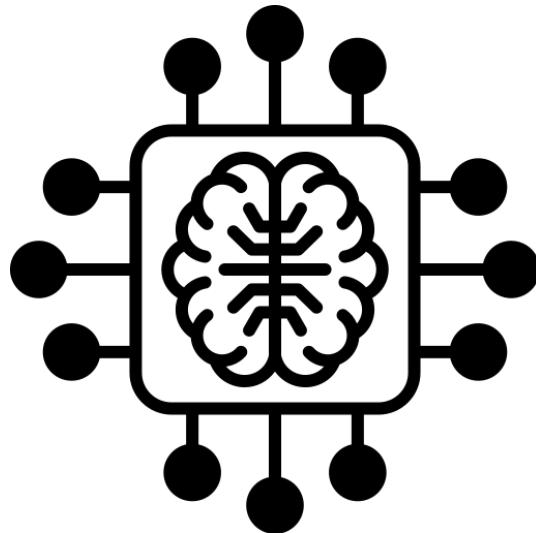


# SBS4115 Fundamentals of AI & Data Analytics



## Introduction to AI

Lecturer: Ir Dr Kelvin K. W. Siu

[email: kelvinsiu@thei.edu.hk](mailto:kelvinsiu@thei.edu.hk)



Department of Construction,  
Environment and Engineering

# Intended Learning Outcomes



- By the end of this lecture, you will be able to...
  - Describe basic concepts of Artificial Intelligence (AI)
  - Classify different types of AI
  - Appreciate the basic terminology in the AI
  - Discuss some common applications of AI

# Lecturer



## **Ir Dr Kelvin K. W. Siu**

- PhD graduate from the Mechanical Engineering Department, HKU
- Postdoctoral Research Fellow in HKU
- Lecturer in Technological and Higher Education Institute of Hong Kong
- Lecturer in HKU SPACE (2014,2022)
- Professional Member of Institute of Materials, Minerals and Mining, U.K.
- Member of The Hong Kong Institute of Engineers

