# 2024 Data Mining

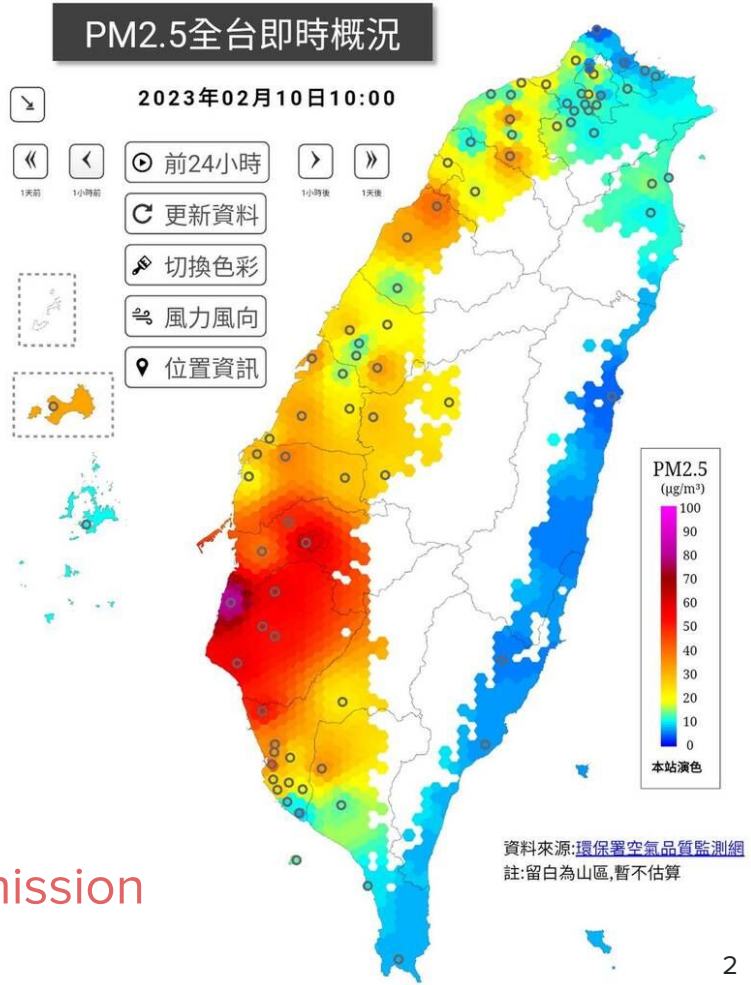
HW 1

# Task introduction

- PM2.5 prediction
  - Implement linear regression using only numpy to predict the value of PM2.5
  - pandas, csv and matplotlib are available for data analysis and pre-processing

- Requirement
  - Upload your submission to Kaggle
  - Submit a report and your source code to E3

- Deadine is 4/16 (Tue.) 23:59, no late submission



# Dataset

Hsinchu meteorological observation data form Central Weather Bureau.

- train.csv
  - Climate data for the first 20 days of each month.
  - link

- test.csv
  - Sample continuous data for 10 hours from the remaining 10 days of each month. Use data from the first 9 hours as features and PM 2.5 from the last hour as the target.
  - link

