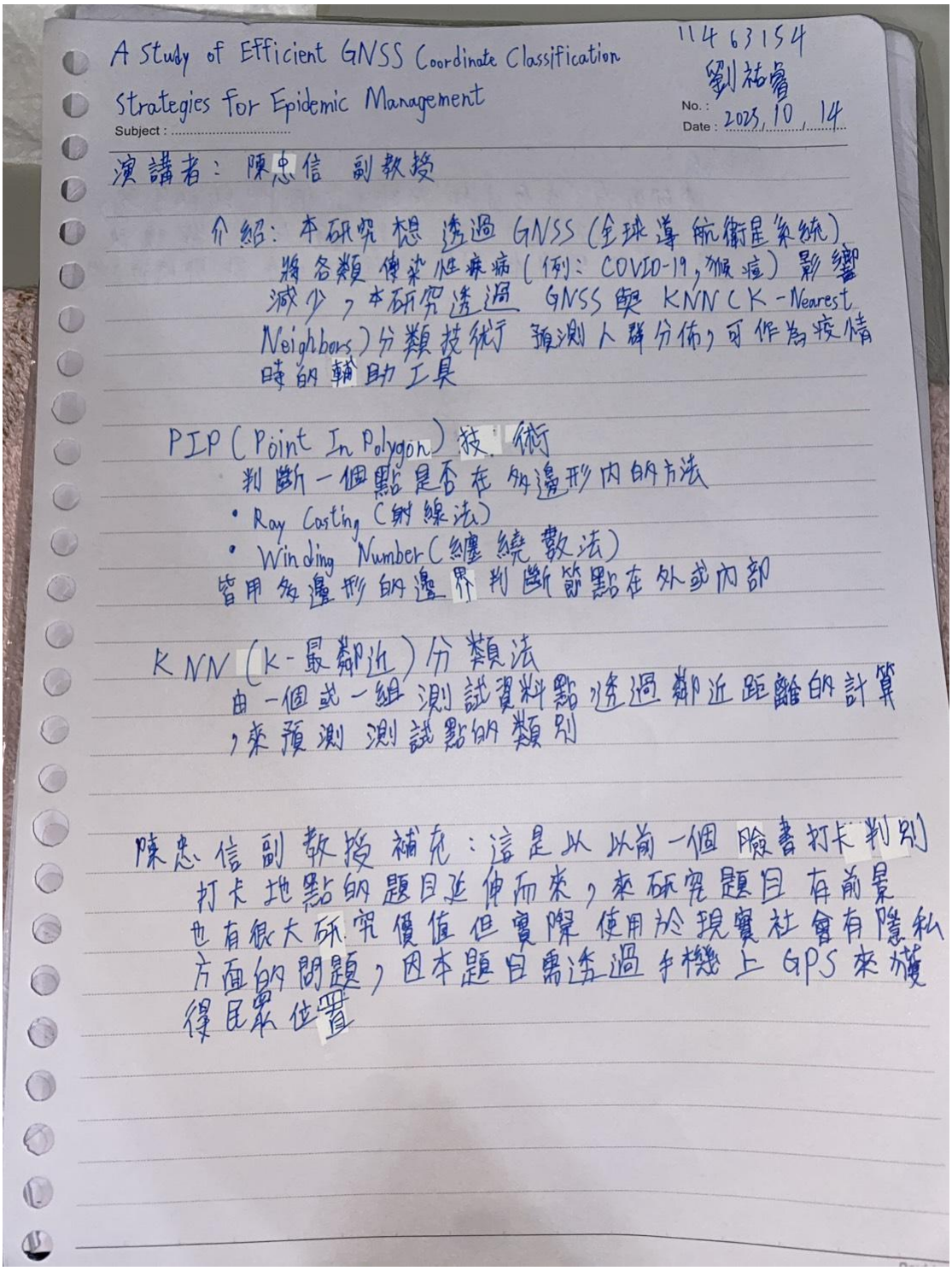
11463154 劉祐睿 2025/10/14

手寫筆記



A Study of Efficient GNSS Coordinate Classification Strategies for Epidemic Management

Subject :

