請保持社交距離

本課程有直播可以線上觀看

直播連結

課程網頁

加簽表單

https://youtu.be/eKgDxp-_A0c

機器學習
課程速覽

李宏毅 Hung-yi Lee

課程內容

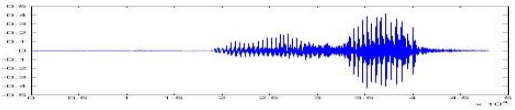
- 本課程共十五講，課程錄影已經放在課程網頁上
- 每一講都有一個對應的作業，作業內容之後上課時間公布
- 上課時間會講新的內容 (與作業無關)

課程網頁

什麼是機器學習？

Machine Learning
≈ Looking for Function

- Speech Recognition

$f($  $)=$ “How are you”

- Image Recognition

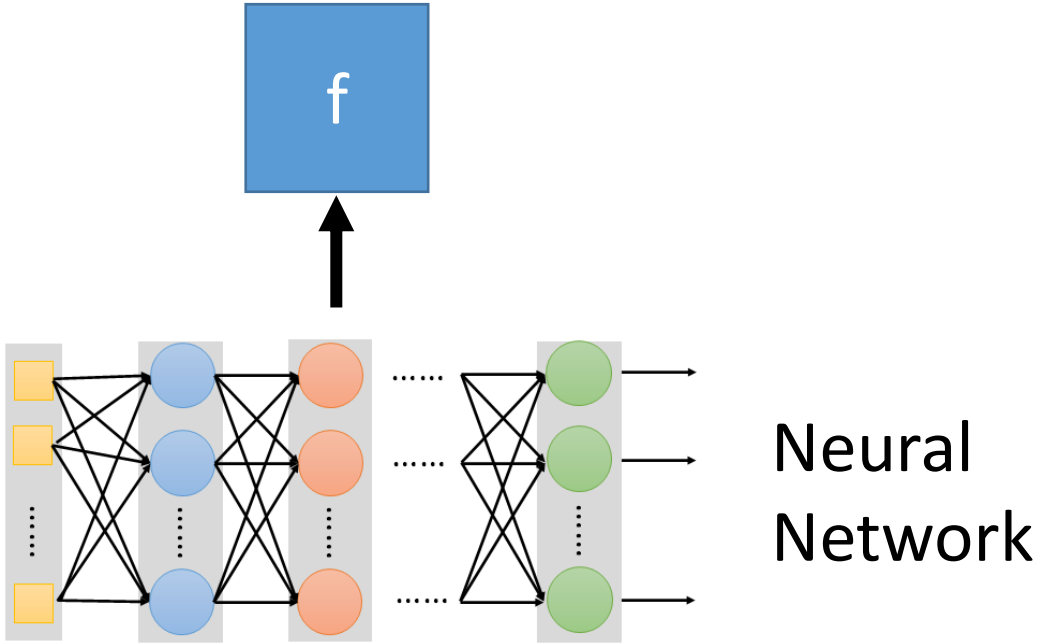
$f($  $)=$ “Cat”

- Playing Go

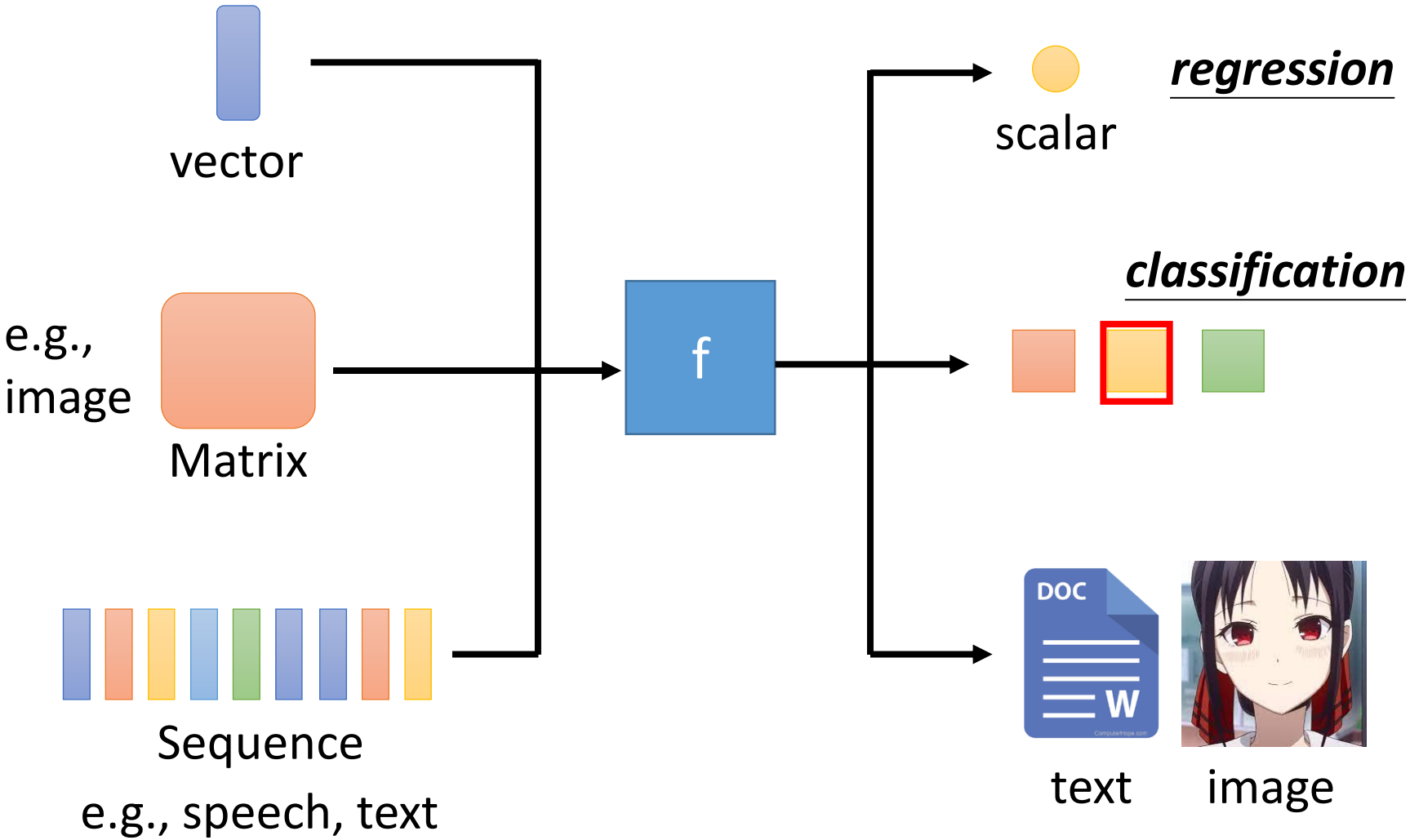
$f($  $)=$ “5-5” (next move)

Different types of Functions

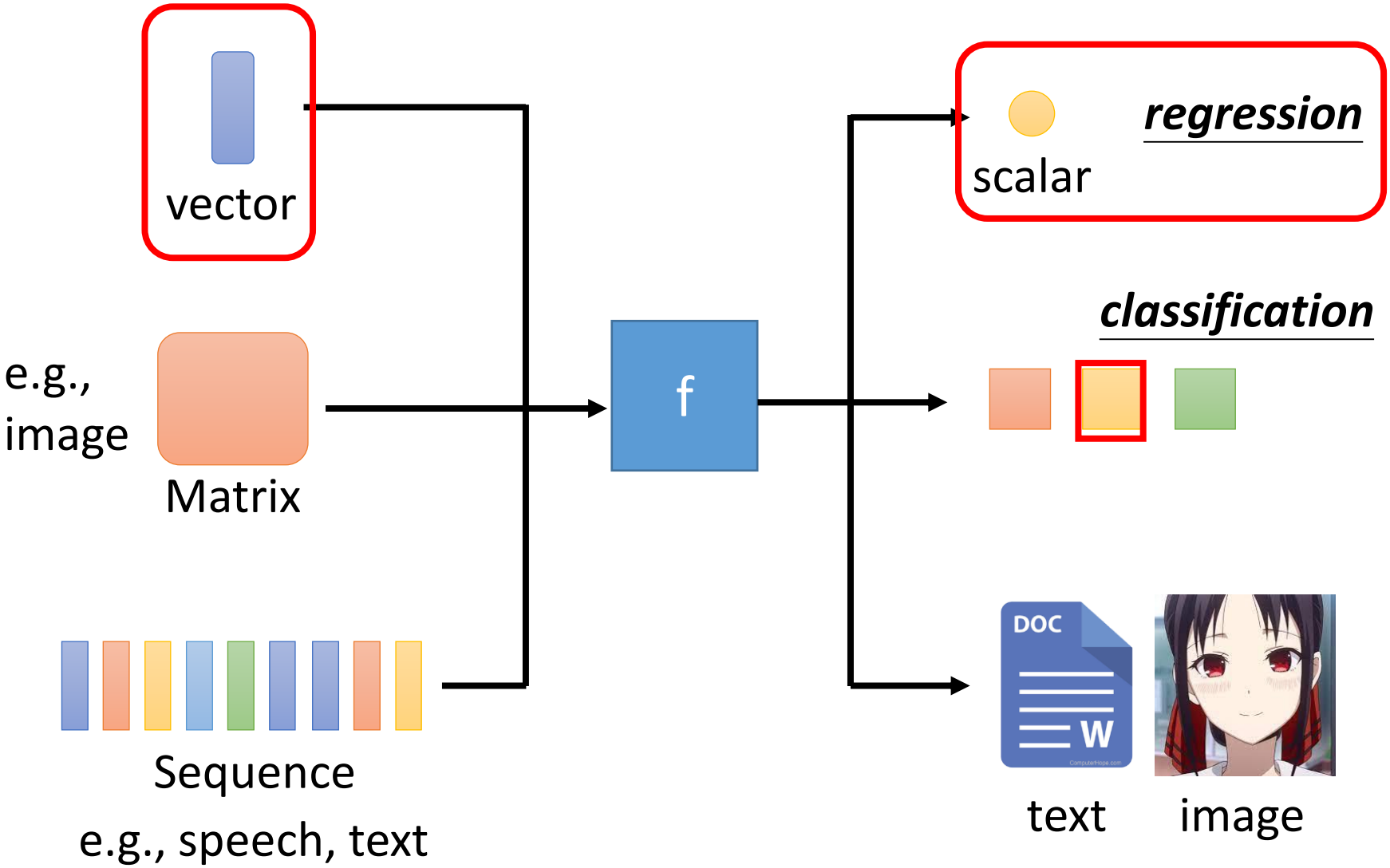
This course focuses on **Deep Learning**.