# Training Data

| Location | Date | ItemName | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|---|---|---|
| Hsinchu | 1/1 0:00 | AMB_TEMP | 11.1 | 11.2 | 11.4 | 11.5 | 11.6 | 11.7 | 11.9 |
| Hsinchu | 1/1 0:00 | CH4 | 2.01 | 1.99 | 2 | 2.02 | 2.03 | 2.02 | 2.02 |
| Hsinchu | 1/1 0:00 | CO | 0.31 | 0.28 | 0.28 | 0.33 | 0.32 | 0.26 | 0.25 |
| Hsinchu | 1/1 0:00 | NMHC | 0.1 | 0.1 | 0.08 | 0.09 | 0.1 | 0.07 | 0.07 |
| Hsinchu | 1/1 0:00 | NO | 1.5 | 1.4 | 1.4 | 1.5 | 1.4 | 1.3 | 1.4 |
| Hsinchu | 1/1 0:00 | NO2 | 11.9 | 10.4 | 9.8 | 12.1 | 12.4 | 9.2 | 8.5 |
| Hsinchu | 1/1 0:00 | NOx | 13.5 | 11.9 | 11.2 | 13.7 | 13.9 | 10.6 | 10 |
| Hsinchu | 1/1 0:00 | O3 | 21.6 | 25.1 | 25.6 | 22.4 | 21.1 | 26.5 | 25.4 |
| Hsinchu | 1/1 0:00 | PM10 | 38 | 29 | 27 | 24 | 29 | 22 | 26 |
| Hsinchu | 1/1 0:00 | PM2.5 | 25 | 24 | 13 | 14 | 15 | 12 | 10 |
| Hsinchu | 1/1 0:00 | RAINFALL | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Hsinchu | 1/1 0:00 | RH | 64 | 65 | 63 | 63 | 63 | 63 | 63 |
| Hsinchu | 1/1 0:00 | SO2 | # | 2.1 | 2.1 | 1.8 | 1.1 | 0.7 | 0.8 |
| Hsinchu | 1/1 0:00 | THC | 2.11 | 2.09 | 2.08 | 2.11 | 2.13 | 2.09 | 2.09 |
| Hsinchu | 1/1 0:00 | WD_HR | 38 | 41 | 49 | 54 | 50 | 44 | 38 |
| Hsinchu | 1/1 0:00 | WIND_DIREC | 53 | 46 | 43 | 54 | 50 | 40 | 36 |
| Hsinchu | 1/1 0:00 | WIND_SPEED | 3 | 3.4 | 2.7 | 3 | 2.6 | 2.7 | 2.4 |
| Hsinchu | 1/1 0:00 | WS_HR | 2.6 | 2.4 | 2.5 | 2.5 | 2.1 | 2.1 | 2.1 |

- #,*,x,A, represented as an invalid value.

# ItemName

| ItemName (English) | ItemName (Chinese) | Units of measurement |
|---|---|---|
| AMB_TEMP | 溫度 | ℃ |
| CH4 | 甲烷 | ppm |
| CO | 一氧化碳 | ppm |
| NMHC | 非甲烷碳氫化合物 | ppm |
| NO | 一氧化氮 | ppb |
| NO2 | 二氧化氮 | ppb |
| NOx | 氮氧化物 | ppb |
| O3 | 臭氧 | ppb |
| PM10 | 懸浮微粒 | μg/m3 |
| PM2.5 | 細懸浮微粒 | μg/m3 |
| RAINFALL | 雨量 | mm |
| RH | 相對濕度 | % |
| SO2 | 二氧化硫 | ppb |
| THC | 總碳氫化物 | ppm |
| WD_HR | 小時風向值 | degrees |
| WIND_DIREC | 風向 | degrees |
| WIND_SPEED | 風速 | m/sec |
| WS_HR | 小時風速值 | m/sec |

