

# 基於遊戲的機器學習 HW2

Pingpong

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# Outline

- Introduction
- Method
- Result
- Discussion
- Conclusion
- Reference-執行結果截圖(執行結果截圖一律都會放在投影片最後幾頁)

# Introduction

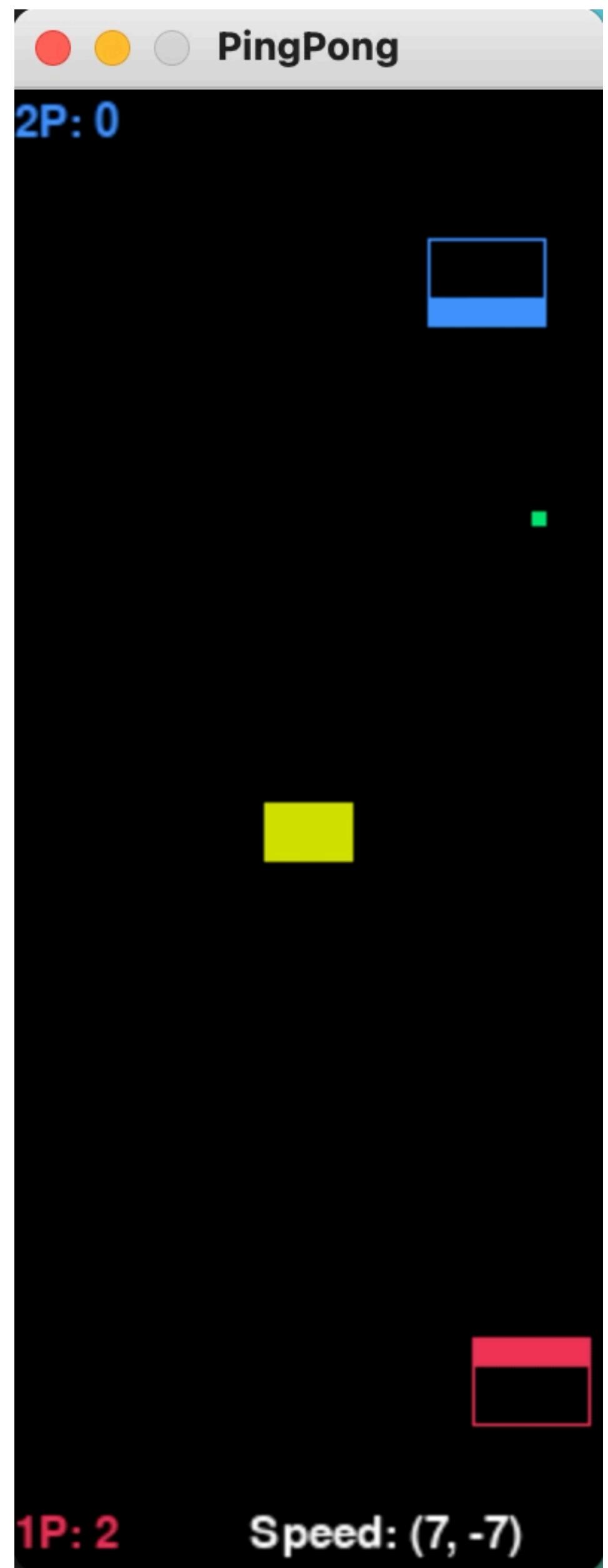
- 作業題目
- 觀察到的現象
  - 1-rule的改良-rule不加入球通過障礙物以前板子在中間的機制
  - 2-rule的改良-rule加入避免切球機制
  - 3-使用的訓練檔的改良-篩選使用的訓練檔
  - 4-使用的訓練檔的改良-使用100筆資料訓練

機器學習實際執行的影片

# Introduction

## 作業題目

- 作業題目：pingpong
- 1P、2P互打接乒乓球的遊戲，利用ML技術實現AI對打。



(真的會動！但轉成PDF就不會動了，可以點下面連結)

<https://drive.google.com/file/d/1EVogR3MUZkwSeEcsXqv6H4XEOxgOXc1H/view?usp=sharing>

# Introduction

觀察到的現象1-rule的改良-rule不加入球通過障礙物以前板子在中間的機制

- 在寫rule時我曾經嘗試過球過中間的障礙物以前，把版子維持在中間，希望增加球回彈時能接到的機率。但效果不好，反而比球一出去就忽略障礙物，預測回彈位置來得差。（執行結果圖參考reference-1）
- 結論：rule不加入球通過障礙物以前板子在中間的機制

	加入過障礙物以前板子在中間的機制	不加入過障礙物以前板子在中間的機制
結束速度大於(15, 15)的比例	$0/11 = 0$	$17/18 = 0.94$

# Introduction

觀察到的現象2-rule的改良-rule加入避免切球機制

- 在寫rule時我嘗試讓板子在球接近時不動（避免切球機制）。比較板子不動以及板子會動兩種狀況，用rule檔案玩會有明顯差異。（執行結果圖參考reference-2）
- 結論：rule加入避免切球機制

	加入避免切球機制	不加入避免切球機制
結束速度>= (20, 20)的比例	17/17 = 1	5/12 = 0.41

# Introduction

## 觀察到的現象3-使用的訓練檔的改良-篩選使用的訓練檔

- 有篩選pickle檔與不篩選pickle檔有什麼差異？(train p1使用的檔案都是p1贏的檔案，p2同理) (執行結果圖參考reference-3)
- 結論：篩選使用的訓練檔

結束速度的比例\	篩選使用的訓練 檔	不篩選使用的訓 練檔
<(10, 10)	$5/13 = 0.38$	$9/9 = 1$
$\geq(10, 10)$ $<(15, 15)$	$4/13 = 0.31$	$0/9 = 0$
$\geq(15, 15)$	$4/13 = 0.31$	$0/9 = 0$

# Introduction

## 觀察到的現象4-使用的訓練檔的改良-使用100筆資料訓練

- 用來訓練的檔案多寡有沒有差異？（執行結果圖參考reference-4）
- 結論：使用100筆資料訓練

結束速度的比例\使用的檔案數量	25	50	75	100
<(15, 15)	$10/13 = 0.77$	$9/13 = 0.69$	$6/14 = 0.43$	$4/11 = 0.36$
$\geq(15, 15)$ $<(20, 20)$	$2/13 = 0.15$	$4/13 = 0.31$	$7/14 = 0.5$	$7/11 = 0.64$
$\geq(20, 20)$	$1/13 = 0.08$	$0/13 = 0$	$1/14 = 0.07$	$0/11 = 0$

# Method

- 介紹rule
- 介紹提取之特徵
- 介紹Pickle檔之搜集
- 介紹所使用的機器學習模型

# Method

## 介紹rule

- Rule
  1. 利用randint函式隨機左右發球
  2. 球一離開平臺時就立刻開始判斷
  3. 判斷球的X方向速度是正的還是負的，並計算球的落點（忽略中間的障礙物）
  4. 判斷什麼時候會移動板子，將板子中心對到預測落點
    1. If 球距離板子小於10，且板子的範圍已經有涵蓋到預測的落點，則板子不再移動  
(透過這個方式避免產生切球機制，把問題變簡單)
    2. Else 移動板子，將板子中心對到落點

# Method

## 介紹提取之特徵、介紹Pickle檔之搜集

- 提取之特徵-共六個
  1. 球的x座標
  2. 球的y座標
  3. 預估球的x落點
  4. 球的x方向速度
  5. 球的y方向速度
  6. 板子的x座標
- Pickle檔之搜集：
  - 將P1贏的檔案與P2贏的檔案分開搜集
  - P1, P2 各100筆
  - 只搜集遊戲結束的速度大於15的檔案

