深度學習
Deep Learning

Project Introduction

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2025/04/07

Course GitHub

Slido # DL_0324

如何評估模型效能？

Model

Class	Pred	Gold
Cat	☑	✅
Dog		
Fox		
⋮		

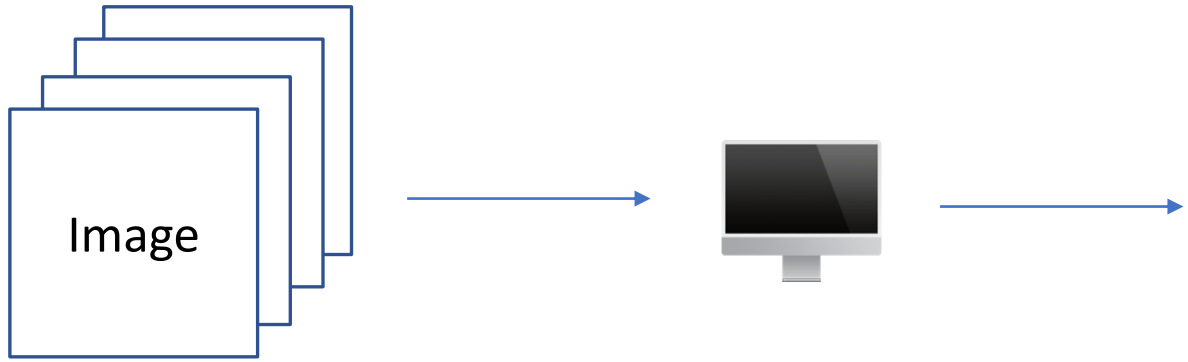
我們不能只憑一筆資料就說模型很棒...

Model

Class	Pred	Gold
Cat		
Dog		✅
Fox	☑	
⋮		

自動化評估

- 「評估」的意義：**量化**模型的表現



資料

(假設用二分類任務)

	Pred	Gold
1	1	0
2	1	1
3	1	1
4	1	1

正確率：0.75

真正答對的數量 /
總預測的數量

評估方式 (計算模型有多高分的方式)

- 不同任務有不同的評估方式

類型

Automatic Evaluation
(自動化評估)

Human Evaluation
(人工評估)

「生成」任務較為需要

What is Kaggle?

- Kaggle is a platform that provides:
  - Real-word datasets for machine learning
  - Competitions with prizes (sometimes with money)
  - Discussion forum with a lots of code examples

kaggle

Kaggle submission types

- Traditional competitions 本課程 projects 採用此方式
  - Upload s**ubmission file** (e.g., *.csv)
- Code / Notebook competitions
  - Upload **code** (e.g., *.ipynb)

If you play Kaggle a lot …

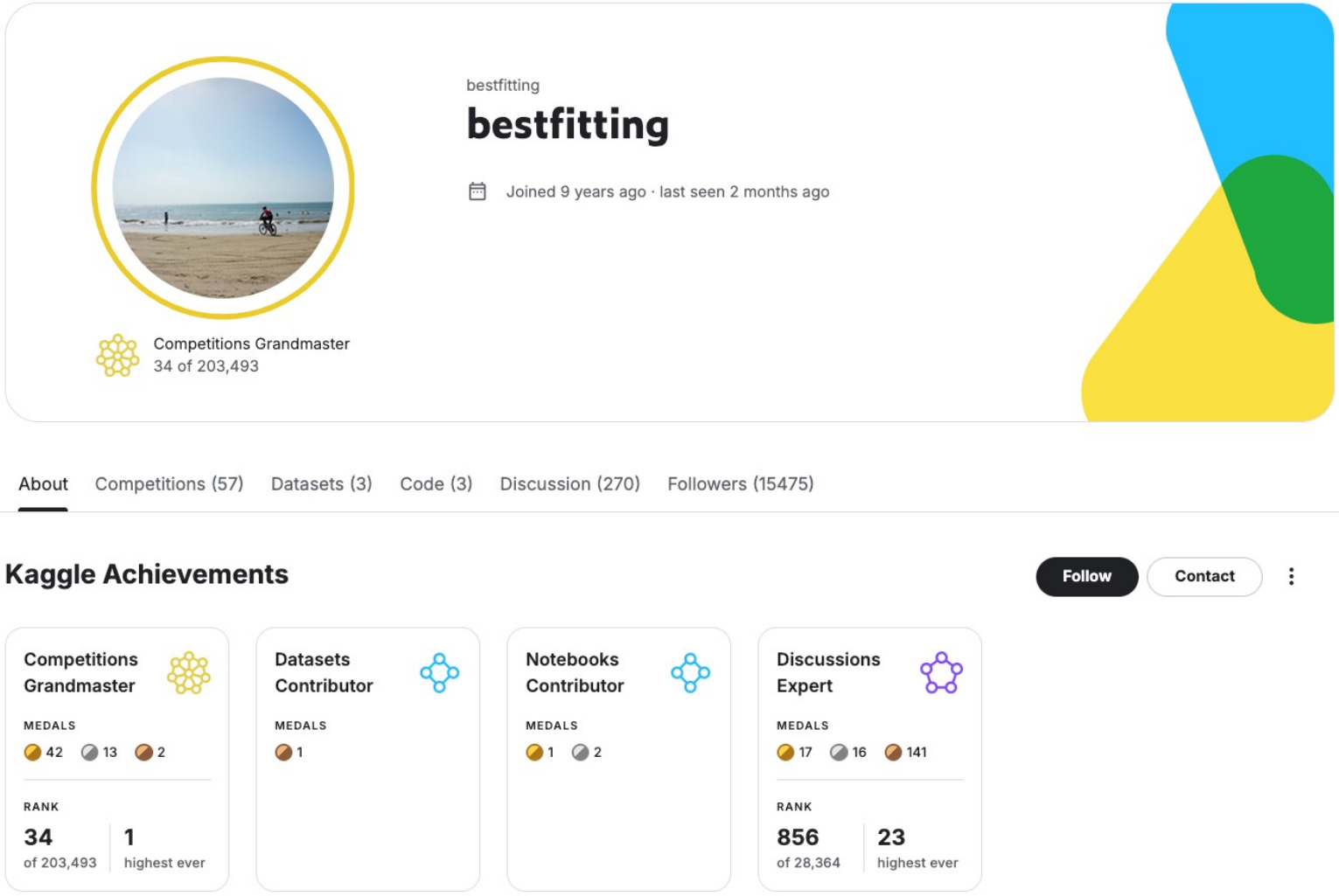


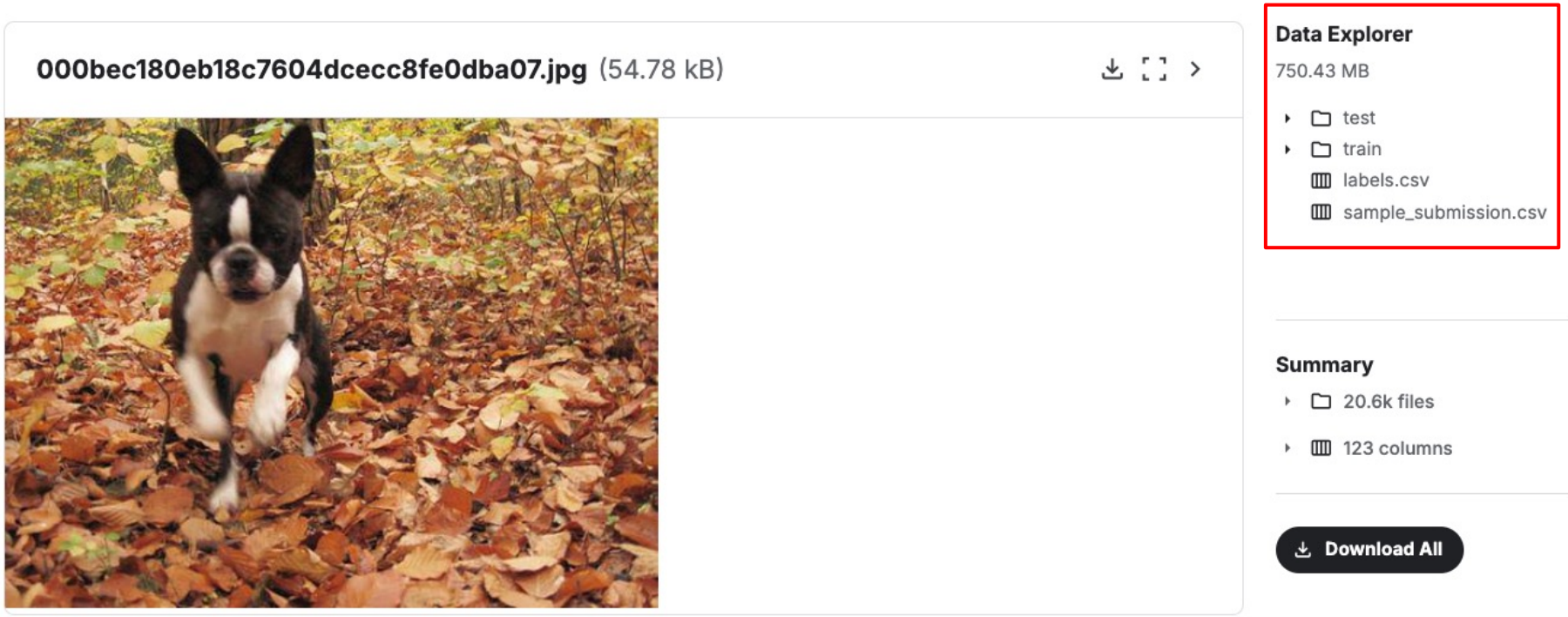
Figure source: https://www.kaggle.com/bestfitting

Outline of tasks

Platform	Competition Name	Data Type	Task Type	Why special? (Difficulty)
Kaggle	Dog Breed Identification	Image	Image Classification	120 classes
	Plant Pathology 2020 - FGVC7	Image	Image Classification	Class imbalance
	Natural Language Processing with Disaster Tweets	Text	Text Classification	NLP

Dog Breed Identification

- https://www.kaggle.com/competitions/dog-breed-identification/overview



Dog Breed Identification

affenpinscher
afghan_hound
african_hunting_dog
airedale
american_staffordshire_terrier
appenzeller
australian_terrier
basenji
basset
beagle
bedlington_terrier
bernese_mountain_dog
black-and-tan_coonhound
blenheim_spaniel
bloodhound
bluetick
border_collie
border_terrier
borzoi
boston_bull
bouvier_des_flandres
boxer
brabancon_griffon
briard
brittany_spaniel

