Kaggle: Parkinson's Freezing of Gait Prediction

資料集介紹

Research Code Competition

Parkinson's Freezing of Gait Prediction

Event detection from wearable sensor data

$100,000
Prize Money

THE MICHAEL J. FOX FOUNDATION · 808 teams · a month to go (a month to go until merger deadline)

Overview

Goal of the Competition

The goal of this competition is to detect freezing of gait (FOG), a debilitating symptom that afflicts many people with Parkinson's disease. You will develop a machine learning model trained on data collected from a wearable 3D lower back sensor.

Your work will help researchers better understand when and why FOG episodes occur. This will improve the ability of medical professionals to optimally evaluate, monitor, and ultimately, prevent FOG events.

Context

An estimated 7 to 10 million people around the world have Parkinson's disease, many of whom suffer from freezing of gait (FOG). During a FOG episode, a patient's feet are "glued" to the ground, preventing them from moving forward despite their attempts. FOG has a profound negative impact on health-related quality of life—people who suffer from FOG are often depressed, have an increased risk of falling, are likelier to be confined to wheelchair use, and have restricted independence.

While researchers have multiple theories to explain when, why, and in whom FOG occurs, there is still no clear understanding of its causes. The ability to objectively and accurately quantify FOG is one of the keys to advancing its understanding and treatment. Collection and analysis of FOG events, such as with your data science skills, could lead to potential treatments.

There are many methods of evaluating FOG, though most involve FOG-provoking protocols. People with FOG are filmed while performing certain tasks that are likely to increase its occurrence. Experts then review the video to score each frame, indicating when FOG occurred. While scoring in this manner is relatively reliable and sensitive, it is extremely time-consuming and requires specific expertise. Another method

Timeline

- **March 9, 2023 -** Start Date.
- **June 1, 2023 -** Entry Deadline. You must accept the competition rules before this date in order to compete.
- **June 1, 2023 -** Team Merger Deadline. This is the last day participants may join or merge teams.
- **June 8, 2023 -** Final Submission Deadline.