# Method

## 介紹所使用的機器學習模型

實際訓練結果相比較，KNN的結果較穩定，因此選用KNN訓練

- 使用的機器學習模型-1

KNN(k nearest neighbors)

KNN是一種監督式學習，可以做分類或回歸

1. 設定總共要分成幾類

2. 重複計算距離找出k個最相近的特徵

3. 分類: k個特徵投票、回歸: 平均k個特徵

- 使用的機器學習模型-2

random forest

random forest是一個包含多個決策樹的分類器，並且其輸出的類別是由個別樹輸出的類別的眾數而定

- 輸入特徵數目m

- 從N個樣本中取樣N次，形成一個訓練集，並用未抽到的樣本作預測，評估誤差。

- 對於每一個節點，隨機選擇m個特徵，計算其最佳的分裂方式。

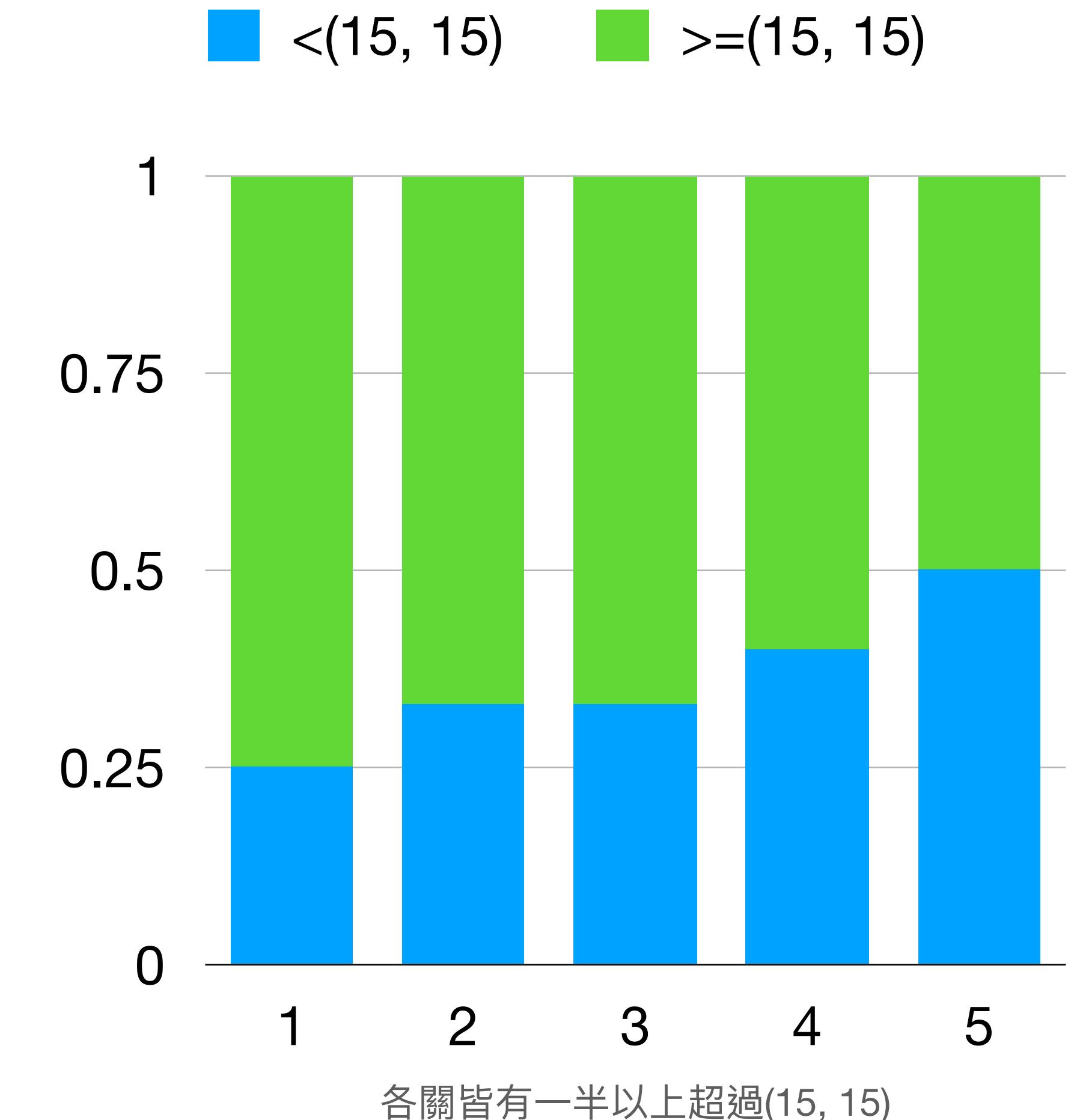
# Result

- 執行結果表格以及圖表
- 執行結果圖在reference-5

# RESULT

如何Train檔案：KNN, 各100files, 1p 2p 檔案分開 (執行結果圖參考reference-5)

	第一局	第二局	第三局	第四局	第五局
<(15, 15)	1	1	1	2	2
>=(15, 15) <(20, 20)	3	2	2	3	2
>=(20, 20)	0	0	0	0	0



# Discussion

- 問題一：以不同的機器學習演算法處理同一筆data會有甚麼差異？
- 問題二之一：所選的特徵數量多寡，也會影響到模型學習的成效。
- 問題二之二：所選的特徵是否具有代表性，也會影響到模型學習的成效。
- 問題三：訓練data的多寡、data多元性是否足夠，是否影響訓練模型的成效？

# Discussion

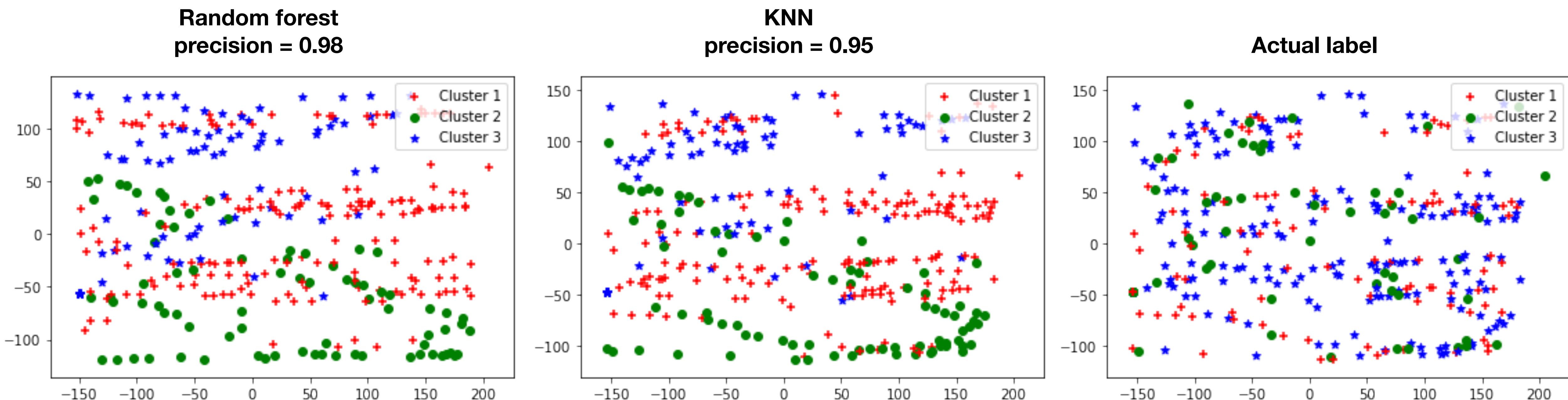
## 問題一：以不同的機器學習演算法處理同一筆data會有甚麼差異？

- 這三張圖，是將所選取的特徵參數以PCA的方式投影到二維畫面所畫出的點，分別以紅、綠、藍將模型預測答案為comment = 0 (“NONE”)、comment = 1 (“MOVE\_LEFT”)、comment = 2 (“MOVE\_RIGHT”和其他狀況）。
- KNN為監督式學習，學習的過程與我們所選的答案有關，正確率較高。但所選的特徵數量多寡、是否具有代表性，也會影響到模型學習的成效。而random forest因為會加入隨機分配的訓練資料，所以預測的準確率時高時低。透過實際測試以後也發現KNN的效果較佳，因此選用KNN訓練。（接續下頁）