# Contact



**Ir Dr Kelvin K. W. Siu**

**Tel:** +852 6938 4827

**WeChat:** Kelvin\_Siu\_KW

**Email:** [kelvinsiu@thei.edu.hk](mailto:kelvinsiu@thei.edu.hk)



**AI = Artificial Intelligence**



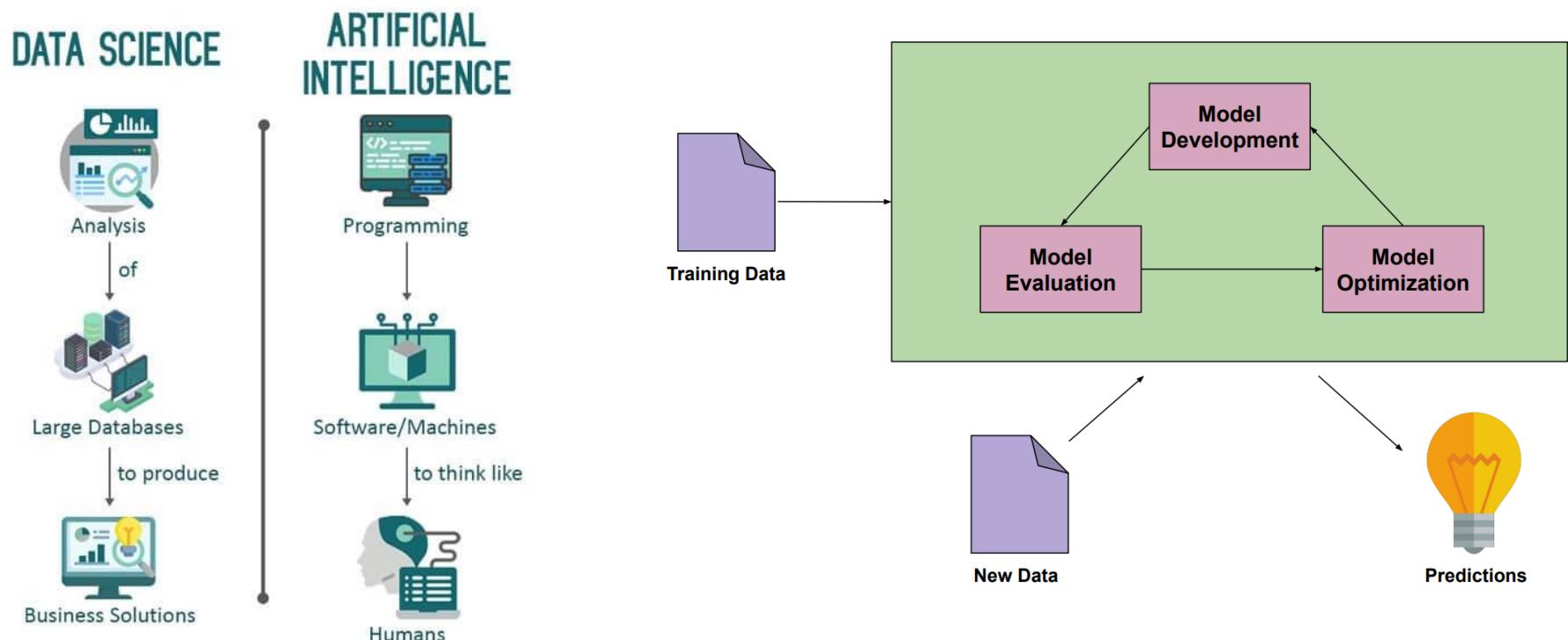
**AI = Artificial Intelligence**

✓ Artificial

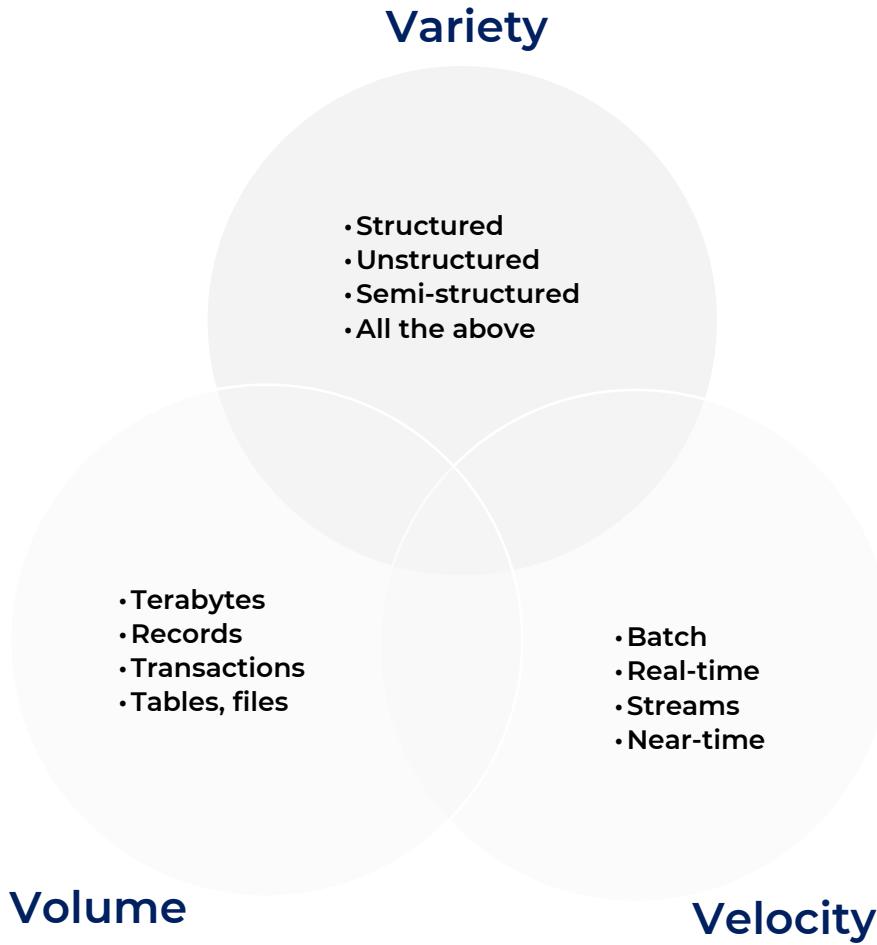
✗ Intelligent



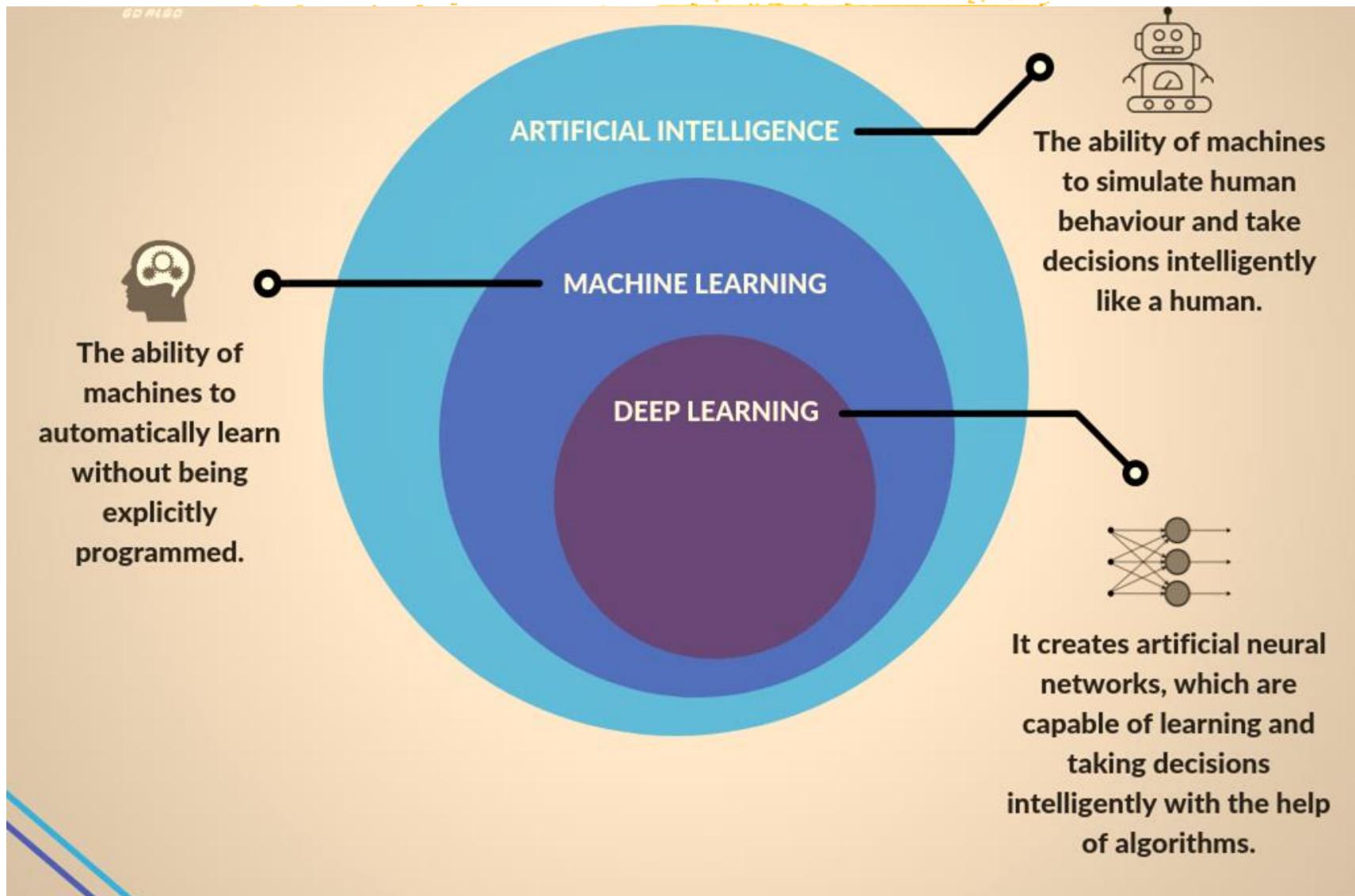
# Data is fundamental in AI



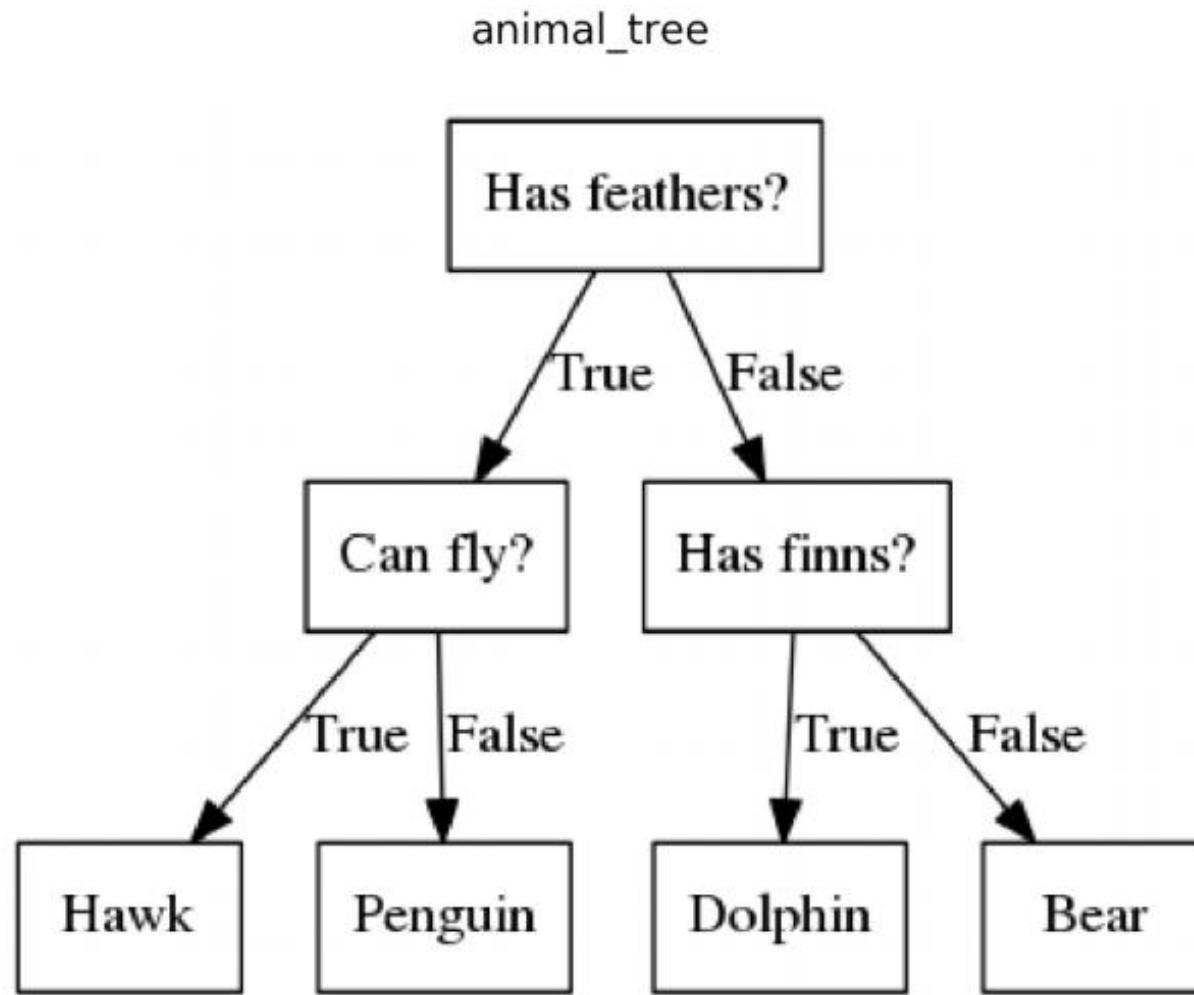
# 3Vs of big data



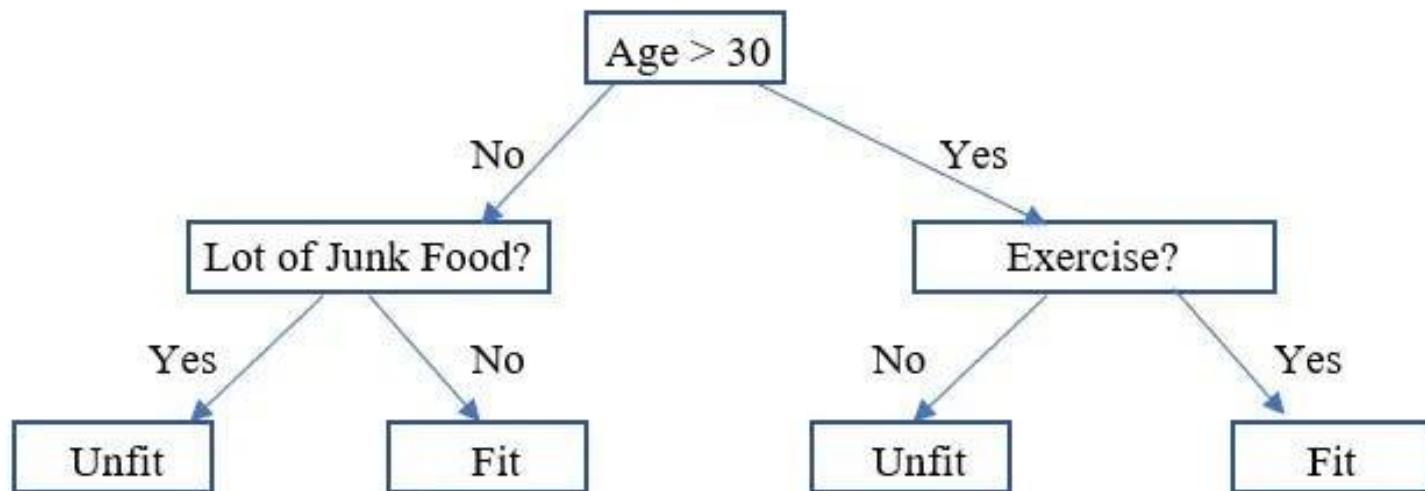
# Classification of AI



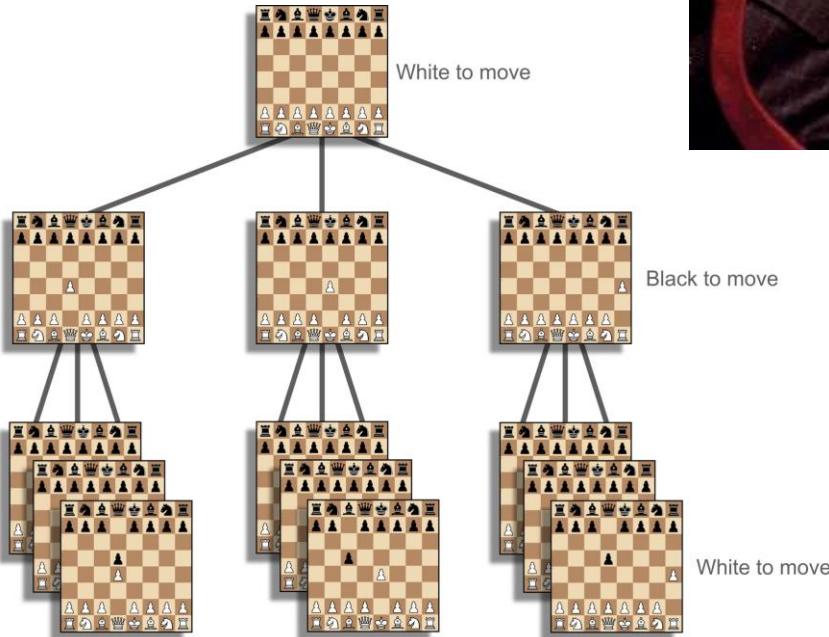
# The example of Decision Tree



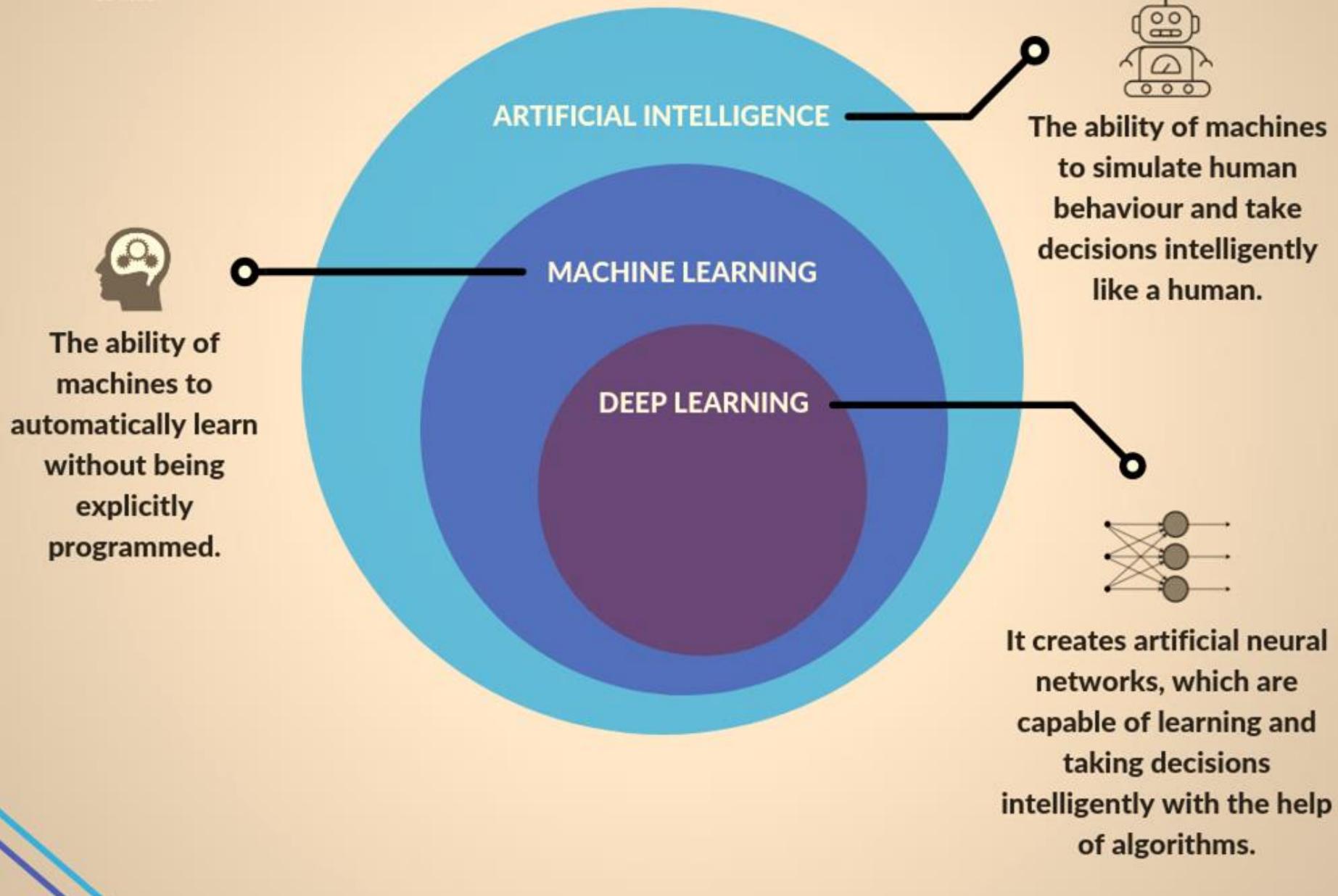
# The example of Decision Tree



# Classic Application – Deep Blue

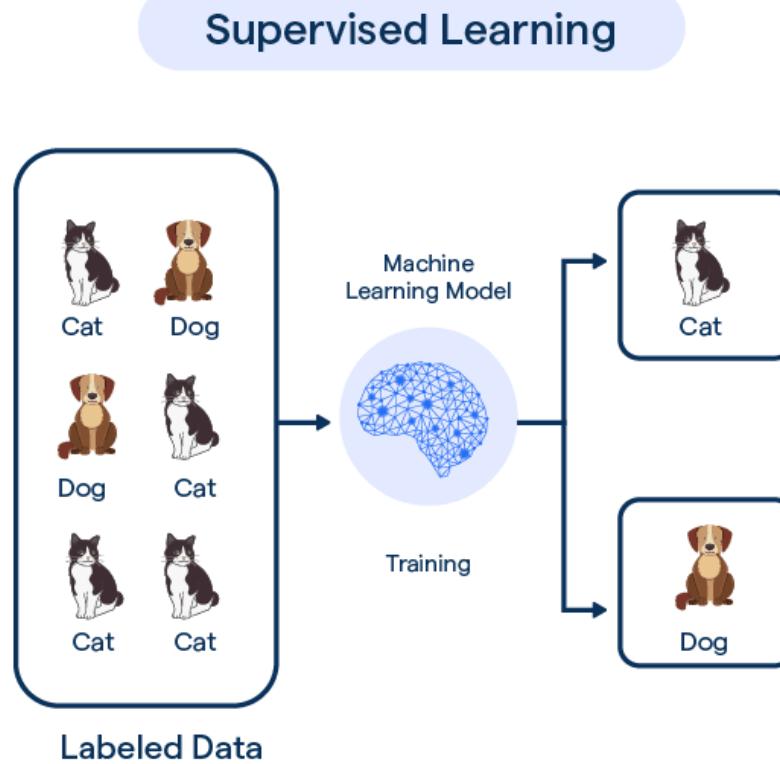


Garry Kasparov vs IBM's Deep Blue (11 May 1997)

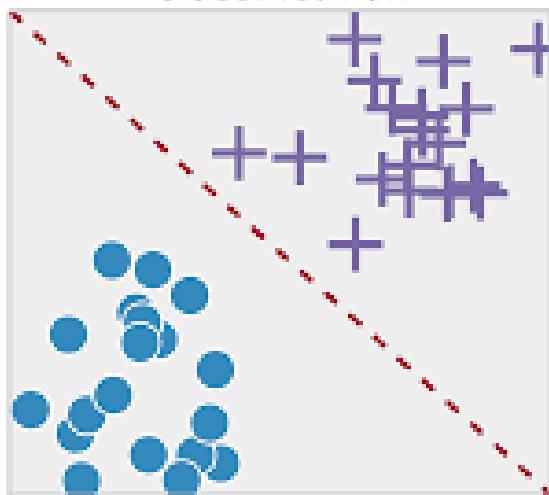


# Supervised Learning

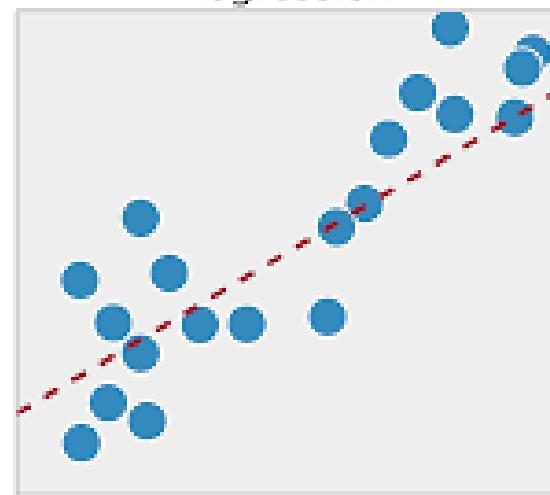
Supervised Learning is the predicted learning method made after analysis of labelled data by computer. Labelled data is like standard answer. Through error comparisons in learning, computer can undergo modifications to achieve more accurate predictions.



Classification



Regression



# Non-Supervised Learning

Database contains only the unlabelled data. In general, the purpose of learning is to predict the real distribution patterns behind the data.

Non-Supervised Learning provides the following classic applications in image processing:

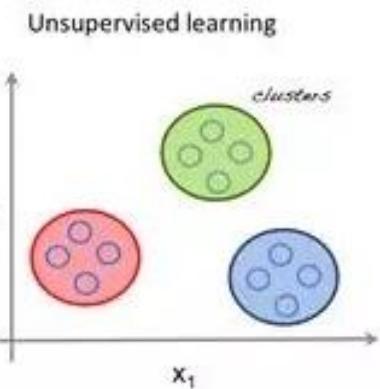
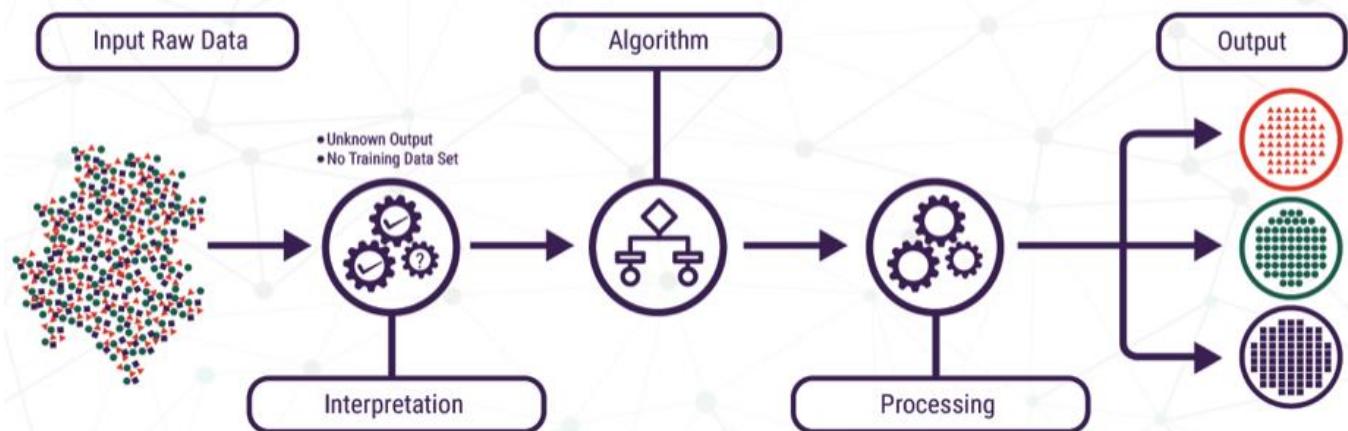