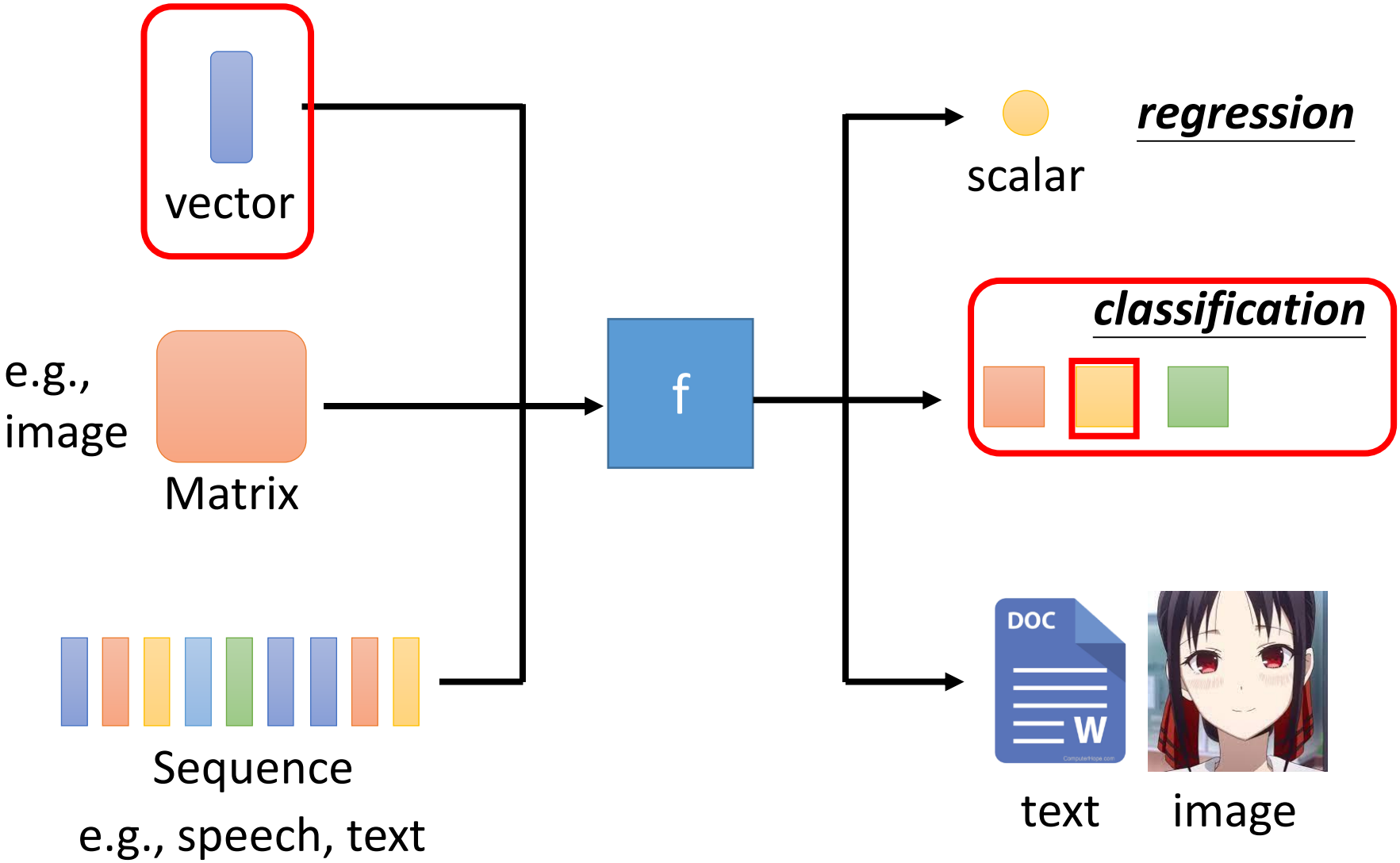
Different types of Functions



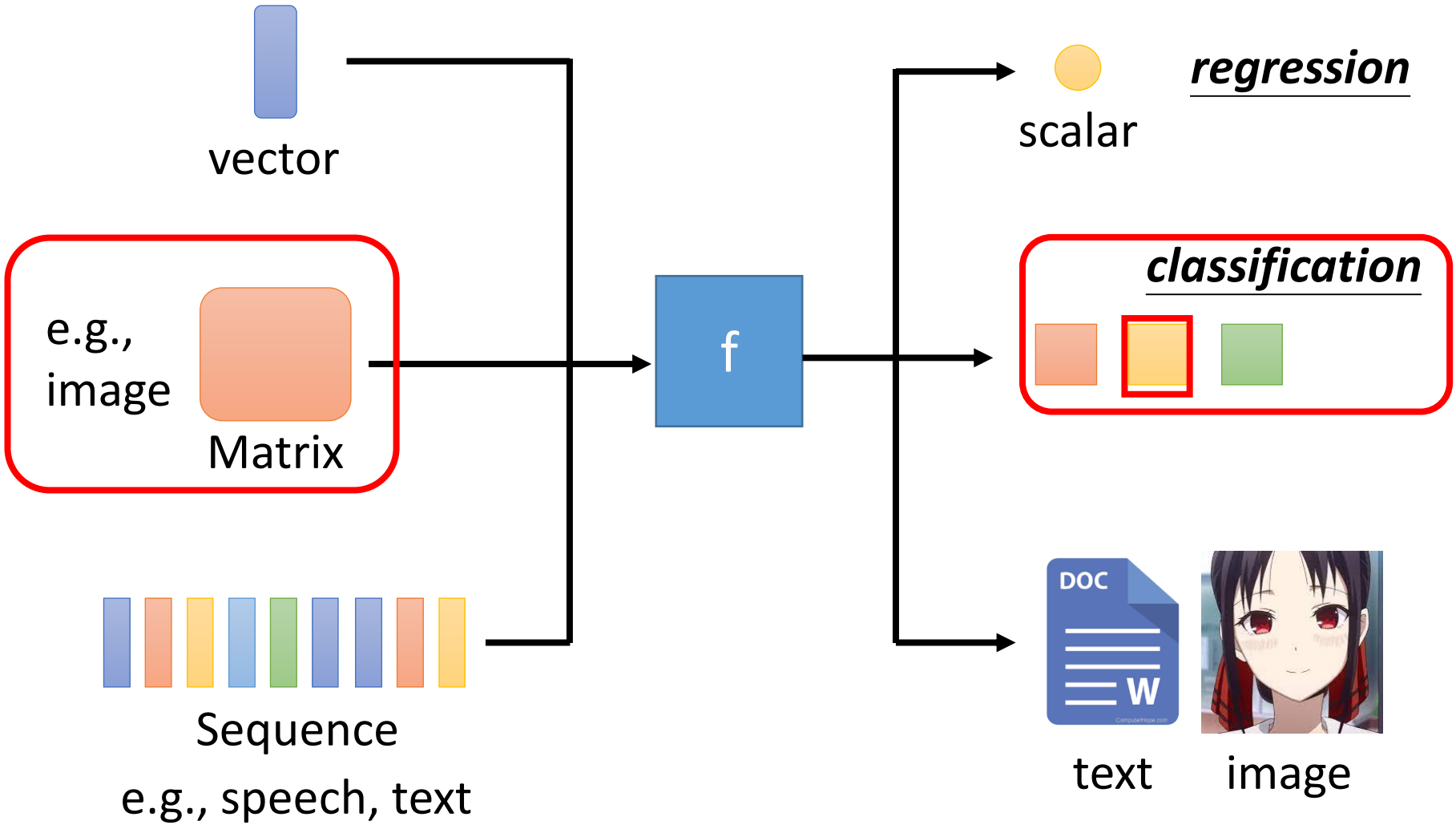
HW1: COVID-19 Case Prediction



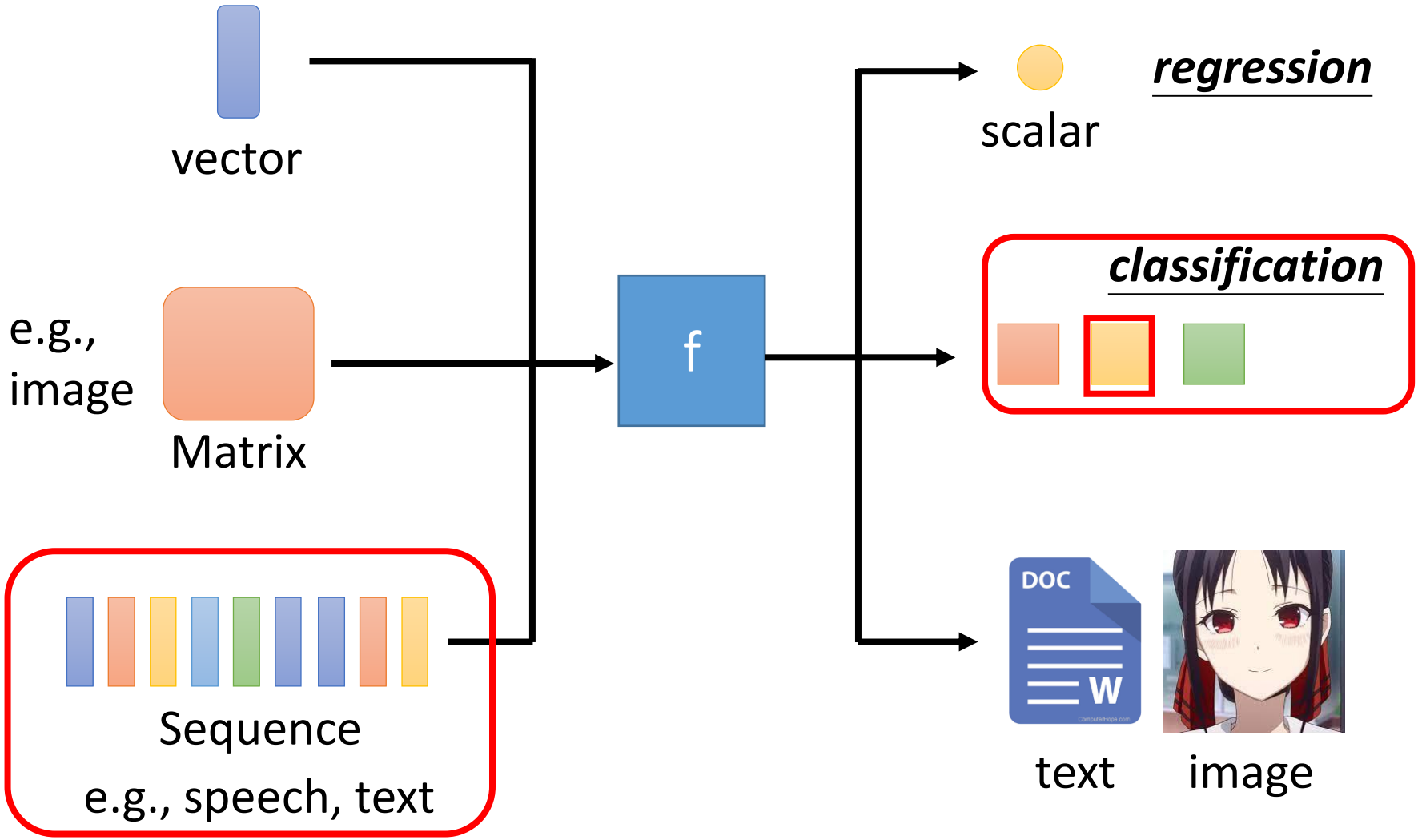
HW2: Phoneme Classification



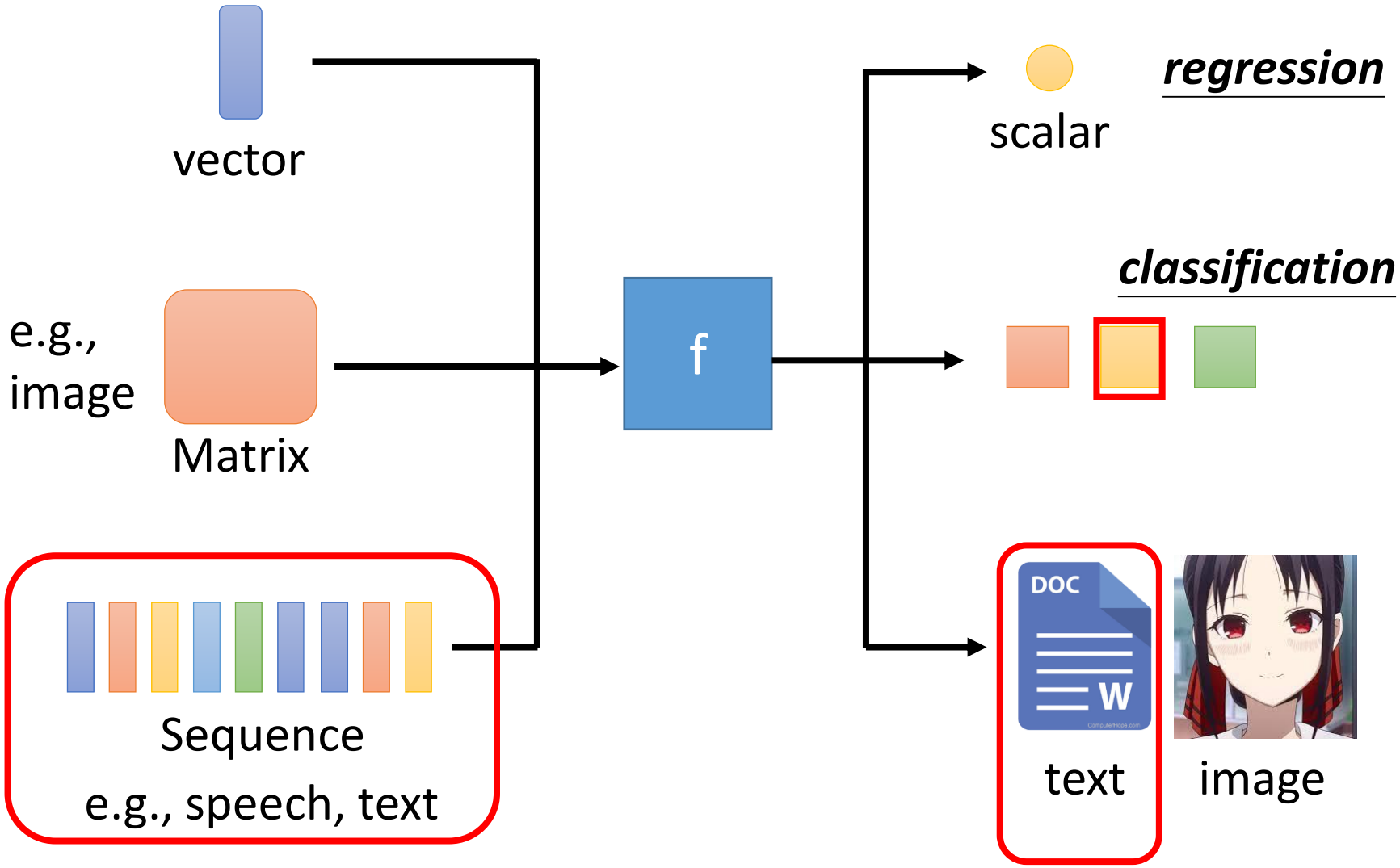
HW3: Image Classification



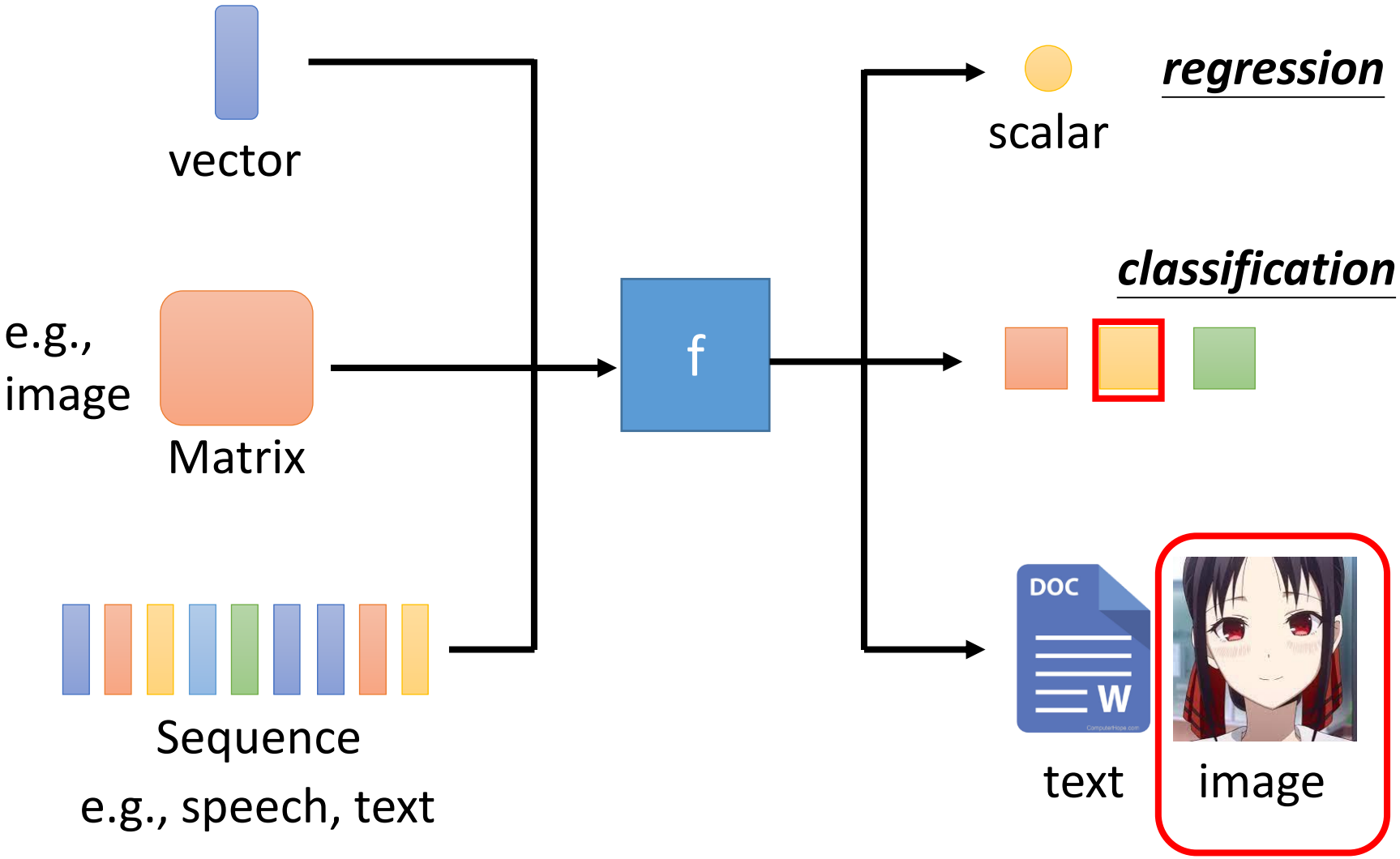
HW4: Speaker Classification



HW5: Machine Translation