# Discussion(cont.)

問題一：以不同的機器學習演算法處理同一筆data會有甚麼差異？

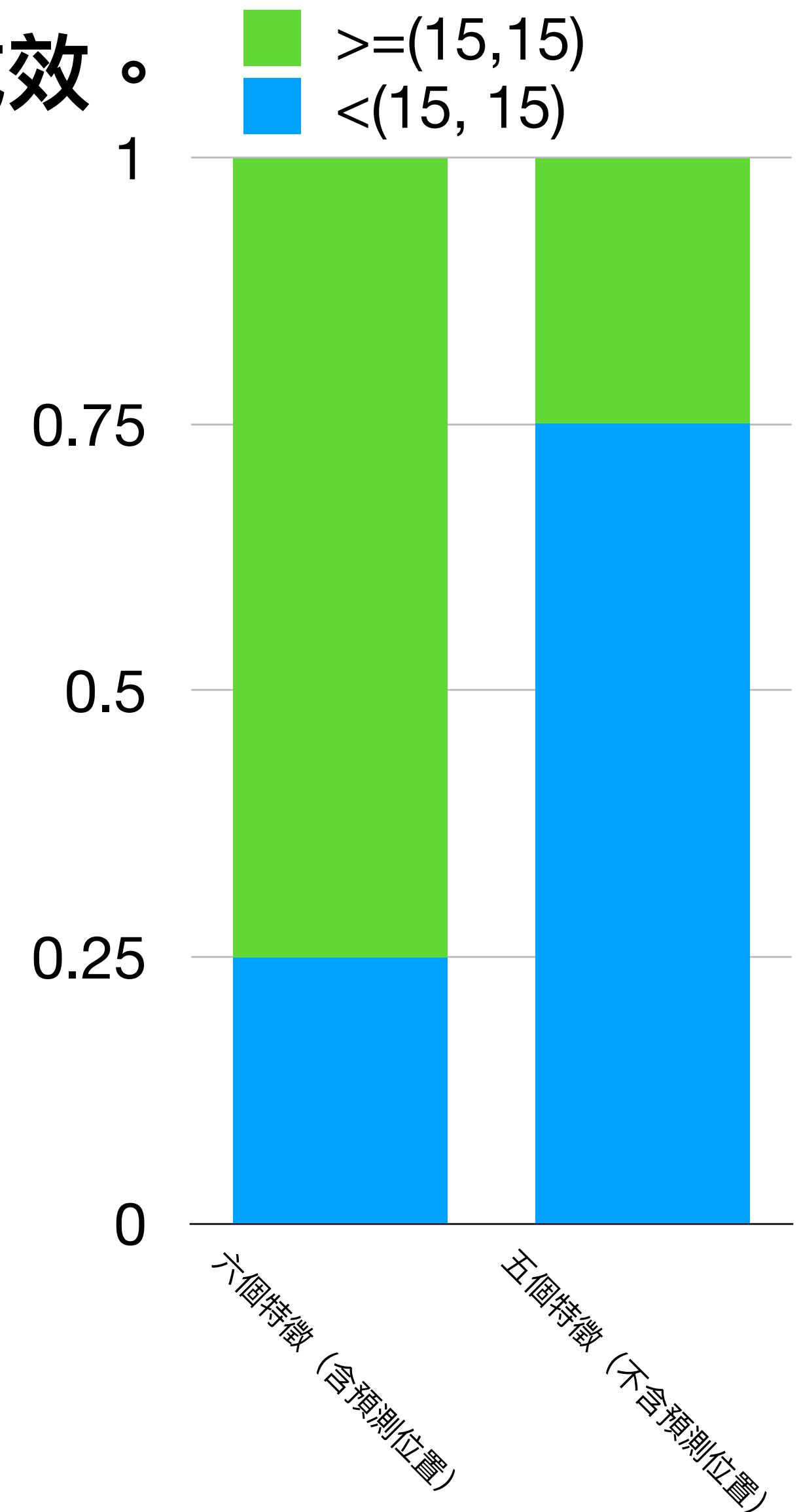
- 此圖是取了六個特徵做的：球的x, y座標，盤子的座標，球的x, y方向速度，球的預測落點。



# Discussion

問題二之一：所選的特徵數量多寡，也會影響到模型學習的成效。

- 我以實際測量有加球的x座標以及沒有加球的x座標訓練出的model破關數差異來說明。下圖說明所選的特徵數量多寡以及是否具代表性都會影響學習的成效。（如右圖）
- 我們可以發現 1. 使用全部六個特徵  $\text{precision} = 0.95$ 。（圖在前兩頁） 2. 少了球的預測落點當成特徵  $\text{precision} = 0.90$ 。（圖在下頁）
- 的確影響到學習的成效。

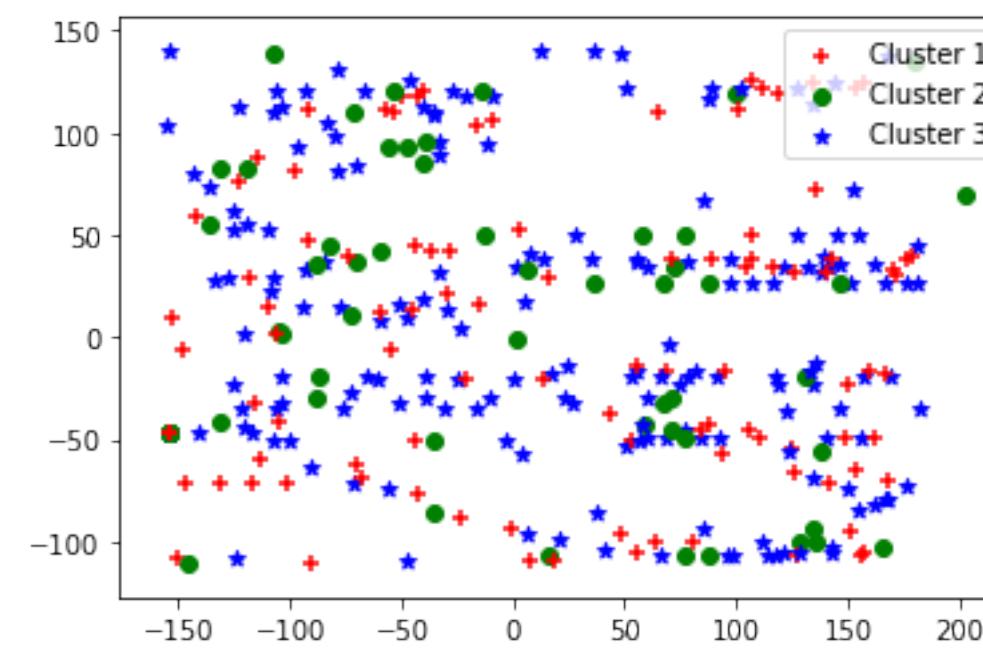
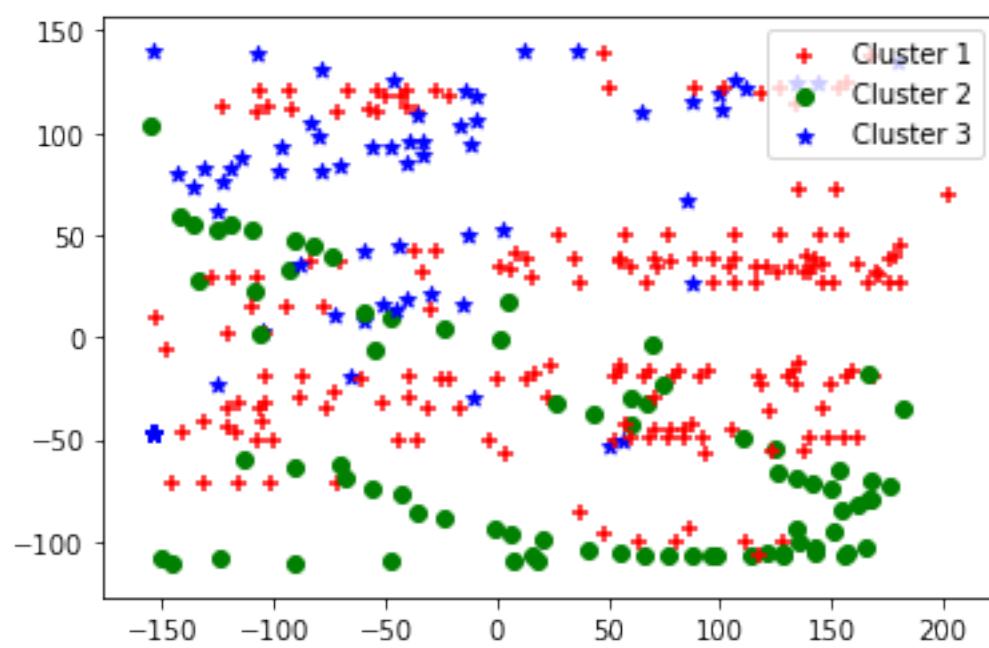