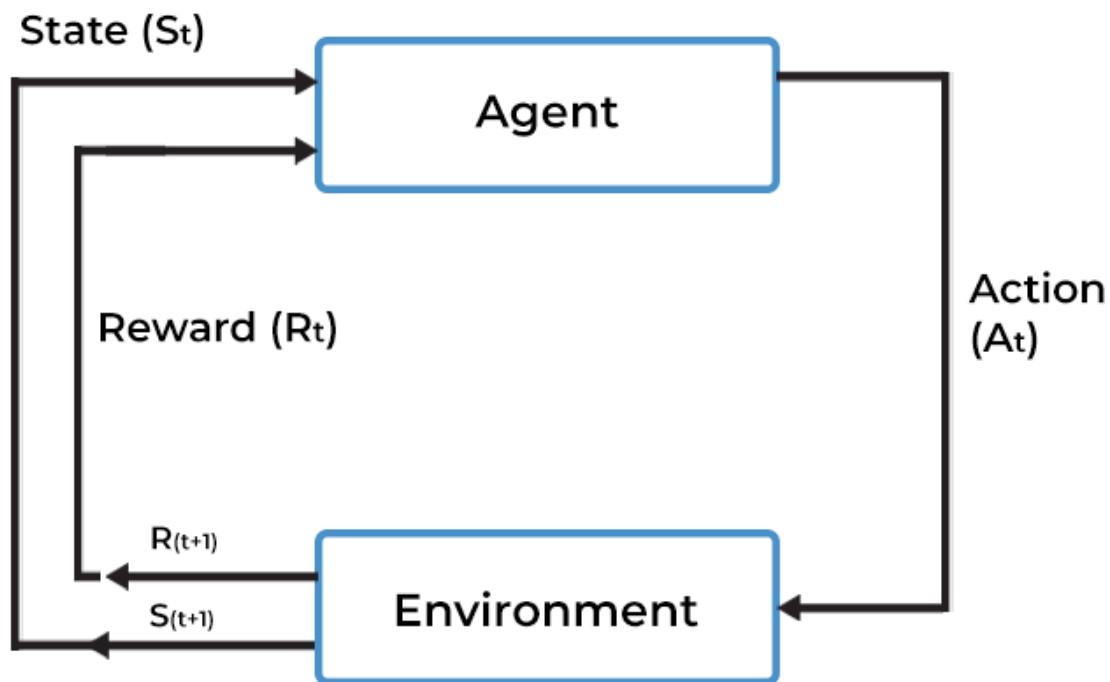
Image Generation  
Style Transfer  
Image Edition



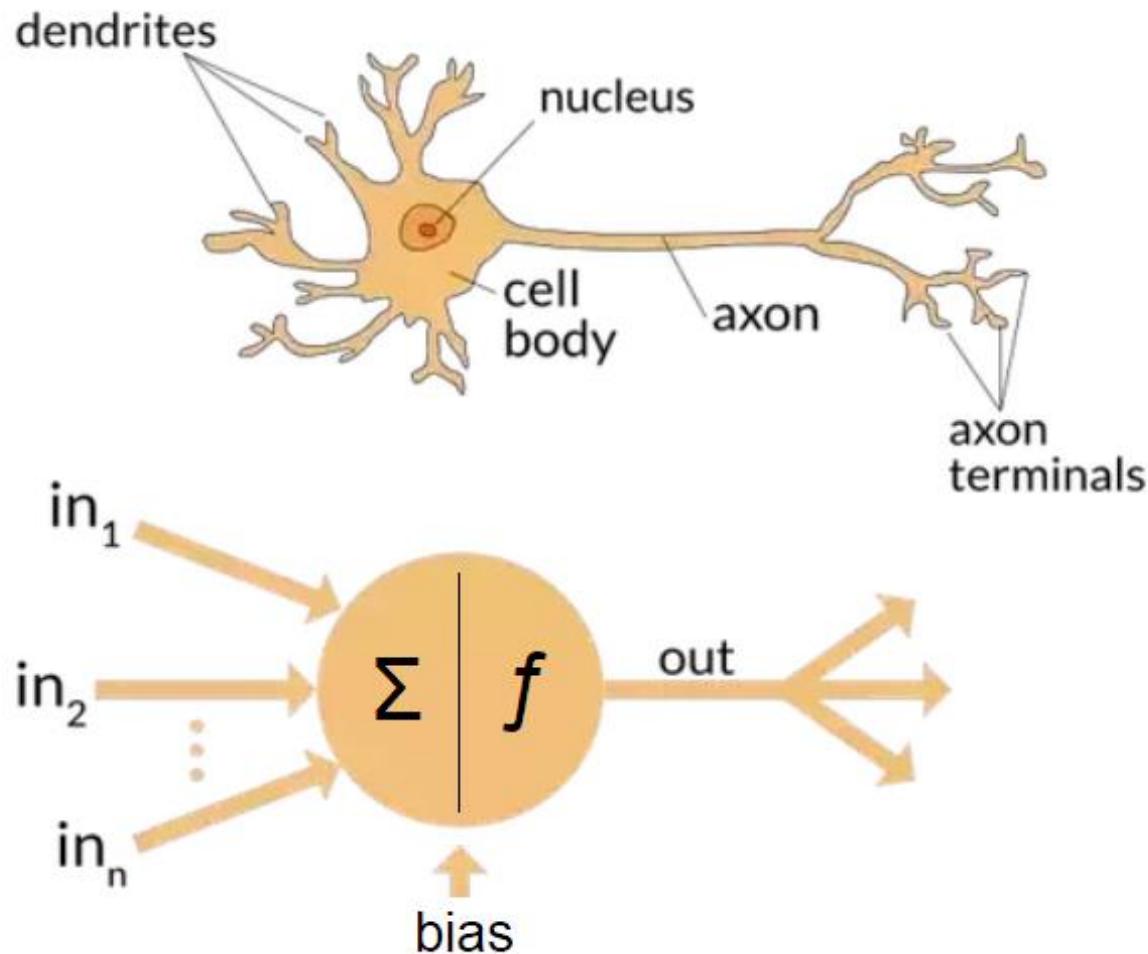
# Reinforcement Learning

Reinforcement Learning is a type of Machine Learning. It means computer can make frequent and repeated interactions through a dynamic situation. To learn how to correctly complete a task through this trial-and-error learning method, computer can perform a series of resolutions without human interference and installation of precise programmes regarding mission performance.

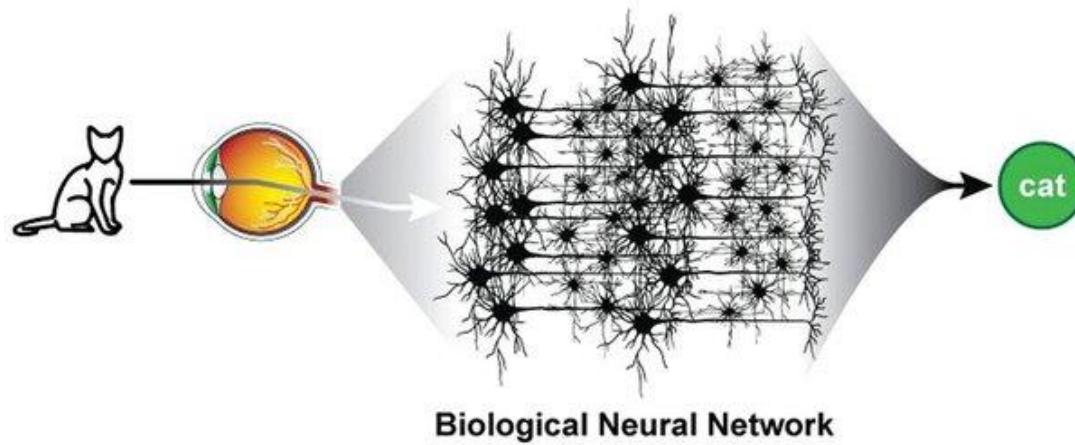
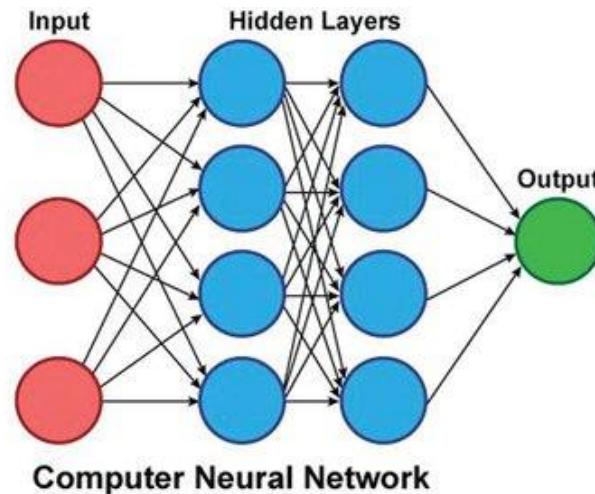
## REINFORCEMENT LEARNING MODEL