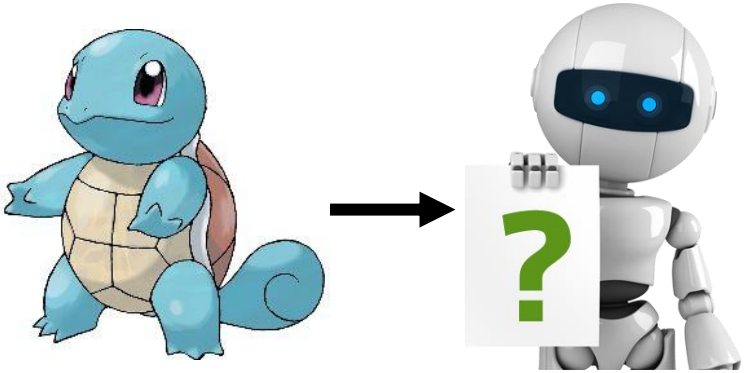
HW6: Anime Face Generation



教機器的種種方法

Supervised Learning

Lecture 1 - 5



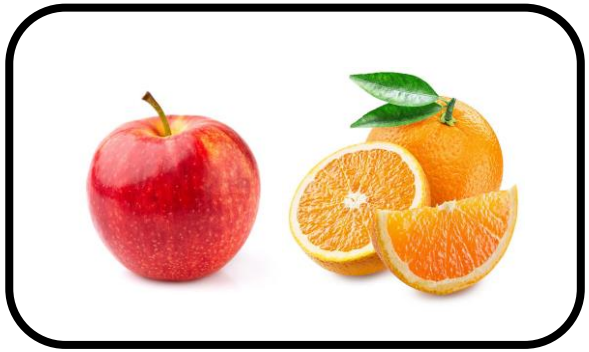
Pokémon
or
Digimon

Training Data

Pokémon	Pokémon	Digimon	Digimon

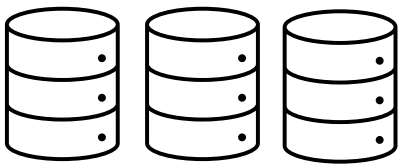
labels

Lecture 7:
Self-supervised Learning

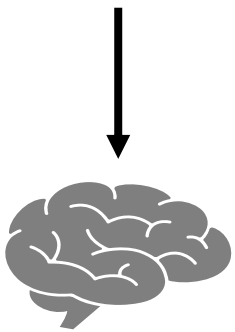


It is not efficient to collect data for each task.

