Spaceship Titanic

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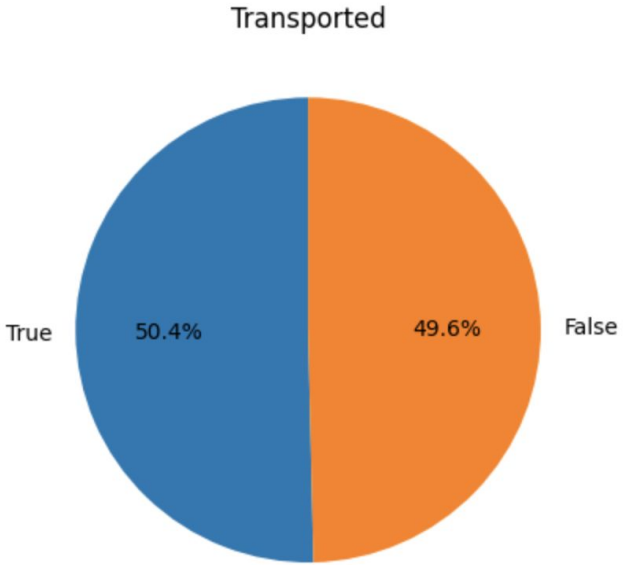
01

Data Preprocessing

資料簡介｜切分欄位資料

資料簡介

- Training set
  - 14個變數
  - 8693筆資料
  - Transported=True的比例為50.4%
- Testing set
  - 13個變數
  - 4277筆資料



切分欄位資料

- **PassengerId**:

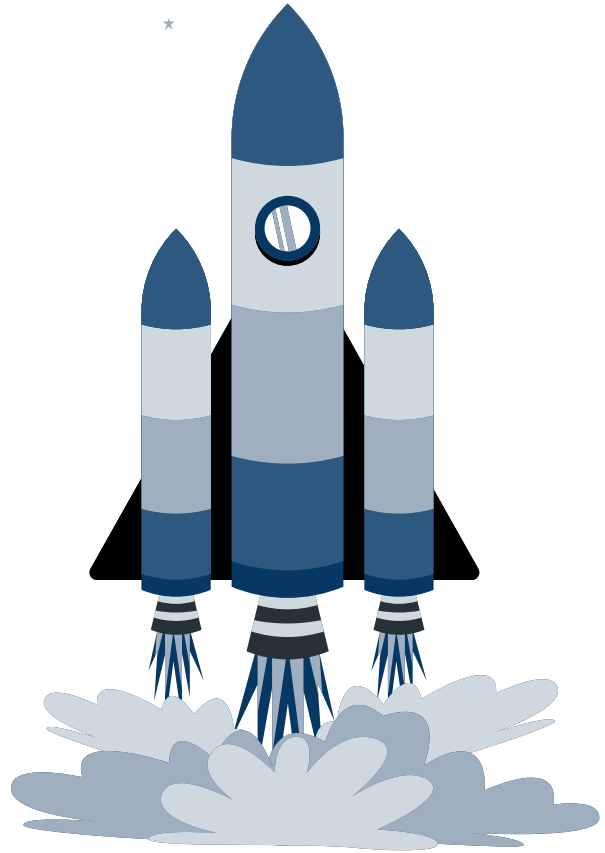
  「gggg_pp」，切分出「gggg」後統計每組人數，新增為”Group”變數

- **Cabin**:

  「deck/num/side」，以/切分出”Deck”、“Number”、”Side”三個變數

PassengerID	Group
0001_01	3
0001_02	3
0001_03	3
0002_01	2
0002_02	2

Cabin	Deck	Number	Side
B/0/P	B	0	P
F/0/S	F	0	S
F/1/S	F	1	S



02

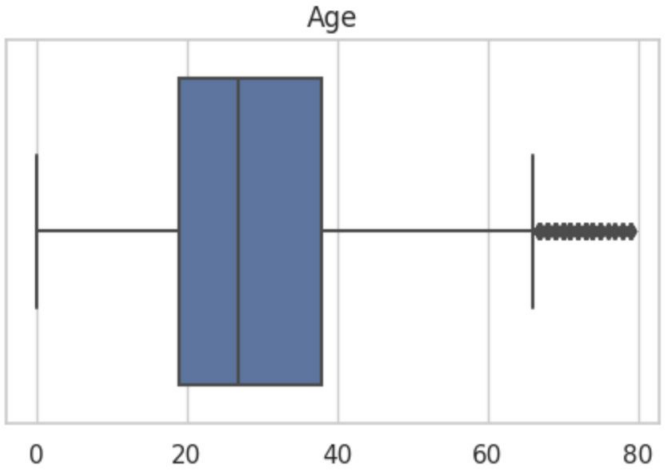
EDA

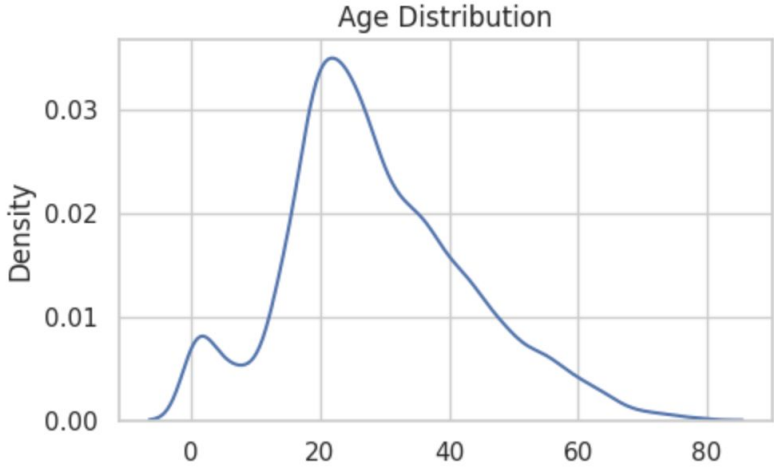
單變數｜雙變數｜
與Transported的關係

單變數EDA-連續型變數

- **連續型變數:**

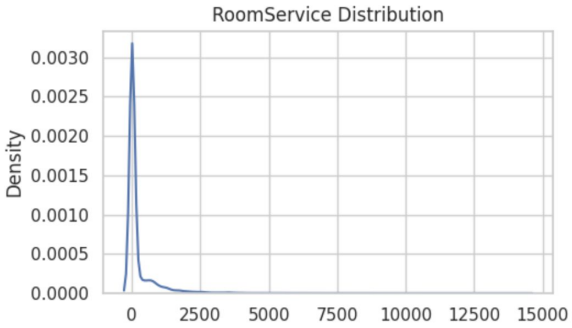
  Age, RoomService, FoodCourt, ShoppingMall, Spa, VRDeck