⋮

000bec180eb18c7604dcecc8fe0dba07.jpg (54.78 kB)

labels.csv (482.06 kB)

Detail | Compact | Column

id	breed
10222 unique values	scottish_deerhound 1% maltese_dog 1% Other (9979) 98%
000bec180eb18c7604dcecc8fe0dba07	boston_bull
001513dfcb2ffafc82cccf4d8bbaba97	dingo
001cdf01b096e06d78e9e5112d419397	pekinese
00214f311d5d2247d5dfe4fe24b2303d	bluetick
0021f9ceb3235effd7fcde7f7538ed62	golden_retriever
002211c81b498ef88e1b40b9abf84e1d	bedlington_terrier
00290d3e1fdd27226ba27a8ce248ce85	bedlington_terrier

Dog Breed Identification (evaluation)

Multi Class Log Loss:

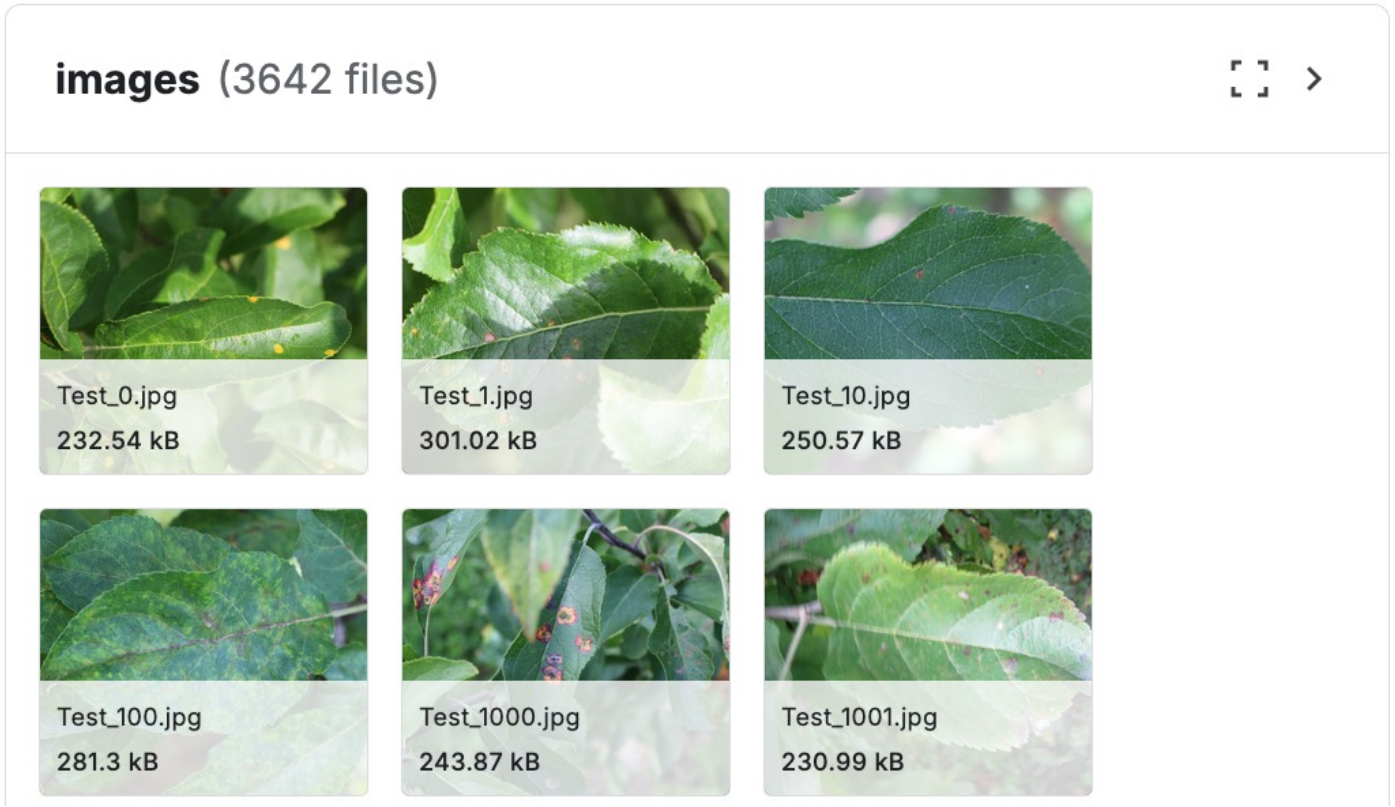
$$\text{loss} = -\frac{1}{N}\sum_{i=1}^{N}\sum_{j=1}^{M} y_{ij}\log(\hat{y}_{ij})$$

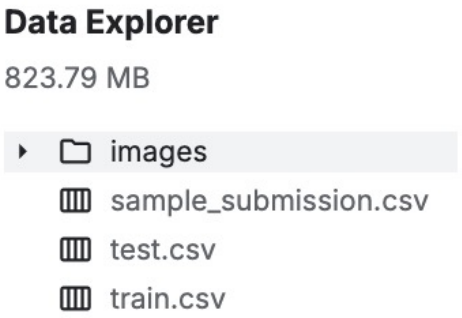
- 值越小越好
  - N: 資料數量 (test set 的數量)
  - M: 類別數量 (120)
  - y_{ij}: 真實的答案
  - $\hat{y}_{ij}$: 模型預測的答案

Cross-entropy: $\mathcal{L}_i = -\log P(Y = y_i | X = x_i)$

Plant Pathology 2020 - FGVC7

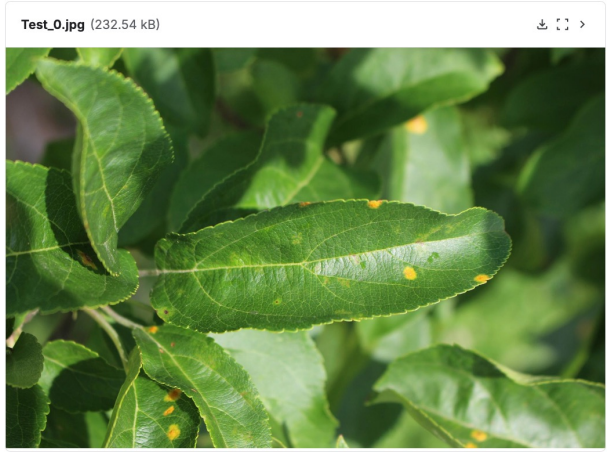
- https://www.kaggle.com/competitions/plant-pathology-2020-fgvc7/data?select=images





Plant Pathology 2020 - FGVC7

- 每張影像有4個類別
  - Healthy
  - Multiple diseases (多重疾病)
  - Rust (鏽病)
  - Scab (疥瘡病)



train.csv (33.53 kB)

Detail Compact Column 5 of 5 columns

image_id	# healthy	# multiple_diseases	# rust	# scab
1821 unique values	0 1	0 1	0 1	0 1
Train_0	0	0	0	1

Plant Pathology 2020 - FGVC7 (Evaluation)

Evaluation

Submissions are evaluated on mean column-wise ROC AUC. In other words, the score is the average of the individual AUCs of each predicted column.

針對每個 label 的模型預測各算一次 AUC (Area Under the Curve) 之後，取平均

ROC Curve

(Useful!!) https://developers.google.com/machine-learning/crash-course/classification/roc-and-auc?hl=zh-tw

ROC curve: Receiver operating characteristic curve (接收者操作特徵曲線)

ROC curve 定義: 針對不同的模型分類門檻下的模型表現圖

- X軸：False positive rate (FPR); Y軸：True positive rate (TPR)
- AUC: ROC 的底面下面積 (越大越好)

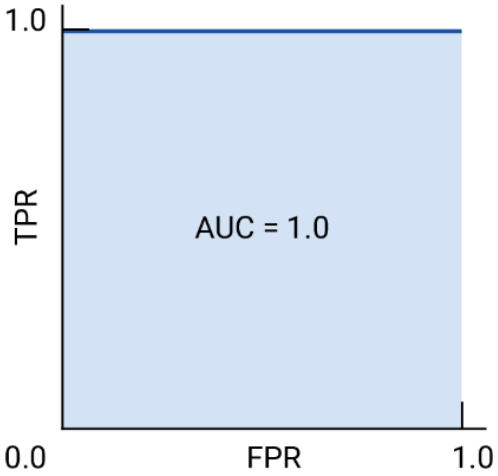


圖 1：ROC 和 AUC，這是一個完美假設的模型。

模型分類門檻 (Threshold)