# Discussion

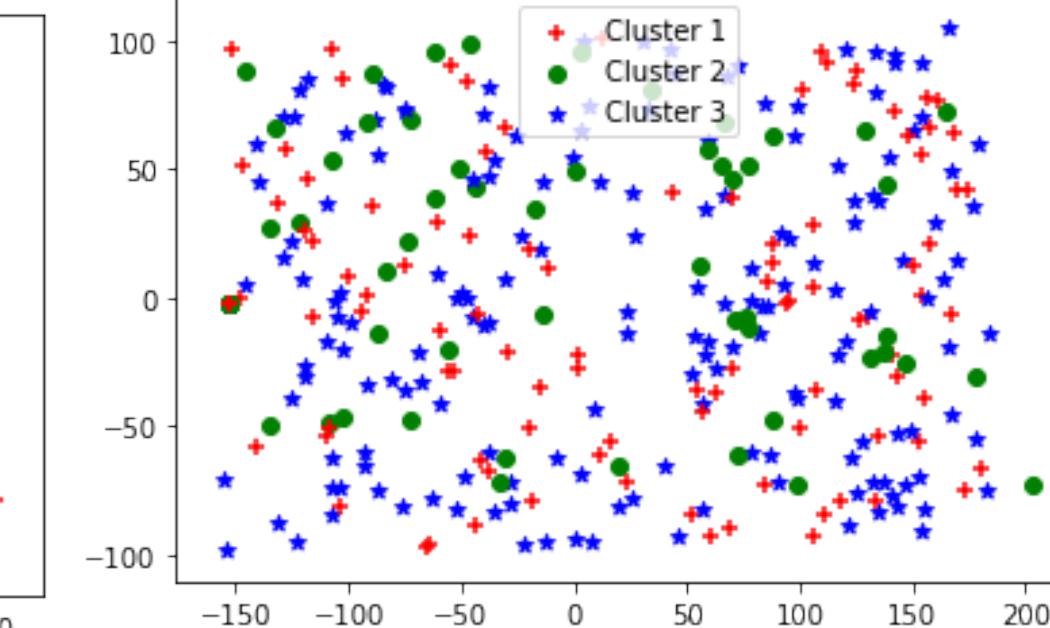
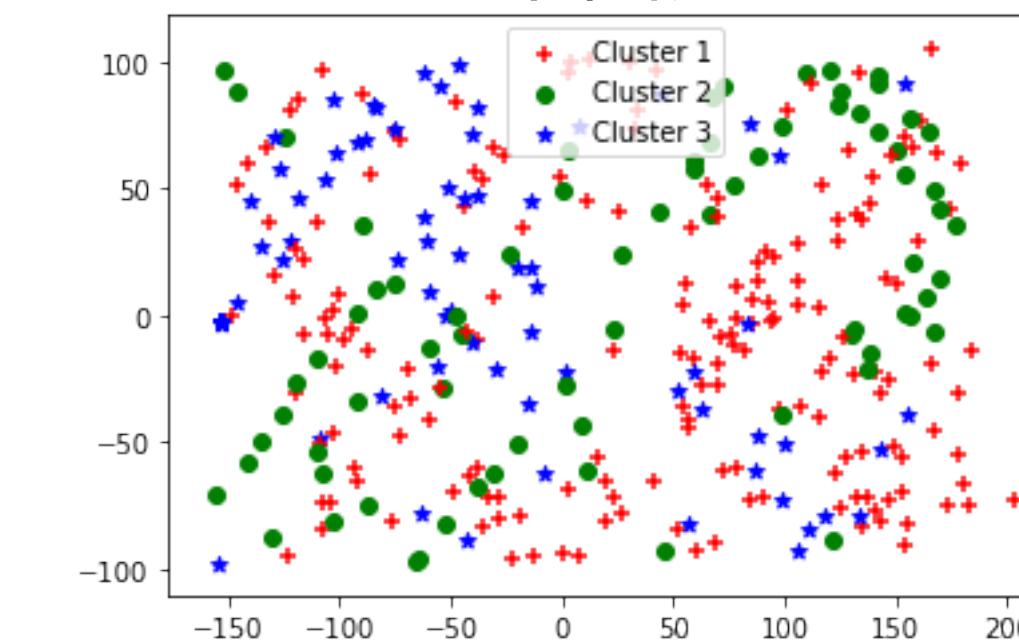
問題二之二：所選的特徵是否具有代表性，也會影響到模型學習的成效。

- 在這個問題上我也嘗試分別拿掉球的x座標以及拿掉球x預測落點測試。發現少了球x座標precision有0.95，少了預測落點precision剩下0.9。
- 結論：所選的特徵是否具有代表性，也會影響到模型學習的成效。

- 下圖少了球的x座標位置當成特徵。



- 下圖少了球的預測落點當成特徵。



	precision	recall	f1-score	support
0	0.95	0.95	0.95	177
1	0.94	0.90	0.92	84
2	0.96	1.00	0.98	108
accuracy		0.95	0.95	369
macro avg	0.95	0.95	0.95	369
weighted avg	0.95	0.95	0.95	369

	precision	recall	f1-score	support
0	0.90	0.89	0.89	177
1	0.94	0.86	0.89	84
2	0.87	0.95	0.91	108
accuracy		0.90	0.90	369
macro avg	0.90	0.90	0.90	369
weighted avg	0.90	0.90	0.90	369