Lecture 7:
Self-supervised Learning



unlabeled images



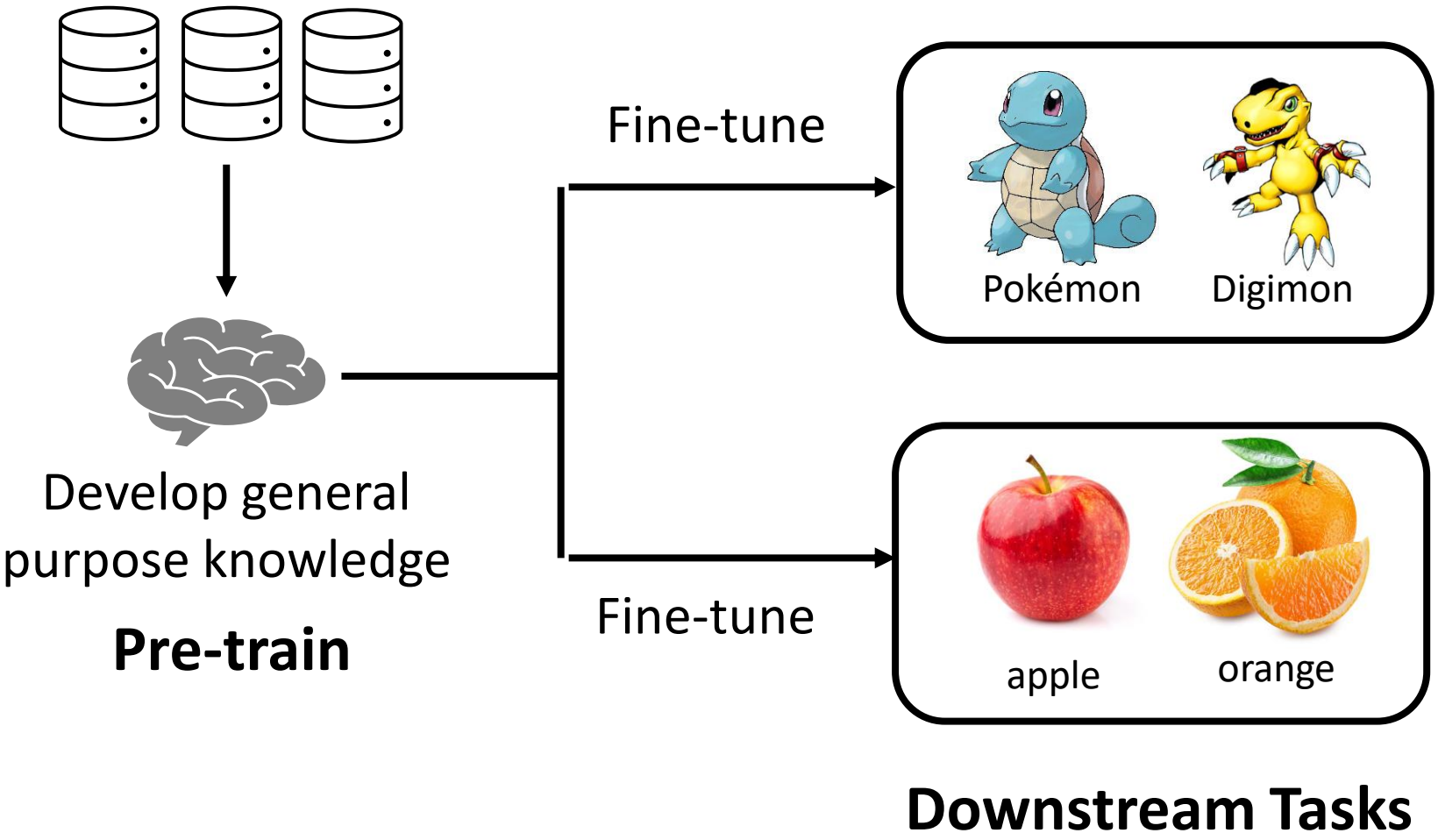
Develop general purpose knowledge

Pre-train

Are they the same?

Are they the same?

Lecture 7:
Self-supervised Learning

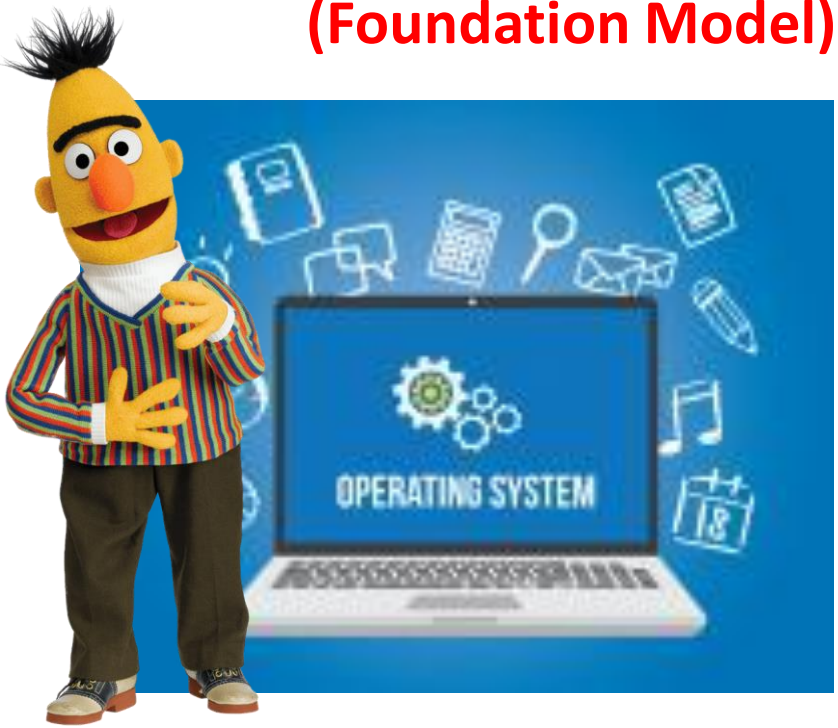


Lecture 7:
Self-supervised Learning

BERT

Pre-trained Model vs. **Downstream Tasks**

(Foundation Model)