Model

Rust

模型輸出	答案
機率 = 0.55	1

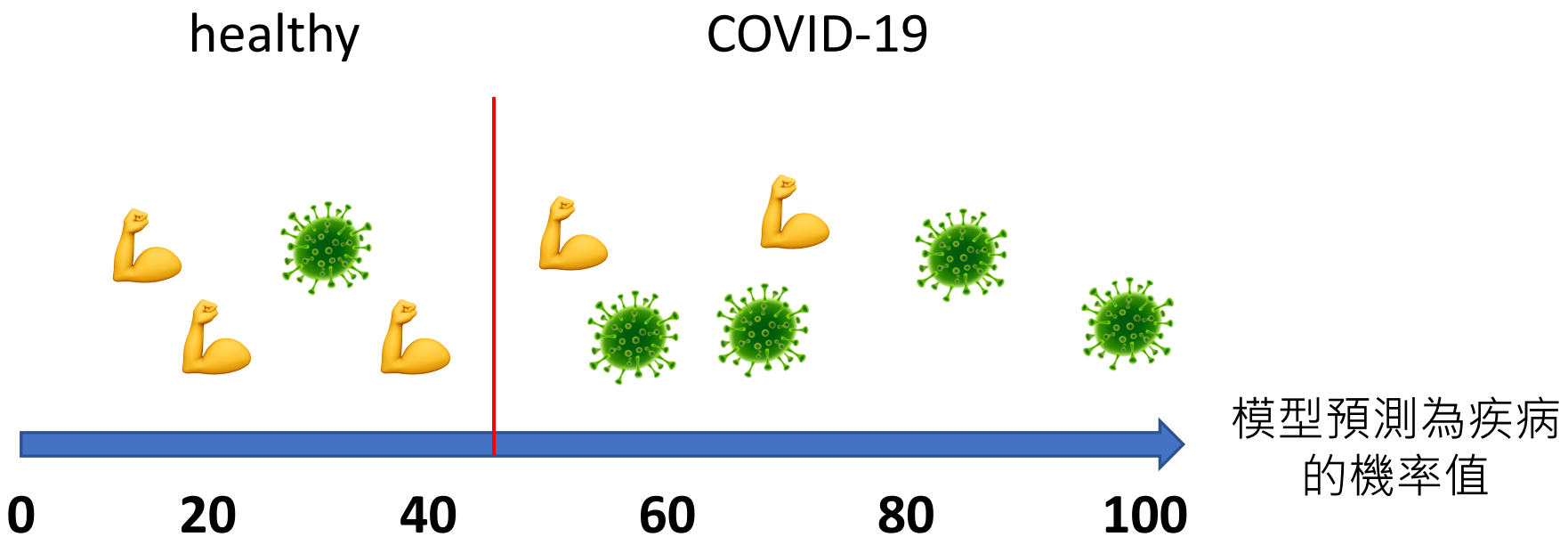
我們應該設多少門檻？

threshold = 0.5 -> 模型預測為1，正確數量+1

threshold = 0.6 -> 模型預測為0，正確數量-1

TPR and FPR 範例

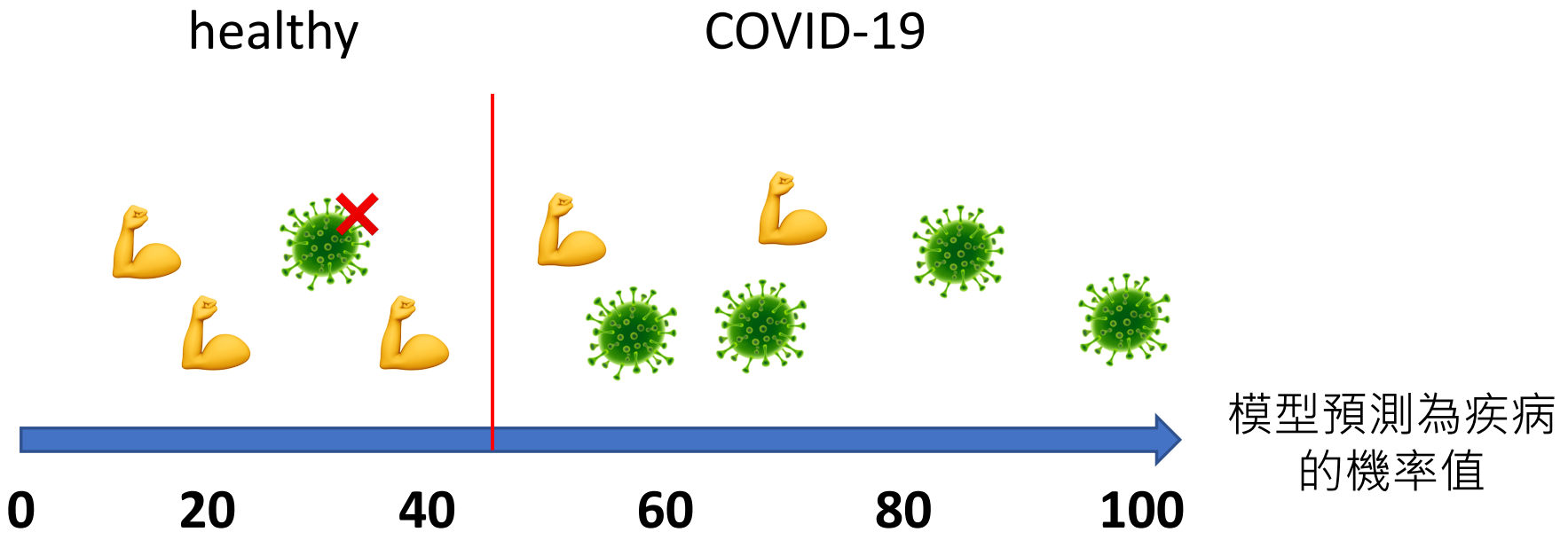
假設我們用模型對10個人做COVID-19檢測：
(COVID-19 代表 positive)



TPR and FPR 範例 (TPR)

假設我們用模型對10個人做COVID-19檢測：
(COVID-19 代表 positive)

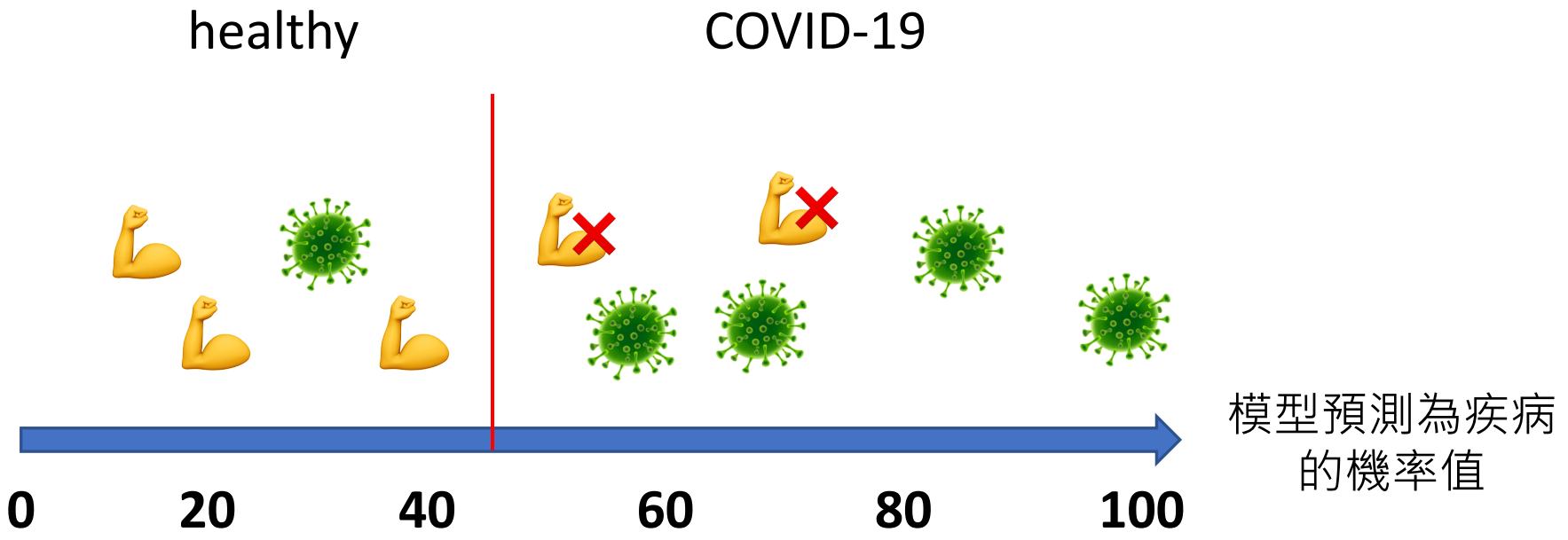
True positive rate
(TPR) = 4 / 5 = 0.8



TPR and FPR 範例 (FPR)

假設我們用模型對10個人做COVID-19檢測：
(healthy 代表 negative)

False positive rate
(FPR) = 2 / 5 = 0.4



ROC Curve

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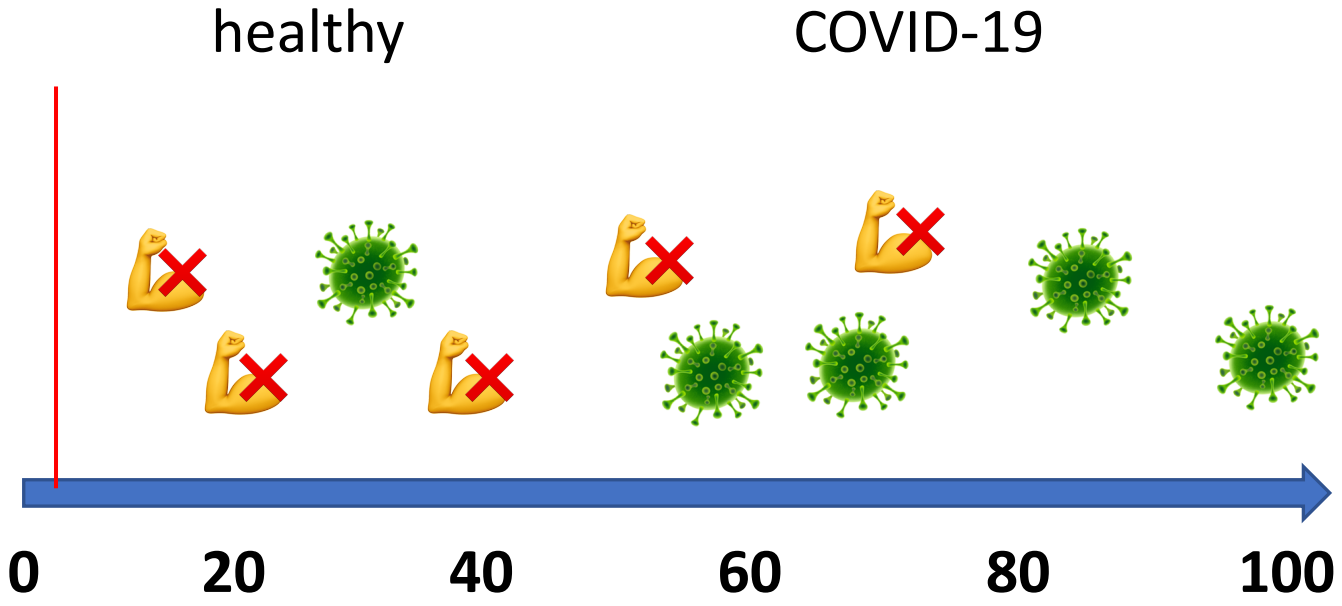