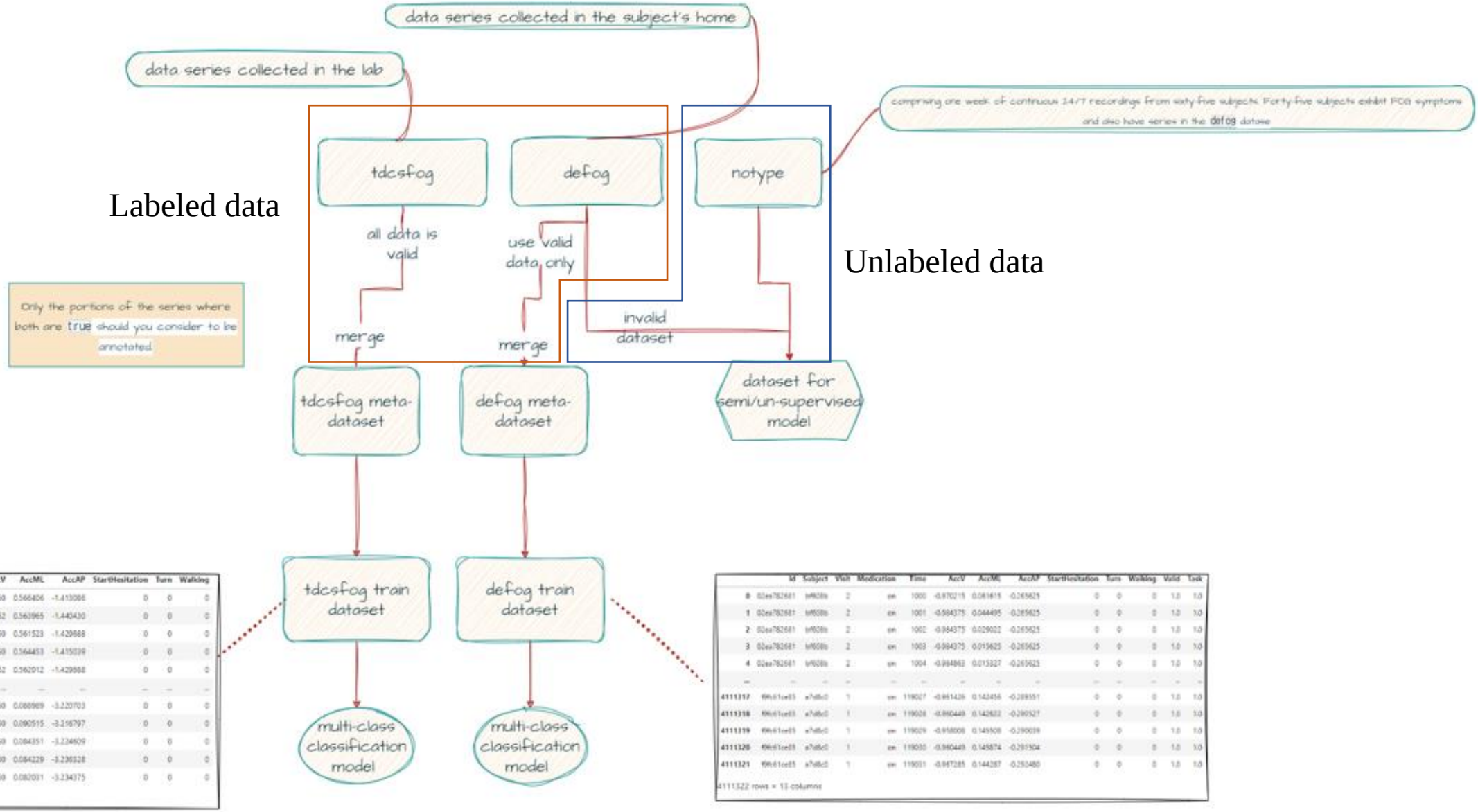
Target

- Detect the start and stop of each freezing episode (FOG)
- And the occurrence in these series of three types of freezing of gait events: Start Hesitation, Turn and Walking.

{SeriesId}_{Time}, StartHesitation, Turn, Walking

```
Id,StartHesitation,Turn,Walking
003f117e14_0,0,0,0
003f117e14_1,0,0,0
003f117e14_2,0,0,0
003f117e14_3,0,0,0
```