# Machine Learning – Imitating Human Neurons

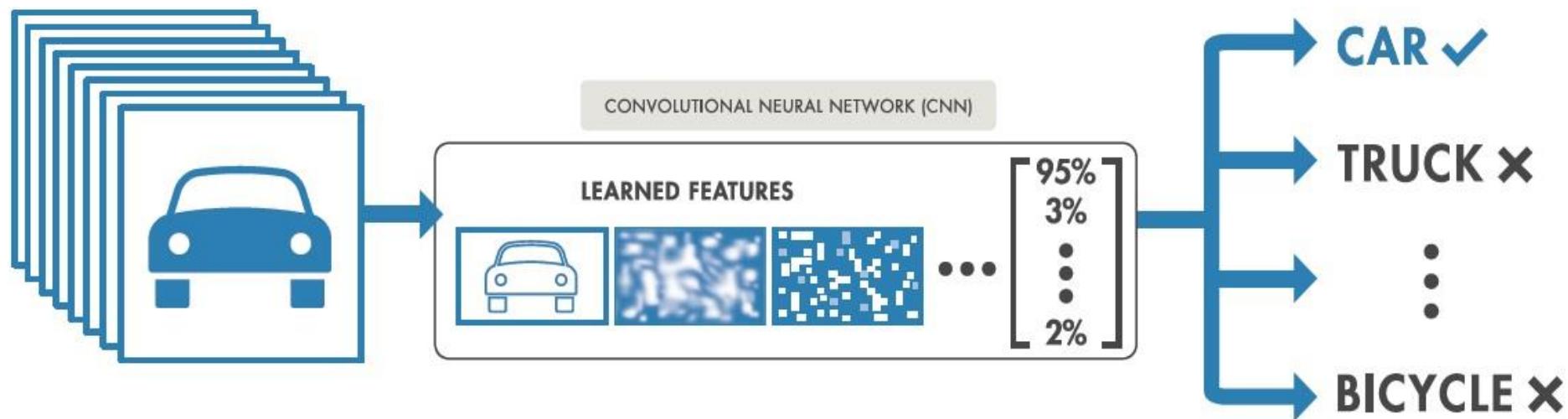


# Multi-Layer Neurons

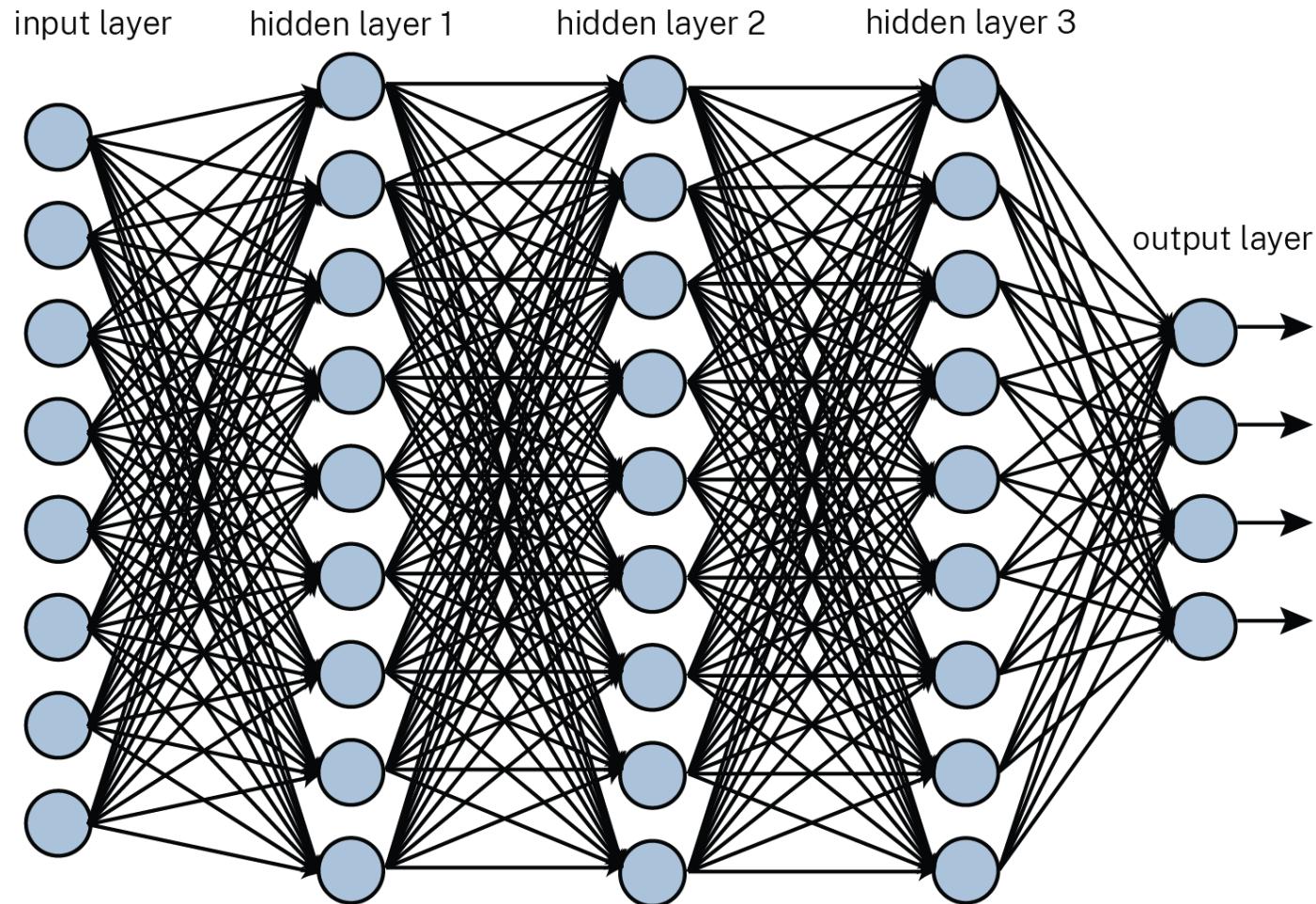


# Convolutional Neural Network (CNN)

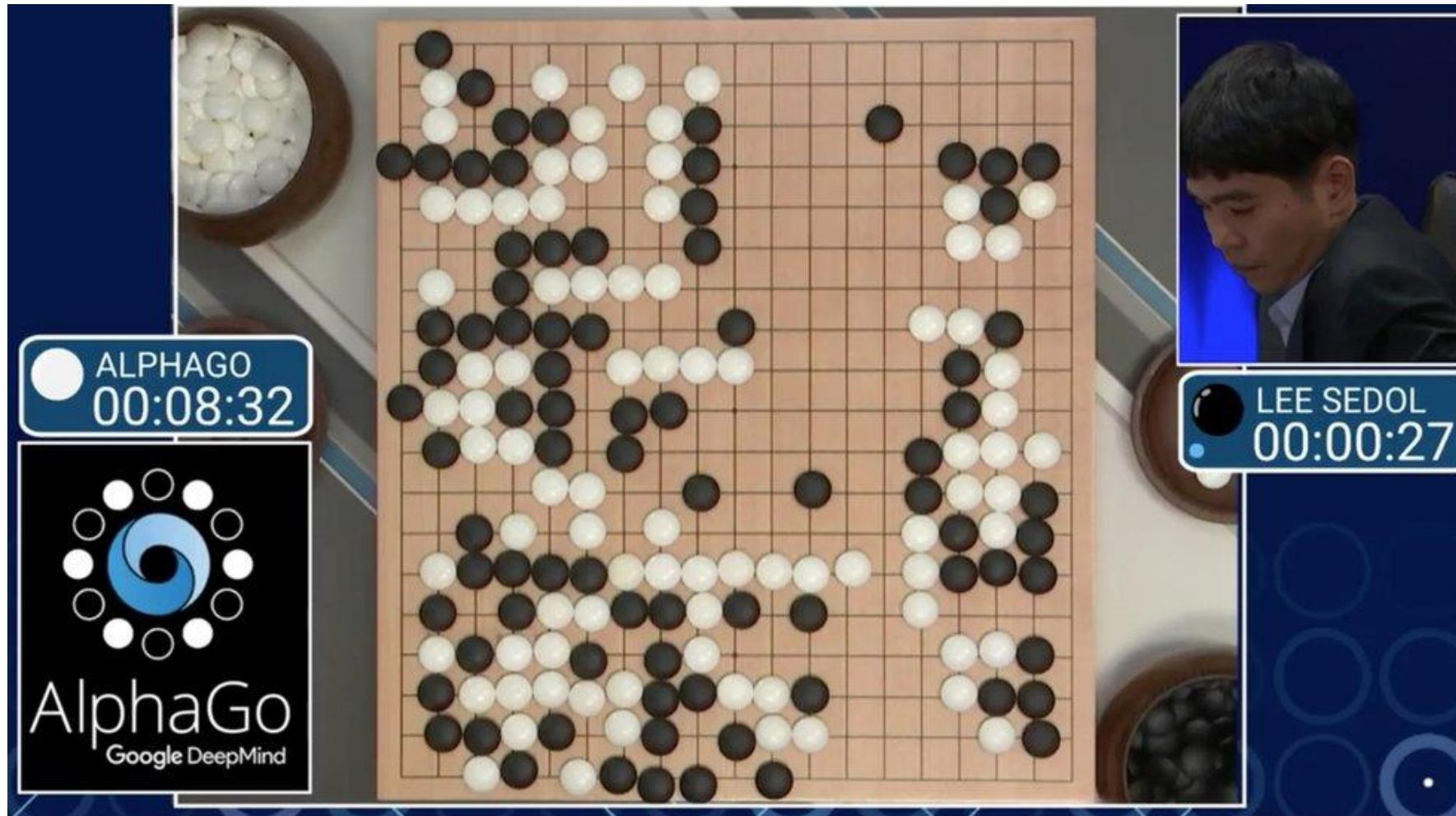
- Extract features through Convolution
- With fully automatic operation, we only need to input image data and labels into CNN.



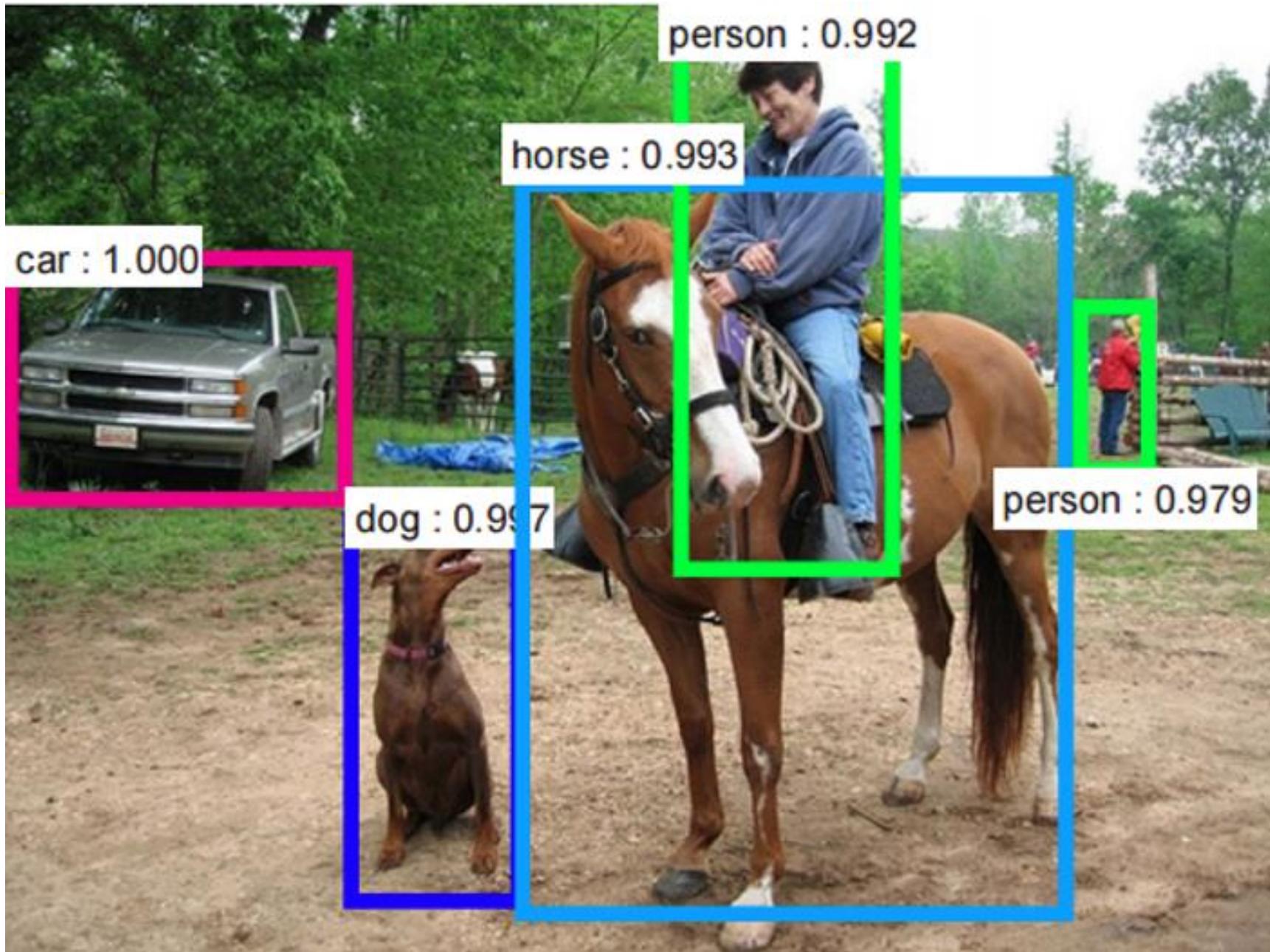
# Deep Learning : Model of Artificial Neural Network



# Classic Application – AlphaGo



March 2016



# Generative Adversarial Network (GAN)

Which cat is fake?



# What is GAN?

- Proposed by Ian Goodfellow of Google Inc. in 2014
- Two Neural Networks which compete with each other
  - One acts as thief: Fictitious (Printing fake bank notes)
  - Another acts as prosecutor: Tell the right from the wrong (Checking bank notes)



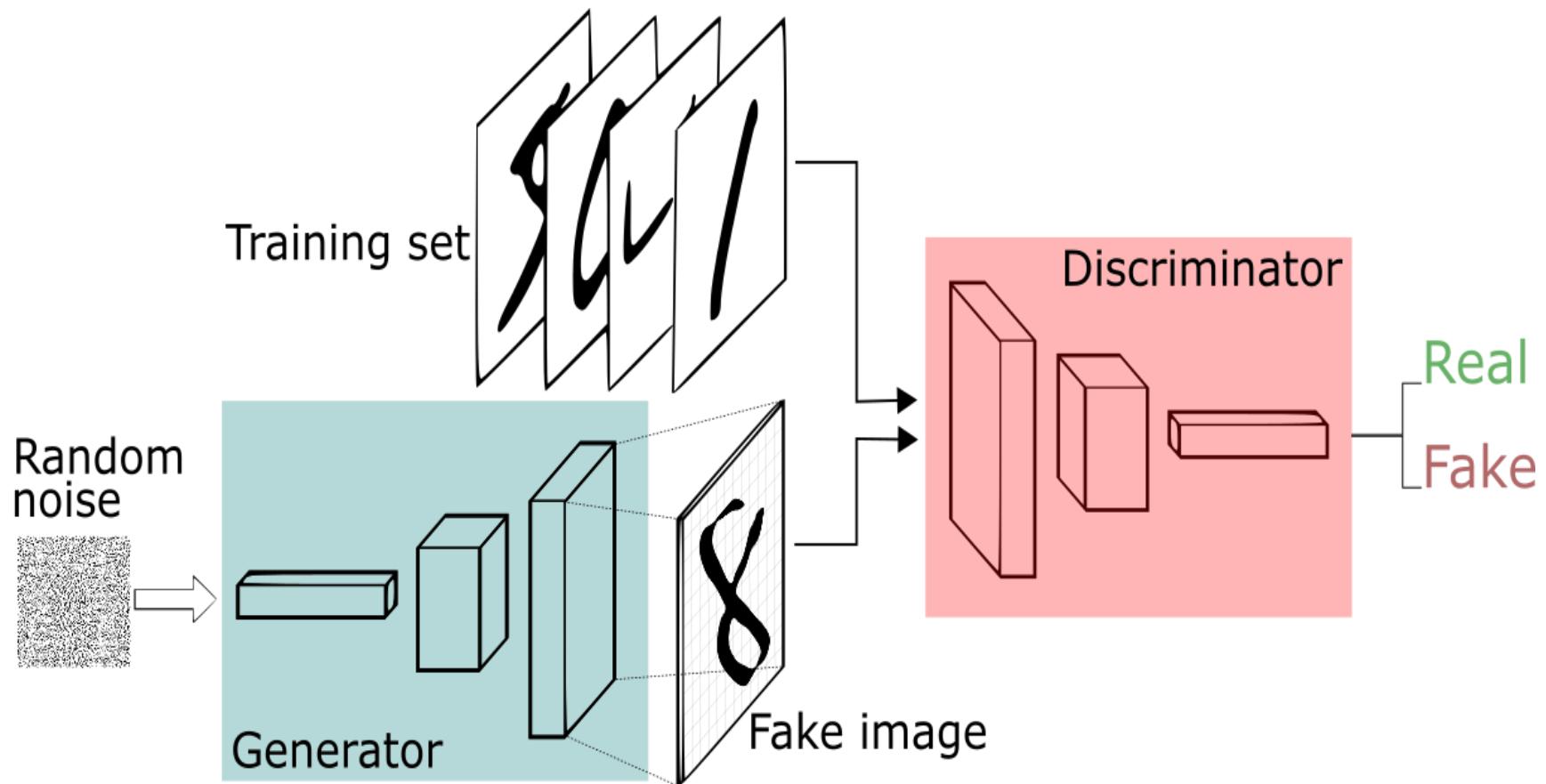
Generator



Discriminator

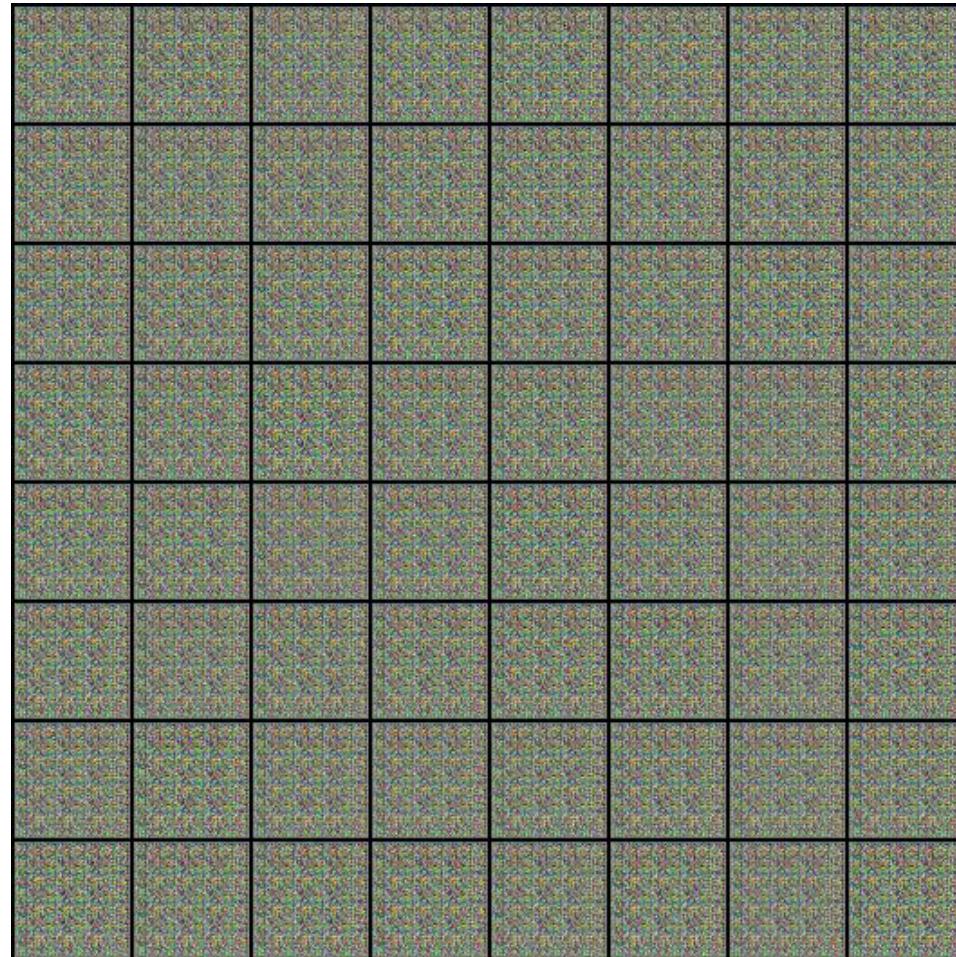
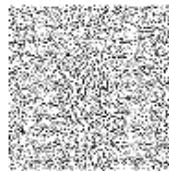


# Example



# Generative Image

Random  
noise



# Generative Image: Formation of image after reading texts

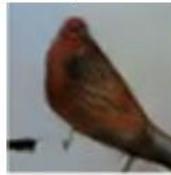
Text description	This bird is red and brown in color, with a stubby beak	The bird is short and stubby with yellow on its body	A bird with a medium orange bill white body gray wings and webbed feet	This small black bird has a short, slightly curved bill and long legs	A small bird with varying shades of brown with white under the eyes	A small yellow bird with a black crown and a short black pointed beak	This small bird has a white breast, light grey head, and black wings and tail

# Generative Image: Formation of image after reading texts

Text  
description

64x64  
GAN-INT-CLS  
[22]

This bird is red and brown in color, with a stubby beak



The bird is short and stubby with yellow on its body



A bird with a medium orange bill white body gray wings and webbed feet



This small black bird has a short, slightly curved bill and long legs



A small bird with varying shades of brown with white under the eyes



A small yellow bird with a black crown and a short black pointed beak



This small bird has a white breast, light grey head, and black wings and tail



# Generative Image: Formation of image after reading texts

Text description	This bird is red and brown in color, with a stubby beak	The bird is short and stubby with yellow on its body	A bird with a medium orange bill white body gray wings and webbed feet	This small black bird has a short, slightly curved bill and long legs	A small bird with varying shades of brown with white under the eyes	A small yellow bird with a black crown and a short black pointed beak	This small bird has a white breast, light grey head, and black wings and tail	
64x64 GAN-INT-CLS [22]								
128x128 GAWWN [20]								

# Generative Image: Formation of image after reading texts

Text description	This bird is red and brown in color, with a stubby beak	The bird is short and stubby with yellow on its body	A bird with a medium orange bill white body gray wings and webbed feet	This small black bird has a short, slightly curved bill and long legs	A small bird with varying shades of brown with white under the eyes	A small yellow bird with a black crown and a short black pointed beak	This small bird has a white breast, light grey head, and black wings and tail
64x64 GAN-INT-CLS [22]							
128x128 GAWWN [20]							
256x256 StackGAN							

# Generative Image: Formation of image after reading texts

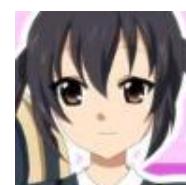
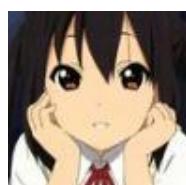
The petals of the flower are purple with a yellow center and have thin filaments coming from the petals.



