

Spaceship Titanic

DM23-Team09

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01 Data Preprocessing

資料簡介 | 切分欄位資料



資料簡介

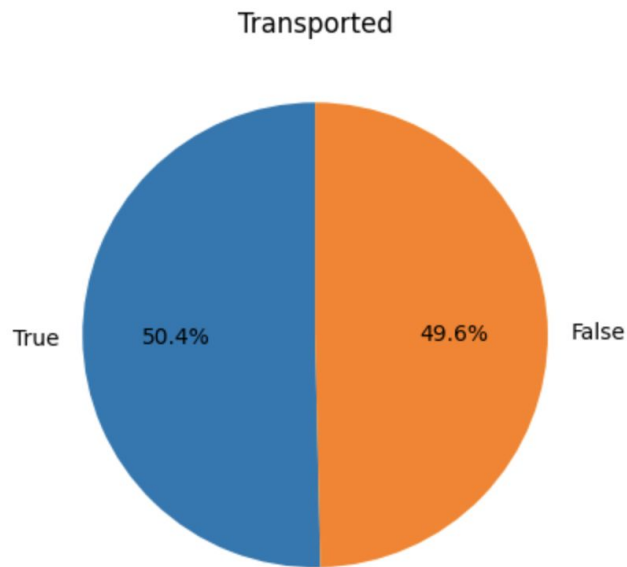


- Training set

- 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:**

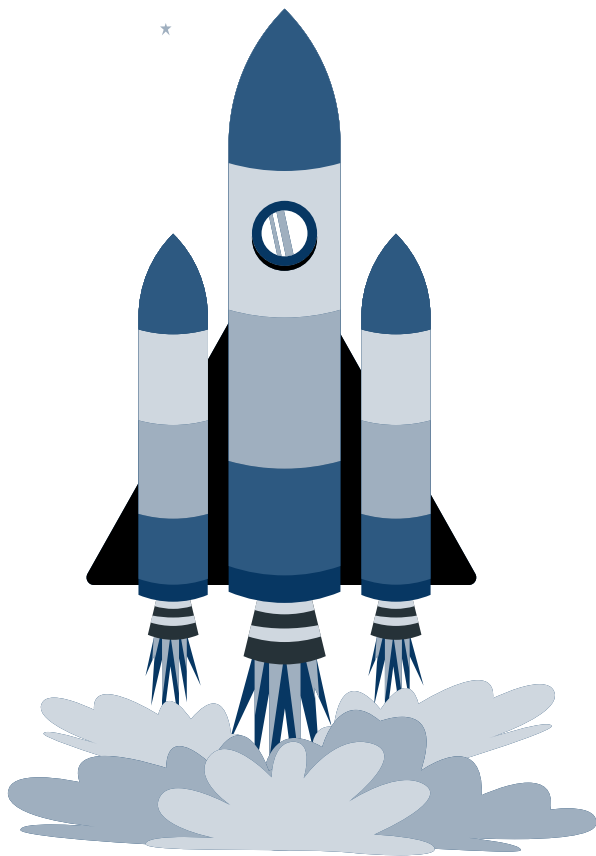
「gggg_pp」, 切分出「gggg」後統計每組人數, 新增為”Group”變數