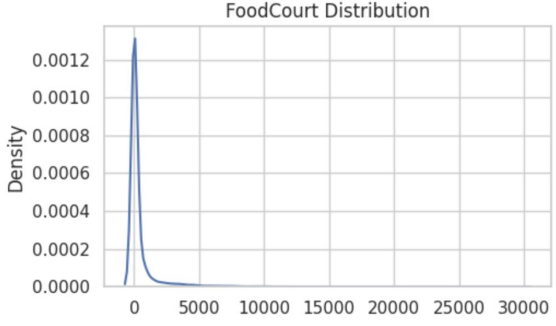


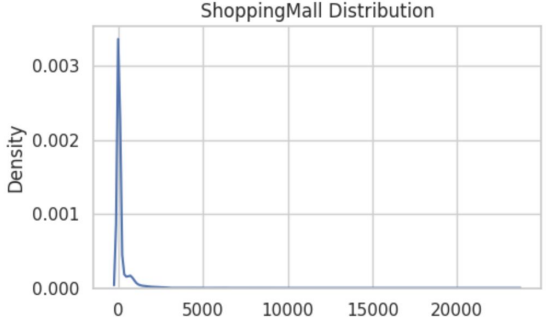


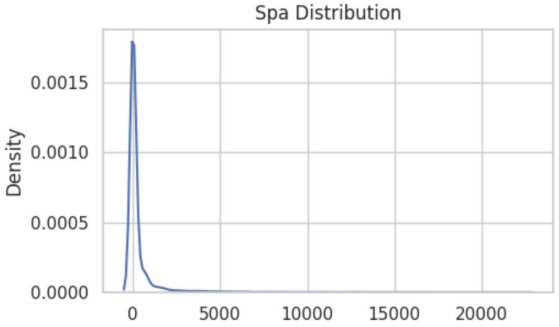
單變數EDA-連續型變數

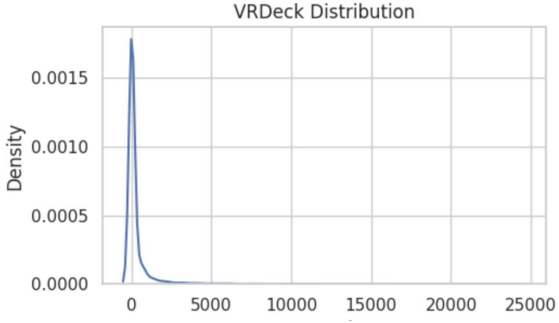
- **觀察到連續型變數皆有很多離群值，且有很嚴重的右偏**





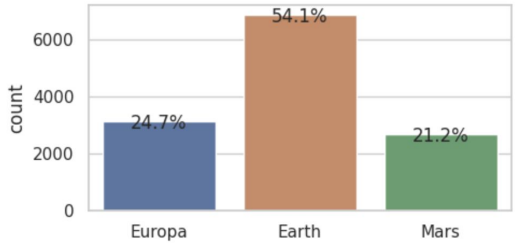




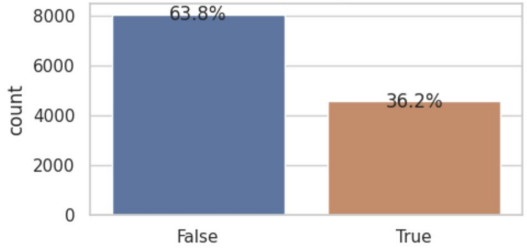


單變數EDA-離散型變數

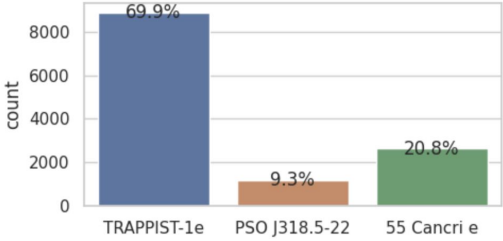
HomePlanet



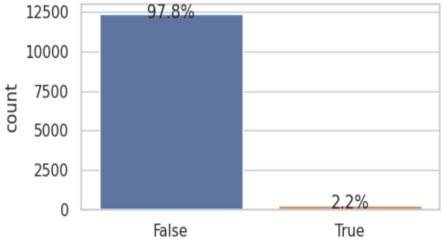
CryoSleep



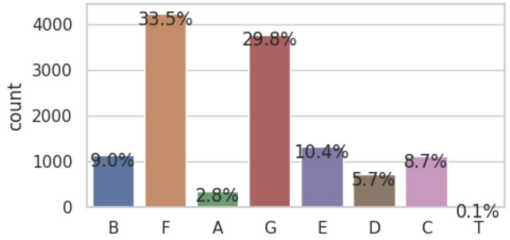
Destination



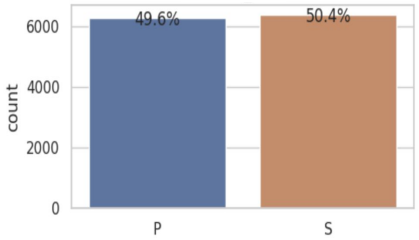
VIP



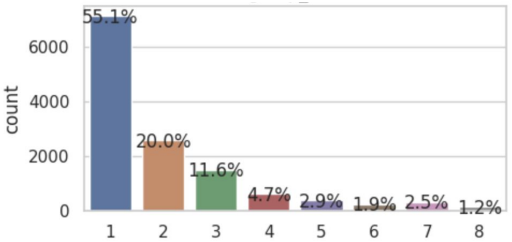
Deck



Side



Group

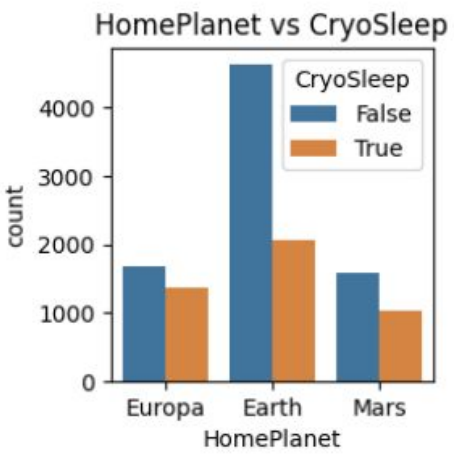


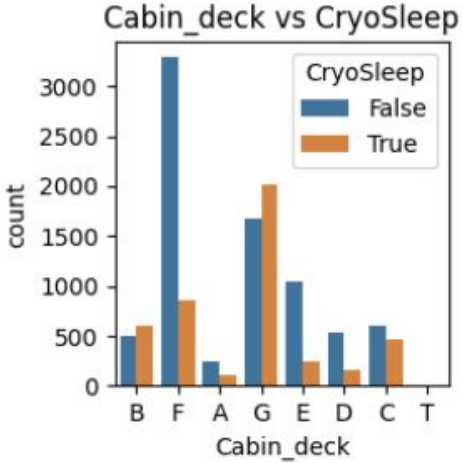
雙變數EDA-連續vs連續

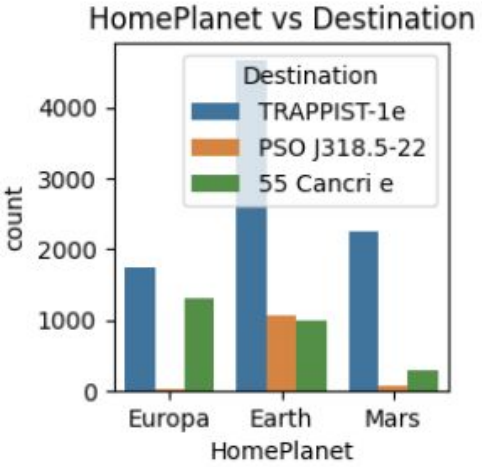
- 計算連續型變數的pearson相關係數矩陣，發現兩兩變數之間的線性關係都較弱，其中相關程度最高的為**FoodCourt & VRDeck**

雙變數EDA-離散vs離散

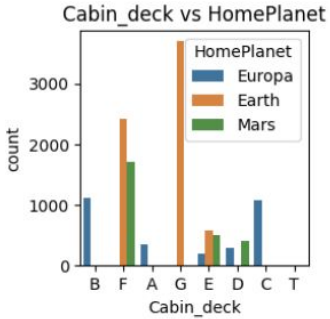
- HomePlanet為Earth的乘客有較高比例不會選擇冷凍睡眠
- Deck為F, E, D的乘客有較高比例不會選擇冷凍睡眠
- Destination為PSO的旅客，有很大的機率HomePlanet為Earth