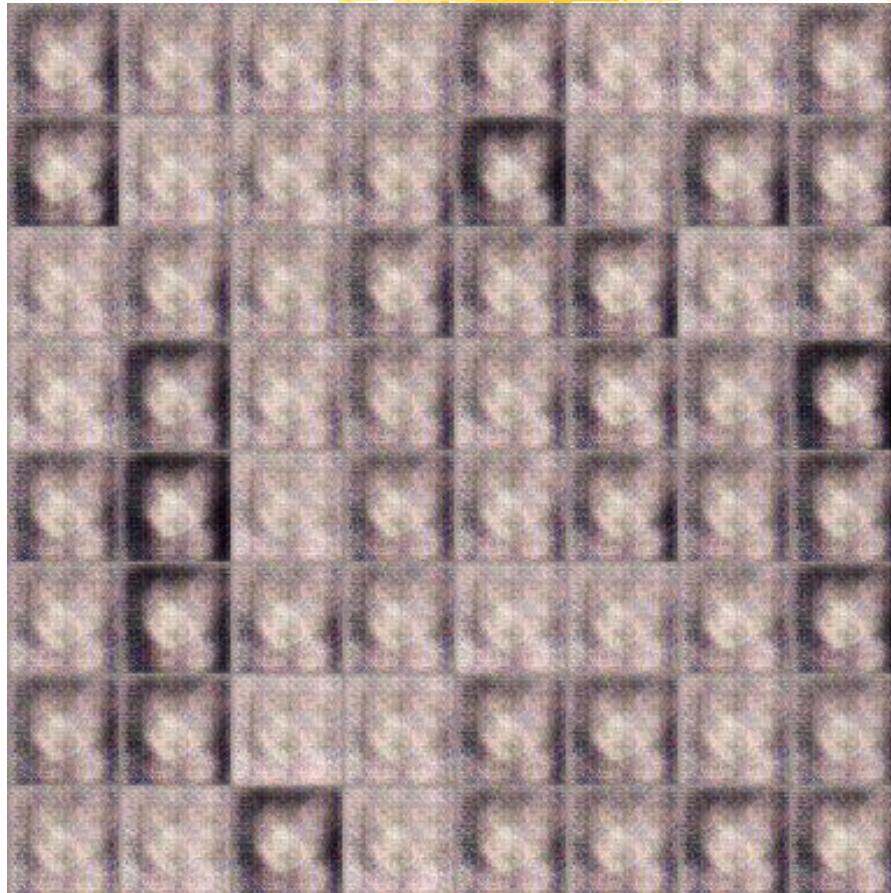
This flower is white and yellow in color, with petals that are oval shaped



# Generative Image: Characters in Animations



(Slide Credit: [Hung-Yi Lee](#))



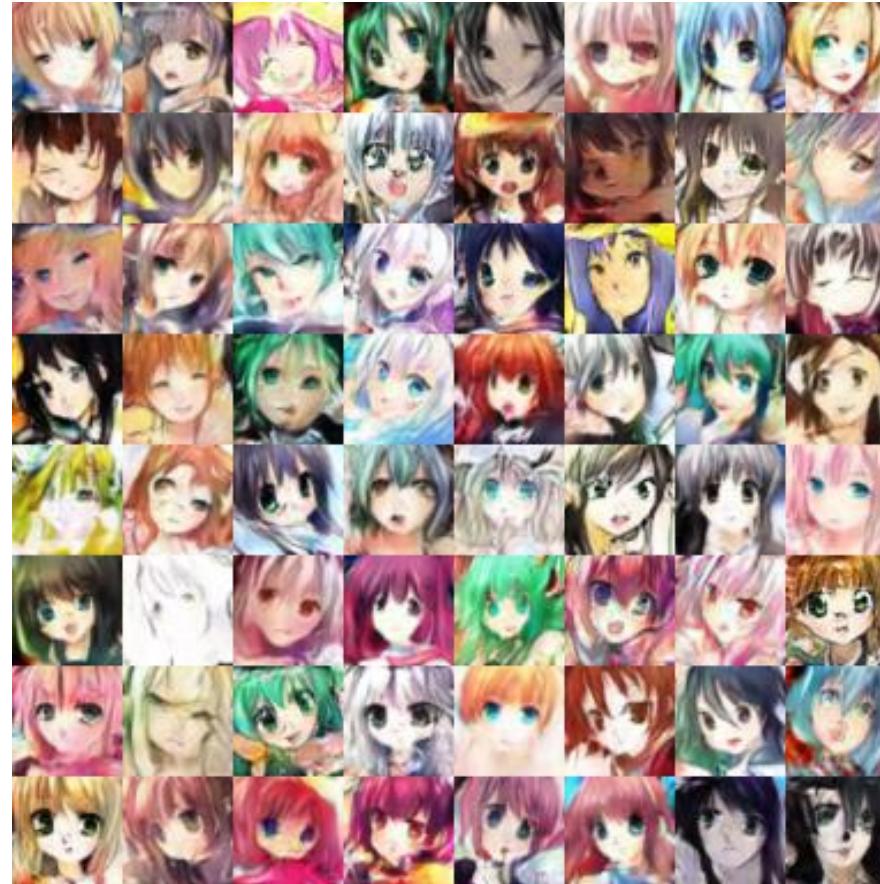
100 rounds



1000 rounds



2000 rounds



50,000 rounds

# Class activity: Copilot

https://www.bing.com/chat

Bing SEARCH COPILOT NOTEBOOK 繁體中文 Technology 634

Copilot

I'll try to create that.

2 of 30

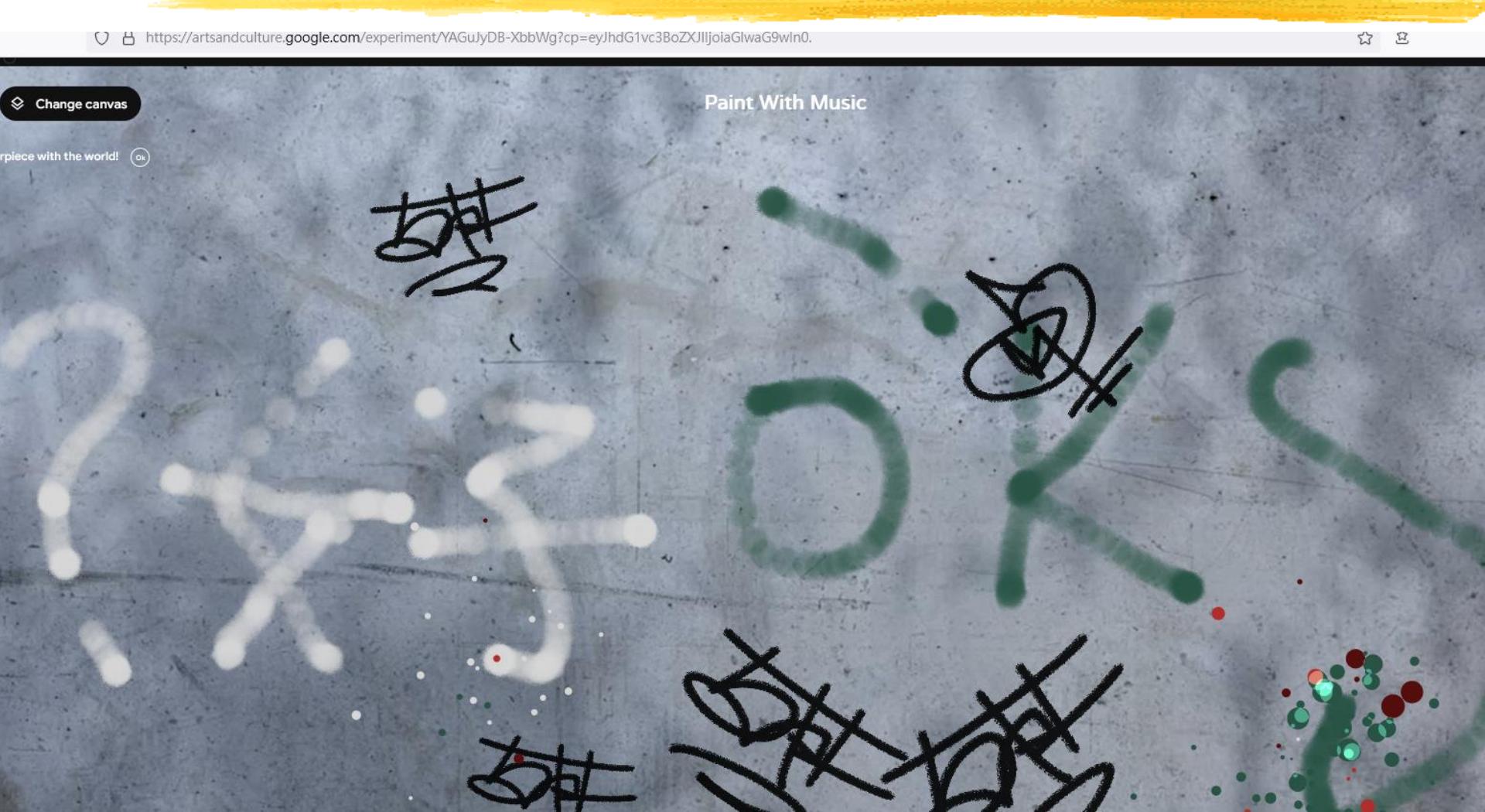
"A pulley system that can bring things to the top of a roof"

Designer Powered by DALL-E 3 14

Make it a colorful pulley system! Can you add some safety features? Include a rooftop garden in the drawing.

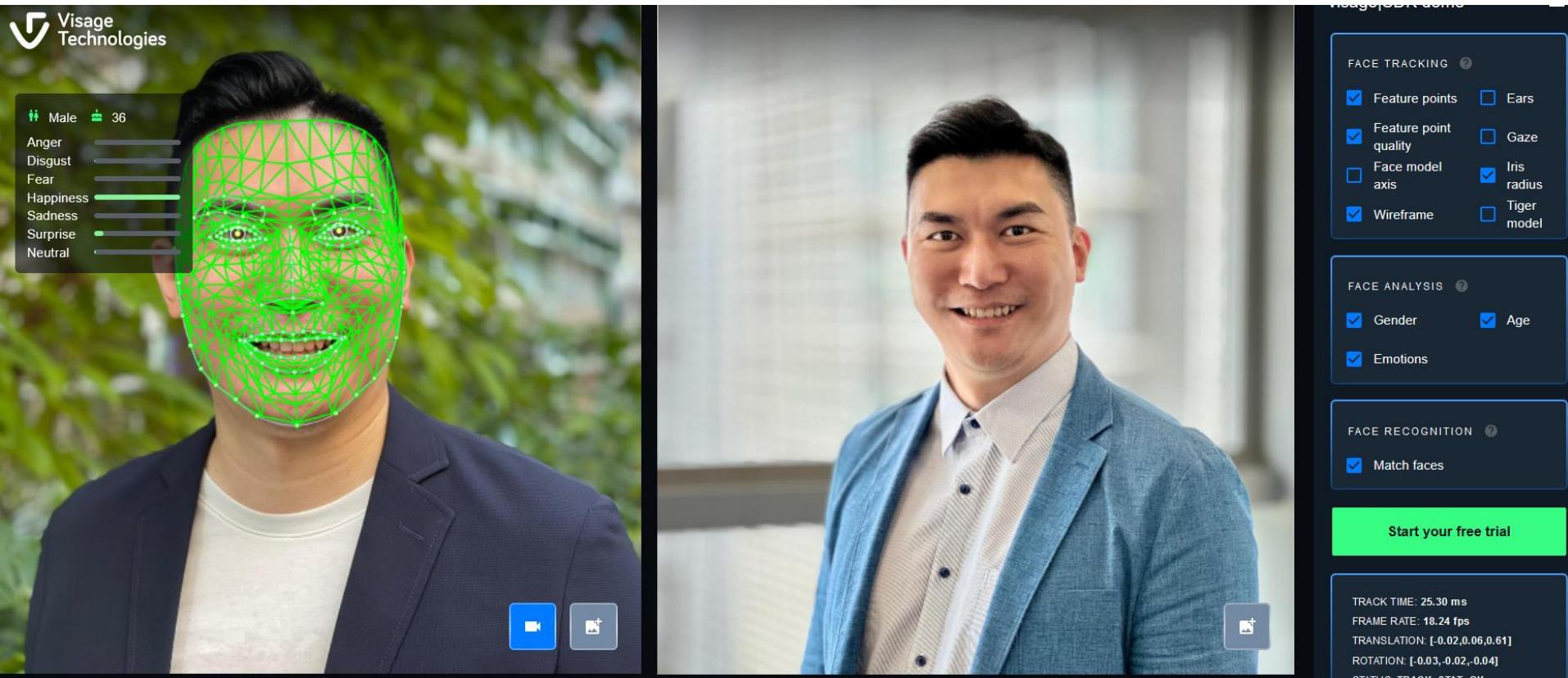
# Class activity: Paint with music

<https://artsandculture.google.com/experiment/YAGuJyDB-XbbWg>



# Class activity: face recognition

<https://visagetechnologies.com/HTML5/latest/Samples>ShowcaseDemo.html>



# Class activity: Teachable machine

<https://teachablemachine.withgoogle.com/train/image>

The screenshot shows the Teachable Machine web interface. At the top, there is a search bar with the URL <https://teachablemachine.withgoogle.com/train/image>. Below the search bar, the title "Teachable Machine" is visible.

The main interface consists of two sections for adding image samples:

- Class 1**: Contains a "Webcam" button and an "Upload" button.
- Class 2**: Contains a "Webcam" button and an "Upload" button.

Between these sections is a central "Training" area:

- A "Train Model" button.
- An "Advanced" dropdown menu.