11463154
劉祐睿
No. :
Date : 2025, 10, 14

演講者：陳忠信 副教授

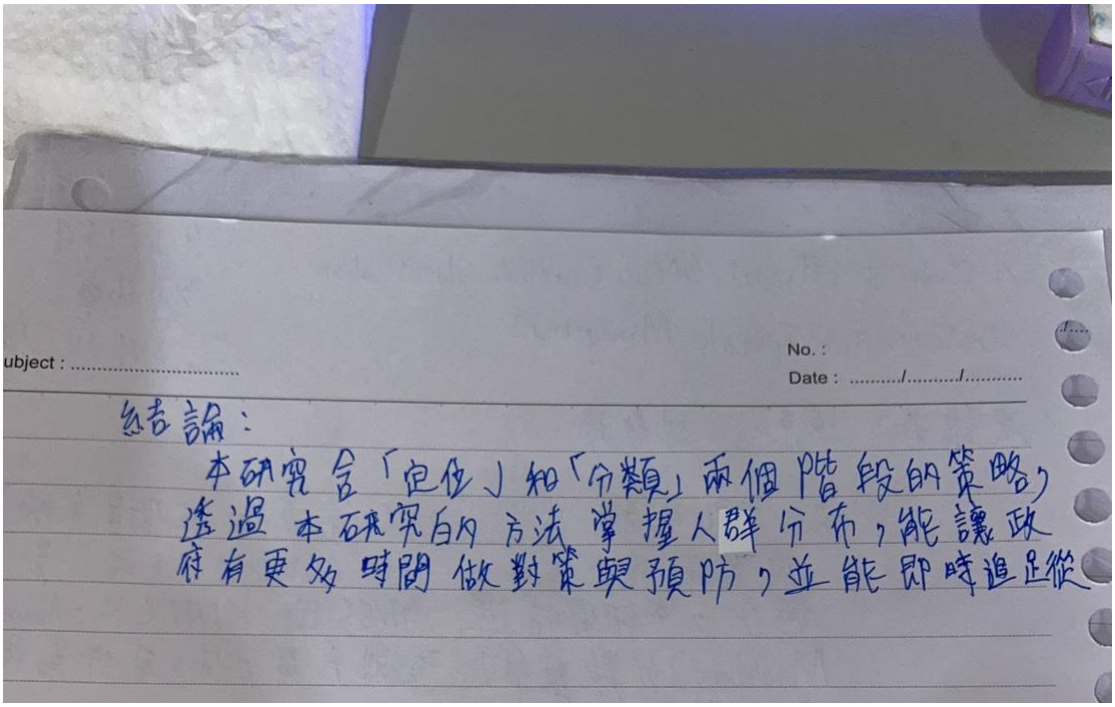
介紹：本研究想透過 GNSS（全球導航衛星系統）將各類傳染性疾病（例：COVID-19，猴痘）影響減少，本研究透過 GNSS 與 KNN（K-Nearest Neighbors）分類技術 預測人群分佈，可作為疫情時的輔助工具

PIP（Point In Polygon）技術
判斷一個點是否在多邊形內的方法
- Ray Casting（射線法）
- Winding Number（纏繞數法）