詳細架構圖



Simple LGBM multi-class classification baseline

Updated 2mo ago

13 comments · Parkinson's Freezing of Gait Prediction

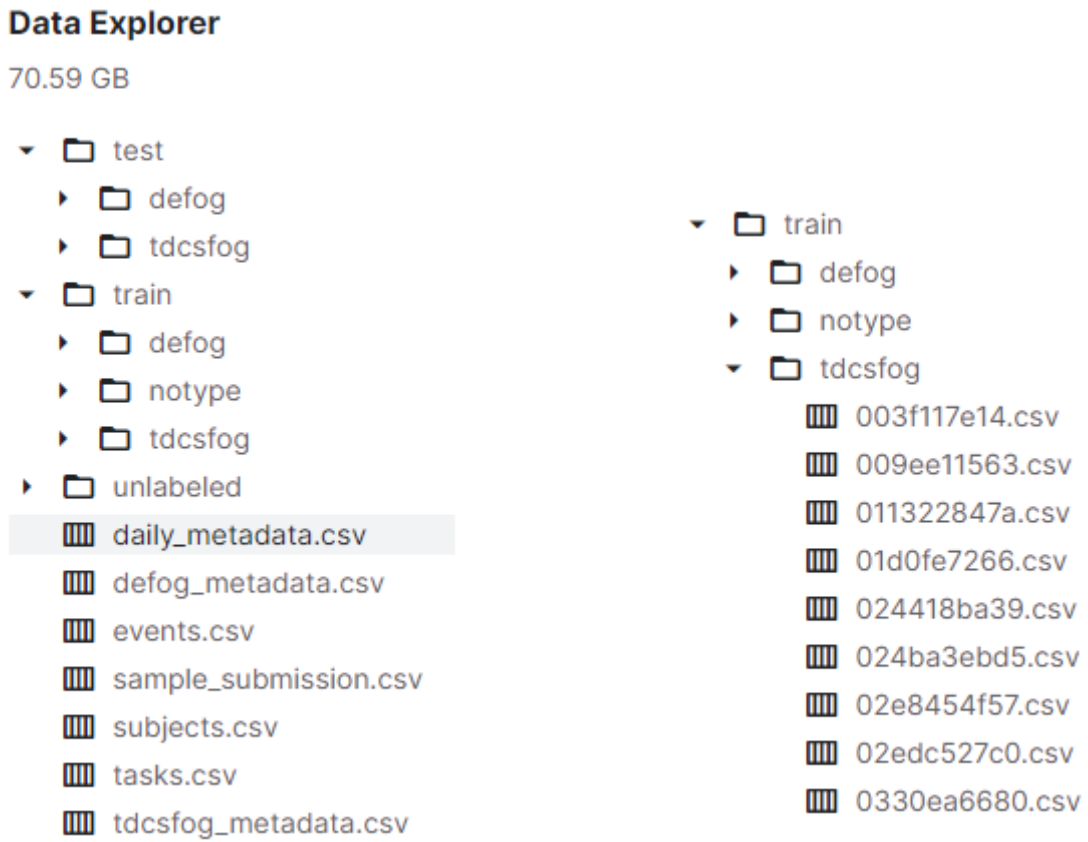
103

https://www.kaggle.com/code/kimtaehun/simple-lgbm-multi-class-classification-baseline

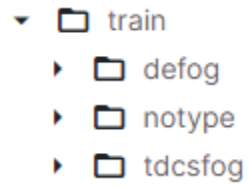
Dataset

- tdcsfog
  - 在實驗室中收集的資料系列，有準確且可信的標記
- defog
  - 在受測者家中收集的資料系列，有標記但有些不保證可信(unlabeled)
- daily living (notype)
  - 受測者在家中連續一週的錄音，共65人，45位有症狀並被收錄在defog，無症狀的20位無標記(unlabeled)

File and Field Descriptions



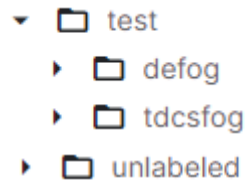
File and Field Descriptions



- Train/
  - tdcsfog/
    - Time, AccV, AccML, AccAP, StartHesitation, Turn, Walking
  - defog/
    - Time, AccV, AccML, AccAP, StartHesitation, Turn, Walking, Valid, Task
  - notype/
    - Time, AccV, AccML, AccAP, Event, Valid, Task

File and Field Descriptions

- Test/
  - tdcsfog/
    - Time, AccV, AccML, AccAP
  - defog/
    - Time, AccV, AccML, AccAP
- Unlabeled/
    - Time, AccV, AccML, AccAP



File and Field Descriptions

- 每個csv由唯一ID命名
  - Time : 蒐集資料的時間點，受蒐集資料頻率影響
  - AccV, AccML, AccAP : V-垂直、ML-中側向、AP-前後向的加速度
  - StartHesitation, Turn, Walking : 每種事件類型的發生
  - Event : 任何FOG類型事件的發生

    -僅存在於缺少類型級別標註的notype序列中，但我們沒用unlabeled data
  - Valid : 在標註者無法決定是否存在運動停頓的FOG，只有true是可以肯定的狀況
  - Task : True時才視作有標記，其餘未標記

File and Field Descriptions

範例(defog)

02ea782681.csv (9.47 MB)

Detail | Compact | Column

9 of 9 columns

# Time	# AccV	# AccML	# AccAP	# StartHesit...	# Turn	# Walking	✓ Valid	✓ Task
0	-1.0	0.0441294600297506	-0.25	0	0	0	false	false
1	-1.0	0.0344313599752663	-0.25	0	0	0	false	false
2	-1.0	0.03125	-0.25	0	0	0	false	false
3	-1.0	0.03125	-0.25	0	0	0	false	false
4	-1.0	0.03125	-0.25	0	0	0	false	false
5	-1.0	0.03125	-0.25	0	0	0	false	false
6	-1.0	0.03125	-0.25	0	0	0	false	false

File and Field Descriptions

每個資料集有的數據和詳細單位，X表示該資料及無此數據

	Time	AccV	AccML	AccAP	StartHesitation	Turn	Walking	Event	Valid	Task
tdcsfog	128Hz	m/s^2	m/s^2	m/s^2	0/1	0/1	0/1	X	X	X
defog	100Hz	g	g	g	0/1	0/1	0/1	X	T/F	T/F
notype	100Hz	g	g	g	X	X	X	0/1	T/F	T/F