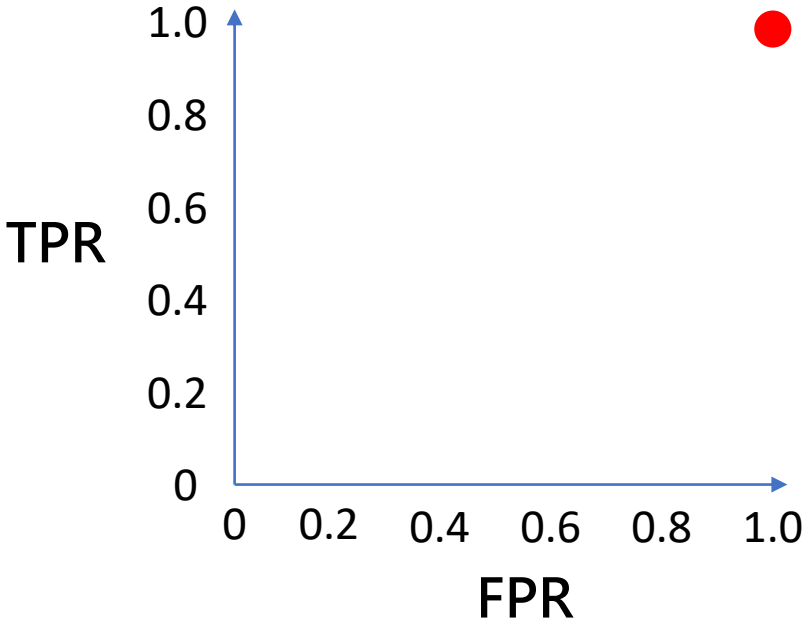

模型預測為疾病
的機率值

ROC Curve

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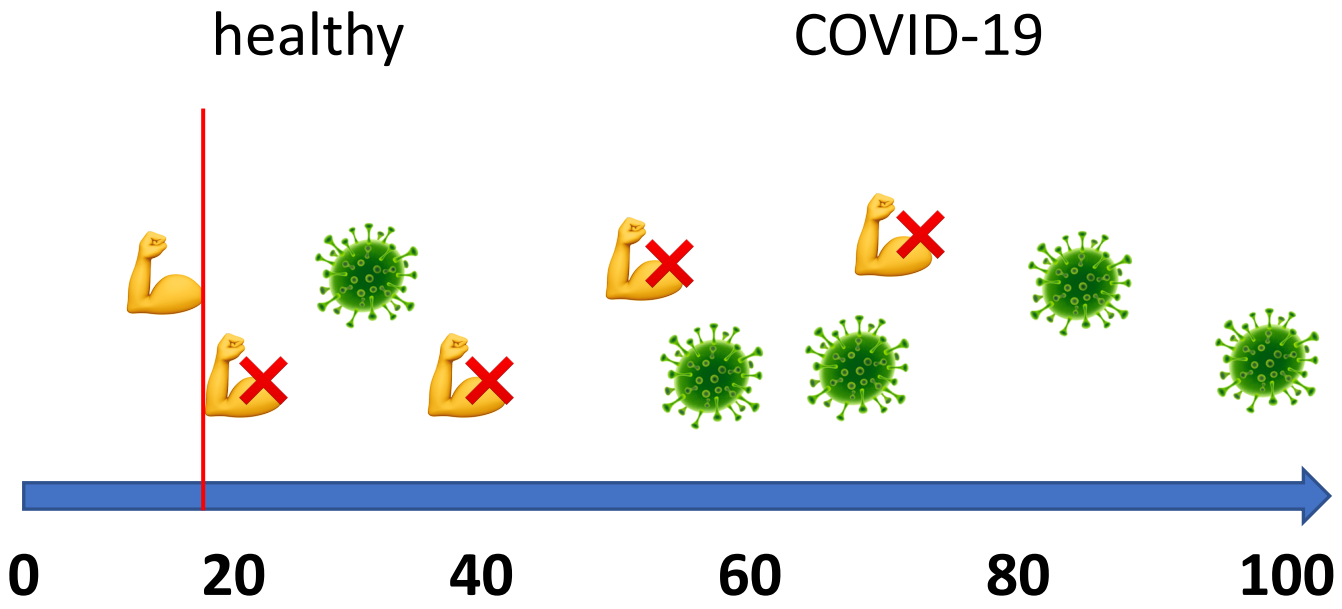

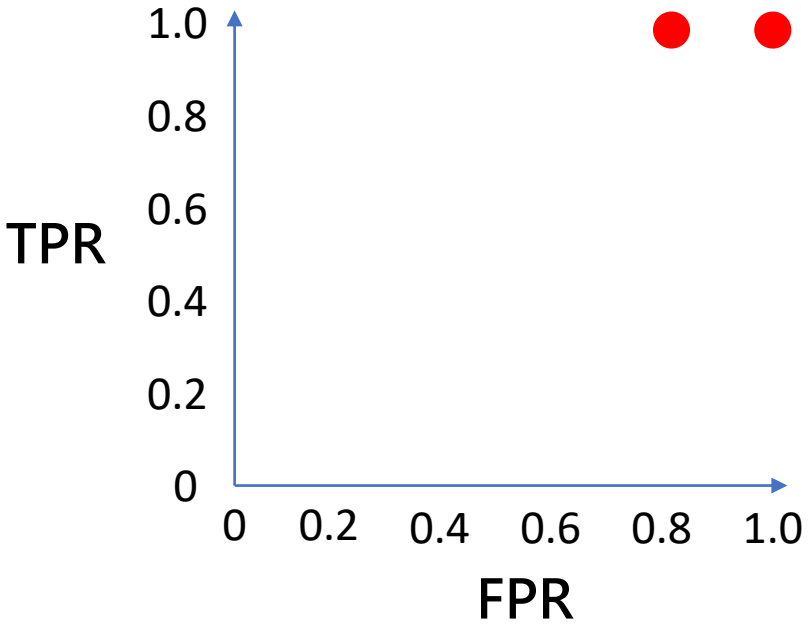

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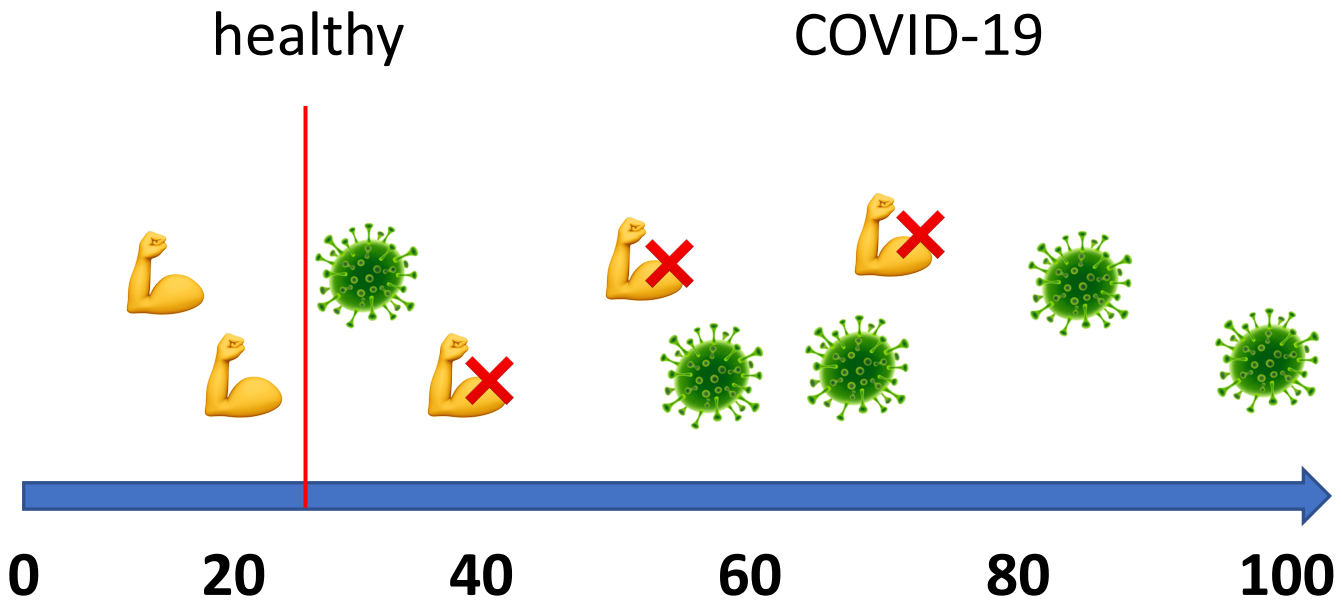