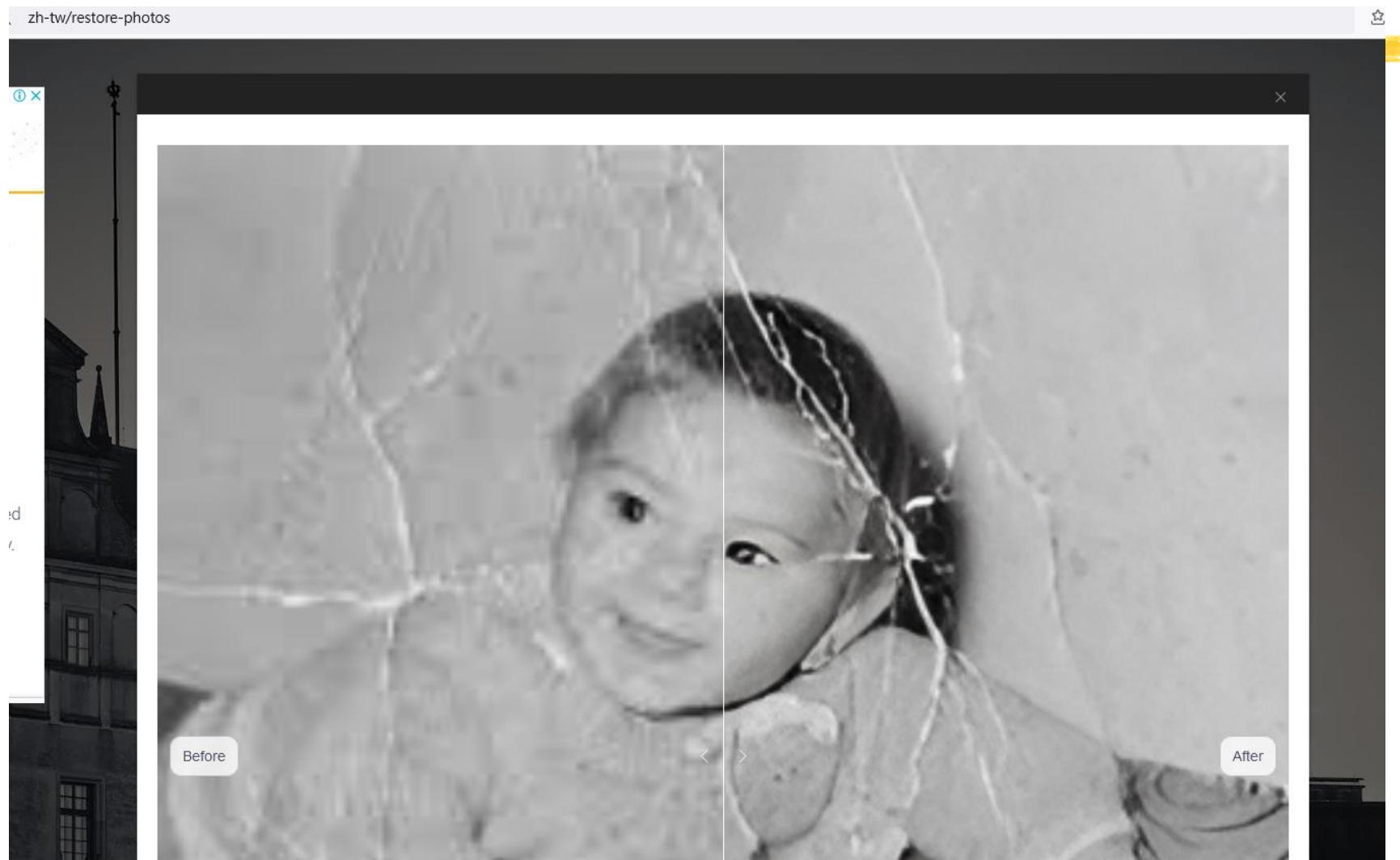
To the right of the training area is a "Preview" section:

- A "Preview" button.
- An "Export Model" button.
- A message: "You must train a model on the left before you can preview it here."

At the bottom center, there is a dashed box with the text "+ Add a class".

# Class activity: Image restore

<https://imagecolorizer.com>



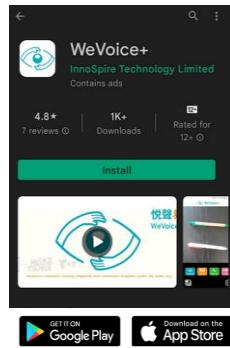
# Application of AI in Technology Start-Up

- InnoSpire Technology Limited
- Established in 2018
- An incubatee of Hong Kong Science and Technology Park
- Vision: Application of AI Computer Vision and Smart Glasses to projects with social mission

## Examples

### WeVoice+ Mobile App

- Text Recognition, Colour Recognition and Real-Time Video Call



### InnoSpire Smart Glasses



## Clients (Technical Projects):



炜 狄 科 技 有 限 公 司  
REDIX TECHNOLOGY COMPANY LIMITED



## Clients (STEM Education):



## Supporting Organizations:



# Silver Medal in the International Exhibition of Inventions Geneva



# AI Computer Vision



[https://news.now.com/home/local/player?newsId=543215&refer=Share&utm\\_source=now\\_appshare&utm\\_medium=share](https://news.now.com/home/local/player?newsId=543215&refer=Share&utm_source=now_appshare&utm_medium=share)

Tim：「以前我們可能會到協會找義工幫我們讀信，漏報了稅，可能在限期之後才趕得及有人讀信，然後做這件事就衍生了一些罰款。」

Tim：「前面在搭棚或維修道路，例如去到一個比較陌生的地方，對周遭環境完全不熟悉時，其實都害怕撞到東西。」

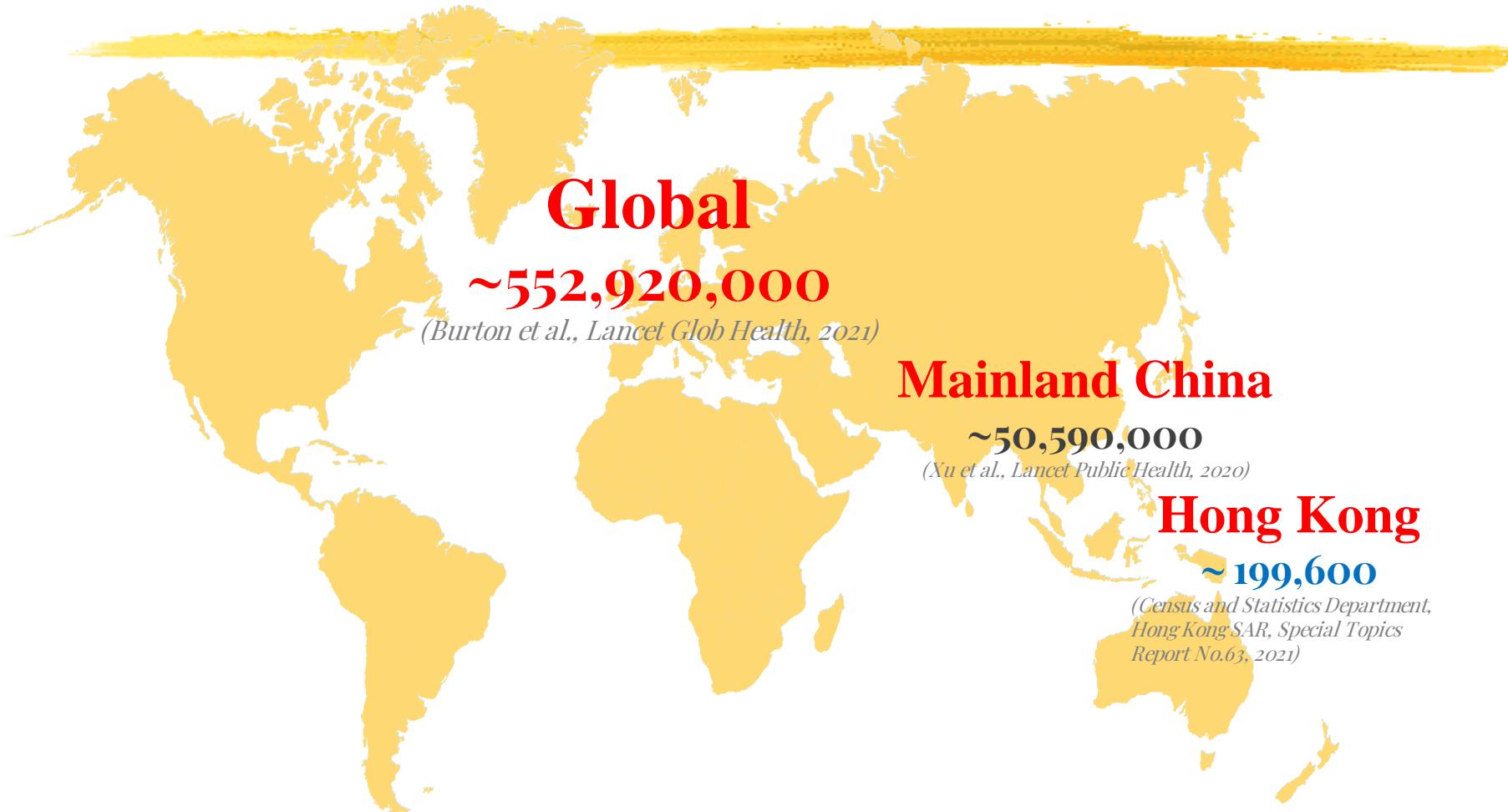
## 初創公司研智能眼鏡便利視障人士 獲日內瓦國際發明獎

【Now新聞台】有本地初創公司研發智能眼鏡，利用人工智能轉化文字成聲音，便利視障人士生活，並獲日內瓦國際發明獎，期望普及後可大量生產，從而壓縮售價四成。

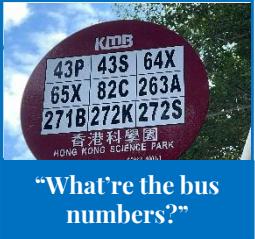
眼鏡由本地公司研發，售價約為5000元，是外國同類型產品的六分之一，目前主要賣給非政府組織，資助視障人士購買使用，公司期望推廣至更多不同層面。

眼鏡獲得日內瓦國際發明展銀獎，將來可大量生產，可做到三千元以下一副

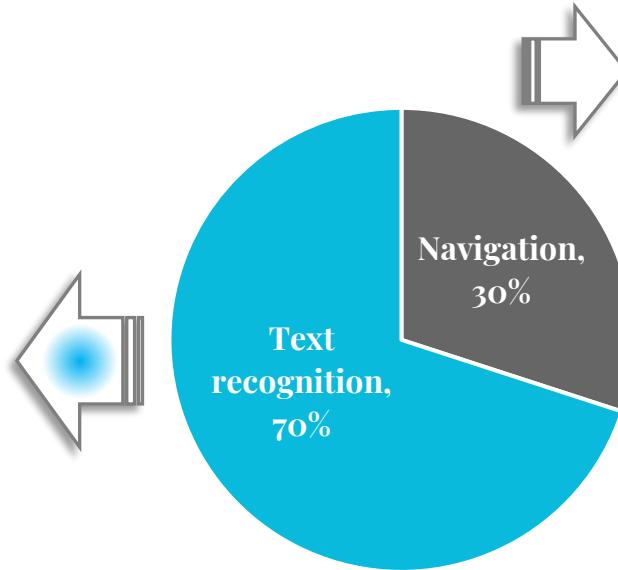
# Visually Impaired Population

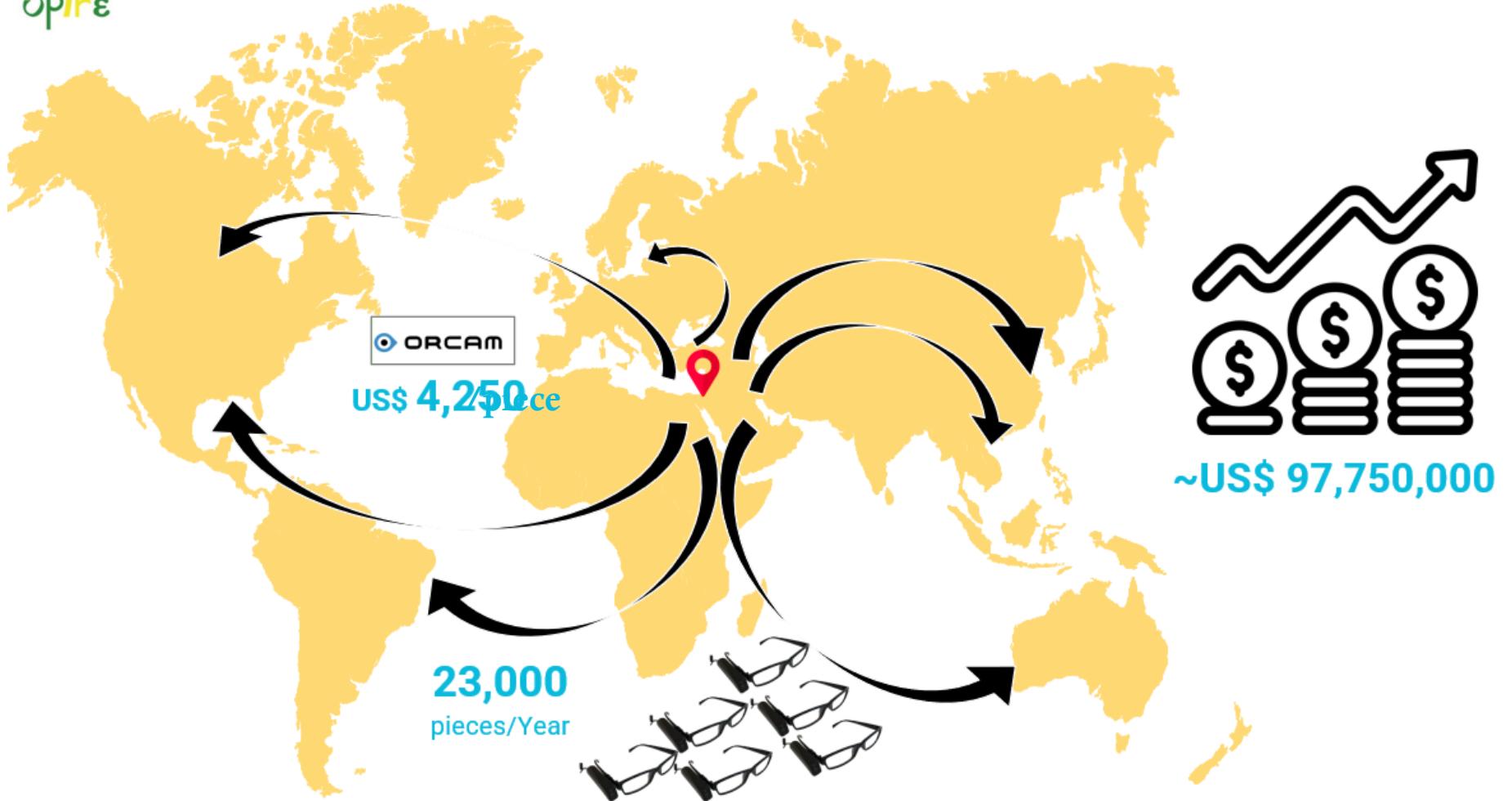


# Daily Challenges of Visually Impaired People

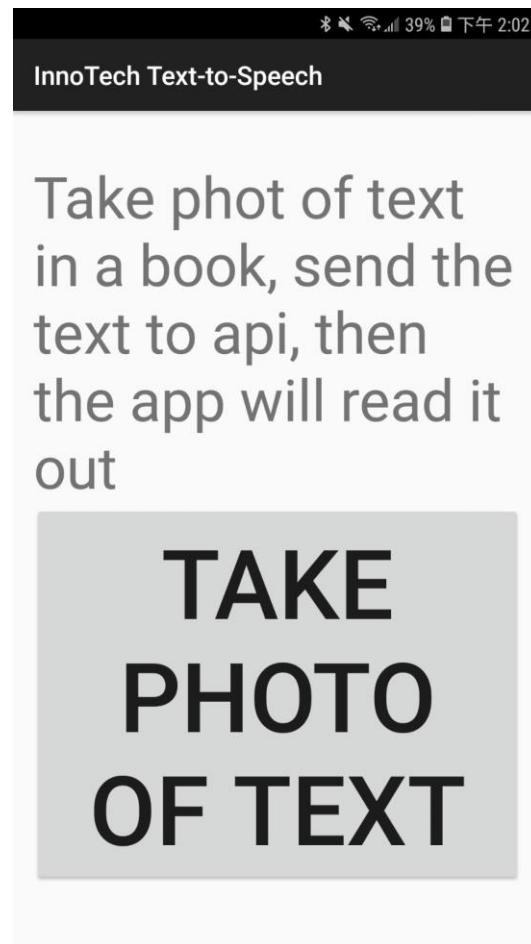


Source: More than 200 face-to-face interviews with the visually impaired conducted by InnoSpire in 2022