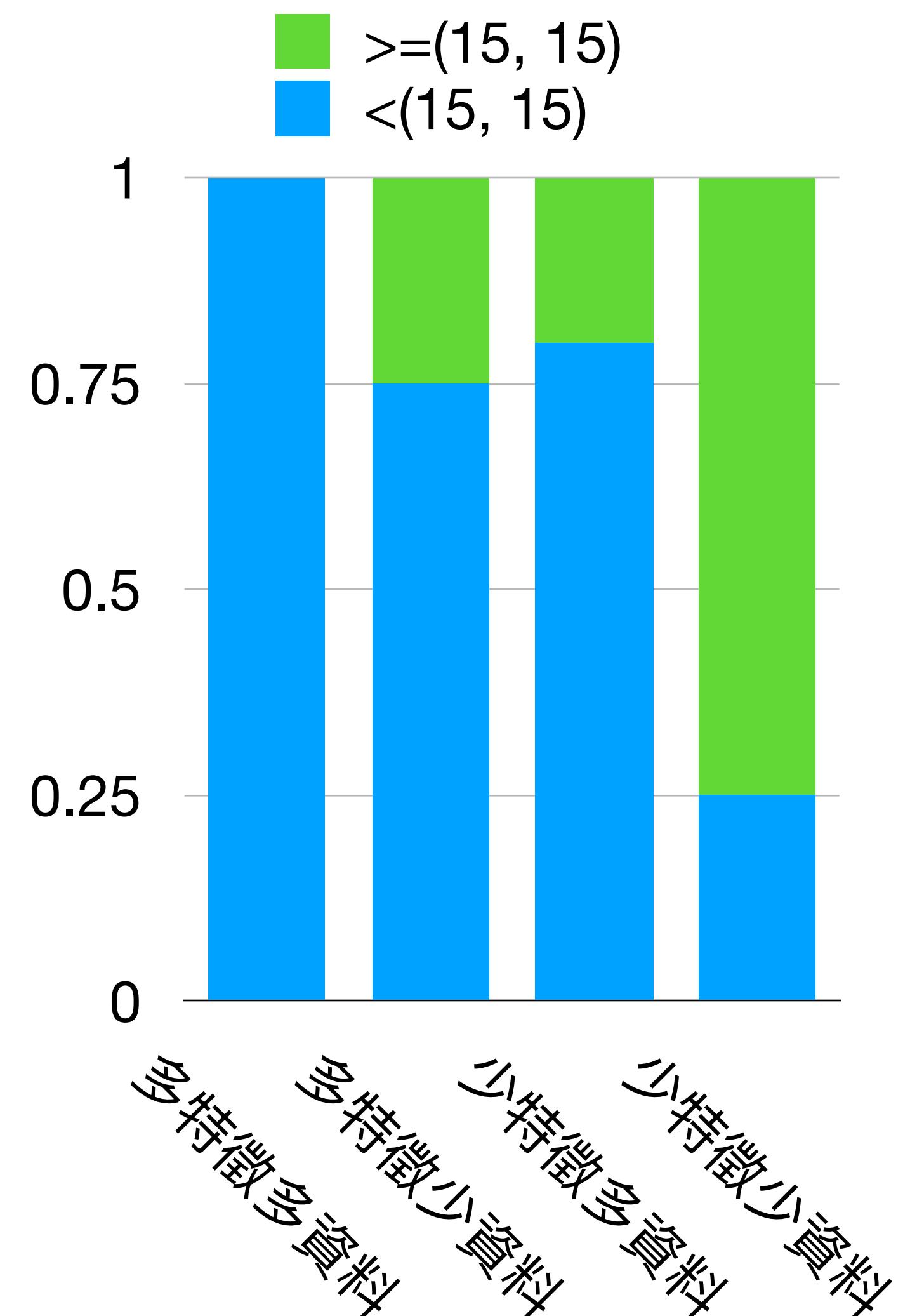
# Discussion

## 問題三：訓練data的多寡、data多元性是否足夠，是否影響訓練模型的成效？

- 我以實際測量多或少data、多或少特徵四種排列組合來說明。結果說明data多寡以及data多元性都會影響成效。
- 圖上特徵及資料的含義

多特徵：6個特徵 少特徵：除去球的x座標的五個特徵

多資料：1p, 2p 各100筆資料 少資料：1p, 2p各25筆資料



# **Conclusion**

# Conclusion

- 在第二次的作業中，我開始比較熟悉機器學習的運作模式，因此比較有餘力去做一些不同的測試。比方說：嘗試讓板子在球接近時不動（避免切球機制），比較板子不動以及板子會動兩種狀況的結果有什麼不同。測試有篩選pickle檔與不篩選pickle檔有什麼差異等等不同的狀況。做這些測試就像是讓我實際驗證自己在測試前的猜想是不是正確的，是非常有趣的環節。

# Reference image

- **Induction rule**不加入球通過障礙物以前板子在中間的機制
- **Induction rule**加入避免切球機制
- **Induction** 篩選使用的訓練檔
- **Induction** 使用100筆資料訓練
- **Result**

# Reference - 1

## Introduction 觀察到的現象-1

加入低於某個高度板子不動的機制

加入低於某個高度板子不動的機制&&過半才動

```
(base) ~/Documents/109-2(2-2)/machine_learning/MLGame ➜ master ± python3 MLGame.py -i ml_play_template.py -f 500 pingpong HARD 10
pygame 2.0.1 (SDL 2.0.14, Python 3.8.5)
Hello from the pygame community. https://www.pygame.org/contribute.html
pygame 2.0.1 (SDL 2.0.14, Python 3.8.5)
Hello from the pygame community. https://www.pygame.org/contribute.html
pygame 2.0.1 (SDL 2.0.14, Python 3.8.5)
Hello from the pygame community. https://www.pygame.org/contribute.html
GAME_1P_WIN
(-17, -14)
(-17, -14)
GAME_1P_WIN
(-12, -12)
(-12, -12)
GAME_1P_WIN
(-17, -14)
(-17, -14)
GAME_2P_WIN
(-12, 12)
(-12, 12)
GAME_1P_WIN
(-12, -12)
(-12, -12)
GAME_1P_WIN
(-12, -12)
(-12, -12)
GAME_1P_WIN
(12, -12)
(12, -12)
GAME_1P_WIN
1P wins! Final score: 10-1
(12, -12)
(12, -12)
```

```
(base) ~/Documents/109-2(2-2)/machine_learning/MLGame ➜ master ± python3 MLGame.py -i ml_play_template.py -f 500 pingpong HARD 10
pygame 2.0.1 (SDL 2.0.14, Python 3.8.5)
Hello from the pygame community. https://www.pygame.org/contribute.html
pygame 2.0.1 (SDL 2.0.14, Python 3.8.5)
Hello from the pygame community. https://www.pygame.org/contribute.html
pygame 2.0.1 (SDL 2.0.14, Python 3.8.5)
Hello from the pygame community. https://www.pygame.org/contribute.html
2021-04-18 17:22:52.294 Python[18082:890217] TSM AdjustCapsLockLEDForKeyTransitionHandling - _ISSetPhysicalKeyboardCapsLocked Inhibit
GAME_2P_WIN
(17, 17)
(17, 17)
The client 'ml_1P' delayed 1 frame(s)
The client 'ml_2P' delayed 1 frame(s)
GAME_1P_WIN
(14, -14)
(14, -14)
GAME_1P_WIN
(-15, -15)
(-15, -15)
GAME_1P_WIN
(16, -16)
(16, -16)
GAME_2P_WIN
(15, 15)
(15, 15)
GAME_1P_WIN
(-16, -16)
(-16, -16)
GAME_1P_WIN
(-15, -15)
(-15, -15)
GAME_2P_WIN
(17, 17)
(17, 17)
GAME_2P_WIN
(16, 16)
(16, 16)
GAME_2P_WIN
(15, 15)
(15, 15)
GAME_2P_WIN
(-16, 16)
(-16, 16)
GAME_1P_WIN
(-16, -16)
(-16, -16)
GAME_2P_WIN
(17, 17)
(17, 17)
GAME_1P_WIN
(-21, -21)
(-21, -21)
GAME_1P_WIN
(-18, -18)
(-18, -18)
GAME_2P_WIN
(20, 20)
(20, 20)
GAME_1P_WIN
(-18, -18)
(-18, -18)
GAME_1P_WIN
1P wins! Final score: 10-8
(18, -18)
(18, -18)
```