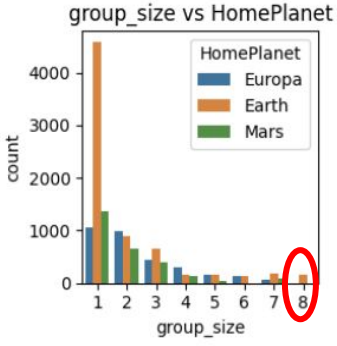




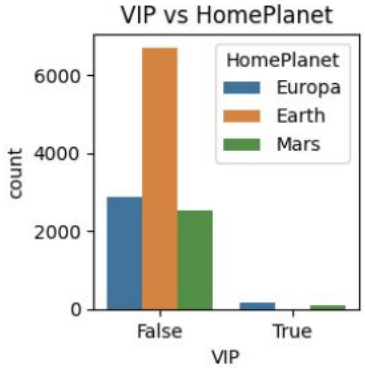
雙變數EDA-離散vs離散



- Deck為A,B,C,T的乘客，HomePlanet皆為Europa
- Deck為G的乘客，HomePlanet皆為Earth



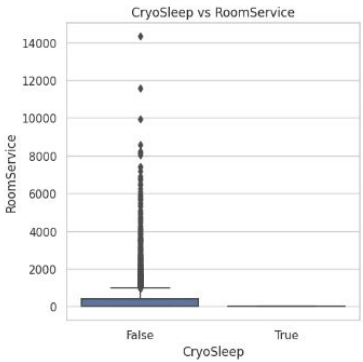
- Group為8的乘客，HomePlanet皆為Earth

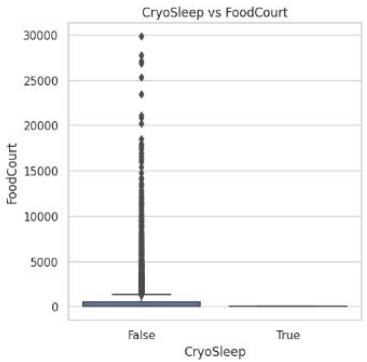


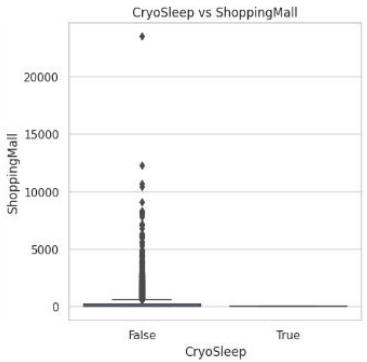
- HomePlanet為Earth的乘客，VIP皆為False

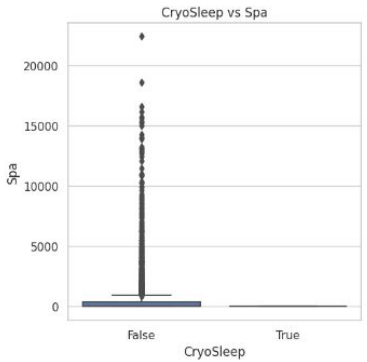
雙變數EDA-離散vs連續

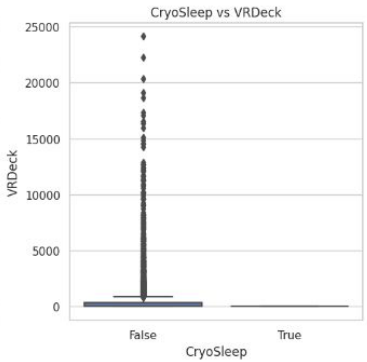
- Cryosleep與5個消費變數的boxplot,
  發現CryoSleep = True的乘客不會有任何消費





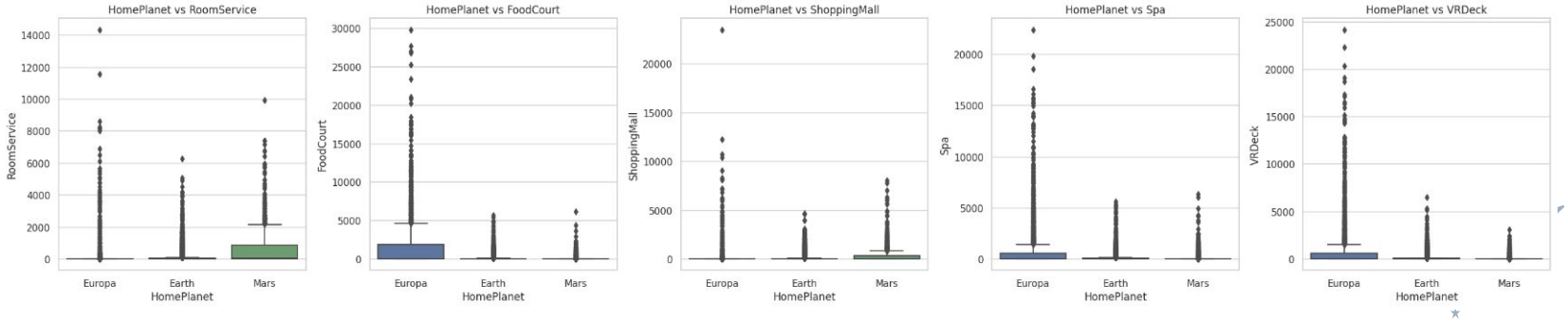




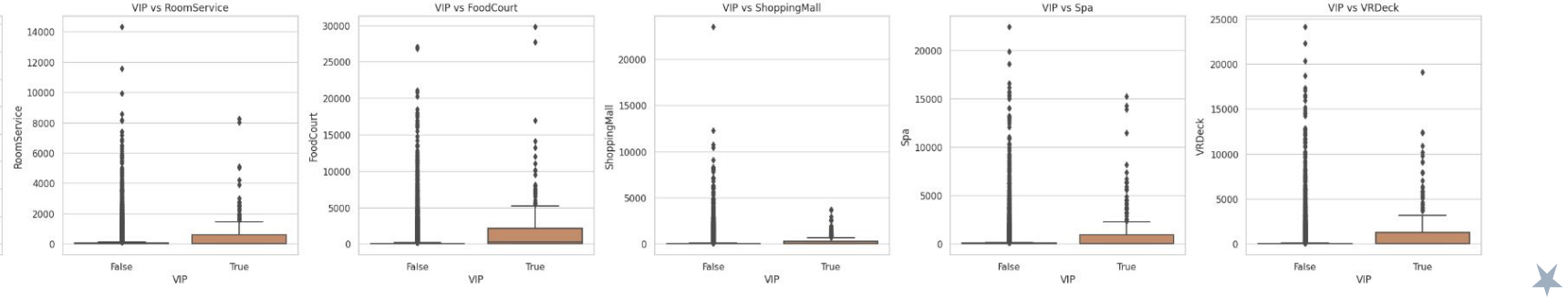


雙變數EDA-離散vs連續

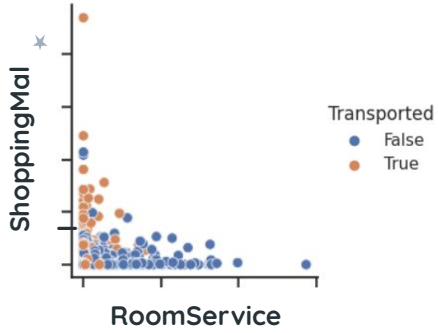
- **HomePlanet = Europa 的乘客消費金額普遍較高**



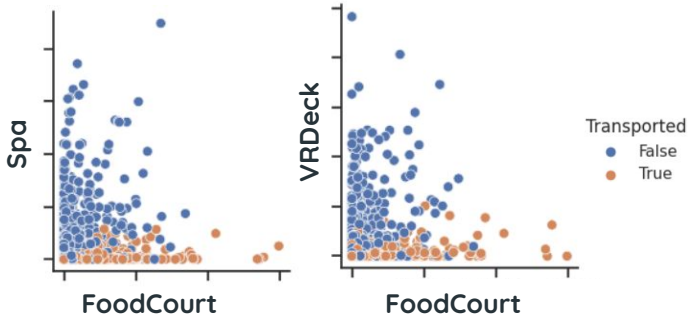
- **VIP = True 的乘客普遍消費金額較高**



雙變數EDA-各變數vs “Transported”