File and Field Descriptions

- tdcsfog_metadata.csv
  - ID, Subject, Visit, Test , Medication
- defog_metadata.csv
  - ID, Subject, Visit, Medication
- daily_metadata.csv
  - ID, Subject, Visit, Time of day the recording began

1. ID:該測試紀錄的編號
2. Subject:該紀錄的受試對象，每個受試對象有唯一編號
3. Visit:參訪實驗室次數
4. Test:表示進行了哪一種測試，其中3表示最具挑戰性的測試
5. Medication:記錄期間可能服用或未服用抗帕金森病藥物
6. Time of day the recording began: 紀錄開始的時間點

File and Field Descriptions

- subjects.csv
  - Visit, YearsSinceDx, UPDRSIIIOn / UPDRSIIIOff, NFOGQ

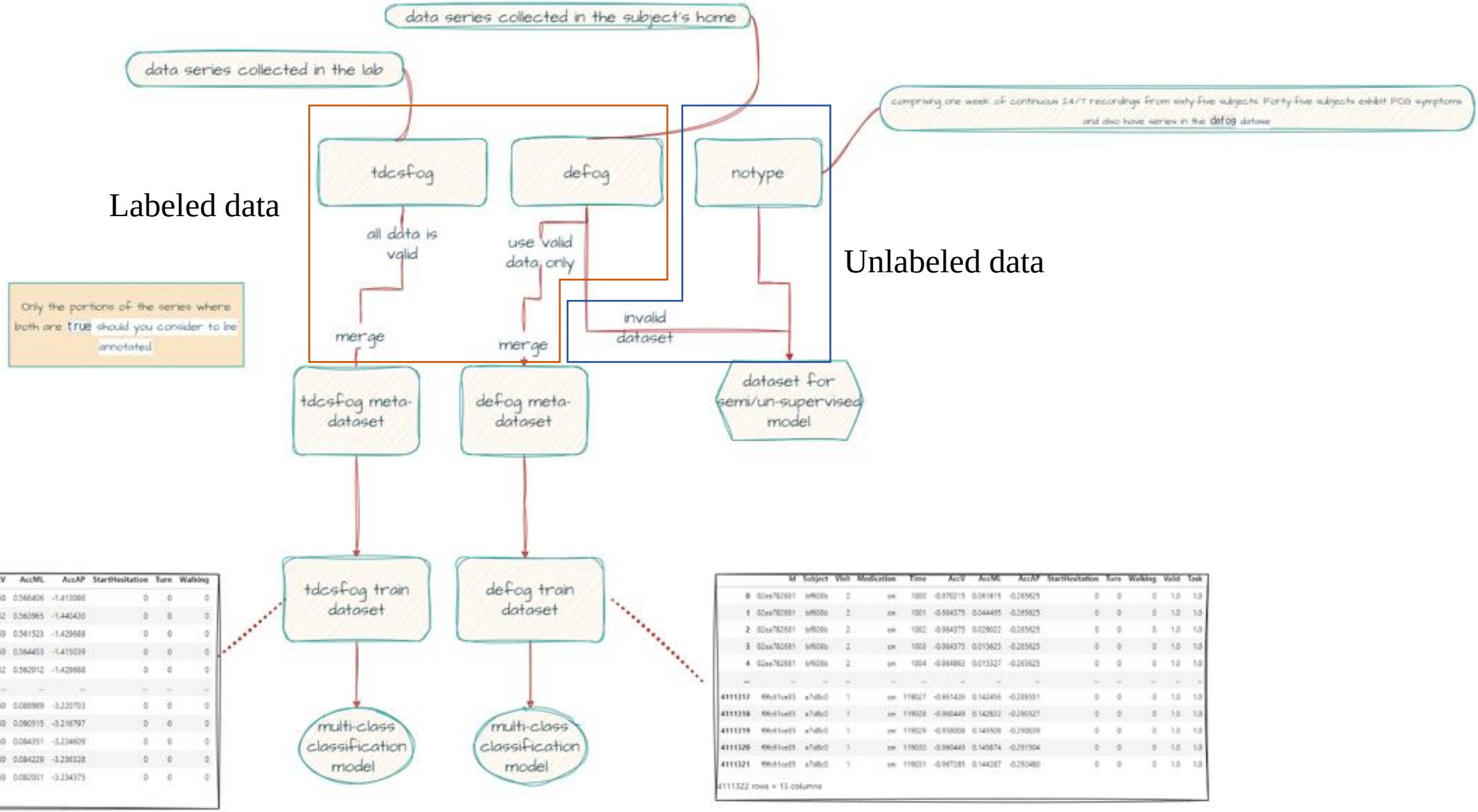
1. Visit:參訪實驗室次數
2. YearsSinceDx:自帕金森病診斷以來的年數
3. UPDRSIIIOn / UPDRSIIIOff: 在有/無藥物作用時的帕金森病評分量表分數
4. NFOGQ: 來自報凍結步態問卷得分