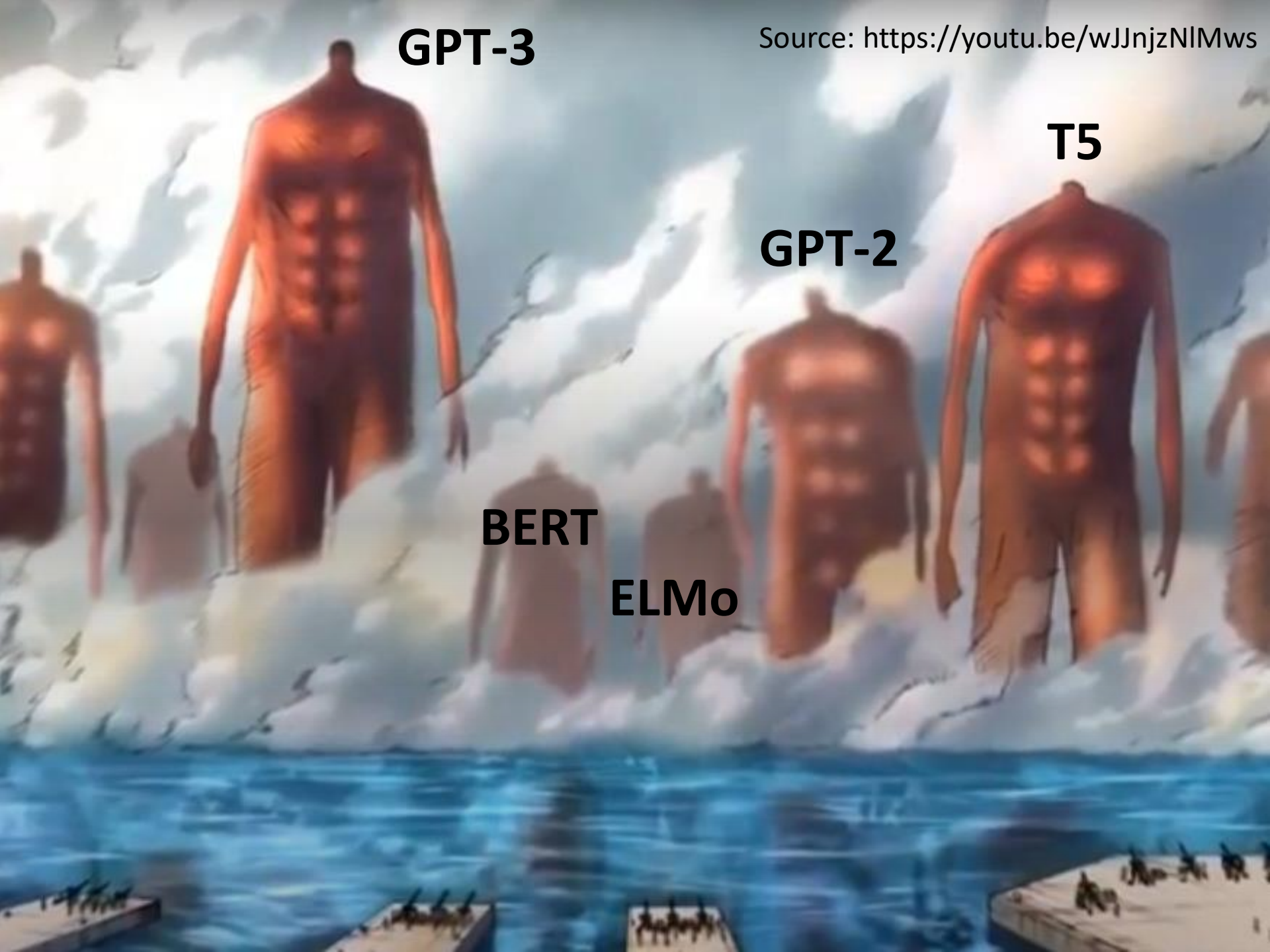
Operating Systems

Applications

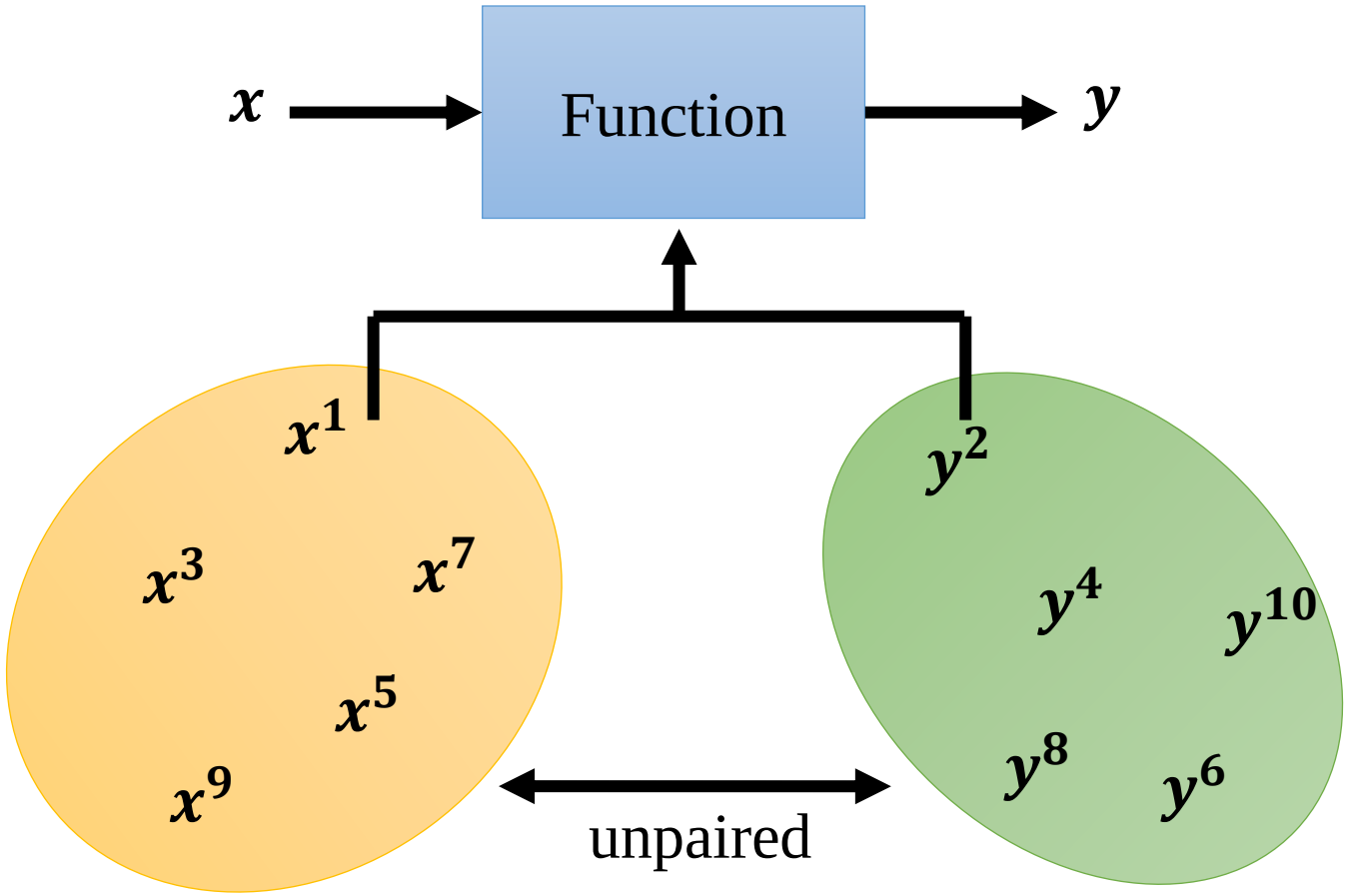
Source of image:
https://leemeng.tw/attack_on_bert_transfer_learning_in_nlp.html

Spoiler Alert

Source of image:
https://leemeng.tw/attack_on_bert_transfer_learning_in_nlp.html

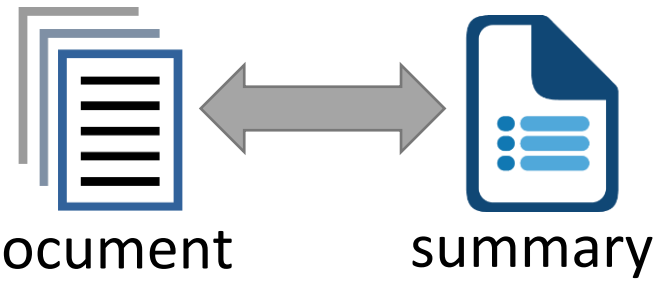

GPT-3
Source: https://youtu.be/wJJnjzNlMws
T5
GPT-2
BERT
ELMo

Lecture 6:
Generative Adversarial Network



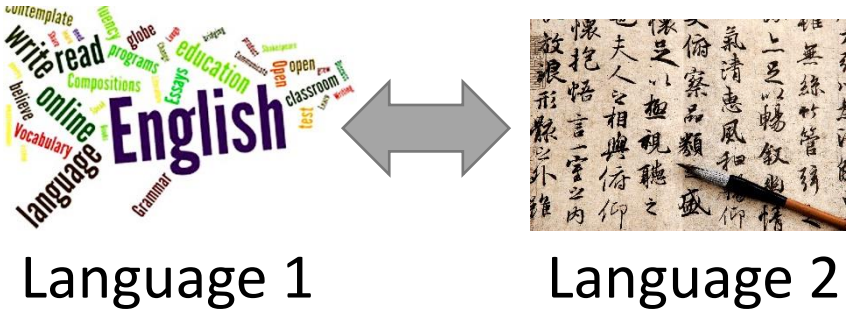
Unsupervised Abstractive Summarization

https://arxiv.org/abs/1810.02851



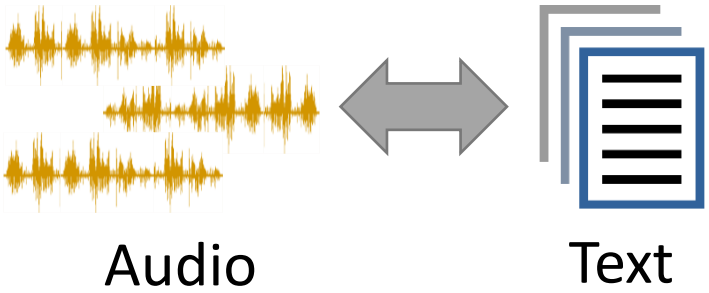
Unsupervised Translation

https://arxiv.org/abs/1710.04087
https://arxiv.org/abs/1710.11041

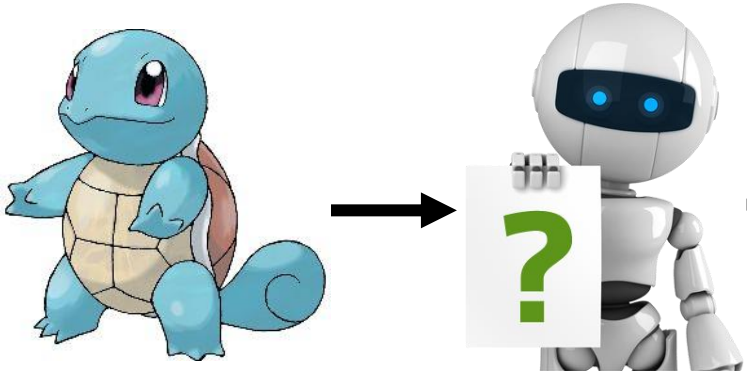


Unsupervised ASR

https://arxiv.org/abs/1804.00316
https://arxiv.org/abs/1812.09323
https://arxiv.org/abs/1904.04100
https://arxiv.org/abs/2105.11084



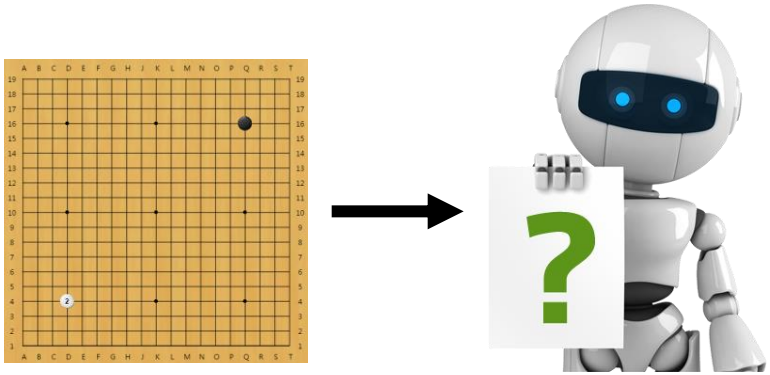
Lecture 12: Reinforcement Learning (RL)



Human label

? ⟷ Pokémon

It is challenging to label data in some tasks.