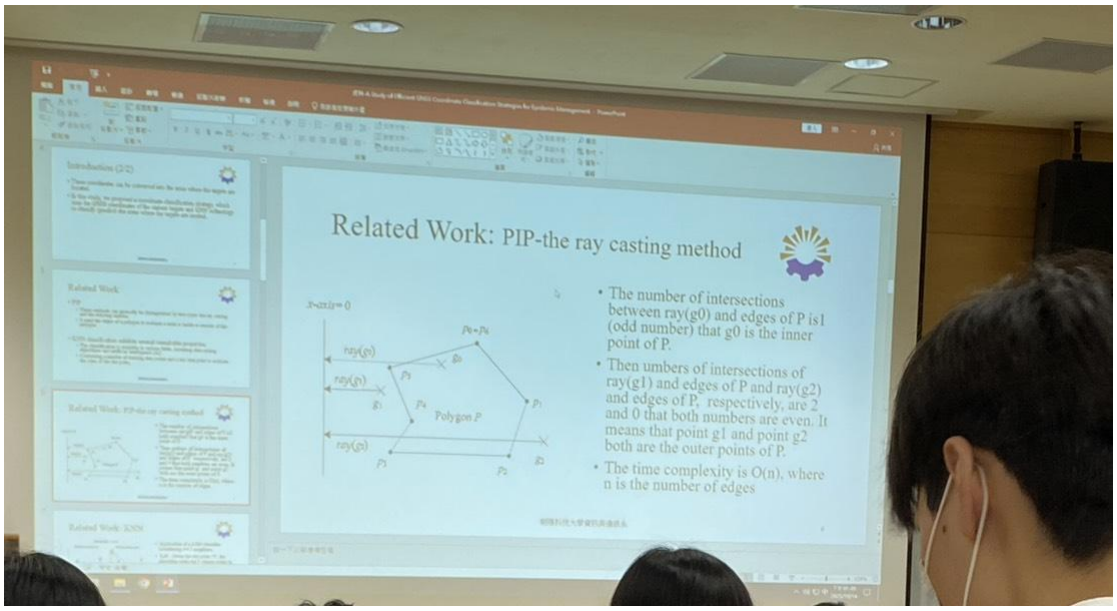
皆用多邊形的邊界判斷節點在外或內部

KNN（k-最鄰近）分類法
由一個或一組測試資料點透過鄰近距離的計算，來預測測試點的類別

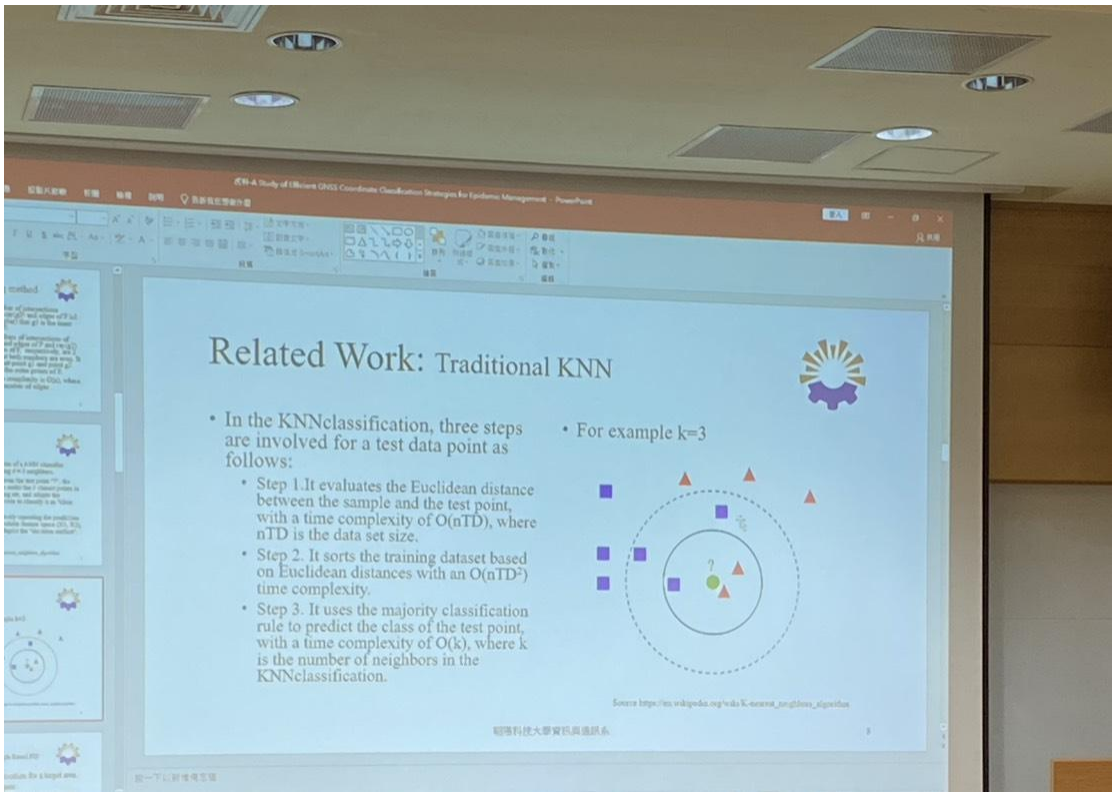
陳忠信副教授補充：這是以以前一個險書打卡判別打卡地點的題目延伸而來，來研究題目有前景也有很大研究價值但實際使用於現實社會有隱私方面的問題，因本題目需透過手機上 GPS 來獲得民眾位置