File and Field Descriptions

- events.csv
  - ID, Init, Completion, Type, Kinetic
- tasks.csv
  - ID, Begin, End, Task One of seven tasks types
- sample_submission.csv
  - ID_time, StartHesitation, Turn, Walking

1. Init Time:事件開始的時間
2. Completion Time:事件結束的時間
3. Type:事件類型，是StartHesitation、Turn還是Walking
4. Kinetic:事件是否是動態事件（1）且涉及運動，或是靜態事件（0）

詳細架構圖



Simple LGBM multi-class classification baseline

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https://www.kaggle.com/code/kimtaehun/simple-lgbm-multi-class-classification-baseline

Evalution

- Mean Average Precision (mAP)
- GT中三個行為最多只會有一個為1
- Predict則無此限制，且每個行為的預測可為機率

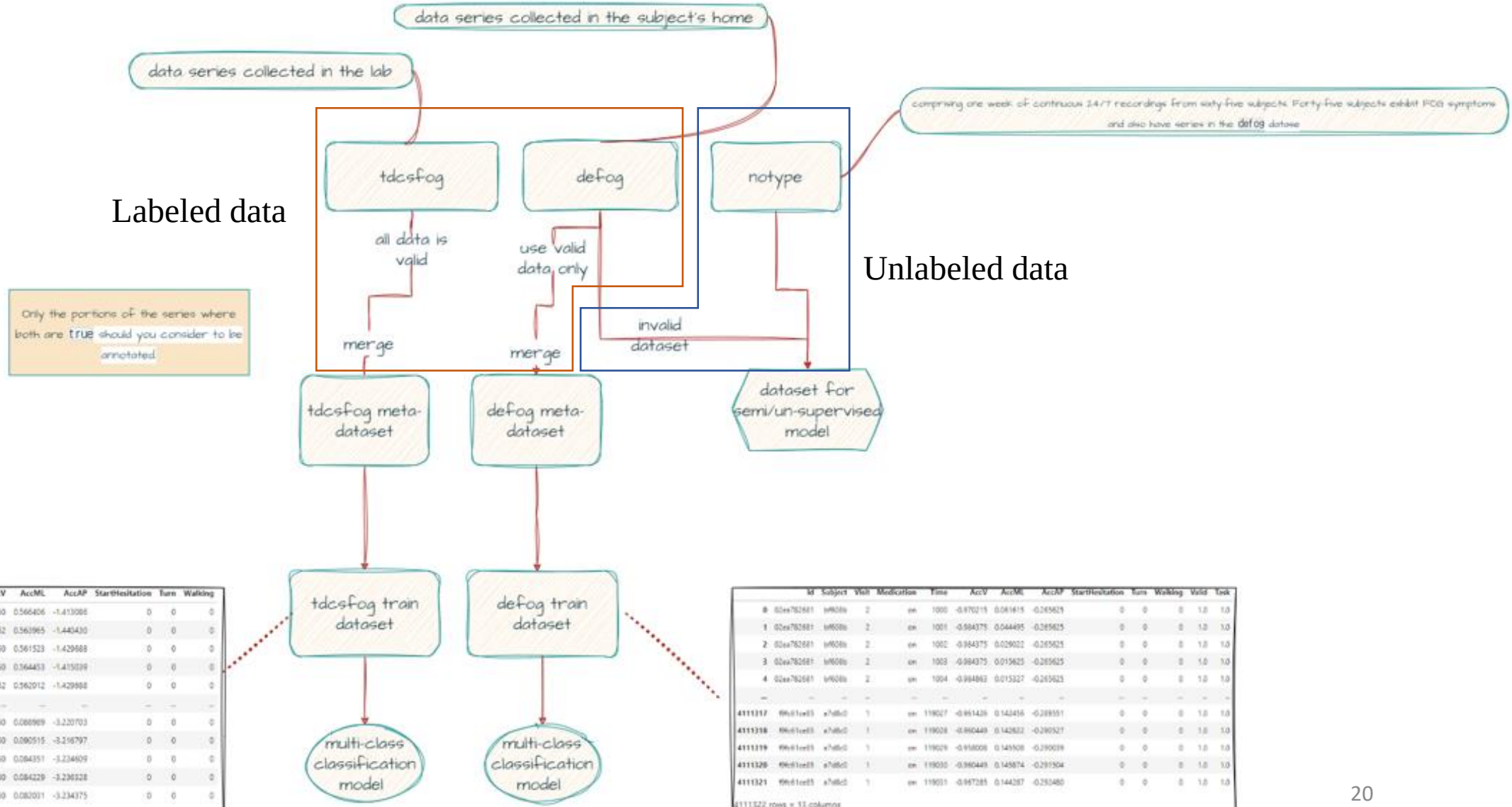
```
Id,StartHesitation,Turn,Walking
003f117e14_0,0,0,0
003f117e14_1,0,0,0
003f117e14_2,0,0,0
003f117e14_3,0,0,0
```