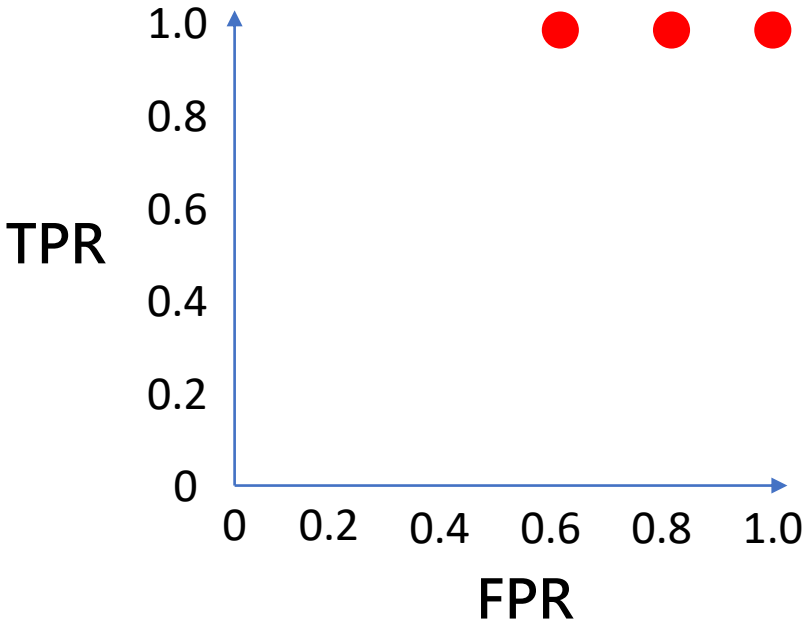

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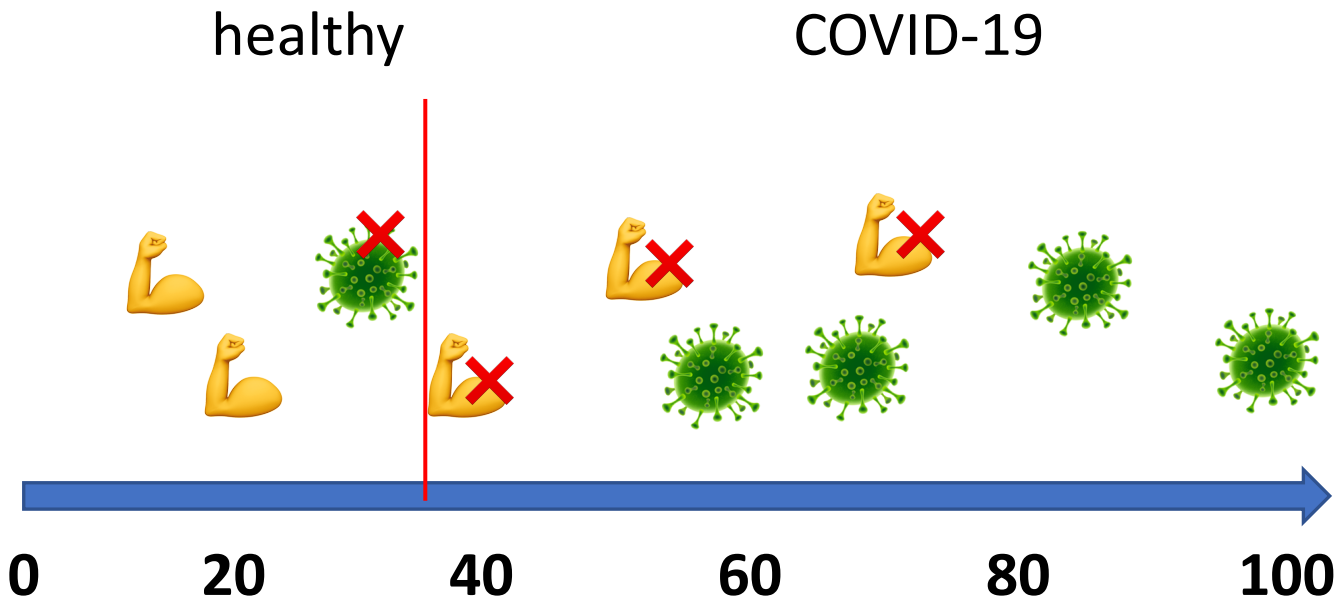

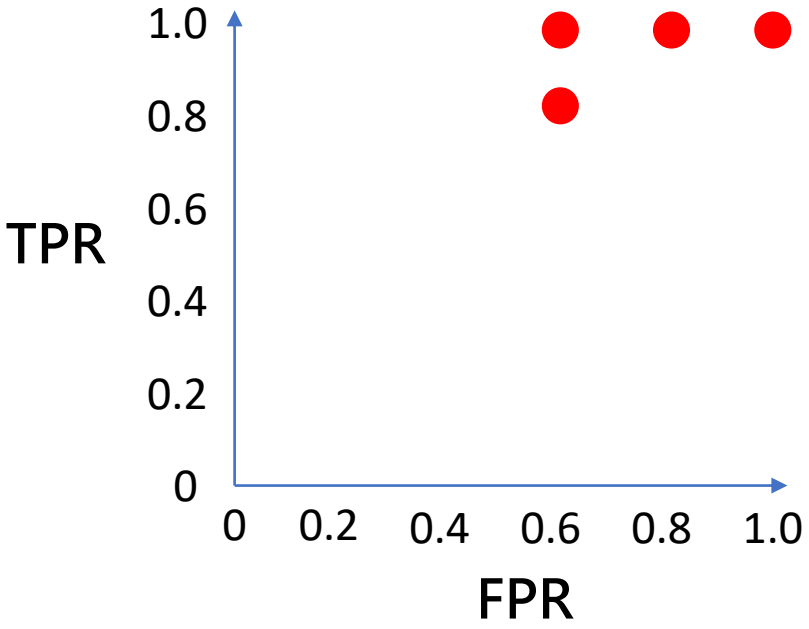

模型預測為疾病
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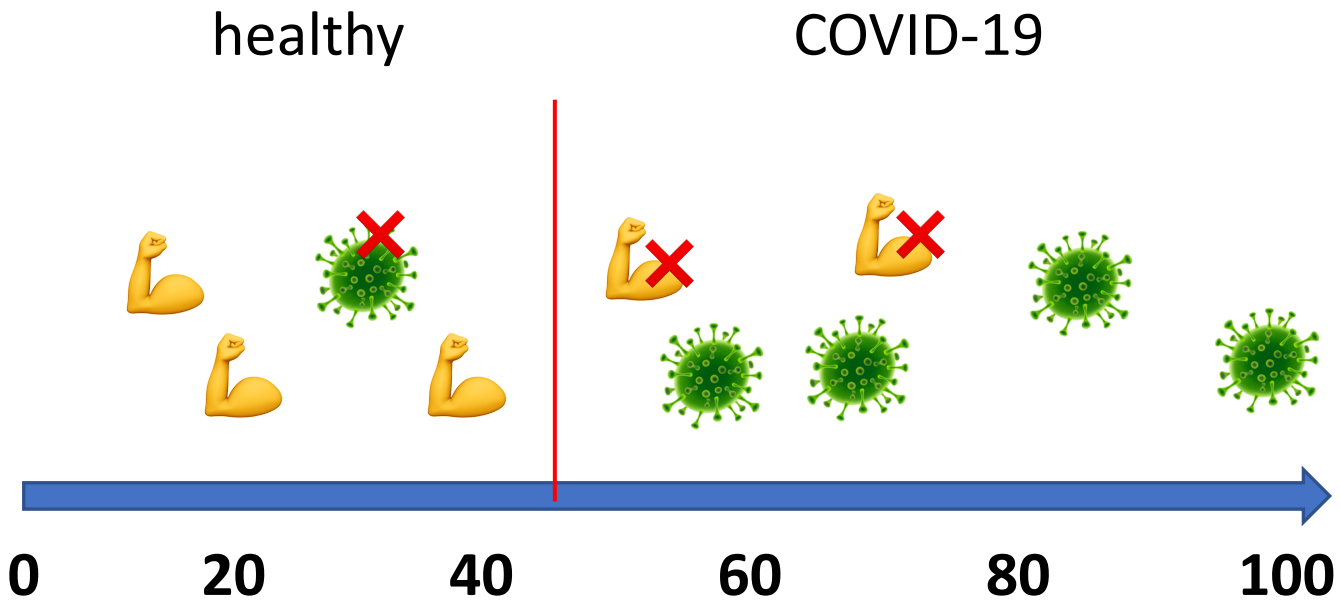

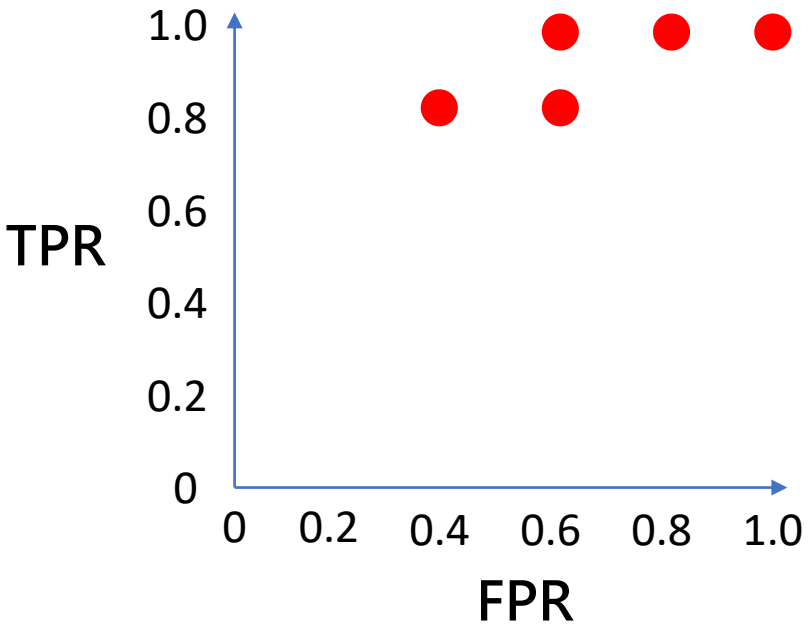

模型預測為疾病
的機率值

ROC Curve

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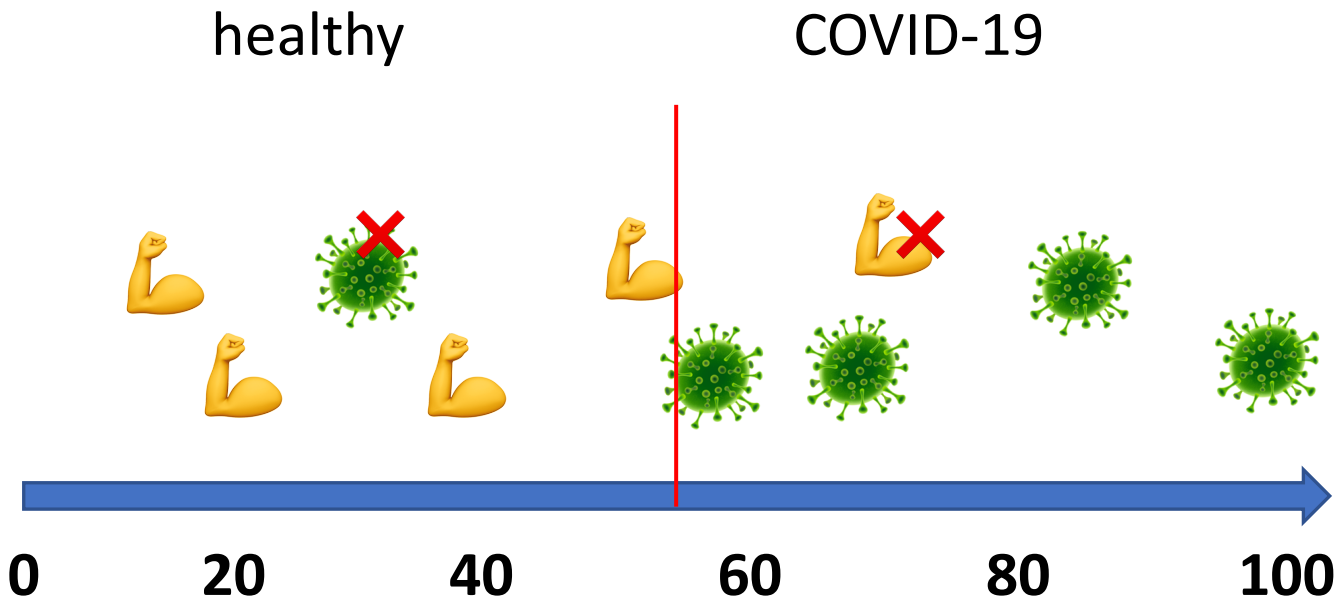