Human label

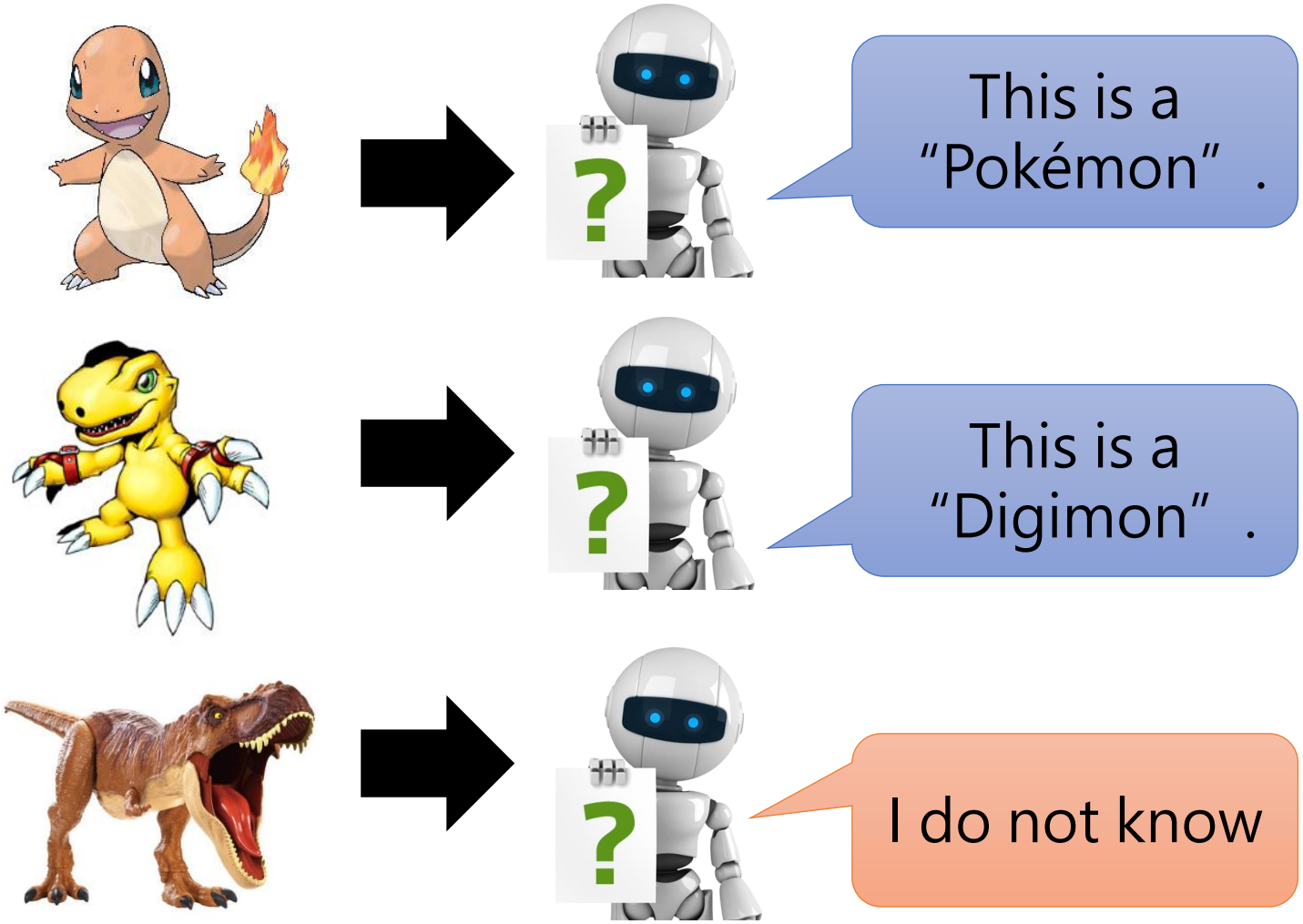
? ⟷ “3-3”?

We can know the results are good or not. → **RL**

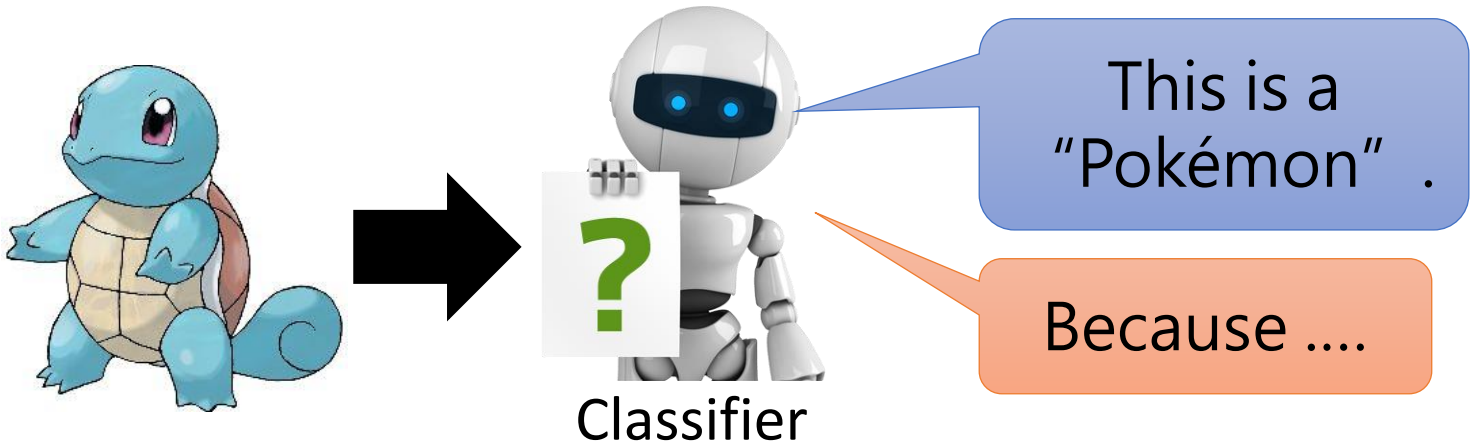
進階課題

不只是追求正確率 ...

Lecture 8: Anomaly Detection



Lecture 9: Explainable AI



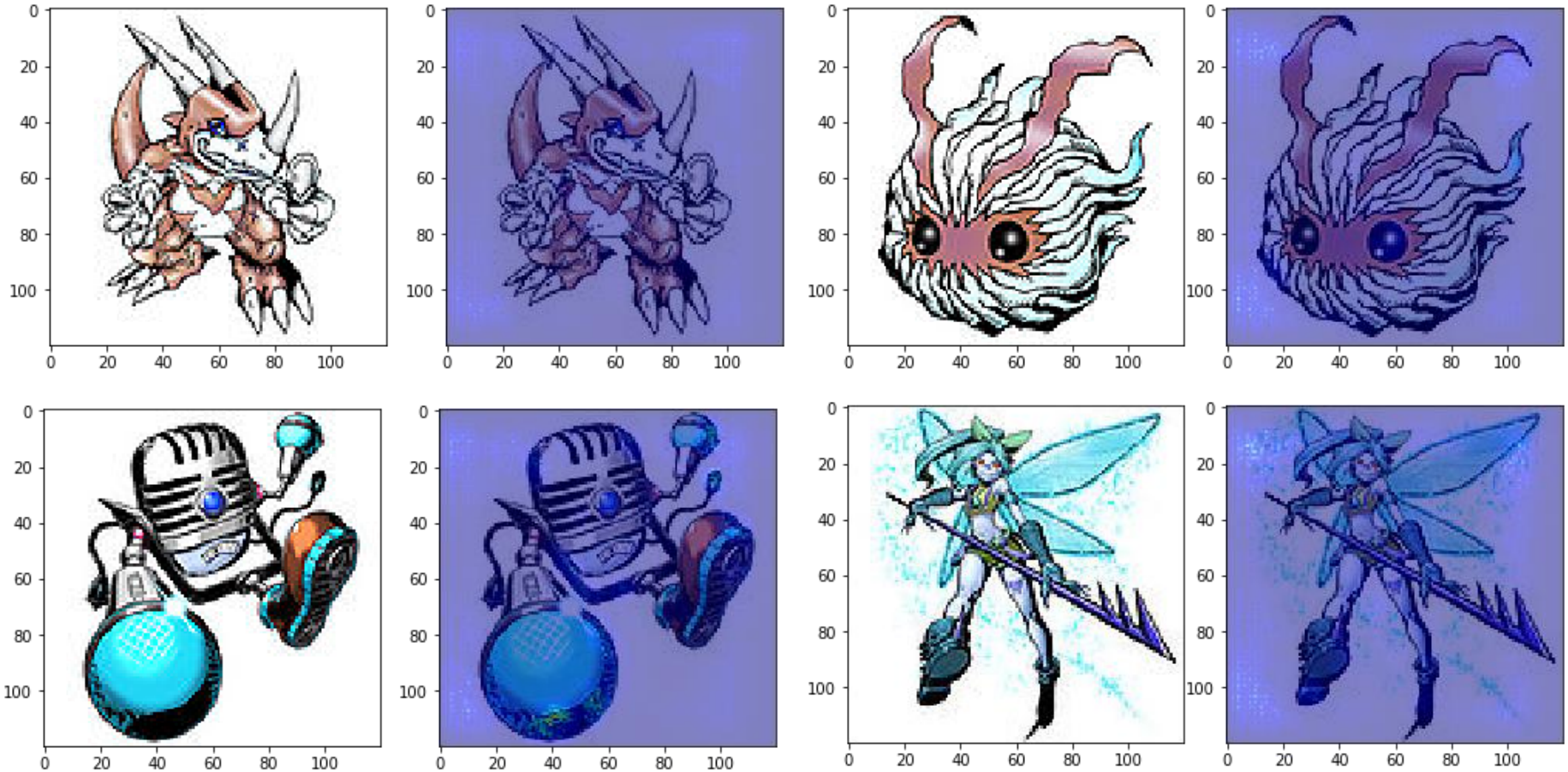
Why do you think this image is a Pokémon?