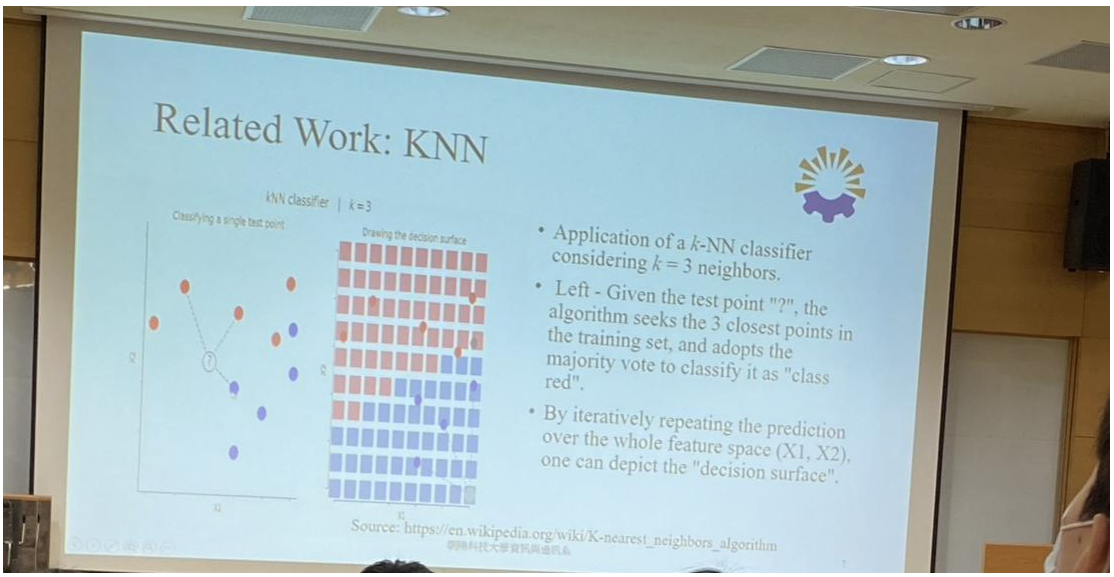


上課紀錄

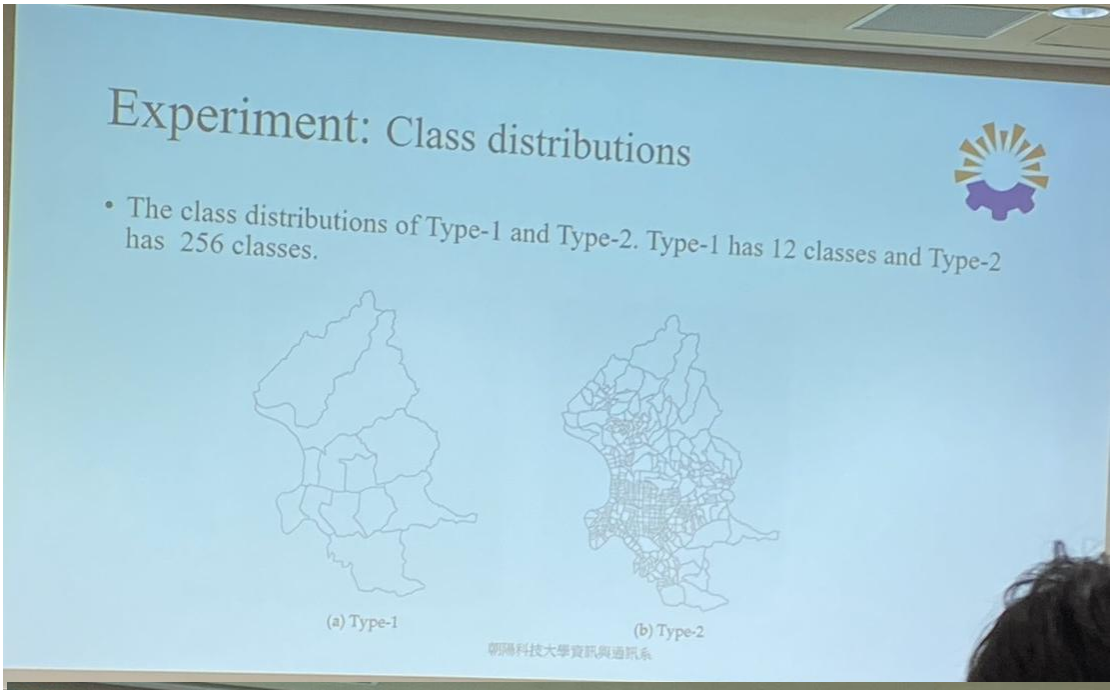


PIP 範例與介紹


Related Work: Traditional KNN
• In the KNNclassification, three steps are involved for a test data point as follows:
• Step 1.It evaluates the Euclidean distance between the sample and the test point, with a time complexity of O(nTD), where nTD is the data set size.
• Step 2. It sorts the training dataset based on Euclidean distances with an O(nTD²) time complexity.
• Step 3. It uses the majority classification rule to predict the class of the test point, with a time complexity of O(k), where k is the number of neighbors in the KNNclassification.
• For example k=3


Related Work: KNN
KNN classifier | k = 3
Classifying a single test point
Drawing the decision surface
• Application of a k-NN classifier considering k = 3 neighbors.