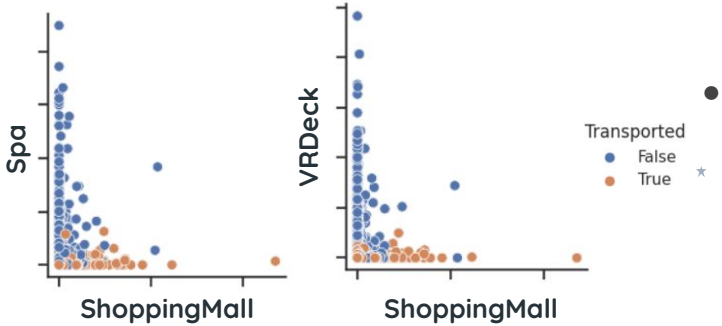


- ShoppingMall金額較高的旅客通常RoomService金額較低，且大多Transprted=True

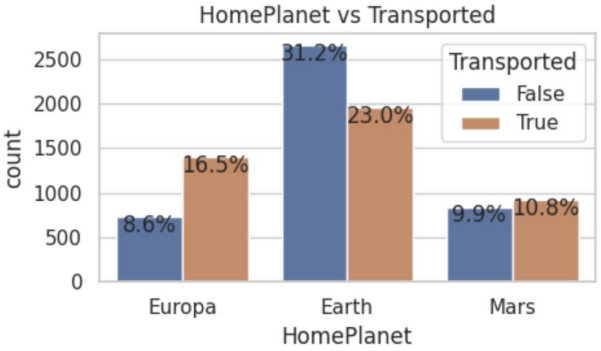


- Spa及VRDeck金額較高的旅客，通常Transported=False
- FoodCourt消費金額若較高，則Spa及VRDeck消費金額會較低，且大多Transprted=True

雙變數EDA-各變數vs “Transported”



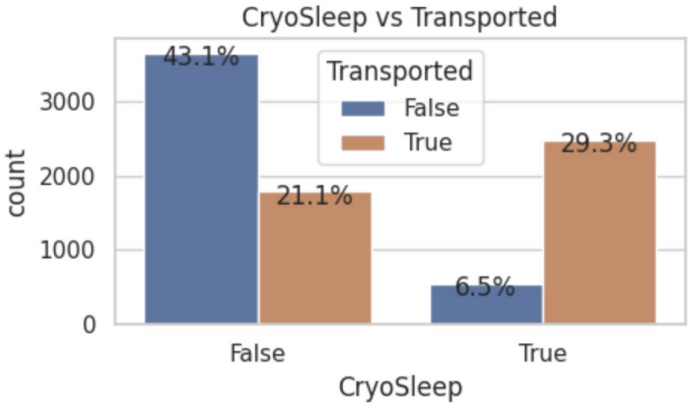
- 若Spa或VRDeck的消費金額較高，則ShoppingMall的消費金額會較低，且Transported=False

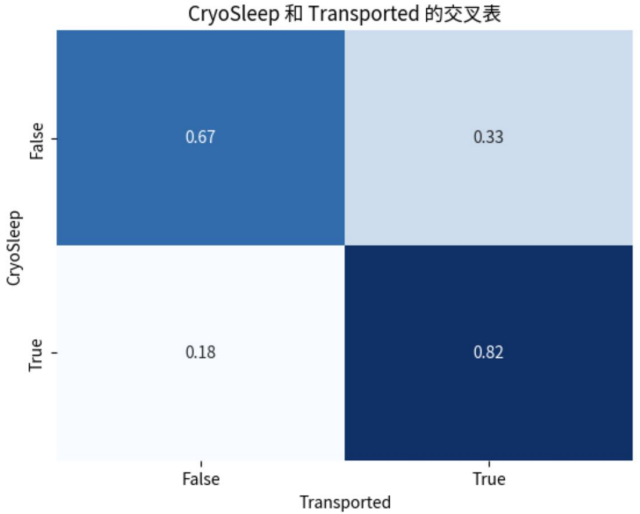


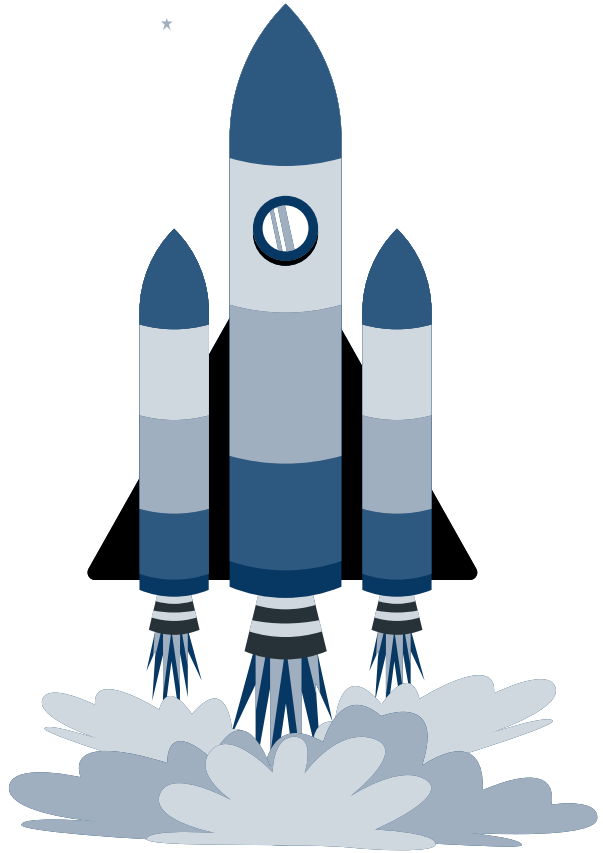
- HomePlanet為Europa及Mars的乘客，被傳送的比例較高；Earth的乘客則是沒有被傳送的比例較高