- **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

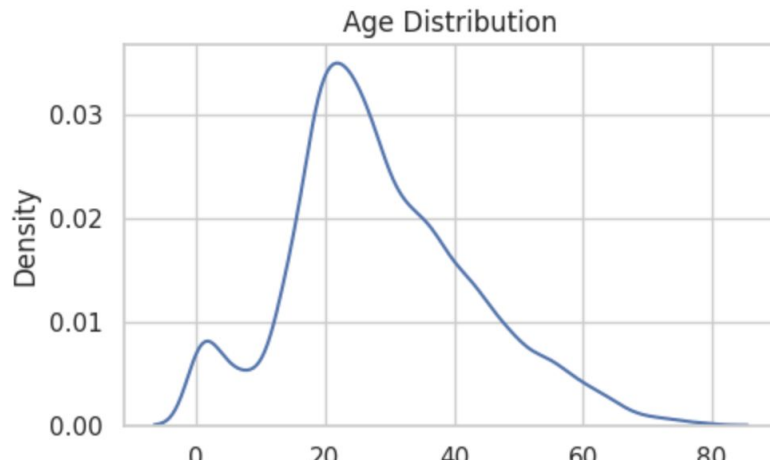
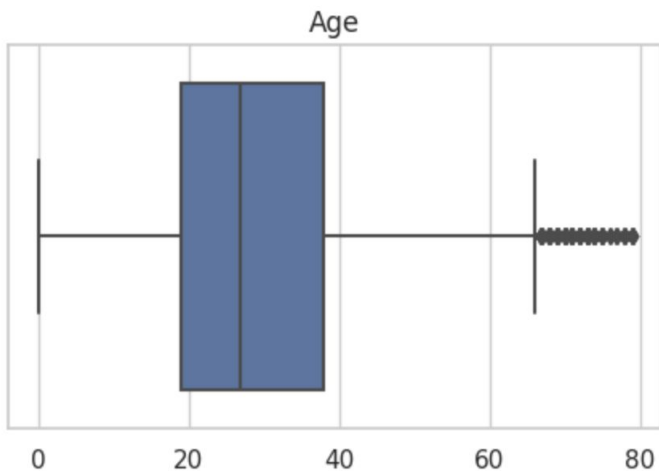


單變數EDA-連續型變數



- 連續型變數:

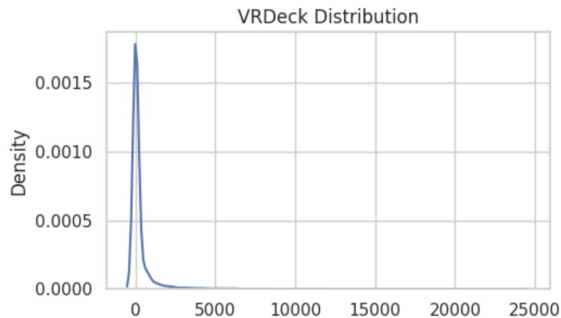
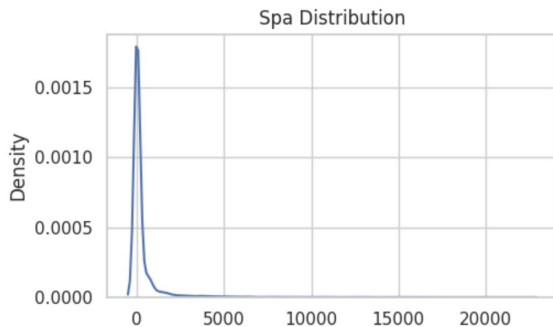
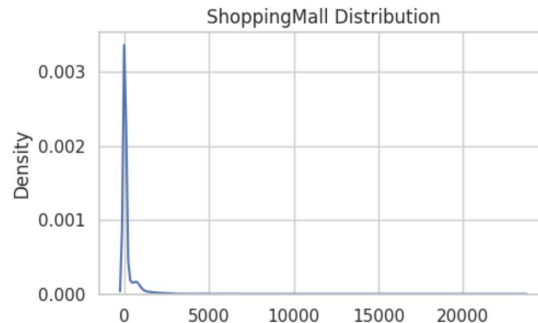
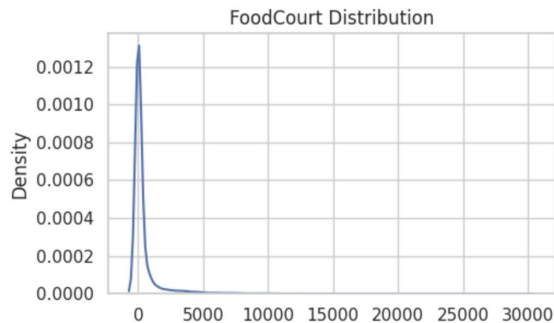
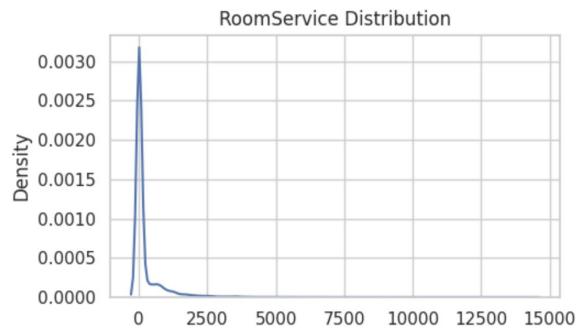
Age, RoomService, FoodCourt, ShoppingMall, Spa, VRDeck