• Left - Given the test point "?", the algorithm seeks the 3 closest points in the training set, and adopts the majority vote to classify it as "class red".
• By iteratively repeating the prediction over the whole feature space (X1, X2), one can depict the "decision surface".
Source: https://en.wikipedia.org/wiki/K-nearest_neighbors_algorithm

KNN 範例與介紹


Experiment: Class distributions
• The class distributions of Type-1 and Type-2. Type-1 has 12 classes and Type-2 has 256 classes.
(a) Type-1
(b) Type-2
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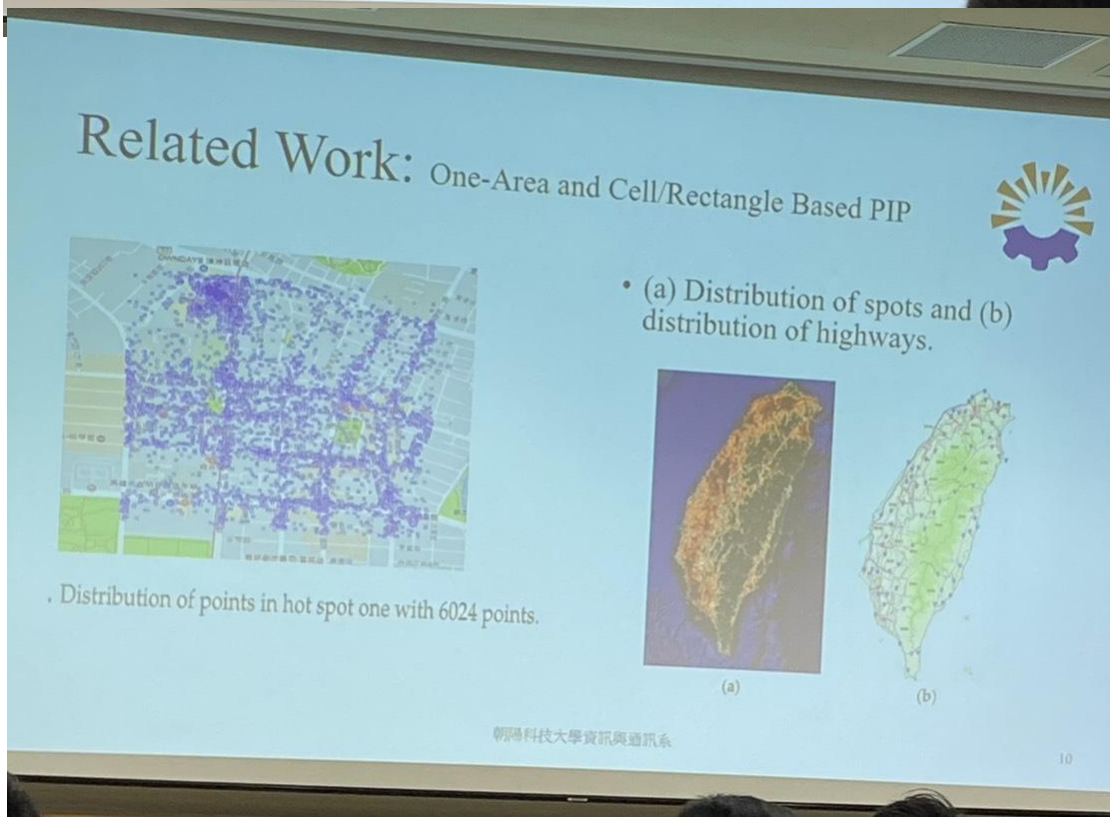
Related Work: One-Area and Cell/Rectangle Based PIP
• (a) Distribution of spots and (b) distribution of highways.
. Distribution of points in hot spot one with 6024 points.
(a)
(b)
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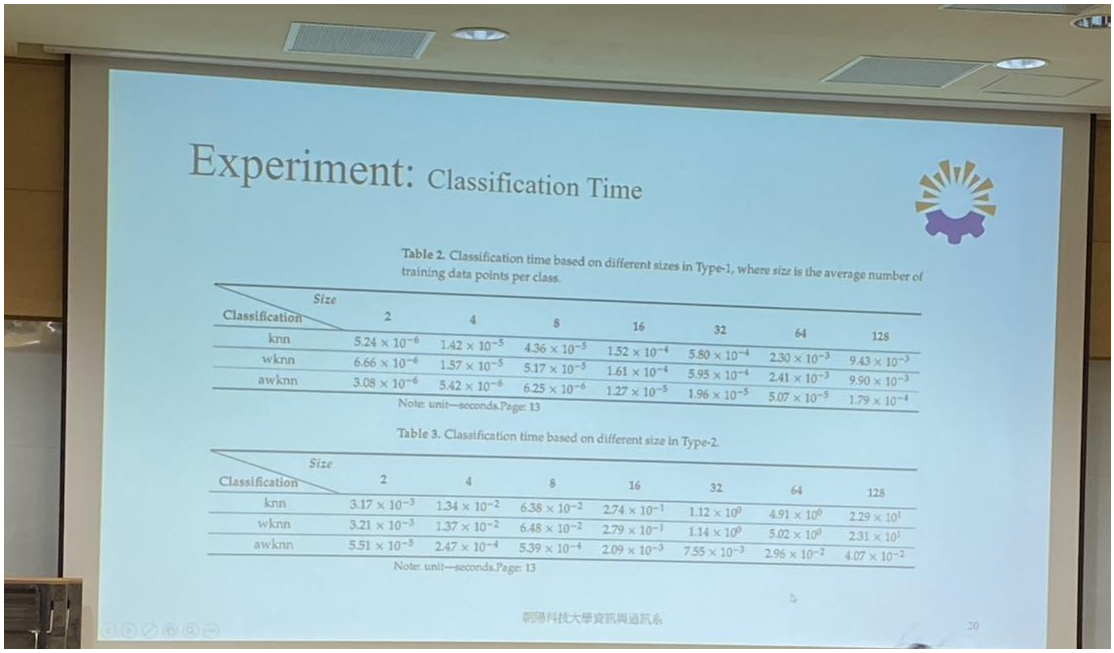
10