# Reference - 2

## Introduction 觀察到的現象-2

### 不加低於某個高度板子不動的機制

```
(base) ~/Documents/109-2(2-2)/machine_learning/MLGame ➜ master ✘ python3 MLGame.py -i ml_play_template.py -f 500 pingpong NORMAL 10
pygame 2.0.1 (SDL 2.0.14, Python 3.8.5)
Hello from the pygame community. https://www.pygame.org/contribute.html
pygame 2.0.1 (SDL 2.0.14, Python 3.8.5)
Hello from the pygame community. https://www.pygame.org/contribute.html
pygame 2.0.1 (SDL 2.0.14, Python 3.8.5)
Hello from the pygame community. https://www.pygame.org/contribute.html
GAME_2P_WIN
(-16, 16)
(-16, 16)
The client 'ml_1P' delayed 1 frame(s)
The client 'ml_2P' delayed 1 frame(s)
GAME_1P_WIN
(20, -20)
(20, -20)
GAME_2P_WIN
(-16, 16)
(-16, 16)
GAME_2P_WIN
(21, 21)
(21, 21)
GAME_2P_WIN
(-16, 16)
(-16, 16)
GAME_2P_WIN
(19, 19)
(19, 19)
GAME_2P_WIN
(-16, 16)
(-16, 16)
GAME_2P_WIN
(21, 21)
(21, 21)
GAME_1P_WIN
(21, -21)
(21, -21)
GAME_2P_WIN
(21, 21)
(21, 21)
GAME_2P_WIN
(-16, 16)
(-16, 16)
GAME_2P_WIN
2P wins! Final score: 2-10
(19, 19)
(19, 19)
```

加入低於某個高度板子不動的機制

```
(base) ~/Documents/109-2(2-2)/machine_learning/MLGame ➜ master ✘ python3 MLGame.py -i ml_play_template.py -f 500 pingpong NORMAL 10
pygame 2.0.1 (SDL 2.0.14, Python 3.8.5)
Hello from the pygame community. https://www.pygame.org/contribute.html
pygame 2.0.1 (SDL 2.0.14, Python 3.8.5)
Hello from the pygame community. https://www.pygame.org/contribute.html
pygame 2.0.1 (SDL 2.0.14, Python 3.8.5)
Hello from the pygame community. https://www.pygame.org/contribute.html
GAME_2P_WIN
(-22, 22)
(-22, 22)
GAME_1P_WIN
(24, -24)
(24, -24)
GAME_2P_WIN
(-22, 22)
(-22, 22)
GAME_1P_WIN
(24, -24)
(24, -24)
GAME_2P_WIN
(-22, 22)
(-22, 22)
GAME_1P_WIN
(24, -24)
(24, -24)
The client 'ml_1P' delayed 1 frame(s)
The client 'ml_2P' delayed 1 frame(s)
GAME_2P_WIN
(-21, 21)
(-21, 21)
GAME_1P_WIN
(24, -24)
(24, -24)
GAME_2P_WIN
(-22, 22)
(-22, 22)
The client 'ml_1P' delayed 1 frame(s)
The client 'ml_2P' delayed 1 frame(s)
GAME_1P_WIN
(22, -22)
(22, -22)
GAME_2P_WIN
(-25, 25)
(-25, 25)
GAME_1P_WIN
(24, -24)
(24, -24)
GAME_2P_WIN
(-22, 22)
(-22, 22)
GAME_1P_WIN
(24, -24)
(24, -24)
GAME_2P_WIN
(-25, 25)
(-25, 25)
GAME_2P_WIN
(-24, 24)
(-24, 24)
GAME_2P_WIN
2P wins! Final score: 7-10
(-25, 25)
(-25, 25)
```

# Reference - 3

## Introduction 觀察到的現象-3

# XNN, 50files, 1p 2p 檔案不分開, 使用加上 板子不切球機制的檔案

```
se) ~/Documents/109-2(2-2)/machine_learning/MLGame ➜ master ✚ python3 MLGame.py -i ml_play_knn2.py -f 200 pingpong HARD
ame 2.0.1 (SDL 2.0.14, Python 3.8.5)
lo from the pygame community. https://www.pygame.org/contribute.html
ame 2.0.1 (SDL 2.0.14, Python 3.8.5)
lo from the pygame community. https://www.pygame.org/contribute.html
ame 2.0.1 (SDL 2.0.14, Python 3.8.5)
lo from the pygame community. https://www.pygame.org/contribute.html
brary/Frameworks/Python.framework/Versions/3.8/lib/python3.8/site-packages/sklearn/base.py:310: UserWarning: Trying to unpickle
arnings.warn(
E_1P_WIN
-7)
-7)
E_1P_WIN
, -8)
, -8)
E_1P_WIN
wins! Final score: 3-0
-7)
-7)
se) ~/Documents/109-2(2-2)/machine_learning/MLGame ➜ master ✚ python3 MLGame.py -i ml_play_knn2.py -f 200 pingpong HARD
ame 2.0.1 (SDL 2.0.14, Python 3.8.5)
lo from the pygame community. https://www.pygame.org/contribute.html
ame 2.0.1 (SDL 2.0.14, Python 3.8.5)
lo from the pygame community. https://www.pygame.org/contribute.html
ame 2.0.1 (SDL 2.0.14, Python 3.8.5)
lo from the pygame community. https://www.pygame.org/contribute.html
brary/Frameworks/Python.framework/Versions/3.8/lib/python3.8/site-packages/sklearn/base.py:310: UserWarning: Trying to unpickle
arnings.warn(
E_1P_WIN
-7)
-7)
E_1P_WIN
, -8)
, -8)
E_1P_WIN
wins! Final score: 3-0
-7)
-7)
se) ~/Documents/109-2(2-2)/machine_learning/MLGame ➜ master ✚ python3 MLGame.py -i ml_play_knn2.py -f 200 pingpong HARD
ame 2.0.1 (SDL 2.0.14, Python 3.8.5)
lo from the pygame community. https://www.pygame.org/contribute.html
ame 2.0.1 (SDL 2.0.14, Python 3.8.5)
lo from the pygame community. https://www.pygame.org/contribute.html
ame 2.0.1 (SDL 2.0.14, Python 3.8.5)
lo from the pygame community. https://www.pygame.org/contribute.html
brary/Frameworks/Python.framework/Versions/3.8/lib/python3.8/site-packages/sklearn/base.py:310: UserWarning: Trying to unpickle
arnings.warn(
E_1P_WIN
, -7)
, -7)
E_1P_WIN
, -8)
, -8)
E_1P_WIN
wins! Final score: 3-0
-8)
-8)
```