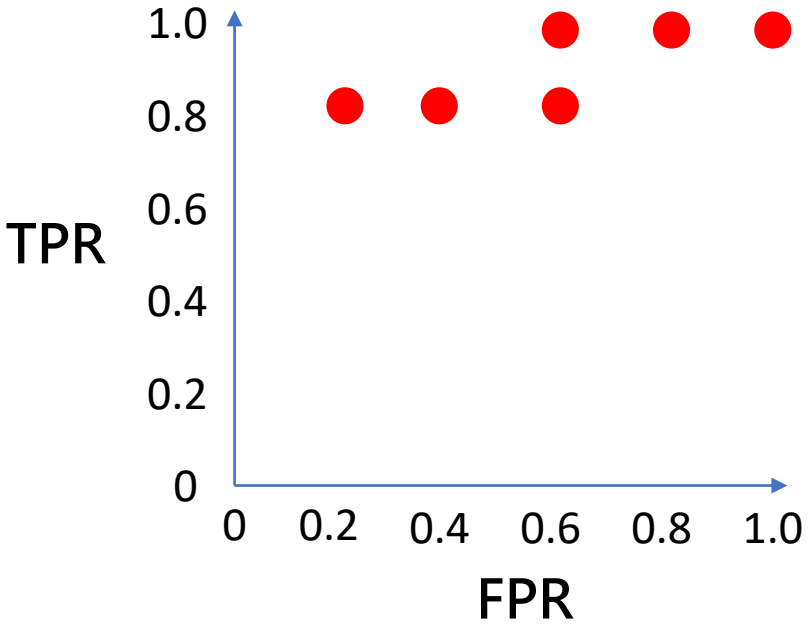

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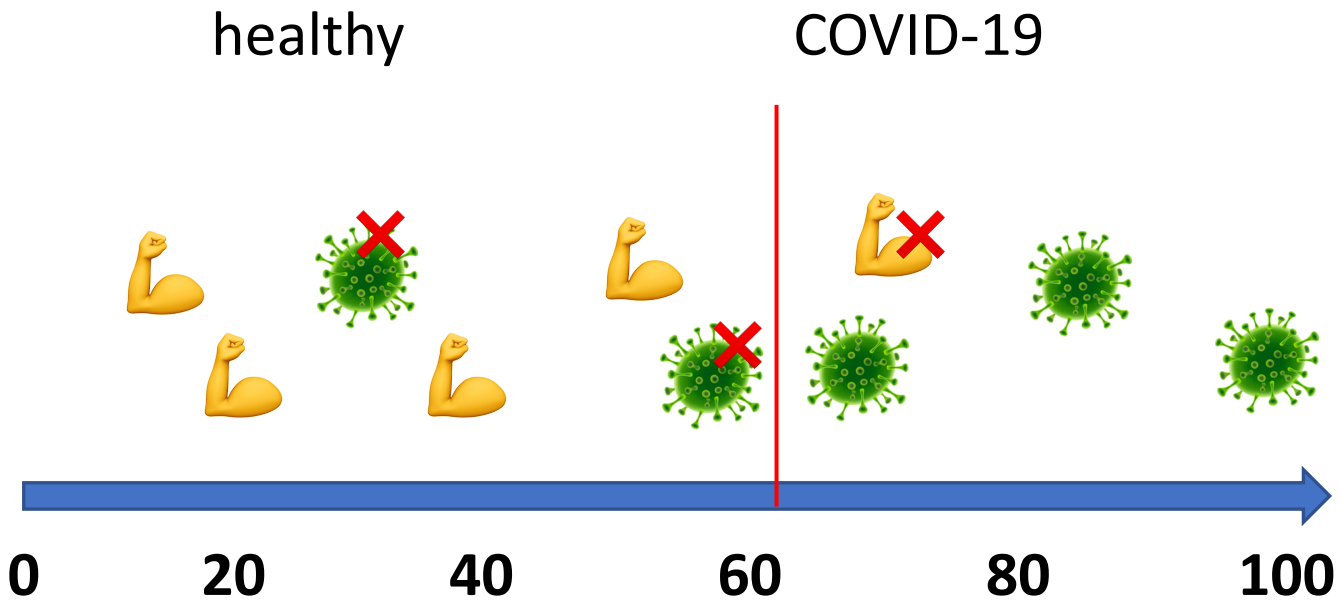

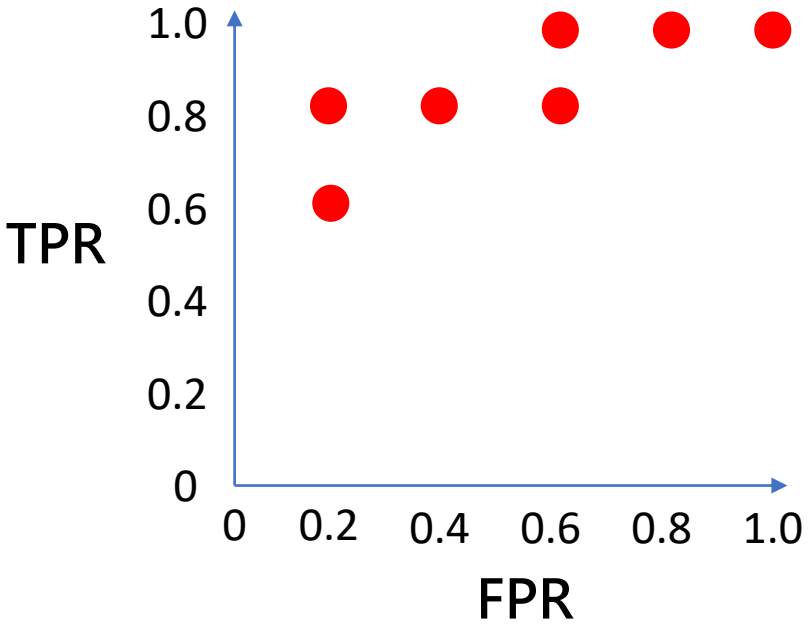

模型預測為疾病
的機率值

ROC Curve

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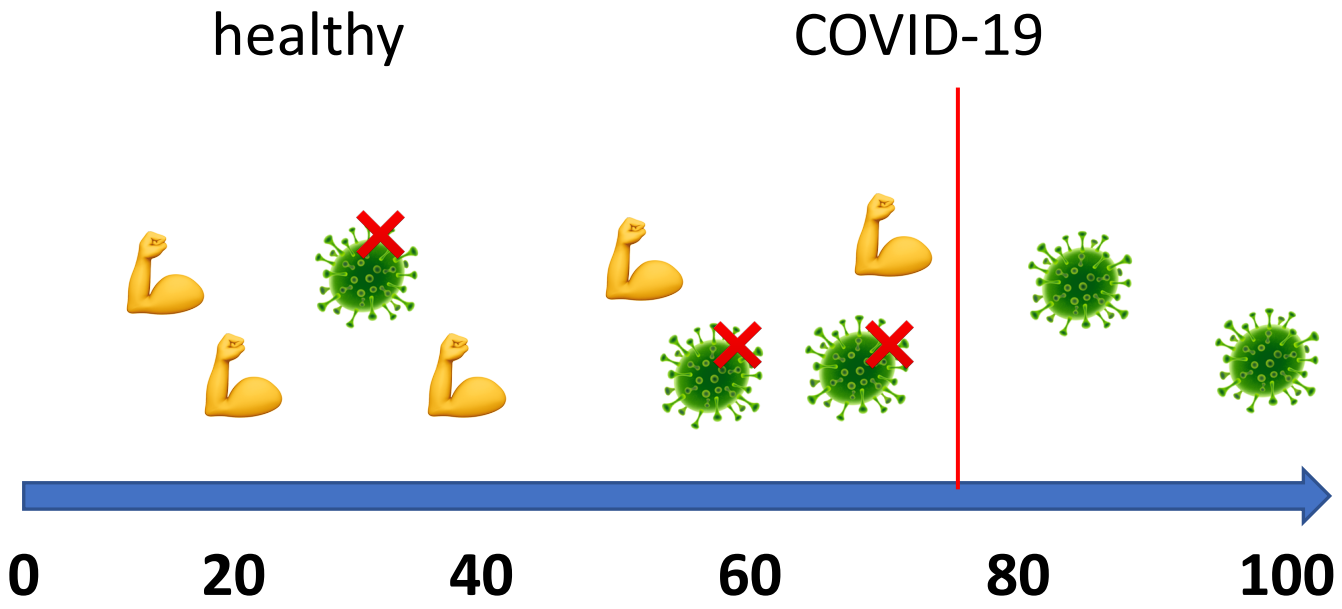