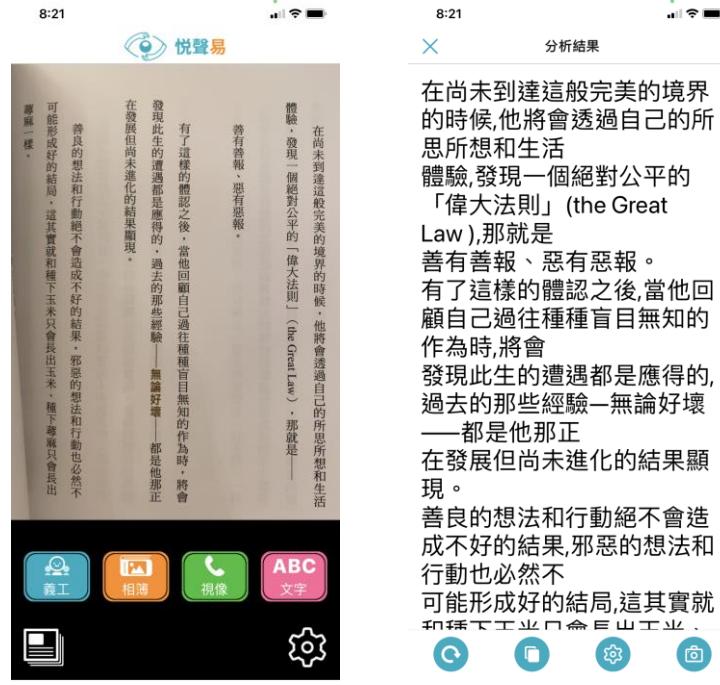
# 1<sup>st</sup> Version



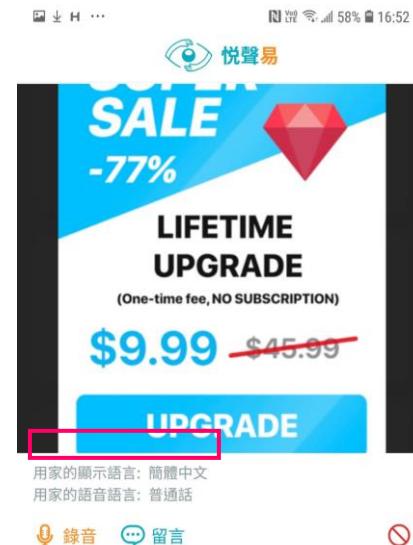
## 2<sup>nd</sup> Version



# 3<sup>rd</sup> Version



# Human + AI



# Different Scenarios of Application

12:43



9:04



6:06



2:07



2020年05月11日

用家使用的顯示語言：繁體中文  
用家使用的語音語言：廣東話



錄音 留言



3 個留言

User 184275

好的好的



2020年06月28日



用家的顯示語言：繁體中文  
用家的語音語言：普通話

錄音 留言



5 個留言

Brenda Han

應該是 2606 8801

2020年06月28日 回覆 封鎖

Brenda Han

通知

設定

LinkedIn

2:07



2021年01月26日



用家的顯示語言：繁體中文  
用家的語音語言：廣東話

錄音 留言



1 個留言

KS

地址是屯門屯利街4號地下，眼科。

2020年05月27日 回覆 舉報

↪ KS

2020年11月6日上午10時正。

高速全球CDN智能內容緩存。現在登錄 Cloudflare 加速您的網站！聯絡我們。

開啟







用家的顯示語言: 繁體中文  
用家的語音語言: 廣東話

錄音 留言

1個留言

KS (義工)

一條線，陰性

2022年06月25日 回覆 編輯 舉報



用家的顯示語言: 繁體中文  
用家的語音語言: 廣東話

錄音 留言



2 個留言

Horacet

播放錄音 8"

2022年02月26日 回覆 舉報



或許有助他們解決相關的難題



# Challenges of Visually Impaired People in Outdoor Environments



# Challenges of Visually Impaired People in Outdoor Environments



**Problem of using number sign board:**

1. Easy to be damaged
2. Getting wet after raining
3. Difficult to keep



# Challenges of Visually Impaired People in Outdoor Environments

## High Price



Training cost: HKD200,000/dog

Monthly expense: HKD5,000 (food, vaccination, medication, etc);



1 year training + 2-month joint training with VI



8-10 service years only

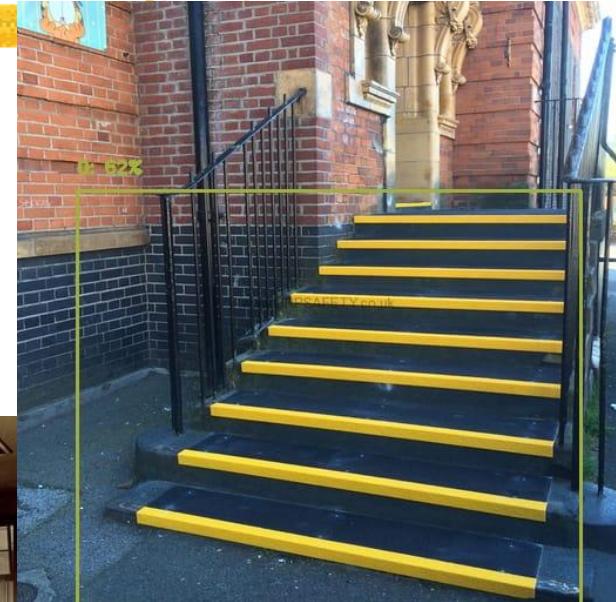
## Other Constraints



Asthma and Allergy  
Foundation of America

20% of world  
population is  
allergic to dogs

# AI Computer Vision



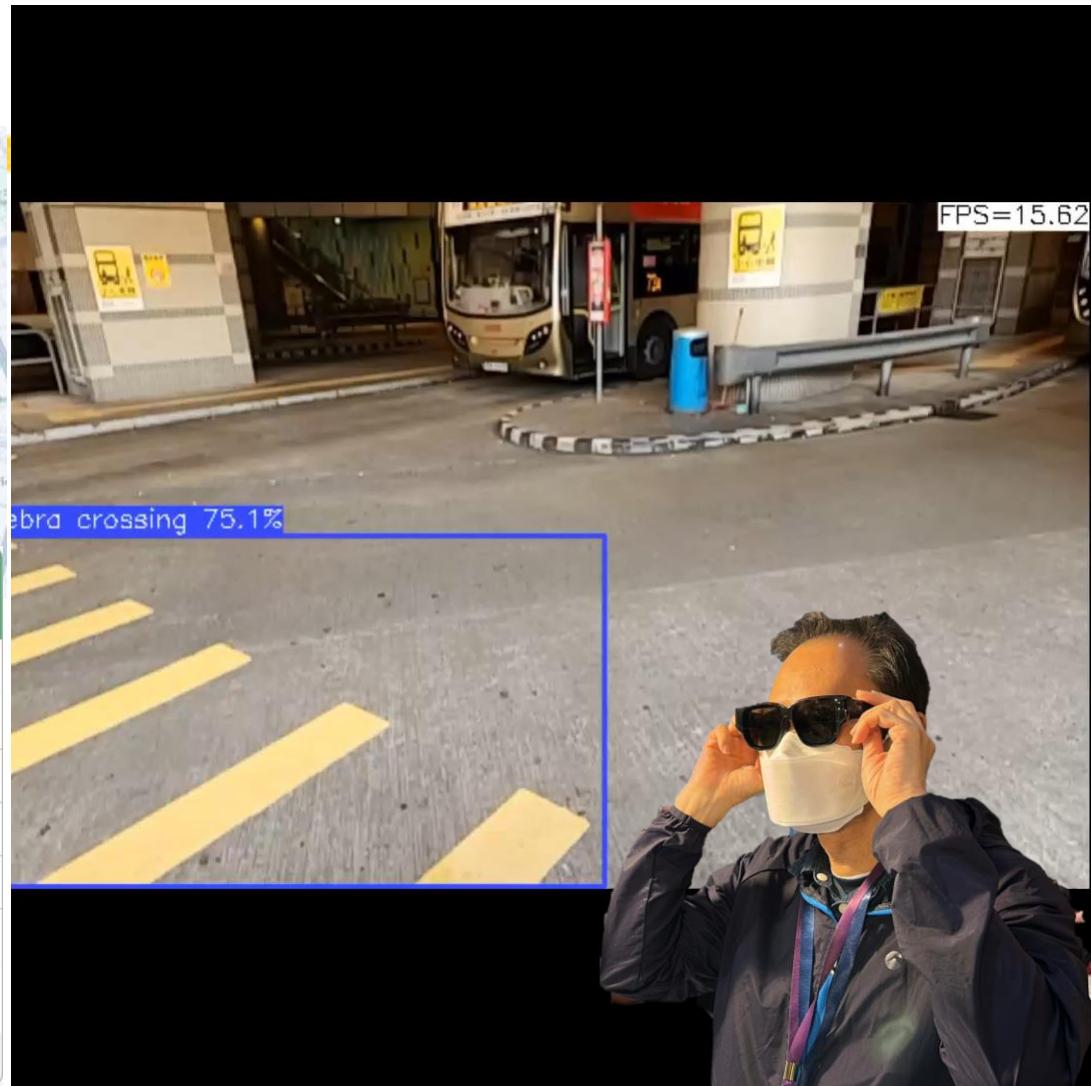
63

# Outdoor Applications

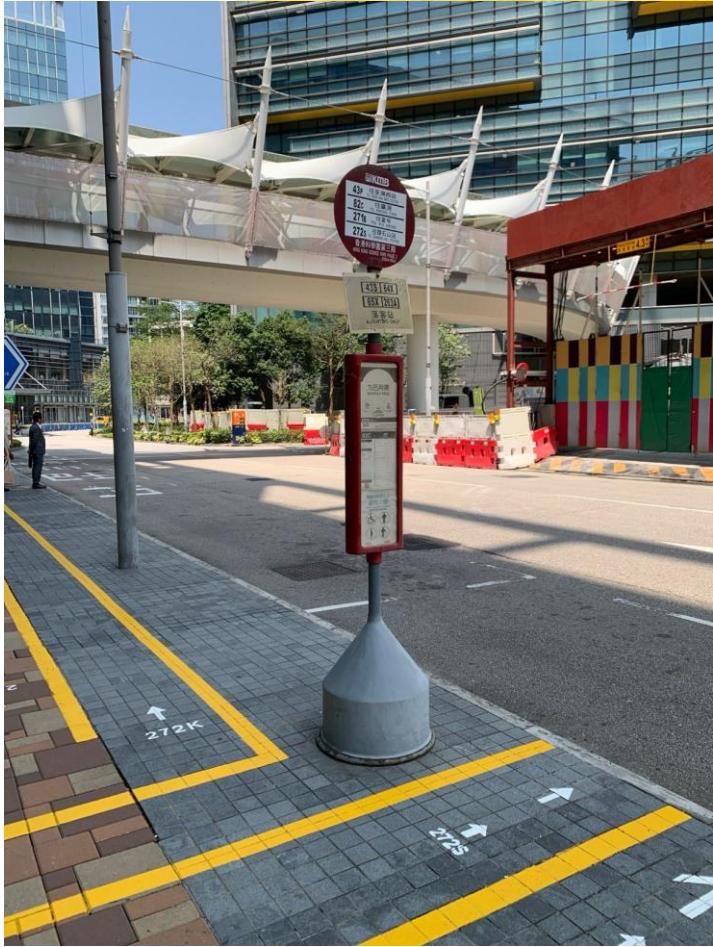


Route  
planning

Precise  
voice-  
guided  
navigatio  
n



# Generative AI



## Generative AI with Local Modifications



InnoMap

在照片中的巴士站牌顯示了數條巴士路線的資訊。我可以看到的巴士路線有：

43P

82C

271B

272S

這些路線號碼上方似乎標有不同的地點或路線名稱，但從這個角度無法完全閱讀。如果您需要知道這些巴士路線的具體目的地或服務時間，建議您詢問站牌附近的服務人員或使用智能手機的巴士資訊應用程式來獲得更詳細的資訊。

# Generative AI



InnoMap

這張照片從一個較低的角度拍攝了一組手扶梯和其周圍的室內環境。在畫面中央可以看見一位男性正在使用手機走路。背景是一個帶有大窗戶的明亮大廳，外面是現代化建築的一部分。大廳內部裝潢以木質面板和潔白的牆面為主，並有嵌入式照明設施。右下角有黃色的標誌和警告標語，提醒使用手扶梯的安全注意事項。