# Testing Data

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| index_0 | AMB_TE | 18.2 | 17.8 | 17.5 | 17.5 | 17.7 | 18.1 | 18.2 | 18.7 | 20.3 |
| index_0 | CH4 | 2.41 | 2.61 | 2.65 | 2.87 | 2.25 | 2.24 | 2.45 | 2.59 | 2.24 |
| index_0 | CO | 0.77 | 0.74 | 0.63 | 0.6 | 0.36 | 0.31 | 0.48 | 1.01 | 1.05 |
| index_0 | NMHC | 0.29 | 0.34 | 0.34 | 0.37 | 0.18 | 0.15 | 0.24 | 0.43 | 0.35 |
| index_0 | NO | 6.8 | 11.1 | 9.6 | 13.6 | 3.1 | 2.4 | 17.8 | 49.5 | 41.1 |
| index_0 | NO2 | 30.9 | 28.2 | 25.9 | 22.8 | 16.5 | 15.8 | 21.3 | 25 | 26.1 |
| index_0 | NOx | 37.7 | 39.3 | 35.6 | 36.4 | 19.6 | 18.3 | 39.1 | 74.5 | 67.2 |
| index_0 | O3 | 4.1 | 2 | 1.9 | 1.8 | 7.4 | 6.2 | 2.2 | 3 | 6.3 |
| index_0 | PM10 | 53 | 50 | 36 | 39 | 23 | 21 | 22 | 25 | 36 |
| index_0 | PM2.5 | 35 | 35 | 24 | 28 | 15 | 11 | 14 | 17 | 17 |
| index_0 | RAINFAI | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| index_0 | RH | 84 | 85 | 85 | 85 | 81 | 77 | 77 | 76 | 69 |
| index_0 | SO2 | 2.8 | 1.9 | 1.9 | 1.9 | 1 | 1.5 | 2.2 | 3.5 | 4.1 |
| index_0 | THC | 2.7 | 2.95 | 2.99 | 3.24 | 2.43 | 2.39 | 2.69 | 3.02 | 2.59 |
| index_0 | WD_HR | 140 | 145 | 169 | 177 | 96 | 111 | 93 | 242 | 3 |
| index_0 | WIND_D | 120 | 115 | 173 | 155 | 104 | 173 | 74 | 303 | 289 |
| index_0 | WIND_SI | 0.4 | 0.5 | 0.4 | 0.4 | 0.5 | 0.6 | 0.7 | 0.5 | 1 |
| index_0 | WS_HR | 0.5 | 0.4 | 0.3 | 0.3 | 0.8 | 0.4 | 0.5 | 0.2 | 0.4 |
| index_1 | AMB_TE | 20.5 | 20.4 | 20.2 | 20 | 19.6 | 19.4 | 19.5 | 19.9 | 21.3 |
| index_1 | CH4 | 2.33 | 2.37 | 2.66 | 2.56 | 2.32 | 2.27 | 2.39 | 2.5 | 2.45 |
| index_1 | CO | 0.68 | 0.64 | 0.69 | 0.63 | 0.4 | 0.36 | 0.5 | 0.79 | 0.92 |

# Kaggle Submission

| | A | B | C |
|---|---|---|---|
| 1 | index | answer | |
| 2 | index_0 | 0 | |
| 3 | index_1 | 0 | |
| 4 | index_2 | 0 | |
| 5 | index_3 | 0 | |
| 6 | index_4 | 0 | |
| 7 | index_5 | 0 | |
| 8 | index_6 | 0 | |

- Kaggle link
- Display team name : <student ID>
- Submission format
  - A 245*2 .csv file, first row is for the column name and the last 244 rows for your result.
  - Column name must be index and answer.
  - sample submission
- There is one simple bassline and one strong bassline. Beat them to achieve a higher score.