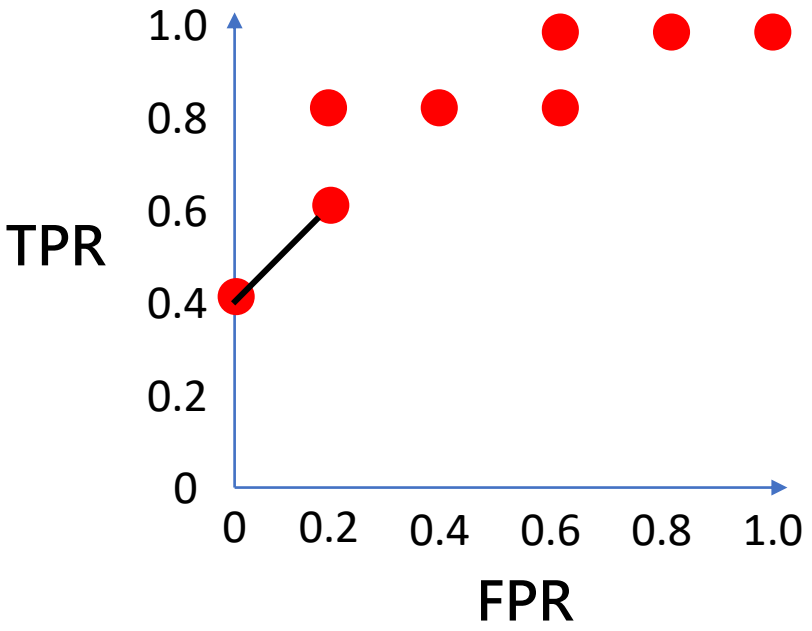

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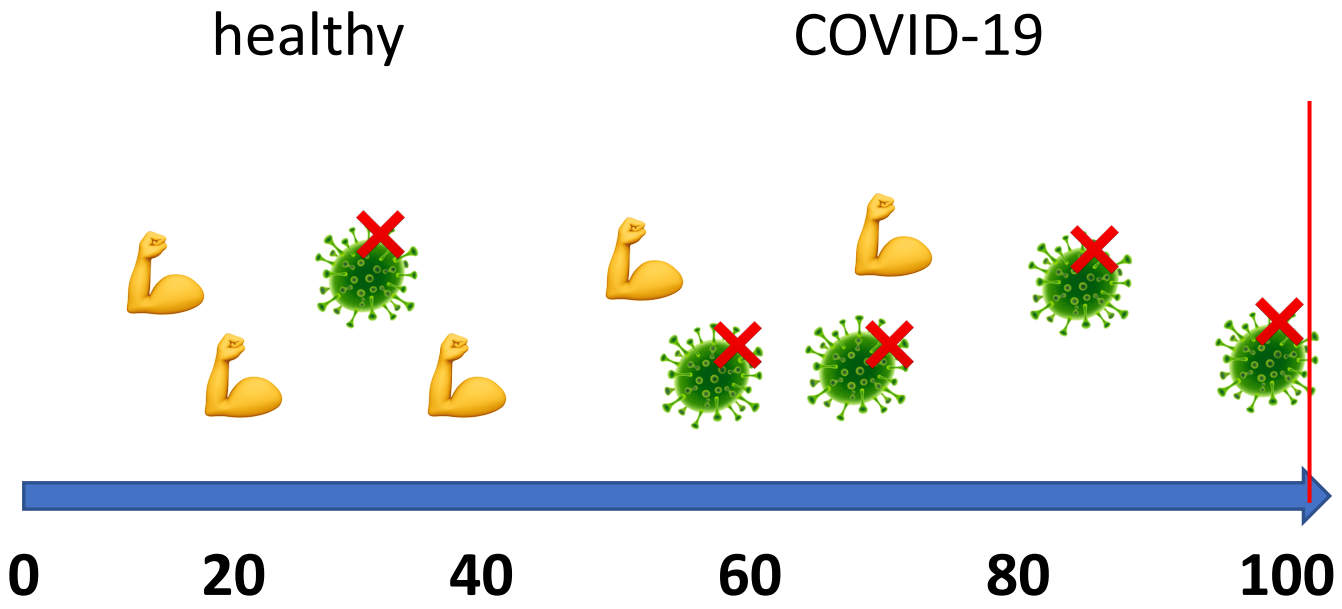

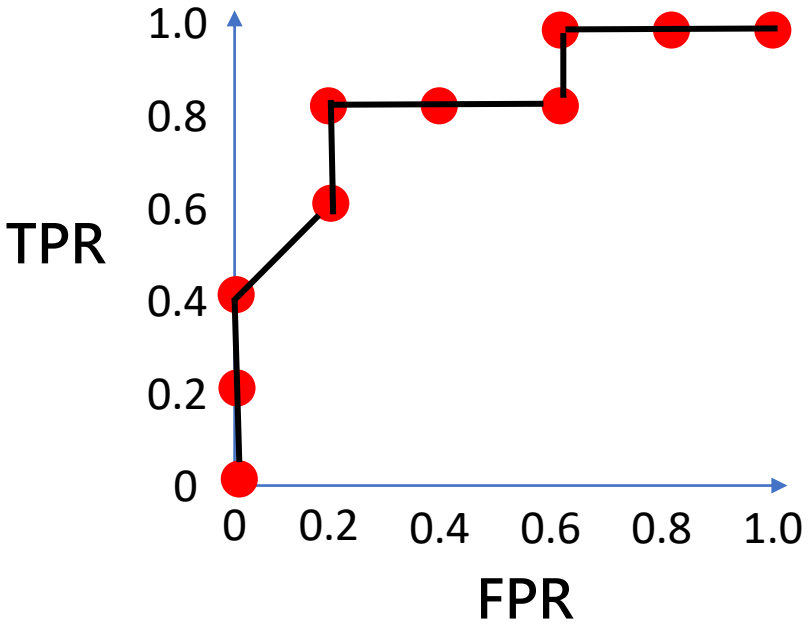

模型預測為疾病
的機率值

ROC Curve (bad case)

(Useful!!) https://developers.google.com/machine-learning/crash-course/classification/roc-and-auc?hl=zh-tw

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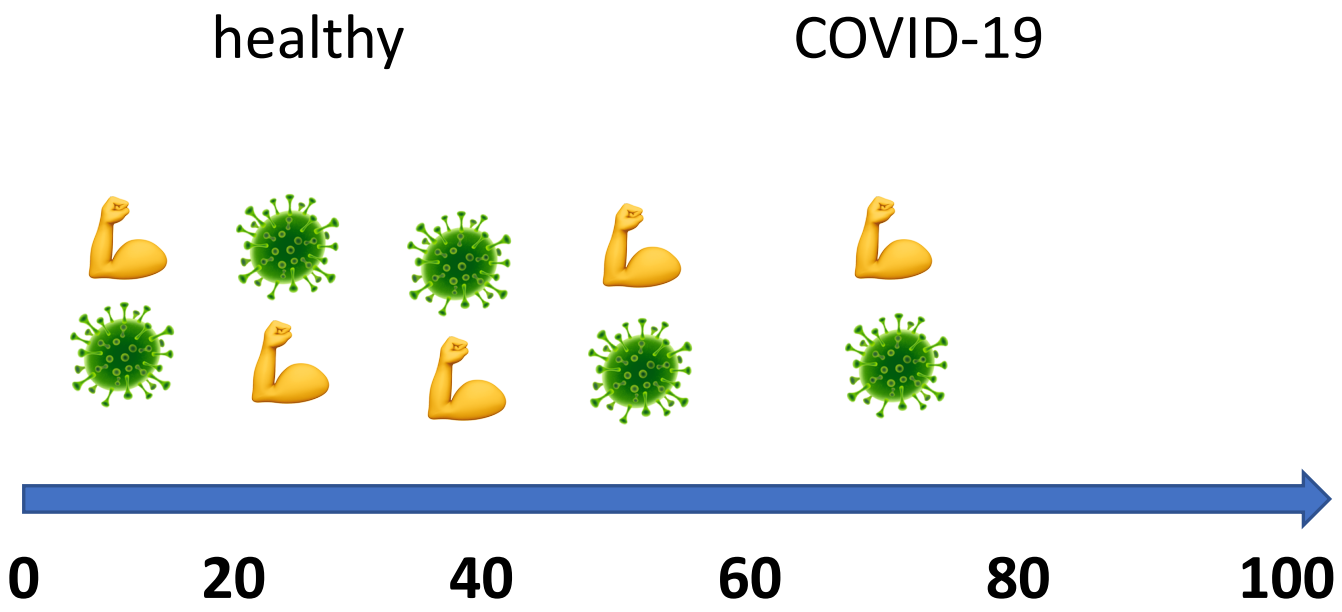
(healthy 代表 negative; COVID-19 代表 positive)



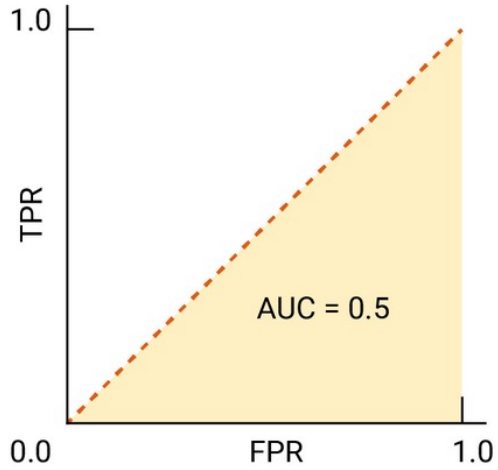


圖 2 ROC 和 AUC 完全隨機猜測。

完美模型的條件

- 分類結果完全正確
  - 沒有誤判
    - No False Negatives: TPR 越高越好
    - No False Positives: FPR 越低越好
- 完美模型中存在一個「理想 threshold 區間」，使我們能同時得到 TPR = 1 且 FPR = 0

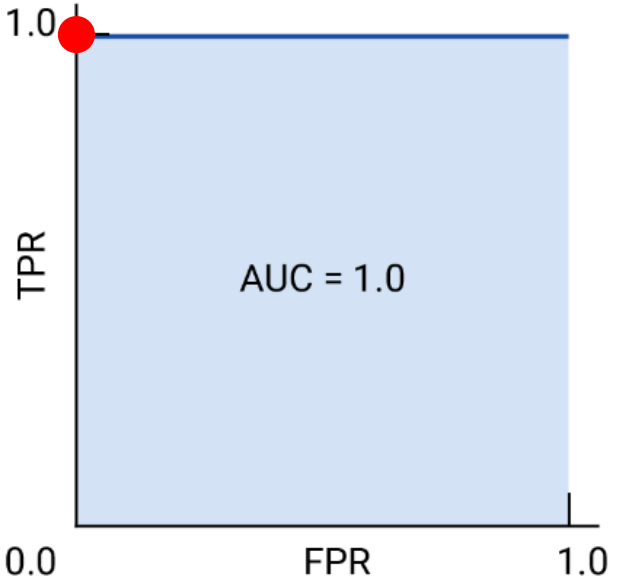


圖 1：ROC 和 AUC，這是一個完美假設的模型。

Confusion Matrix (混淆矩陣) for ROC

	Actually positive	**Actually negative**
Predicted positive	True positive (TP)	False positive (FP)
Predicted negative	False negative (FN)	True negative (TN)

- TP / (TP + FN): True Positive Rate (TPR)
  - 又稱作 Recall
- FP / (FP+TN): False Positive Rate (FPR)

Confusion Matrix for General Uses

	Actually positive	**Actually negative**
Predicted positive	True positive (TP) ↑	False positive (FP)
Predicted negative	False negative (FN)	True negative (TN) ↑