單變數EDA-連續型變數



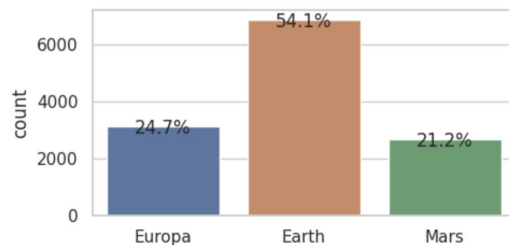
- 觀察到連續型變數皆有很多離群值, 且有很嚴重的右偏



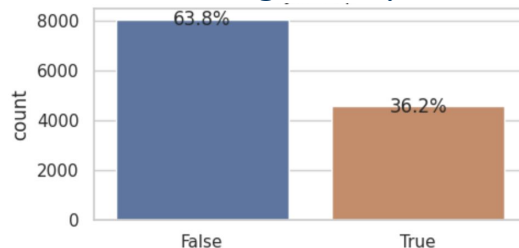
單變數EDA-離散型變數



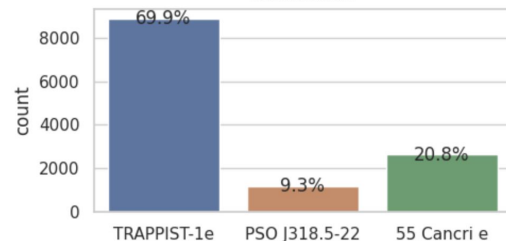
HomePlanet



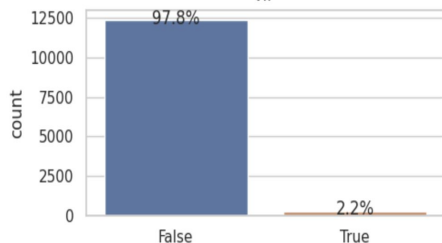
CryoSleep



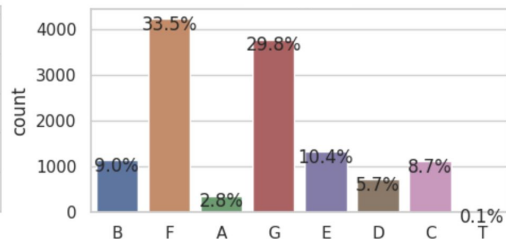
Destination



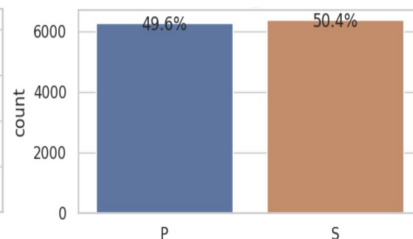
VIP



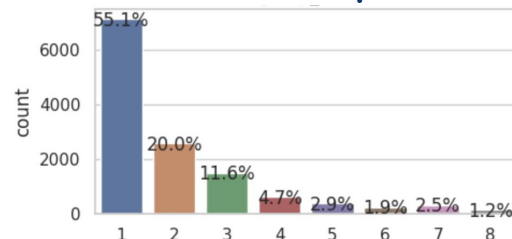
Deck



Side



Group



雙變數EDA-連續vs連續



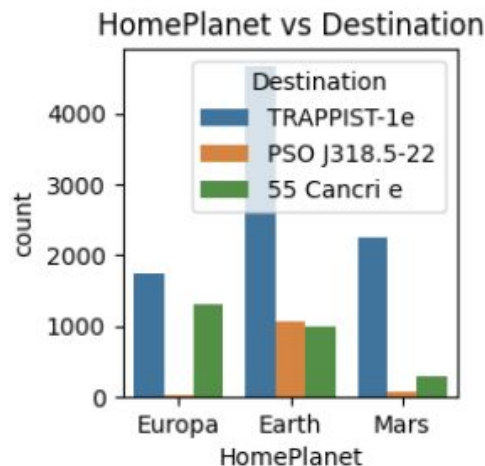