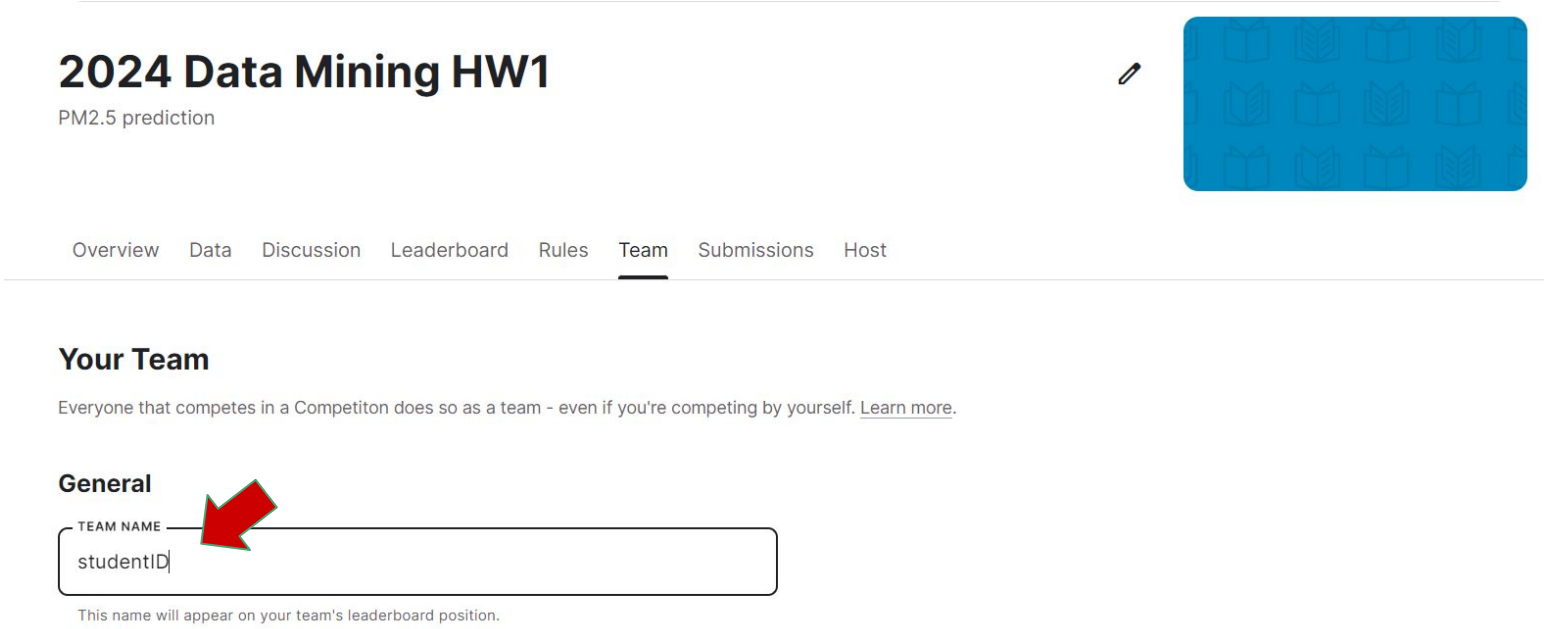
| # | Team | Members | Score | Entries | Last |
|---|---|---|---|---|---|
| | Strong Baseline | | 3.92580 | | |
| | Simple Baseline | | 5.22389 | | |

# Kaggle Submission

- The scoring metric is RMSE.
- You can submit at most 5 times each day.
- You can choose 3 of the submissions to be considered for the private leaderboard, or will otherwise default to the best public scoring submissions.
  You can only view your private leaderboard score after the competition has ended.
- Public leaderboard is calculated with 50% of the test data, and private leaderboard is calculated with other 50% of the test data, so the final standings may be different.
- Please tune your model parameters using your own validation set instead of adjusting parameters based on the public leaderboard. Otherwise, it's easy to overfit, leading to poor performance on the private leaderboard.

# Change your team name

Remember to change the team name to <student ID>, or there will be a deduction of 5 points for HW 1.



# Report Submission

Answer the following 3 questions:

1. How do you select features for your model input, and what preprocessing did you perform?
2. Compare the impact of different amounts of training data on the PM2.5 prediction accuracy. Visualize the results and explain them.
3. Discuss the impact of regularization on PM2.5 prediction accuracy.

Please answer the questions in detail to receive full points for each question.

# Grading policy

- Kaggle (70%)
  - 30% based on the public leaderboard score and 70% based on the private leaderboard score
  - Leaderboard score consists of basic score and ranking score
    - Basic score :

      Over strong baseline : 55

      Over simple bassline : 40

      Under simple baseline : 25
    - Ranking score:

      15-(15/N)*(ranking-1), N=numbers of people in the interval

- Report (30%)
  - 10 for each quesiton

# E3 Submission

Submit your source code and report to E3 before 4/16 (Tue.) 23:59.

No late submission !

- Format
  - source code : HW1_<student ID>.py  or  HW1_<student ID>.ipynb
  - report : HW1_<student ID>.pdf

If you have any question about HW 1, please feel free to contact with TA : WEI-LING HSU through email weiling.hsu.cs11@nycu.edu.tw

# Have Fun !