## Generative AI with Local Modifications

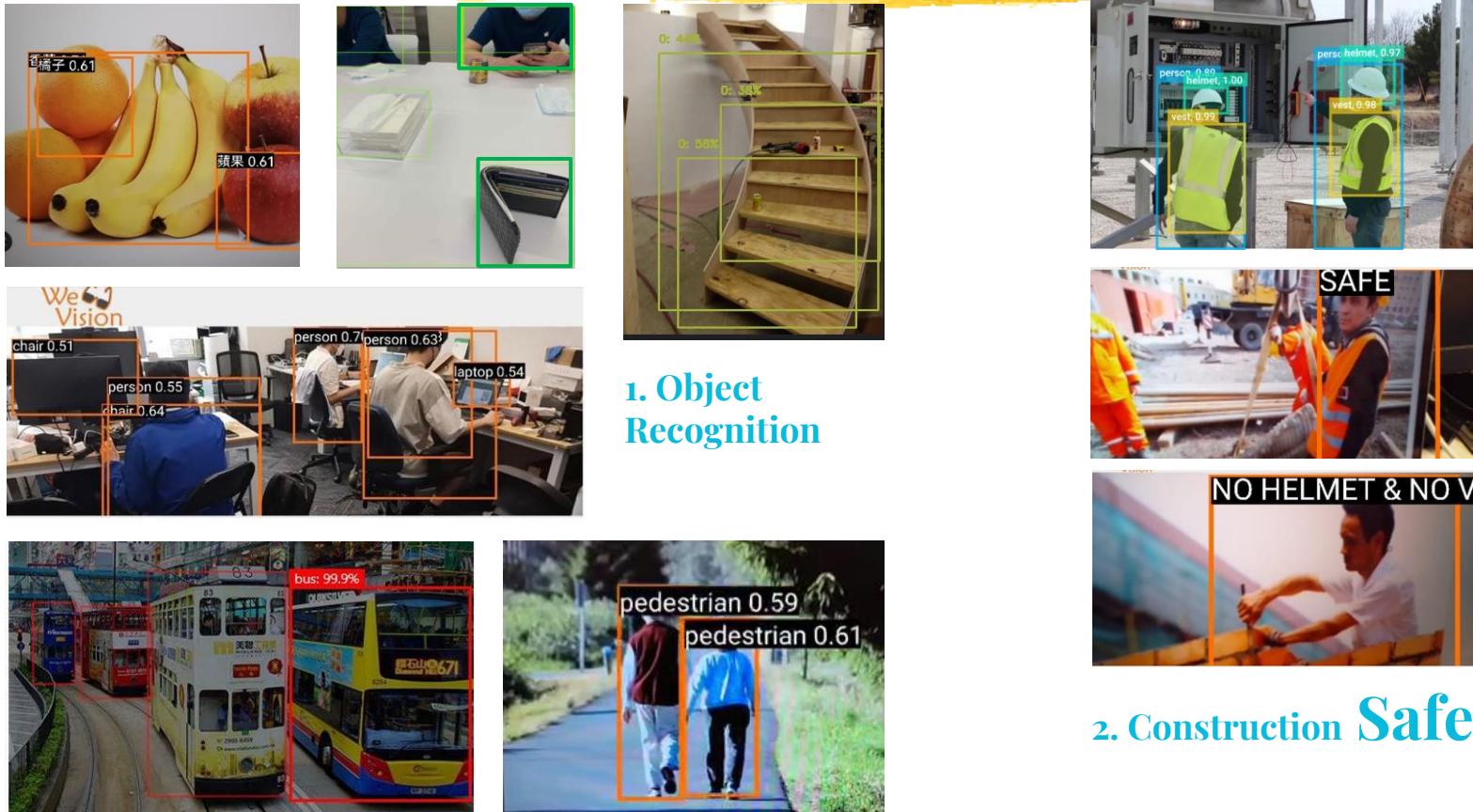


other app

這是一張自動扶梯的照片。自動扶梯前方用黃黑相間的警示帶圍起來，顯示暫時無法使用。自動扶梯的兩側有金屬扶手，並有綠色箭頭指示標誌指向下方。背景是一個室內空間，有大片玻璃窗和一些現代建築。天花板上有長條形的燈具。

## Direct Application of ChatGPT

# Other Applications



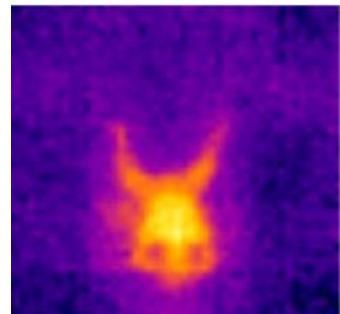
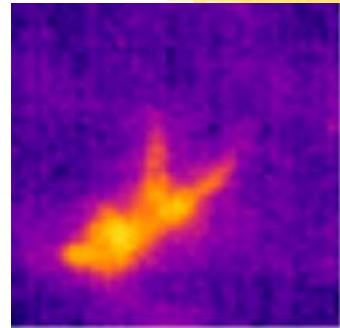
## 1. Object Recognition

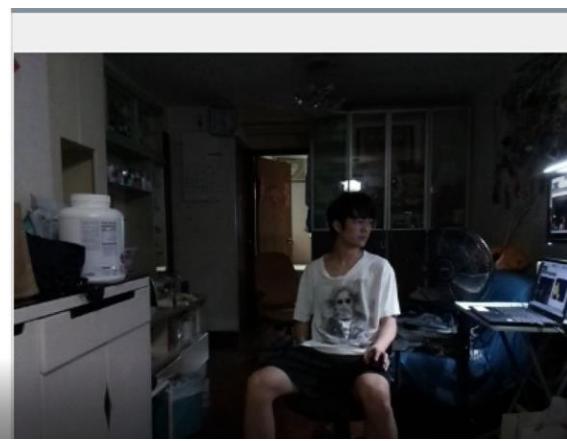
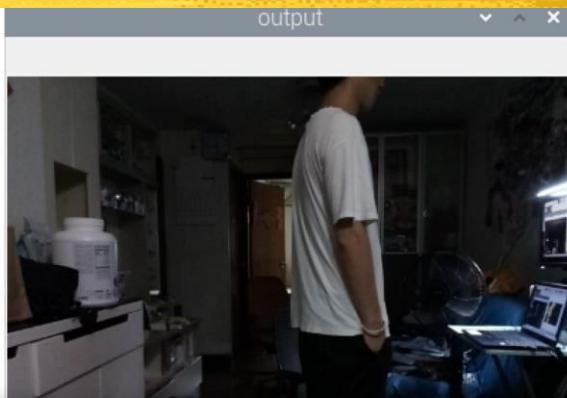
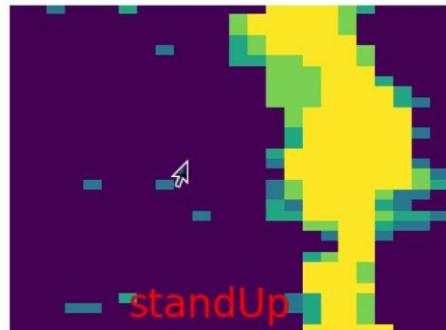
## 2. Construction Safety

## Other Applications – Infrared Fall Detection

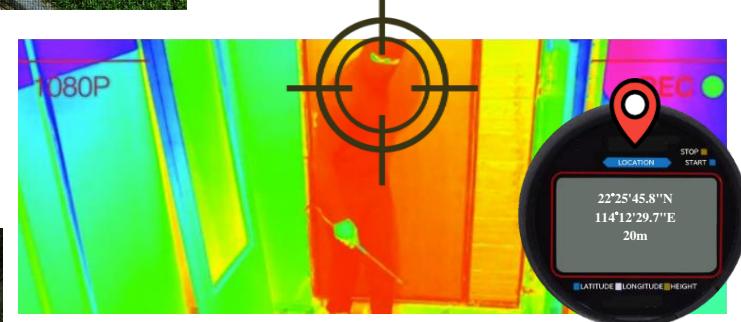
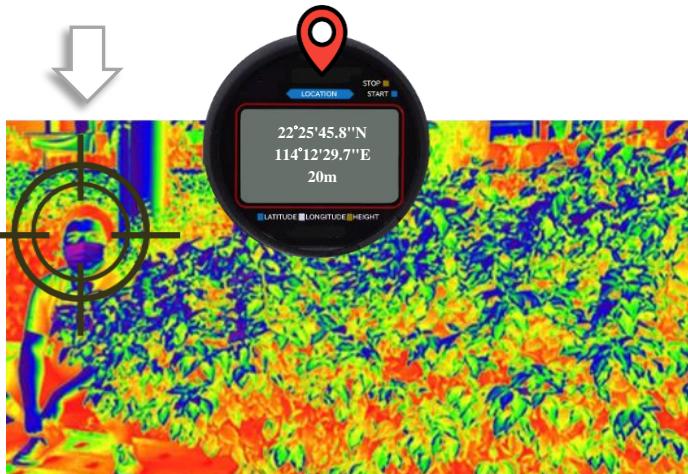


Used in construction sites and residential care homes (Elderly persons)





# Other Applications – Infrared Security Applications



Detect suspicious people at night

# Other Applications



1. Remote communications in construction sector



2. Remote live monitoring

# Other Applications

## Text to Speech

### Reading



### At work

The image shows two screenshots of a mobile application. The left screenshot displays a document titled "Introducing the new iGel® Conotracheal Airway" with several paragraphs of text. The right screenshot shows another document with text and small images.

### Shopping



### Menu



The image is a screenshot of a mobile application. At the top, it shows the time as 14:30 and battery level at 61%. The main content area features a circular profile picture of a man and text identifying him as "Ir Dr Kelvin Siu, Chief Executive Officer". Below this, there is a detailed biography: "PhD graduate from the Mechanical Engineering Department, The University of Hong Kong. Lecturer in HKU School of Professional and Continuing Education. Over 10 years of scientific research experience. He is a Chartered Engineer and Professional Member of Institute of Materials, Minerals and Mining, UK. He is also a Member of The Hong Kong Institute of Engineers (MHKIE)." At the bottom of the screen, there are standard mobile navigation icons for back, forward, and search.

# Other Applications

## Speech to Text



“Class, please turn to Page 5 for classwork. You will have 10 minutes to complete the questions...”

1. Assisting deaf students when teacher is not facing them to speak



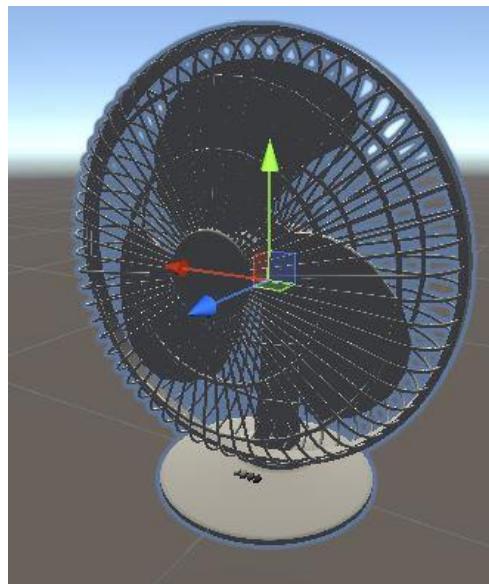
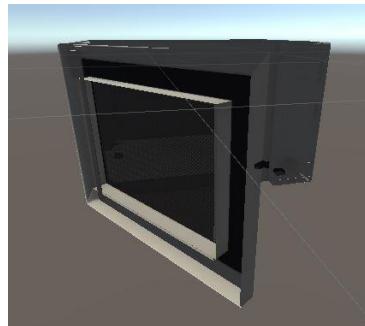
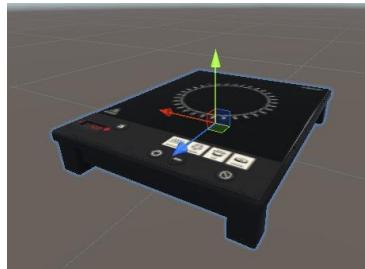
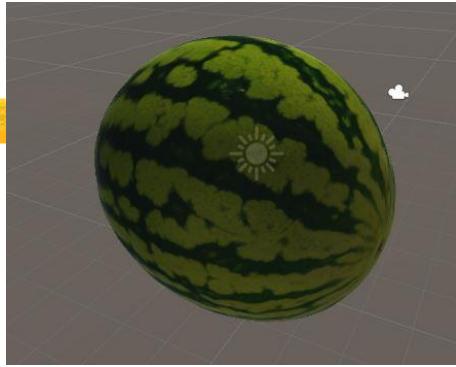
2. Turning voice to text for users to better understand what people said



## Other Applications of Smart Glasses

Application of Augmented Reality (AR) in curing and testing of Dementia



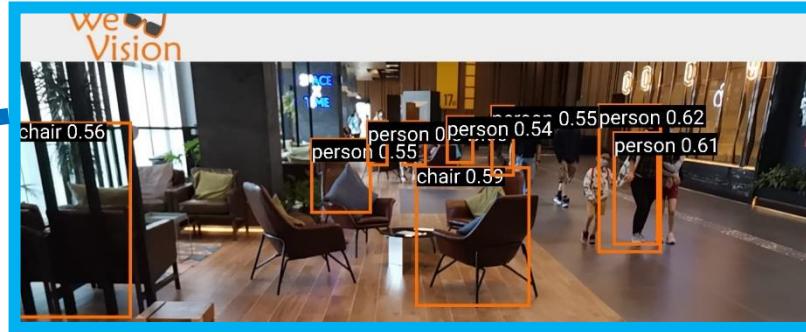


# Training Elderly's Cognitive Ability

VR/AR training

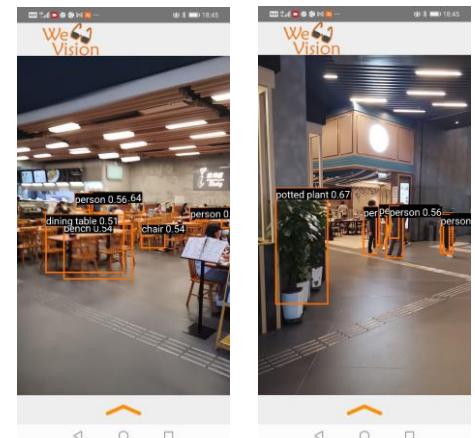


AR smart glasses



Display on the screen

VR immersive training



# Distant Sightseeing

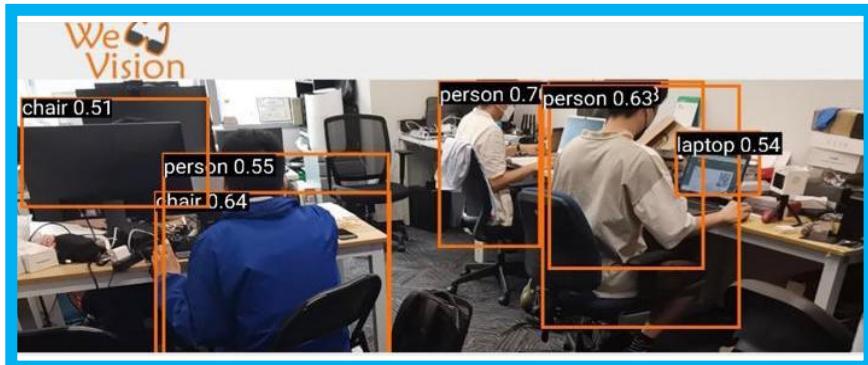


Live  
Streaming

Real-Time  
Video Call



# Digital Applications in Police Stations



Analysis displayed on the screens



# Exhibitions



Audio Description + AI Computer Vision



# Promotions



Exhibitions



Workshops in NGO



Invited speeches

# Media Coverage



# Newspaper Reporting

The image shows the header of the Chinadaily.com.hk website. The top navigation bar includes links for CHINA, GLOBAL EDITION, and various sections like HOME, NEWS, FOCUS, OPINION, VIDEO, DATA, and THAT'S HOW IT IS. A search icon is also present. Below the navigation is a banner featuring a group of people in formal attire. The main headline reads "Technology gives disabled new abilities" by Oasih Hu. A sub-headline below it says, "People with physical disabilities in Hong Kong can now further integrate into society using tech inventions specially developed for their benefit. Oasih Hu reports from Hong Kong." On the right side, there's a sidebar with a video thumbnail titled "China Daily's Oasih Hu Venturing into the meta..." and a link to YouTube.

A photograph of a man with dark hair and a beard, wearing a white face mask and a light-colored suit jacket over a white shirt. He is holding a pair of black smart glasses in his right hand, showing them towards the camera. The background shows shelves filled with various packaged food items like meat and vegetables in a supermarket setting.