雙變數EDA-各變數vs “Transported”

- CryoSleep是對Transported較有影響的變數，
  在選擇冷凍睡眠的條件下，乘客被傳送的比例較高(82%)；
  在沒有選擇冷凍睡眠的條件下，乘客沒有被傳送的比例較高(67%)。







03

Imputation

EDA觀察｜平均數眾數

Method 1. 根據EDA觀察

觀察	現象	填補	個數
Deck A, B, C, T	HomePlanet 皆是 Europa	HomePlanet	129
Deck G, Group 8	HomePlanet 皆是 Earth		
HomePlanet Earth, Deck T, Group 8, Age < 18	VIP 皆是 False	VIP	173
CryoSleep True	不會有任何消費	RoomService, FoodCourt, ShoppingMall, Spa, VRDeck	598
有消費, Deck T	CryoSleep 皆是 False	CryoSleep	174

Method 2. 用眾數與平均數補值

- **套件**

  sklearn.impute SimpleImputer

- **眾數 most_frequent**

  針對類別變數

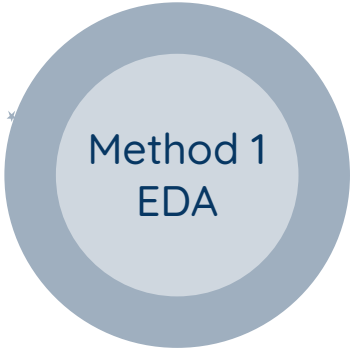
  CryoSleep, Deck, Side, VIP, HomePlanet, Destination, Group

- **平均數 mean**

  針對數值變數

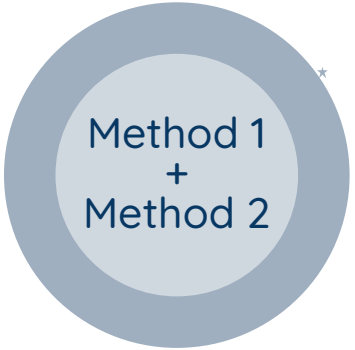
  ShoppingMall, FoodCourt, RoomService, Spa, VRDeck, Age

補値方法比較



0.80687

0.80827



0.80734

04

Feature Engineering

新增變數｜刪減變數

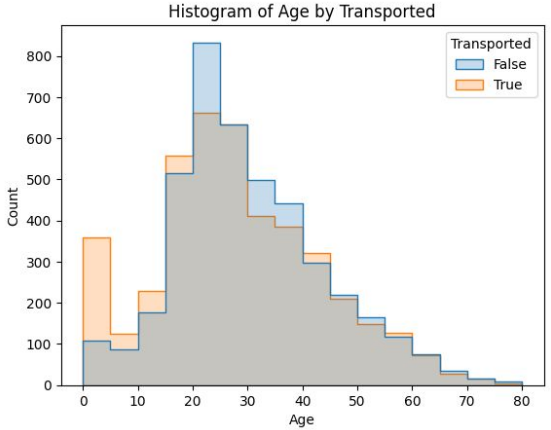
新增變數

- **年齡分組 Age_group**
- **花費總和 Expenses**

  RoomService + FoodCourt + Spa + VRDeck + ShoppingMall
- **One-Hot Encoding**

  Deck, HomePlanet, Destination, Group, Age_group
- **Data Transformation**

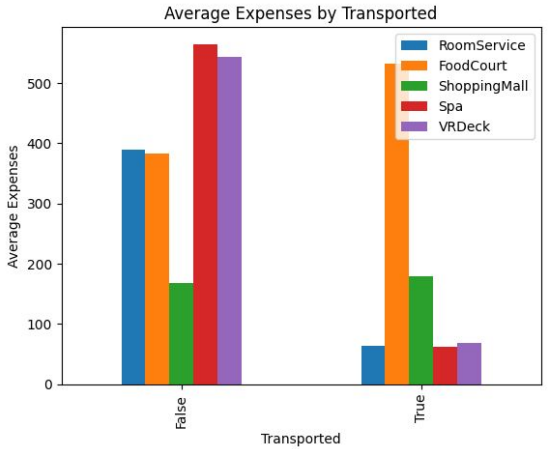
  log, minmax, standardize
- **Clustering**



Age_group	Age
1	0~5
2	6~10
3	11~20
4	21~30
5	31~50
6	51~60
7	61~70
8	>70

刪減變數

- **已建立新變數**: 移除 Age
- **對 Transported 影響不顯著**: 移除 ShoppingMall
- **相關性高的變數**: 移除 Destination_55 Cancri e, FoodCourt, HomePlanet_Earth