Conclusion

- 時序的資料
- Multiclass 問題
- 有Unlabeled data可以使用(Semi-supervised)

Code解説

前處理


data series collected in the subject's home
data series collected in the lab
comprising one week of continuous 24/7 recordings from sixty five subjects. Forty five subjects exhibit PDG symptoms and also have series in the defog dataset
tdcsfog
defog
notype
Labeled data
Unlabeled data
all data is valid
use valid data only
Only the portions of the series where both are true should you consider to be annotated
merge
merge
invalid dataset
tdcsfog meta-dataset
defog meta-dataset
dataset for semi/un-supervised model
tdcsfog train dataset
defog train dataset
multi-class classification model
multi-class classification model

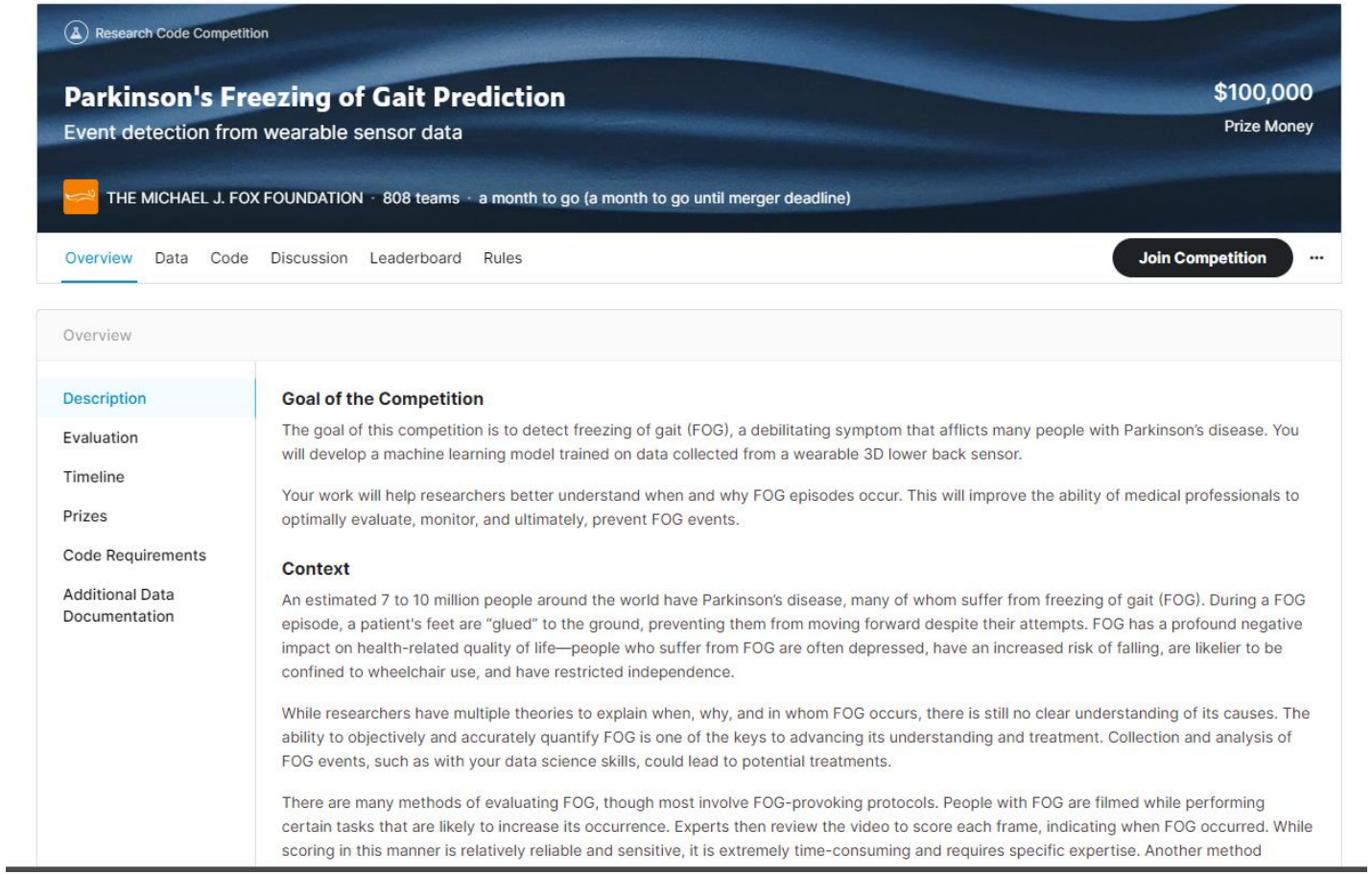
Code

- DNN
  - https://www.kaggle.com/code/qiteng/dnn-parkinson-s-freezing-of-gait-prediction
- ML
  - https://www.kaggle.com/code/qiteng/ml-parkinson-s-freezing-of-gait-prediction

Kaggle繳交教學

進入競賽網站

- https://www.kaggle.com/competitions/tlvmc-parkinsons-freezing-gait-prediction/overview



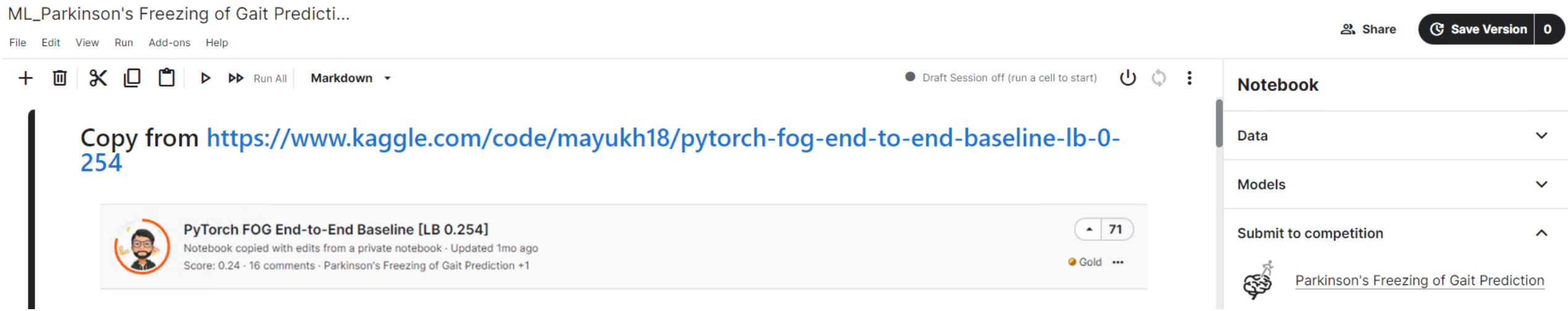
Code

- DNN
  - https://www.kaggle.com/code/qiteng/dnn-parkinson-s-freezing-of-gait-prediction
- ML
  - https://www.kaggle.com/code/qiteng/ml-parkinson-s-freezing-of-gait-prediction