Lecture 9: Explainable AI

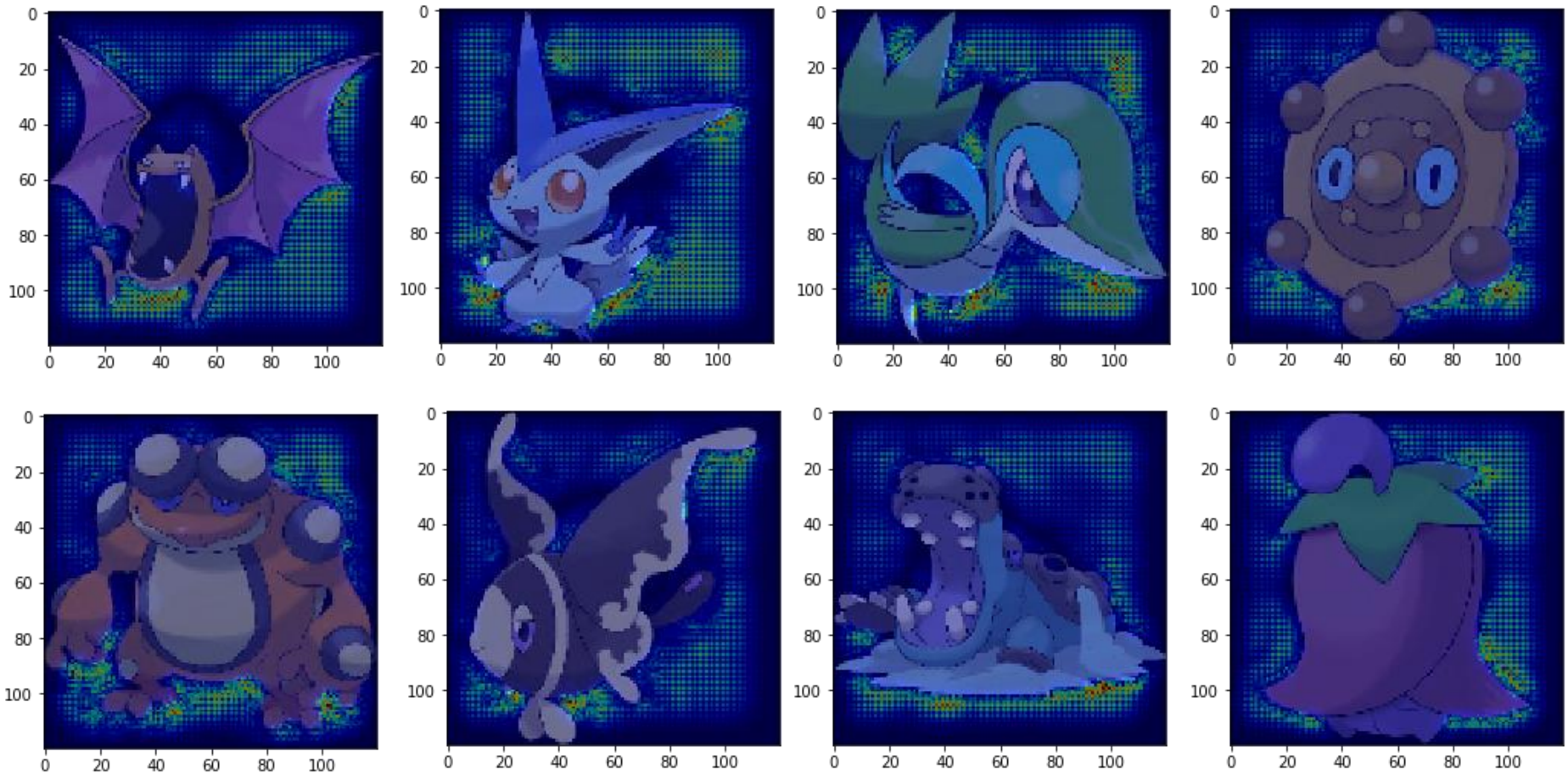
```
model = Sequential()
model.add(Conv2D(32, (3, 3), padding='same', input_shape=(120,120,3)))
model.add(Activation('relu'))
model.add(Conv2D(32, (3, 3)))
model.add(Activation('relu'))
model.add(MaxPooling2D(pool_size=(2, 2)))

model.add(Conv2D(64, (3, 3), padding='same'))
model.add(Activation('relu'))
model.add(Conv2D(64, (3, 3)))
model.add(Activation('relu'))
model.add(MaxPooling2D(pool_size=(2, 2)))

model.add(Conv2D(256, (3, 3), padding='same'))
model.add(Activation('relu'))
model.add(Conv2D(256, (3, 3)))
model.add(Activation('relu'))
model.add(MaxPooling2D(pool_size=(2, 2)))

model.add(Flatten())
model.add(Dense(1024))
model.add(Activation('relu'))
model.add(Dense(2))
model.add(Activation('softmax'))
```

Testing Accuracy: 98.4% **Amazing!!!!!**

Lecture 9: Explainable AI



Lecture 9: Explainable AI



Lecture 9: Explainable AI

- All the images of Pokémon are PNG, while most images of Digimon are JPEG.

loading the files

png files have transparent background

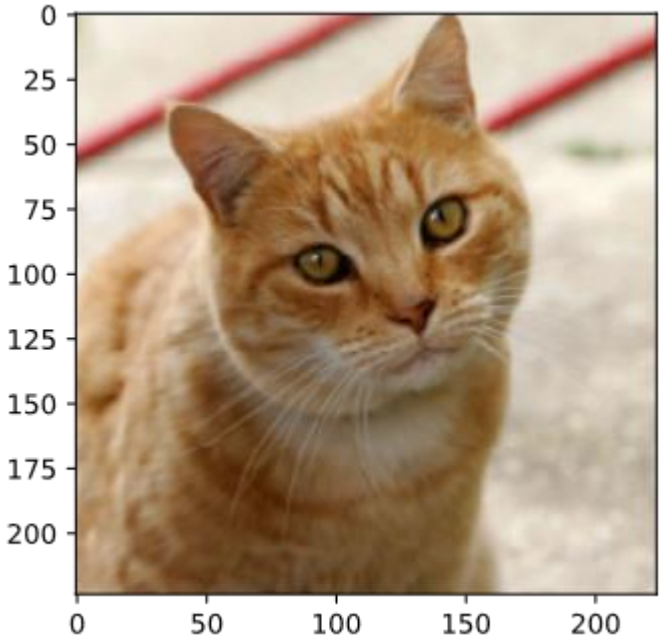
transparent background becomes black

Machine discriminates Pokémon and Digimon based on the background colors.