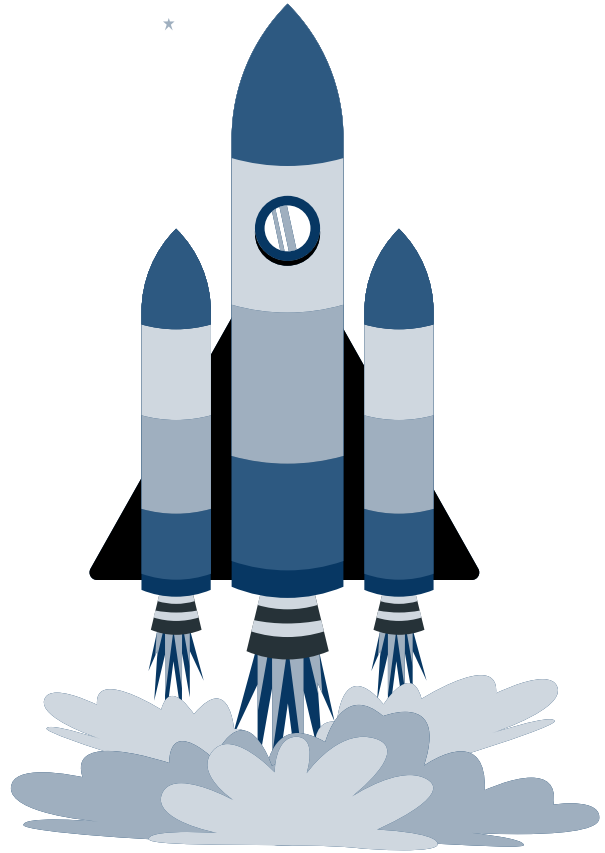


變數	t-test 統計量	p-value	是否顯著
RoomService	-23.4032	< 0.0001	V
FoodCourt	4.1192	< 0.0001	V
ShoppingMall	0.7166	0.4736	
Spa	-21.0460	< 0.0001	V
VRDeck	-19.6559	< 0.0001	V

刪減變數

- **已建立新變數**: 移除 Age
- **對 Transported 影響不顯著**: 移除 ShoppingMall
- **相關性高的變數**: 移除 Destination_55 Cancri e, FoodCourt, HomePlanet_Earth

變數一	變數二	相關係數
Destination_55 Cancri e	Destination_TRAPPIST-1e	0.7831
FoodCourt	Expenses	0.7421
HomePlanet_Earth	HomePlanet_Europa	0.6332
Spa	Expenses	0.5924
...	...	...



05

Model Fitting

Model Selection |
Feature Importance |
Hyperparameter Tuning

Model Selection

- 使用 train_test_split() 以8 : 2的比例分為 :

1) 訓練集: 6954 筆
2) 測試集: 1739 筆

- 評估模型的效能 :

➢ StratifiedKFold 交叉驗證

➢ 最終選擇 XGBoost classifier

	Algorithm	CrossValMeans	CrossValerrors
0	LogisticRegression	0.788569	0.011812
1	SVC	0.788568	0.014188
2	RandomForest	0.787992	0.009447
3	GradientBoosting	0.798118	0.014444
4	KNeighboors	0.760497	0.012738
5	XGBClassifier	0.803525	0.012524