參考Code

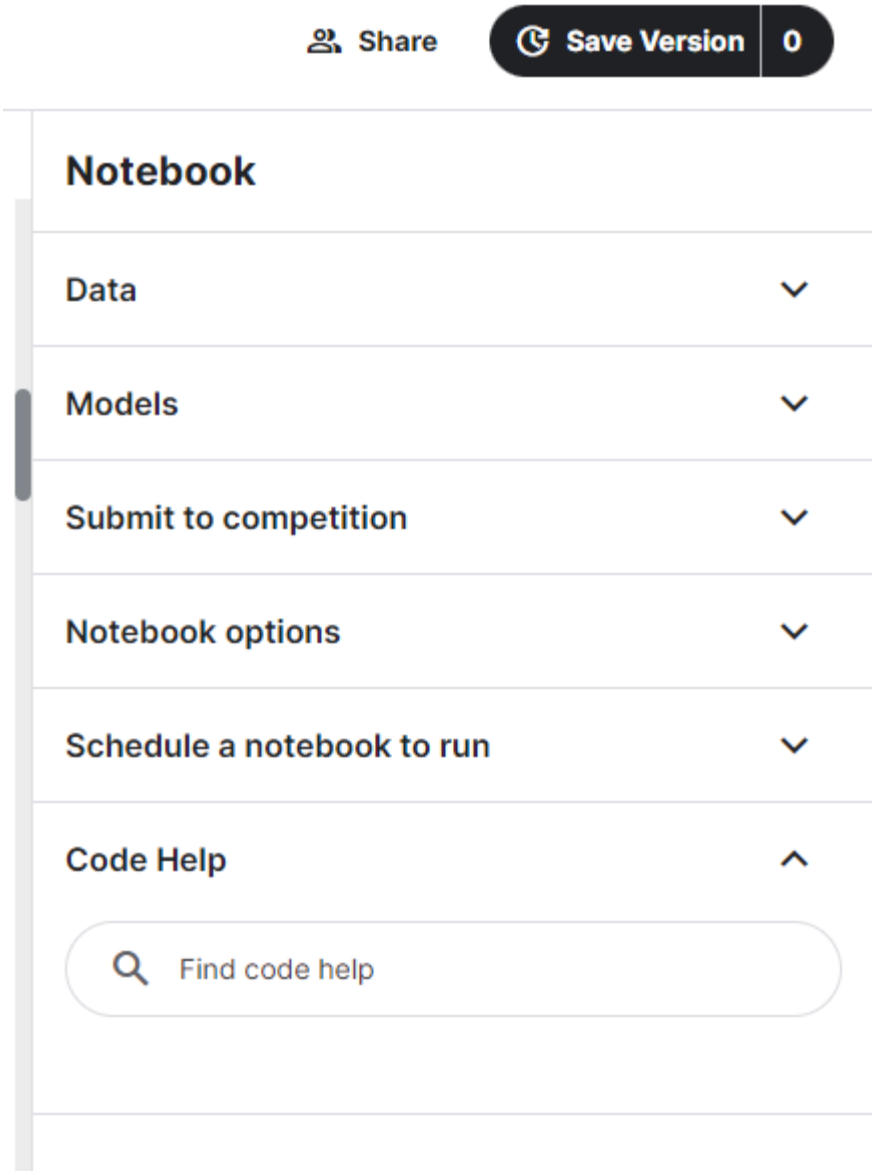
- 點擊右上黑色按鈕“Copy&Edit”

參考Code


ML_Parkinson's Freezing of Gait Predicti...
File Edit View Run Add-ons Help
Share
Save Version 0
Run All
Markdown
Draft Session off (run a cell to start)
Copy from https://www.kaggle.com/code/mayukh18/pytorch-fog-end-to-end-baseline-lb-0-254
PyTorch FOG End-to-End Baseline [LB 0.254]
Notebook copied with edits from a private notebook · Updated 1mo ago
Score: 0.24 · 16 comments · Parkinson's Freezing of Gait Prediction +1
71
Gold
Notebook
Data
Models
Submit to competition
Parkinson's Freezing of Gait Prediction

Submissions

- 展開Notebook options
  - 把Internet on 關閉 (預設是關著的)
- 點擊右上黑色“Save Version”
  - Version type選“Quick save”並存檔
- 展開Submit to competition
  - 按下Submit即可繳交Notebook



Submissions

ML_Parkinson's Freezing of Gait Prediction - Version 5

Succeeded · 22m ago · Notebook ML_Parkinson's Freezing of Gait Prediction | Version 5

0.234