



Given AB = 5m and BC = 3m. Drone is on the point C, and drone is face to the original flying direction. How does drone fly from C to A?

1. Rotate clockwise or anti-clockwise?
2. Rotate in how many degree?
3. Fly how many meters?

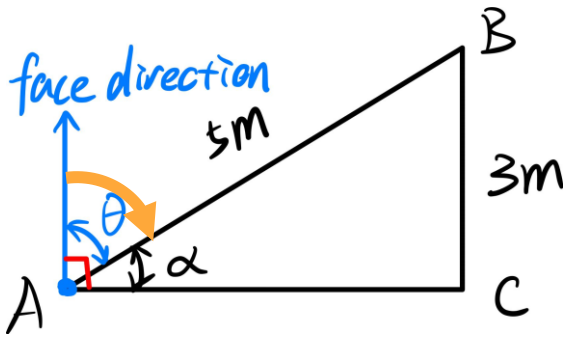
Rotate clockwise
Rotate 90°
180° – 90° = 90°
Fly 4 meters (length of b in calculator)



Trigonometry Calculator:

https://www.omnicalculator.com/math/trigonometry

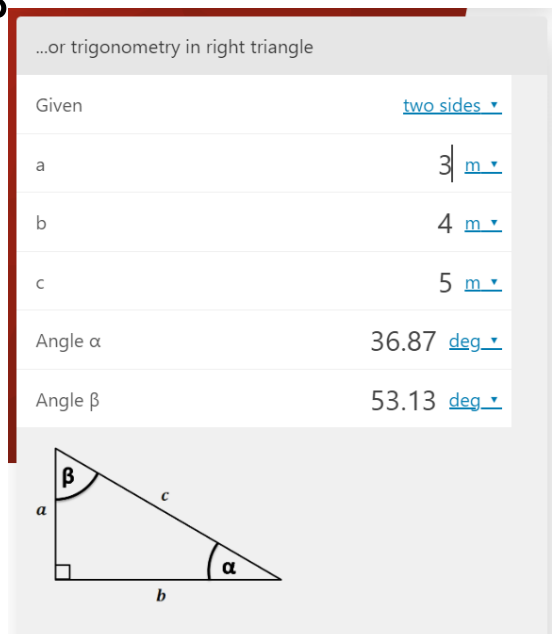
Calculation example



Given AB = 5m and BC = 3m. Drone is on the point B, and drone's direction is now parallel to BC and shown in picture. How does drone fly from A to B?

1. Rotate clockwise or anti-clockwise?
2. Rotate in how many degree?
3. Fly how many meters?

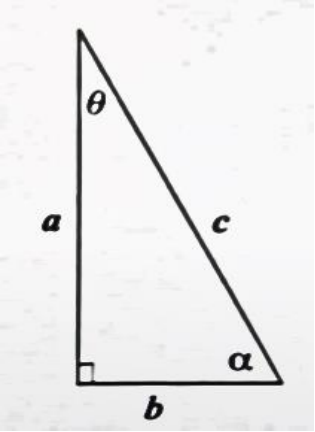
Rotate clockwise
Rotate 53.13°
90° – 36.87°(angle α in calculator) = 53.13°
Fly 5 meters (length of AB)



Trigonometry Calculator:

https://www.omnicalculator.com/math/trigonometry

Calculation Practice



Given a = 48m and b = 36m.

Could you find the trigonometric function values of angle α and θ?

Give answer in digital form using trigonometry calculator below.

i. Degree of θ =36.87° (angle α in calculator)

ii. Degree of α =53.13° (angle β in calculator)

iii. Length of c = 60m (side c in calculator)

Trigonometry Calculator:

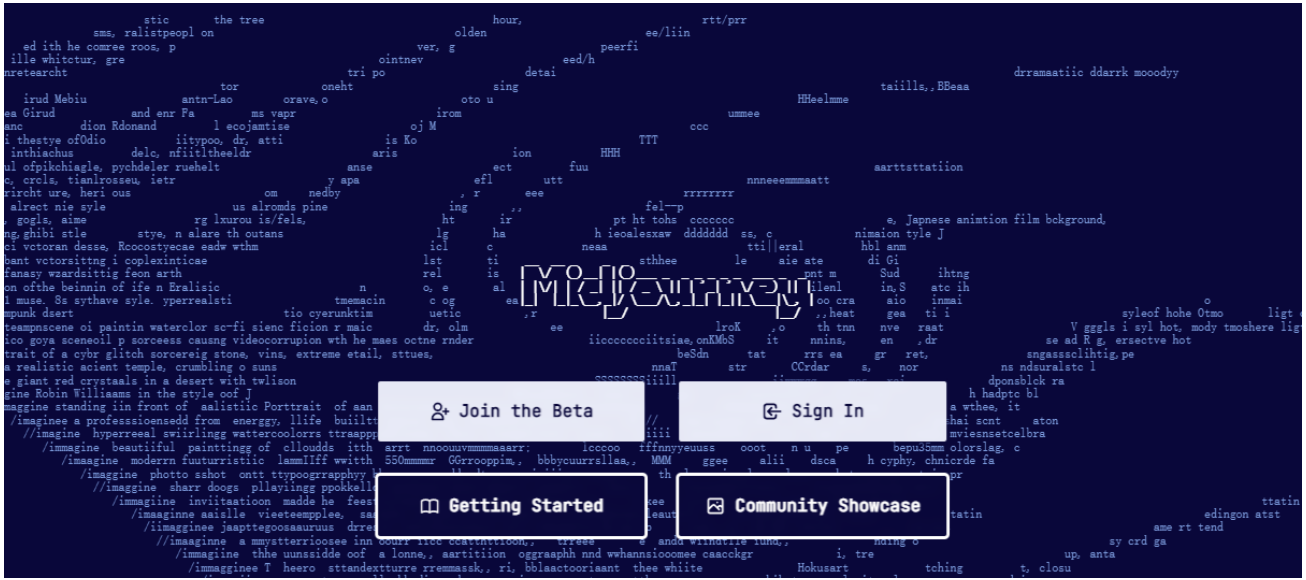
https://www.omnicalculator.com/math/trigonometry

...or trigonometry in right triangle

Given	two sides
a	48 m
b	36 m
c	60 m
Angle α	53.13 deg
Angle β	36.87 deg

Optional Resource

Link: https://www.midjourney.com/home



Thank you for listening!