I will let you know the story after fixing the mistake. ☺

Lecture 10: Model Attack

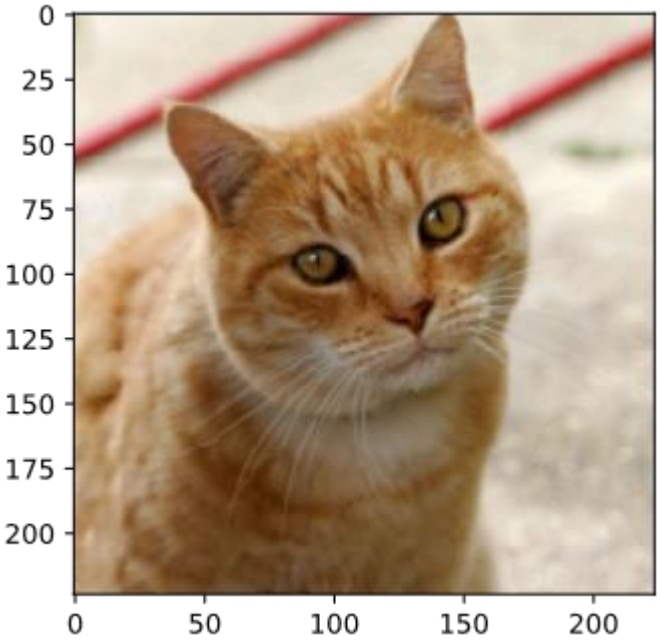
Benign Image



Tiger Cat

0.64

Attacked Image

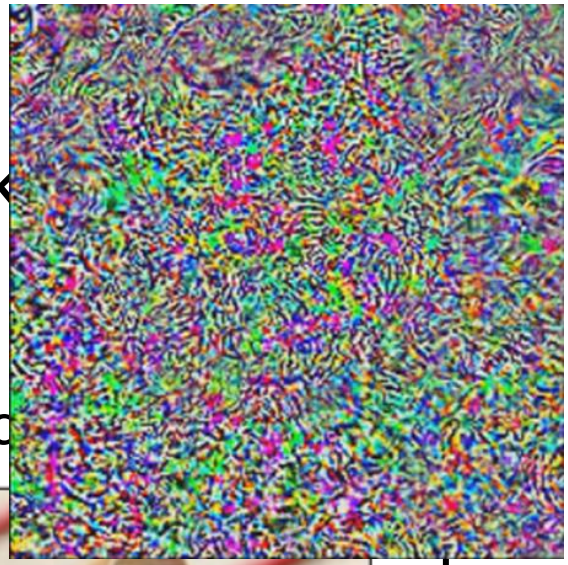


Star Fish

1.00

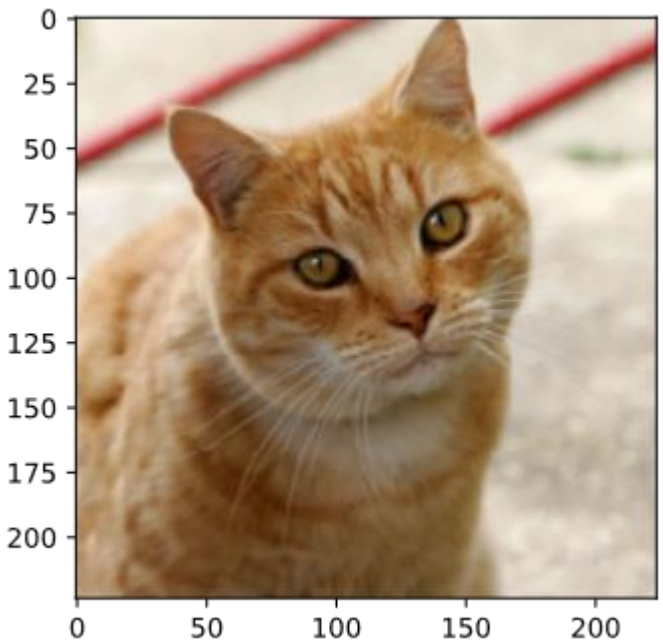
Lecture 10: Model Attack

=



50x

Benign Image

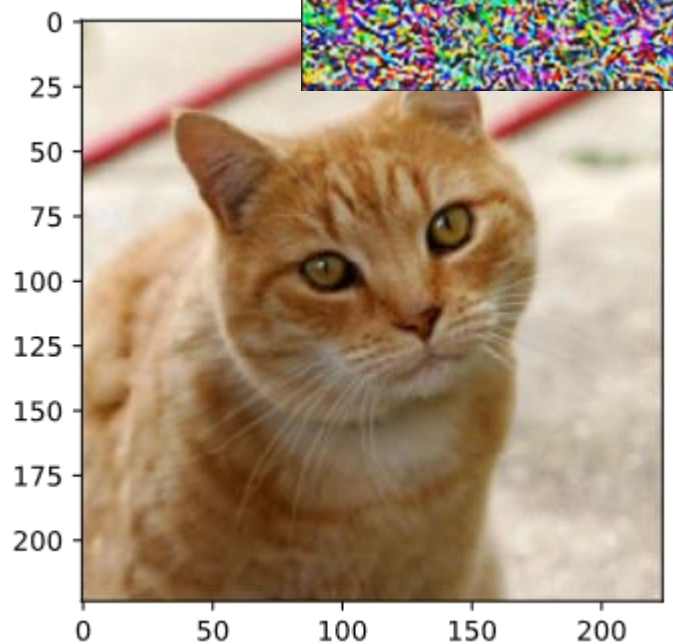


Tiger Cat

0.64

-

Attac



Star Fish

1.00

Lecture 11: Domain Adaptation

Training Data

Testing Data

99.5%

57.5%

The results are from: http://proceedings.mlr.press/v37/ganin15.pdf

Lecture 13: Network Compression

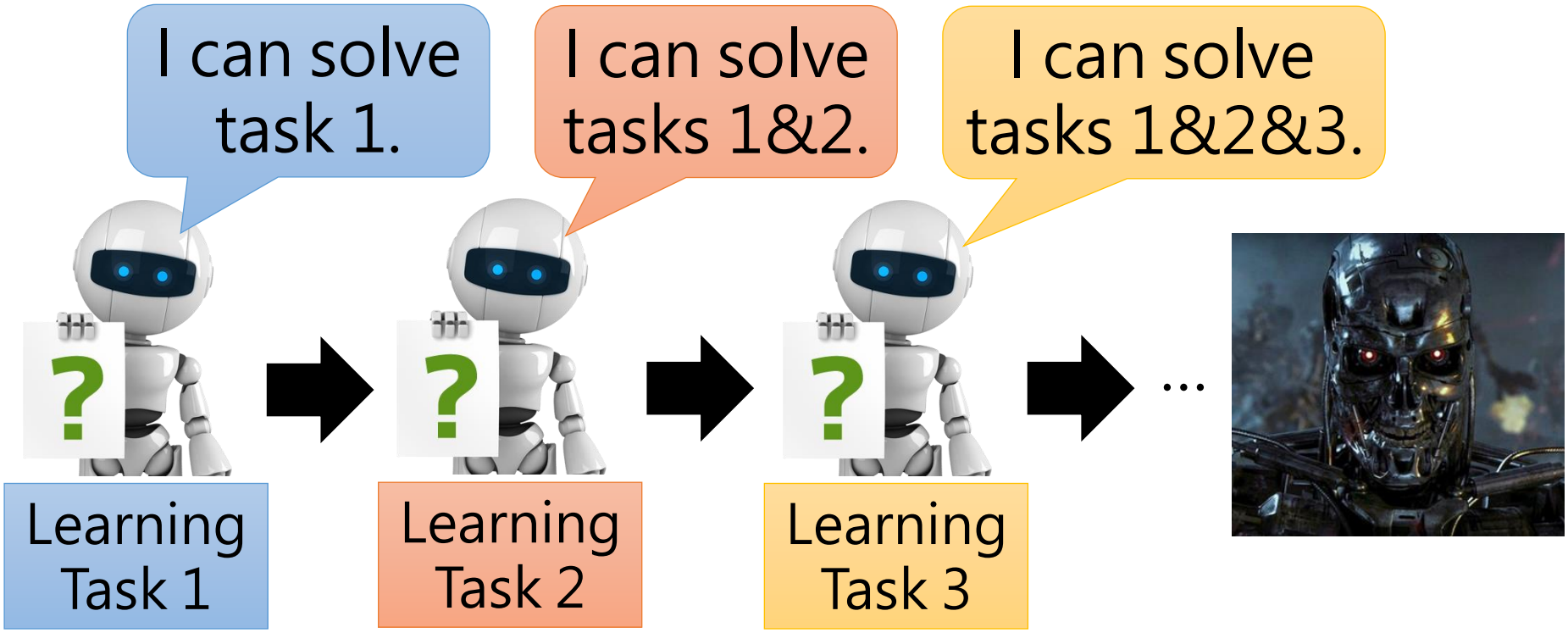
smaller

Too Big!

Deploying ML models in resource-constrained environments

Lower latency, Privacy, etc.

Lecture 14: Life-long Learning



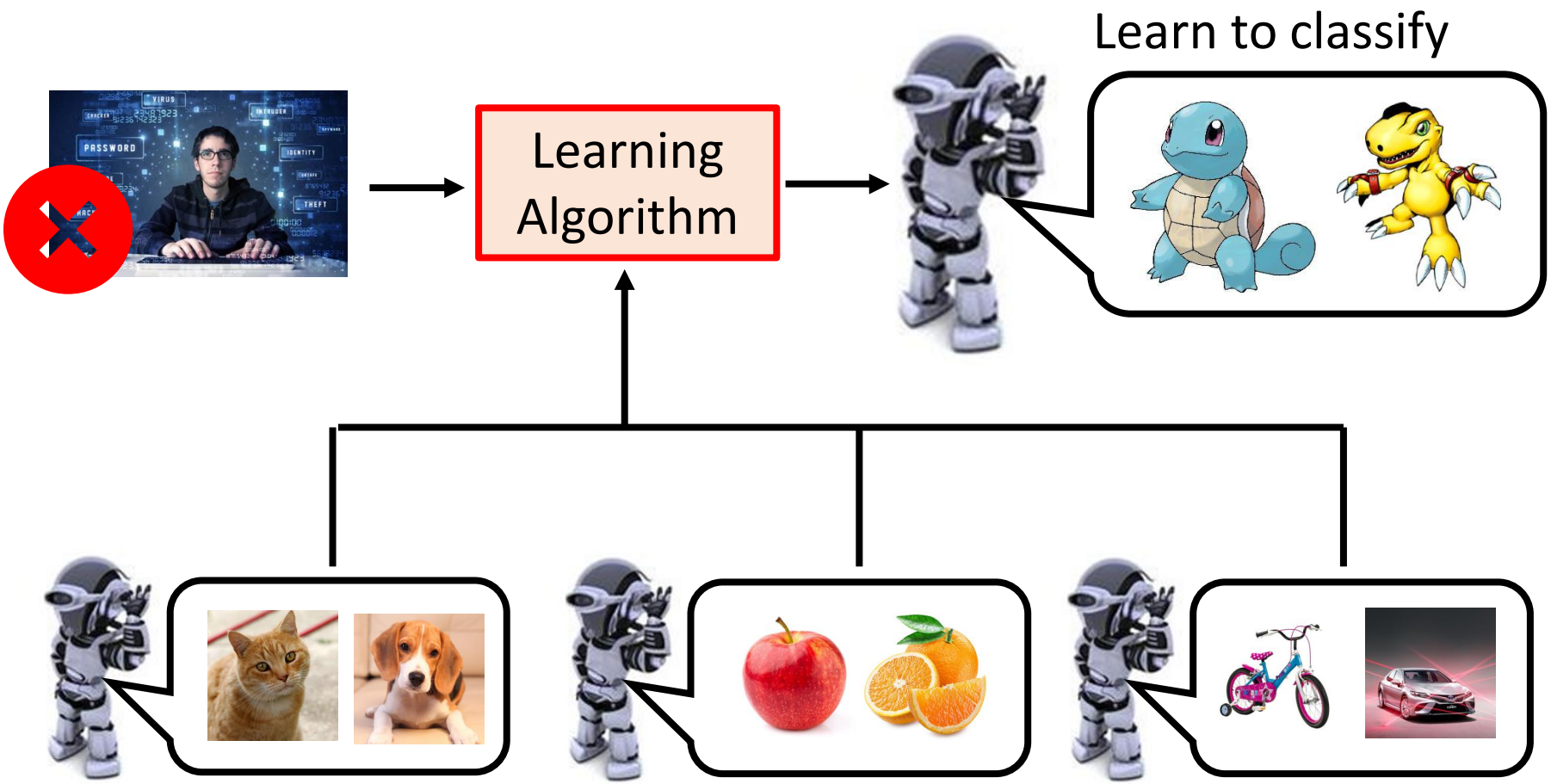
This is the target of life-long learning.
What is the challenge?

學習如何學習

Meta Learning = Learn to Learn

Lecture 15: Meta learning

Few-shot learning is usually achieved by meta-learning.



I hope you enjoy this course!

台大電機系機器學習課程 YouTube 頻道