實驗以台灣城市為例



Experiment: Classification Time

Table 2. Classification time based on different sizes in Type-1, where *size* is the average number of training data points per class.

Classification \ Size	2	4	8	16	32	64	128
knn	5.24×10^{-6}	1.42×10^{-5}	4.36×10^{-5}	1.52×10^{-4}	5.80×10^{-4}	2.30×10^{-3}	9.43×10^{-3}
wknn	6.66×10^{-6}	1.57×10^{-5}	5.17×10^{-5}	1.61×10^{-4}	5.95×10^{-4}	2.41×10^{-3}	9.90×10^{-3}
awknn	3.08×10^{-6}	5.42×10^{-6}	6.25×10^{-6}	1.27×10^{-5}	1.96×10^{-5}	5.07×10^{-5}	1.79×10^{-4}

Note: unit—seconds.Page: 13

Table 3. Classification time based on different size in Type-2.

Classification \ Size	2	4	8	16	32	64	128
knn	3.17×10^{-3}	1.34×10^{-2}	6.38×10^{-2}	2.74×10^{-1}	1.12×10^{0}	4.91×10^{0}	2.29×10^{1}
wknn	3.21×10^{-3}	1.37×10^{-2}	6.48×10^{-2}	2.79×10^{-1}	1.14×10^{0}	5.02×10^{0}	2.31×10^{1}
awknn	5.51×10^{-5}	2.47×10^{-4}	5.39×10^{-4}	2.09×10^{-3}	7.55×10^{-3}	2.96×10^{-2}	4.07×10^{-2}

Note: unit—seconds.Page: 13

實驗結果