# KNN, 50files, 1p 2p 檔案分開, 使用加上板子不切球機制的檔案

```
(base) ~/Documents/109-2(2-2)/machine_learning/MLGame python3 MLGame.py -i ml_play_knn2.py -f 200 pingpong HARD
pygame 2.0.1 (SDL 2.0.14, Python 3.8.5)
Hello from the pygame community. https://www.pygame.org/contribute.html
pygame 2.0.1 (SDL 2.0.14, Python 3.8.5)
Hello from the pygame community. https://www.pygame.org/contribute.html
pygame 2.0.1 (SDL 2.0.14, Python 3.8.5)
Hello from the pygame community. https://www.pygame.org/contribute.html
/Library/Frameworks/Python.framework/Versions/3.8/lib/python3.8/site-packages/sklearn/base.py:310: UserWarning: Trying to unpickle
    warnings.warn(
GAME_2P_WIN
(14, 11)
(14, 11)
GAME_1P_WIN
(-14, -11)
(-14, -11)
GAME_1P_WIN
(17, -14)
(17, -14)
GAME_1P_WIN
1P wins! Final score: 3-1
(12, -9)
(12, -9)
(base) ~/Documents/109-2(2-2)/machine_learning/MLGame python3 MLGame.py -i ml_play_knn2.py -f 200 pingpong HARD
pygame 2.0.1 (SDL 2.0.14, Python 3.8.5)
Hello from the pygame community. https://www.pygame.org/contribute.html
pygame 2.0.1 (SDL 2.0.14, Python 3.8.5)
Hello from the pygame community. https://www.pygame.org/contribute.html
pygame 2.0.1 (SDL 2.0.14, Python 3.8.5)
Hello from the pygame community. https://www.pygame.org/contribute.html
/Library/Frameworks/Python.framework/Versions/3.8/lib/python3.8/site-packages/sklearn/base.py:310: UserWarning: Trying to unpickle
    warnings.warn(
GAME_1P_WIN
(-11, -8)
(-11, -8)
GAME_2P_WIN
(-17, 17)
(-17, 17)
GAME_1P_WIN
(-11, -8)
(-11, -8)
GAME_1P_WIN
1P wins! Final score: 3-1
(16, -16)
(16, -16)
(base) ~/Documents/109-2(2-2)/machine_learning/MLGame python3 MLGame.py -i ml_play_knn2.py -f 200 pingpong HARD
pygame 2.0.1 (SDL 2.0.14, Python 3.8.5)
Hello from the pygame community. https://www.pygame.org/contribute.html
pygame 2.0.1 (SDL 2.0.14, Python 3.8.5)
Hello from the pygame community. https://www.pygame.org/contribute.html
pygame 2.0.1 (SDL 2.0.14, Python 3.8.5)
Hello from the pygame community. https://www.pygame.org/contribute.html
/Library/Frameworks/Python.framework/Versions/3.8/lib/python3.8/site-packages/sklearn/base.py:310: UserWarning: Trying to unpickle
    warnings.warn(
GAME_1P_WIN
(-16, -16)
(-16, -16)
GAME_1P_WIN
(12, -9)
(12, -9)
GAME_2P_WIN
(-12, 9)
(-12, 9)
GAME_2P_WIN
(16, 16)
(16, 16)
GAME_1P_WIN
1P wins! Final score: 3-2
(-13, -10)
(-13, -10)
```

# Reference - 4

# Introduction 觀察到的現象-4

# KNN, 25files, 1p 2p 檔案 分開, 使用加上板子不切球 機制的檔案

**KNN, 50files, 1p 2p 檔案  
分開, 使用加上板子不切球  
機制的檔案**

XNN, 75files, 1p 2p 檔案  
分開，使用加上板子不切球  
機制的檔案

NN, 100files, 1p 2p 檔  
分開, 使用加上板子不切  
球機制的檔案

```
[base] ~/Documents/109-2(2-2)/machine_learning/MLGame> master ➜ python3 MLGame.py -i ml_play_knn.py -f 200 pingpong HARD
pygame 2.0.1 (SDL 2.0.14, Python 3.8.5)
Hello from the pygame community. https://www.pygame.org/contribute.html
pygame 2.0.1 (SDL 2.0.14, Python 3.8.5)
Hello from the pygame community. https://www.pygame.org/contribute.html
pygame 2.0.1 (SDL 2.0.14, Python 3.8.5)
Hello from the pygame community. https://www.pygame.org/contribute.html
/Library/Frameworks/Python.framework/Versions/3.8/lib/python3.8/site-packages/sklearn/base.py:310: UserWarning: Trying to unpickle
warnings.warn(
GAME_2P_WIN
(17, 17)
(17, 17)
GAME_1P_WIN
(-11, -11)
(-11, -11)
GAME_2P_WIN
(-14, 14)
(-14, 14)
GAME_2P_WIN
2P wins! Final score: 1-3
(-14, 11)
(-14, 11)

(base) ~/Documents/109-2(2-2)/machine_learning/MLGame> master ➜ python3 MLGame.py -i ml_play_knn.py -f 200 pingpong HARD
pygame 2.0.1 (SDL 2.0.14, Python 3.8.5)
Hello from the pygame community. https://www.pygame.org/contribute.html
pygame 2.0.1 (SDL 2.0.14, Python 3.8.5)
Hello from the pygame community. https://www.pygame.org/contribute.html
pygame 2.0.1 (SDL 2.0.14, Python 3.8.5)
Hello from the pygame community. https://www.pygame.org/contribute.html
/Library/Frameworks/Python.framework/Versions/3.8/lib/python3.8/site-packages/sklearn/base.py:310: UserWarning: Trying to unpickle
warnings.warn(
GAME_2P_WIN
(16, 16)
(16, 16)
GAME_1P_WIN
(21, -21)
(21, -21)
GAME_1P_WIN
(-12, -9)
(-12, -9)
GAME_1P_WIN
1P wins! Final score: 3-1
(-15, -12)
(-15, -12)

(base) ~/Documents/109-2(2-2)/machine_learning/MLGame> master ➜ python3 MLGame.py -i ml_play_knn.py -f 200 pingpong HARD
pygame 2.0.1 (SDL 2.0.14, Python 3.8.5)
Hello from the pygame community. https://www.pygame.org/contribute.html
pygame 2.0.1 (SDL 2.0.14, Python 3.8.5)
Hello from the pygame community. https://www.pygame.org/contribute.html
pygame 2.0.1 (SDL 2.0.14, Python 3.8.5)
Hello from the pygame community. https://www.pygame.org/contribute.html
/Library/Frameworks/Python.framework/Versions/3.8/lib/python3.8/site-packages/sklearn/base.py:310: UserWarning: Trying to unpickle
warnings.warn(
GAME_2P_WIN
(-11, -8)
(-11, -8)
GAME_2P_WIN
(-17, 17)
(-17, 17)
GAME_1P_WIN
(-11, -8)
(-11, -8)
GAME_1P_WIN
1P wins! Final score: 3-1
(16, -16)
(16, -16)

(base) ~/Documents/109-2(2-2)/machine_learning/MLGame> master ➜ python3 MLGame.py -i ml_play_knn2.py -f 200 pingpong HARD
pygame 2.0.1 (SDL 2.0.14, Python 3.8.5)
Hello from the pygame community. https://www.pygame.org/contribute.html
pygame 2.0.1 (SDL 2.0.14, Python 3.8.5)
Hello from the pygame community. https://www.pygame.org/contribute.html
pygame 2.0.1 (SDL 2.0.14, Python 3.8.5)
Hello from the pygame community. https://www.pygame.org/contribute.html
/Library/Frameworks/Python.framework/Versions/3.8/lib/python3.8/site-packages/sklearn/base.py:310: UserWarning: Trying to unpickle
warnings.warn(
GAME_1P_WIN
(-16, -16)
(-16, -16)
GAME_1P_WIN
(12, -9)
(12, -9)
GAME_2P_WIN
(-12, 9)
(-12, 9)
GAME_2P_WIN
(16, 16)
(16, 16)
GAME_1P_WIN
1P wins! Final score: 3-2
(-13, -10)
(-13, -10)
(14, 11)
(14, 11)
```