- 斜對角數值越大越好
  - TP 和 TN 越大越好
- Precision = TP / (TP + FP)
  - 模型預測的TP比例
- Recall = TP / (TP + FN)
  - True Positive Rate (TPR)
- F1-score (廣義) = 2(Precision*Recall) / (Precision+Recall)

roc_curve using scikit-learn

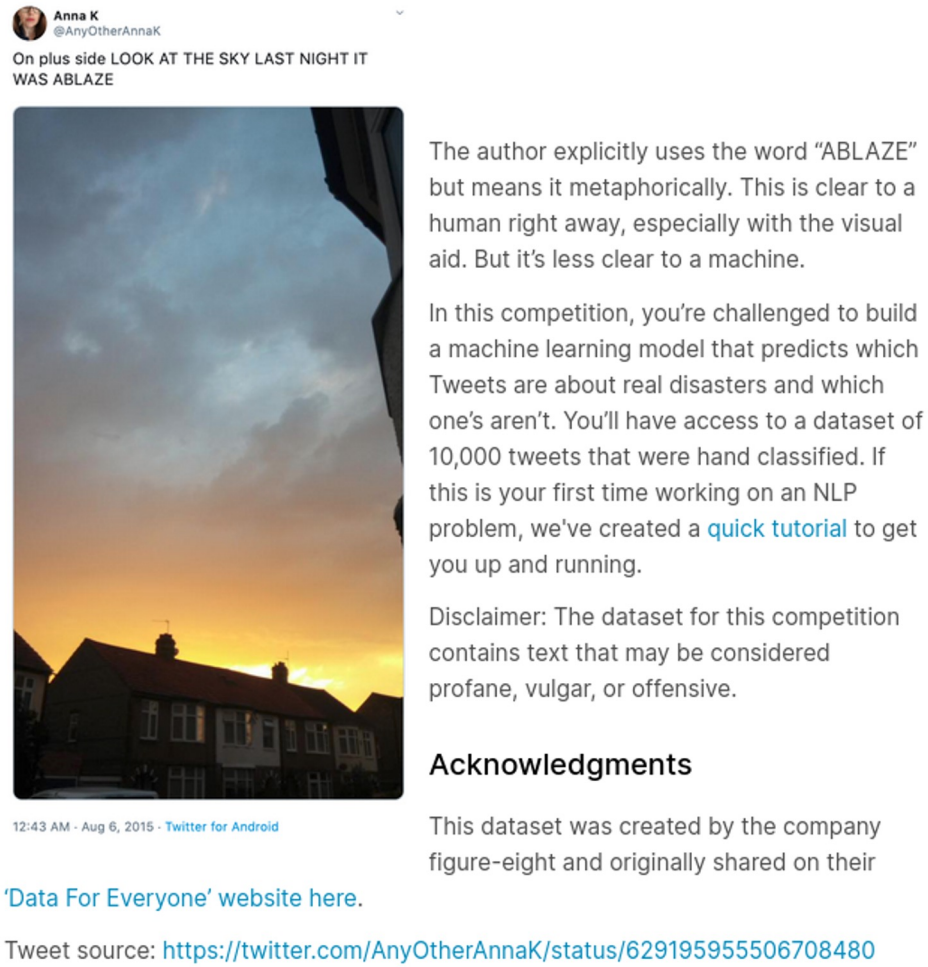
- https://scikit-learn.org/stable/modules/generated/sklearn.metrics.roc_curve.html

```
import numpy as np
from sklearn import metrics

y = np.array([1, 1, 2, 2])
scores = np.array([0.1, 0.4, 0.35, 0.8])
fpr, tpr, thresholds = metrics.roc_curve(y, scores, pos_label=2)
```

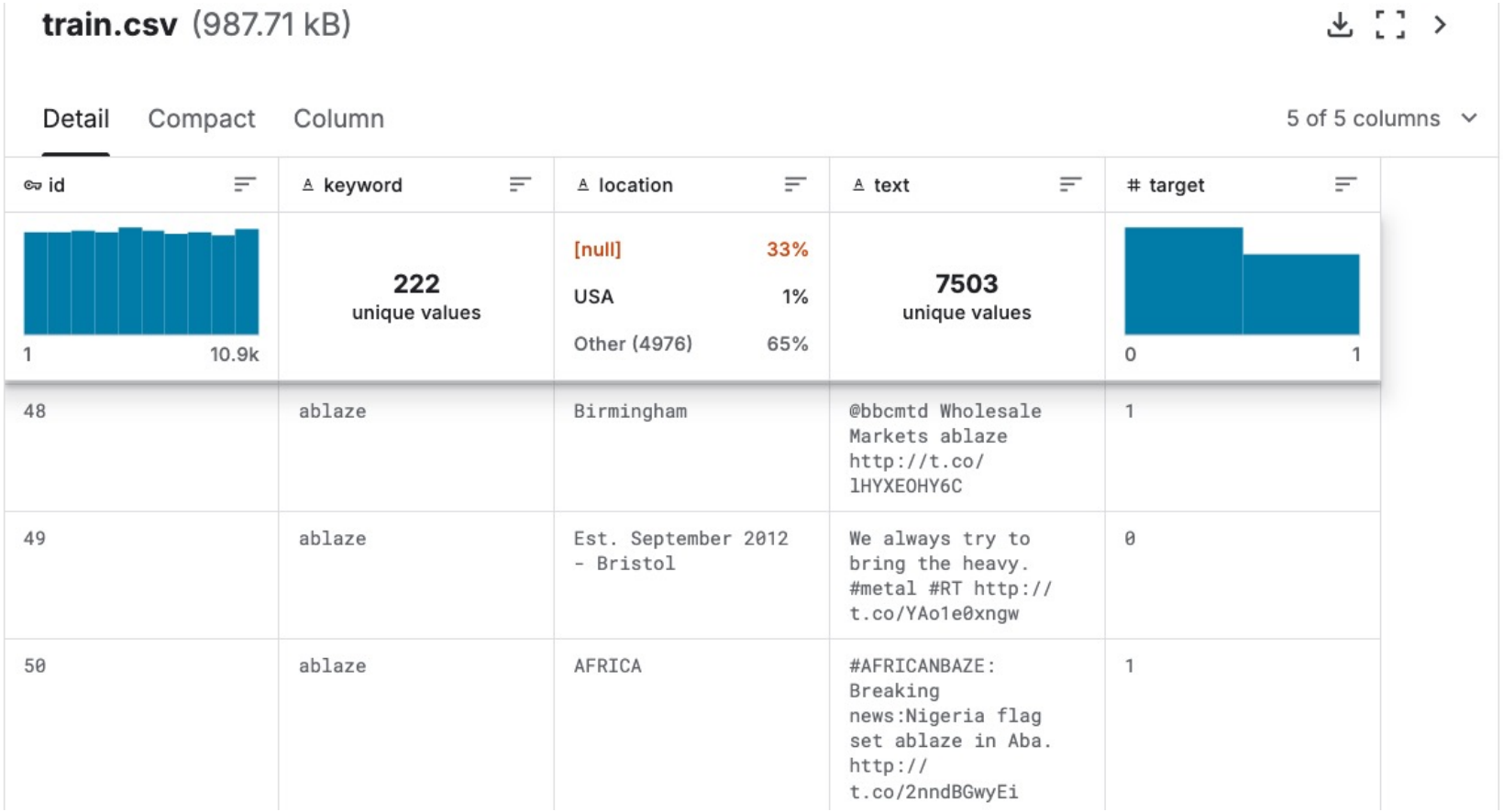
Natural Language Processing with Disaster Tweets

- You are predicting whether a given tweet is about a real disaster or not. If so, predict a 1.
  - If not, predict a 0.
- 資料範例 ➡️ (但任務中只需要進行文字分類)



Natural Language Processing with Disaster Tweets

- Data structure and example



train.csv (987.71 kB)

Detail | Compact | Column | 5 of 5 columns

id	keyword	location	text	target
1 – 10.9k	222 unique values	[null] 33% USA 1% Other (4976) 65%	7503 unique values	0 – 1
48	ablaze	Birmingham	@bbcmtd Wholesale Markets ablaze http://t.co/lHYXEOHY6C	1
49	ablaze	Est. September 2012 - Bristol	We always try to bring the heavy. #metal #RT http://t.co/YAo1e0xngw	0
50	ablaze	AFRICA	#AFRICANBAZE: Breaking news:Nigeria flag set ablaze in Aba. http://t.co/2nndBGwyEi	1

1.43 MB

- sample_submission.csv
- test.csv
- train.csv

Natural Language Processing with Disaster Tweets

- How to submit?

test.csv (420.78 kB)

Detail Compact Column

id	keyword	location	text
0 – 10.9k	222 unique values	[null] 34% New York 1% Other (2120) 65%	3243 unique values
0			Just happened a terrible car crash
2			Heard about #earthquake is different cities, stay safe everyone.
3			there is a forest fire at spot pond, geese are fleeing across the street, I cannot save them all
9			Apocalypse lighting. #Spokane #wildfires
11			Typhoon Soudelor kills 28 in China and Taiwan

sample_submission.csv (22.75 kB)

Detail Compact Column

id	# target
0 – 10.9k	0 – 0
0	0
2	0
3	0
9	0
11	0

Natural Language Processing with Disaster Tweets

- 分數計算? 採用 F1-score

	Actually positive	**Actually negative**
Predicted positive	True positive (TP)	False positive (FP)
Predicted negative	False negative (FN)	True negative (TN)

- Precision = TP / (TP + FP)
  - 模型預測的TP比例
- Recall = TP / (TP + FN)
  - True Positive Rate (TPR)
- F1-score (廣義) = 2(Precision*Recall) / (Precision+Recall)

Candidates

- Google Open Images Object Detection RVC 2020 edition
  - https://www.kaggle.com/competitions/open-images-object-detection-rvc-2020
- NBME - Score Clinical Patient Notes (Code competition)
  - https://www.kaggle.com/competitions/nbme-score-clinical-patient-notes/overview
- Google QUEST Q&A Labeling (Notebook competition)
  - https://www.kaggle.com/competitions/google-quest-challenge

Project checkpoints (暫定)

- Week 9: 確定各組的題目
- Week 11: 進度報告 PPT (5 pages)
- Week 13: 進度報告 PPT (5+5 pages), Presentations (selected teams)
- Week 15 – Week 16: Final presentations for all teams (maybe poster)
- Week 16 結束前: 繳交書面報告以及程式碼

期末 Project 規定 (暫定)

- 需要上傳 Kaggle Leaderboard
  - 這些任務都僅需要上傳 predictions 到 Kaggle 即可
- 每次報告都需要列出每位組員的貢獻內容，以及組員間的工作比重 (%)

Thank you!

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