Feature Importance

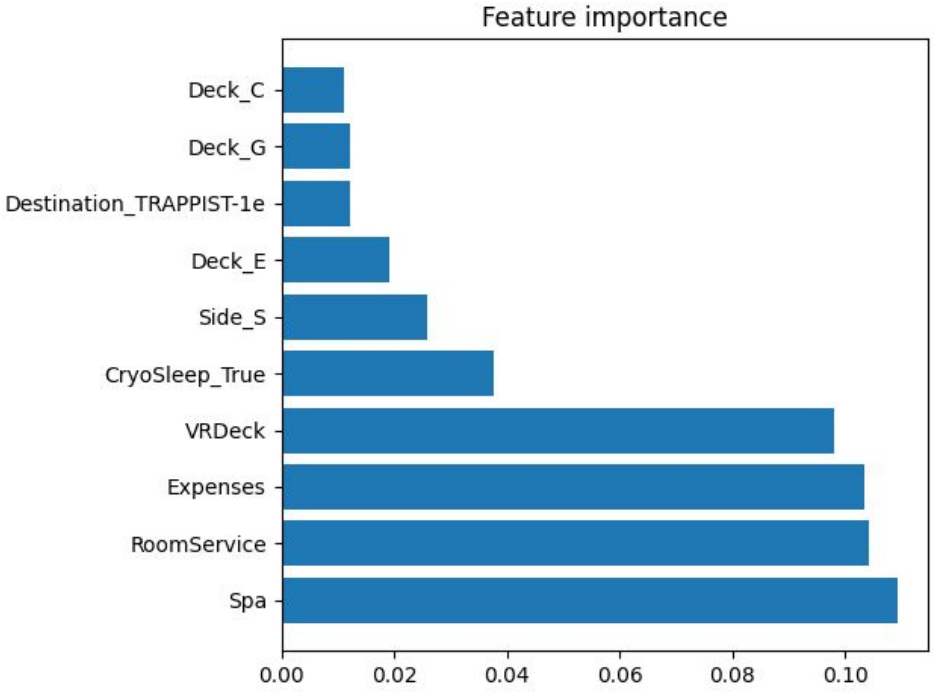
- **Permutation Importance**

➢ **訓練一個模型，可以得到一個基準的評估指標，例如準確率或 R2 等。**

➢ **隨機打散資料集的特徵。**

➢ **計算每個特徵重要性：**

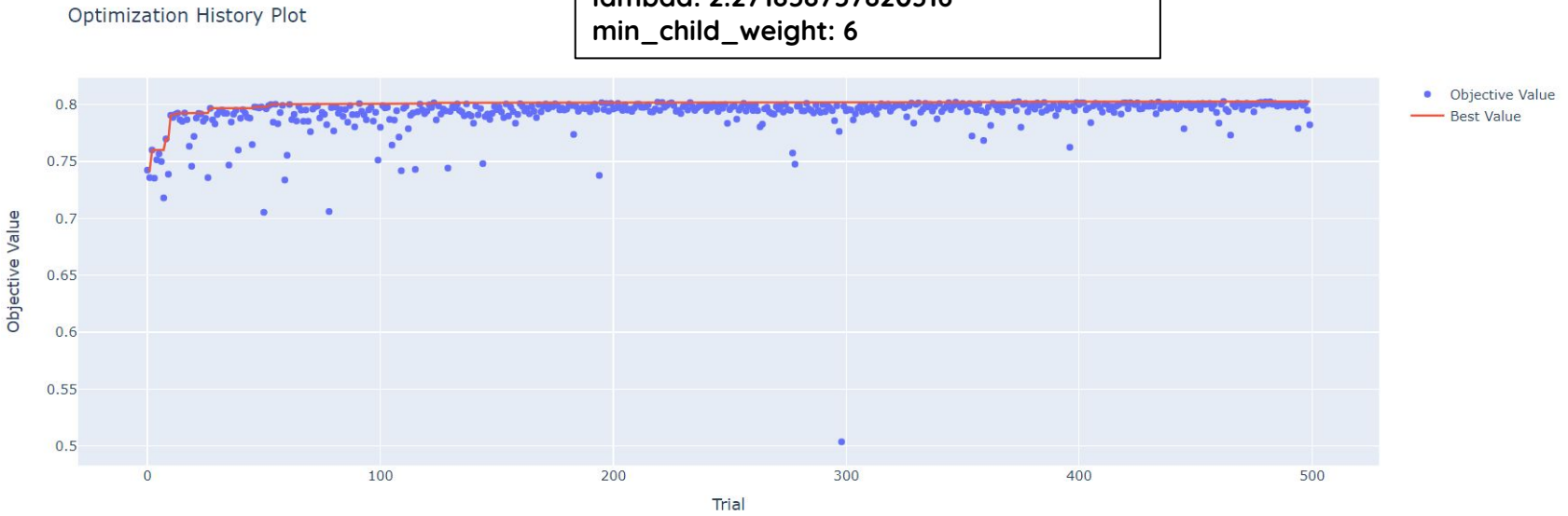
打散資料集的 error - 原始資料集的 error



Hyperparameter Tuning

- **OPTUNA**
- **Best hyperparameters :**

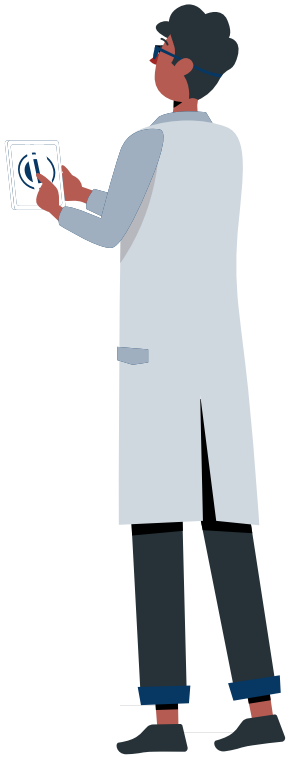
n_estimators: 918
max_depth: 9
learning_rate: 0.0827280846016892
subsample: 0.978321164193843
colsample_bytree: 0.5330631152248969
alpha: 4.370034992967263
lambda: 2.271858757820316
min_child_weight: 6



06

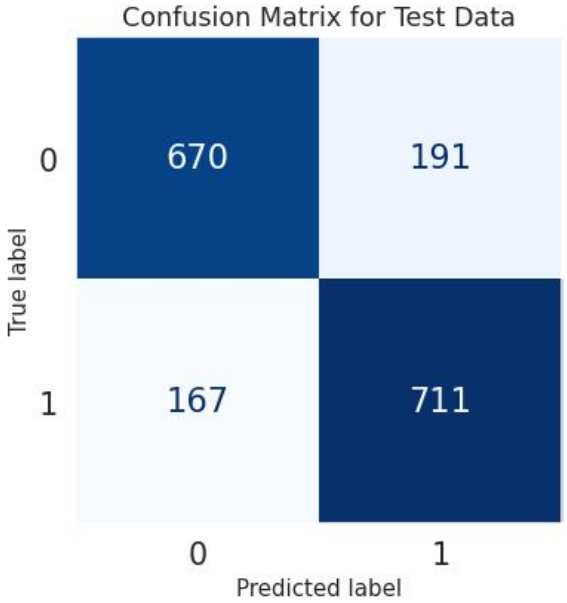
Result

Result | Leaderboard



Result

- **Test Dataset**

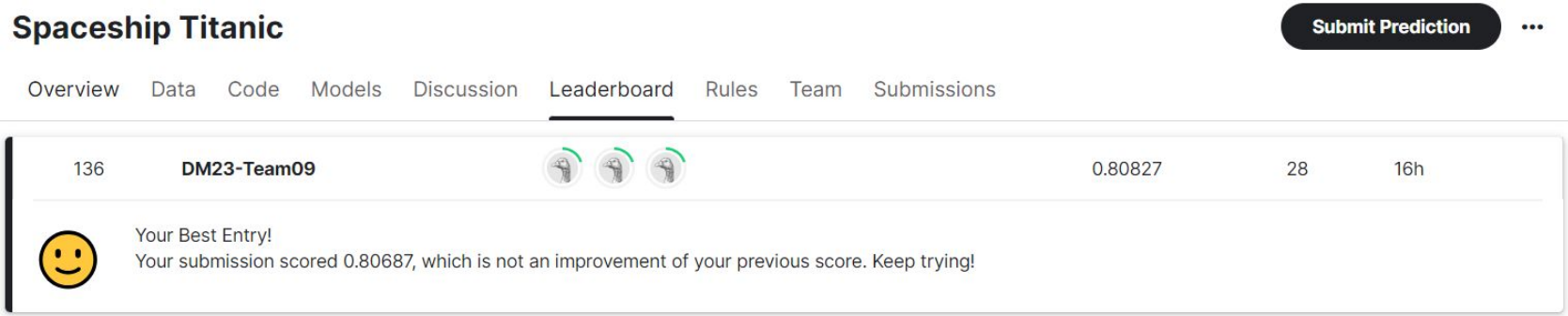


XGBoost Performance Summary on Test Data

	XGBoost
Accuracy	79.41%
Macro Precision	79.44%
Macro Recall	79.4%
Macro F1-score	79.4%
Macro AUC	88.25%

Leaderboard

- **Rank : 136**
- **Score : 0.80827**



THANKS