# Reference - 5

## RESULT KNN, 各100files, 1p 2p 檔案分開

```
(base) ~/Documents/109-2(2-2)/machine_learning/MLGame > ! master ±+
pygame 2.0.1 (SDL 2.0.14, Python 3.8.5)
Hello from the pygame community. https://www.pygame.org/contribute.html
pygame 2.0.1 (SDL 2.0.14, Python 3.8.5)
Hello from the pygame community. https://www.pygame.org/contribute.html
pygame 2.0.1 (SDL 2.0.14, Python 3.8.5)
Hello from the pygame community. https://www.pygame.org/contribute.html
/Library/Frameworks/Python.framework/Versions/3.8/lib/python3.8/site-pa
    warnings.warn(
/Library/Frameworks/Python.framework/Versions/3.8/lib/python3.8/site-pa
    warnings.warn(
/Library/Frameworks/Python.framework/Versions/3.8/lib/python3.8/site-pa
    warnings.warn(
/Library/Frameworks/Python.framework/Versions/3.8/lib/python3.8/site-pa
    warnings.warn(
GAME_2P_WIN
(-19, 19)
(-19, 19)
GAME_1P_WIN
(-16, -16)
(-16, -16)
GAME_2P_WIN
(-12, 9)
(-12, 9)
The client 'ml_1P' delayed 3 frame(s)
The client 'ml_2P' delayed 3 frame(s)
GAME_2P_WIN
(17, -17)
(17, -17)
2P wins! Final score: 1-3
(-15, 15)
(-15, 15)
(base) ~/Documents/109-2(2-2)/machine_learning/MLGame > ! master ±+
pygame 2.0.1 (SDL 2.0.14, Python 3.8.5)
Hello from the pygame community. https://www.pygame.org/contribute.html
pygame 2.0.1 (SDL 2.0.14, Python 3.8.5)
Hello from the pygame community. https://www.pygame.org/contribute.html
pygame 2.0.1 (SDL 2.0.14, Python 3.8.5)
Hello from the pygame community. https://www.pygame.org/contribute.html
/Library/Frameworks/Python.framework/Versions/3.8/lib/python3.8/site-pa
    warnings.warn(
/Library/Frameworks/Python.framework/Versions/3.8/lib/python3.8/site-pa
    warnings.warn(
/Library/Frameworks/Python.framework/Versions/3.8/lib/python3.8/site-pa
    warnings.warn(
/Library/Frameworks/Python.framework/Versions/3.8/lib/python3.8/site-pa
    warnings.warn(
GAME_1P_WIN
(-14, -14)
(-14, -14)
The client 'ml_1P' delayed 1 frame(s)
The client 'ml_2P' delayed 1 frame(s)
GAME_1P_WIN
(17, -17)
(17, -17)
2P wins! Final score: 1-3
(-15, 15)
(-15, 15)
(base) ~/Documents/109-2(2-2)/machine_learning/MLGame > ! master ±+
pygame 2.0.1 (SDL 2.0.14, Python 3.8.5)
Hello from the pygame community. https://www.pygame.org/contribute.html
pygame 2.0.1 (SDL 2.0.14, Python 3.8.5)
Hello from the pygame community. https://www.pygame.org/contribute.html
pygame 2.0.1 (SDL 2.0.14, Python 3.8.5)
Hello from the pygame community. https://www.pygame.org/contribute.html
/Library/Frameworks/Python.framework/Versions/3.8/lib/python3.8/site-pa
    warnings.warn(
/Library/Frameworks/Python.framework/Versions/3.8/lib/python3.8/site-pa
    warnings.warn(
/Library/Frameworks/Python.framework/Versions/3.8/lib/python3.8/site-pa
    warnings.warn(
/Library/Frameworks/Python.framework/Versions/3.8/lib/python3.8/site-pa
    warnings.warn(
GAME_2P_WIN
(16, 16)
(16, 16)
The client 'ml_1P' delayed 2 frame(s)
The client 'ml_2P' delayed 2 frame(s)
GAME_2P_WIN
(-18, 15)
(-18, 15)
GAME_2P_WIN
2P wins! Final score: 2-3
(-12, 9)
(-12, 9)
(base) ~/Documents/109-2(2-2)/machine_learning/MLGame > ! master ±+
pygame 2.0.1 (SDL 2.0.14, Python 3.8.5)
Hello from the pygame community. https://www.pygame.org/contribute.html
pygame 2.0.1 (SDL 2.0.14, Python 3.8.5)
Hello from the pygame community. https://www.pygame.org/contribute.html
pygame 2.0.1 (SDL 2.0.14, Python 3.8.5)
Hello from the pygame community. https://www.pygame.org/contribute.html
/Library/Frameworks/Python.framework/Versions/3.8/lib/python3.8/site-pa
    warnings.warn(
/Library/Frameworks/Python.framework/Versions/3.8/lib/python3.8/site-pa
    warnings.warn(
/Library/Frameworks/Python.framework/Versions/3.8/lib/python3.8/site-pa
    warnings.warn(
/Library/Frameworks/Python.framework/Versions/3.8/lib/python3.8/site-pa
    warnings.warn(
GAME_1P_WIN
(-19, -19)
(-19, -19)
GAME_2P_WIN
(14, 11)
(14, 11)
GAME_1P_WIN
(-16, -16)
(-16, -16)
GAME_1P_WIN
1P wins! Final score: 3-0
(15, -15)
(15, -15)
```

```
(base) ~/Documents/109-2(2-2)/machine_learning/MLGame > ! master ±+
pygame 2.0.1 (SDL 2.0.14, Python 3.8.5)
Hello from the pygame community. https://www.pygame.org/contribute.html
pygame 2.0.1 (SDL 2.0.14, Python 3.8.5)
Hello from the pygame community. https://www.pygame.org/contribute.html
pygame 2.0.1 (SDL 2.0.14, Python 3.8.5)
Hello from the pygame community. https://www.pygame.org/contribute.html
/Library/Frameworks/Python.framework/Versions/3.8/lib/python3.8/site-pa
    warnings.warn(
/Library/Frameworks/Python.framework/Versions/3.8/lib/python3.8/site-pa
    warnings.warn(
/Library/Frameworks/Python.framework/Versions/3.8/lib/python3.8/site-pa
    warnings.warn(
/Library/Frameworks/Python.framework/Versions/3.8/lib/python3.8/site-pa
    warnings.warn(
GAME_1P_WIN
(17, -17)
(17, -17)
2P wins! Final score: 1-3
(-15, 15)
(-15, 15)
(base) ~/Documents/109-2(2-2)/machine_learning/MLGame > ! master ±+
pygame 2.0.1 (SDL 2.0.14, Python 3.8.5)
Hello from the pygame community. https://www.pygame.org/contribute.html
pygame 2.0.1 (SDL 2.0.14, Python 3.8.5)
Hello from the pygame community. https://www.pygame.org/contribute.html
pygame 2.0.1 (SDL 2.0.14, Python 3.8.5)
Hello from the pygame community. https://www.pygame.org/contribute.html
/Library/Frameworks/Python.framework/Versions/3.8/lib/python3.8/site-pa
    warnings.warn(
/Library/Frameworks/Python.framework/Versions/3.8/lib/python3.8/site-pa
    warnings.warn(
/Library/Frameworks/Python.framework/Versions/3.8/lib/python3.8/site-pa
    warnings.warn(
/Library/Frameworks/Python.framework/Versions/3.8/lib/python3.8/site-pa
    warnings.warn(
GAME_1P_WIN
(14, 11)
(14, 11)
GAME_1P_WIN
(-16, -16)
(-16, -16)
GAME_1P_WIN
1P wins! Final score: 3-1
(12, -12)
(12, -12)
```