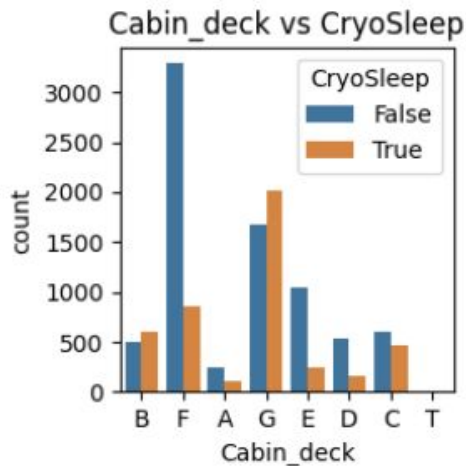
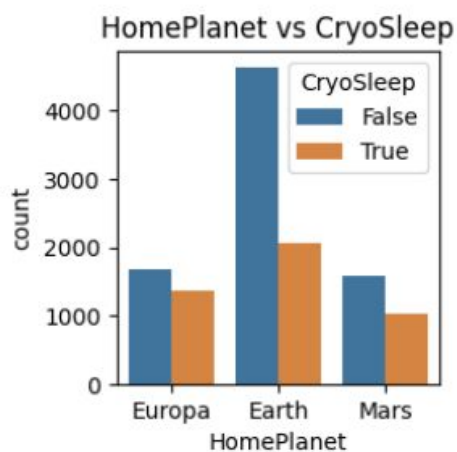
- 計算連續型變數的pearson相關係數矩陣，發現兩兩變數之間的線性關係都較弱，其中相關程度最高的為FoodCourt & VRDeck



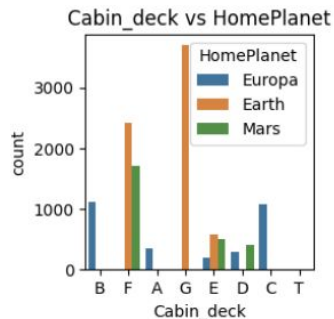
雙變數EDA-離散vs離散



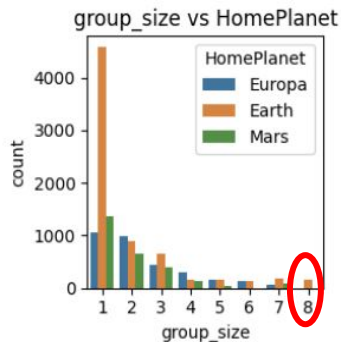
- HomePlanet為Earth的乘客有較高比例不會選擇冷凍睡眠
- Deck為F, E, D的乘客有較高比例不會選擇冷凍睡眠
- Destination為PSO的旅客, 有很大的機率HomePlanet為Earth



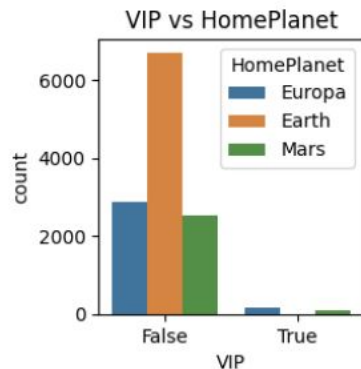
雙變數EDA-離散vs離散



- 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



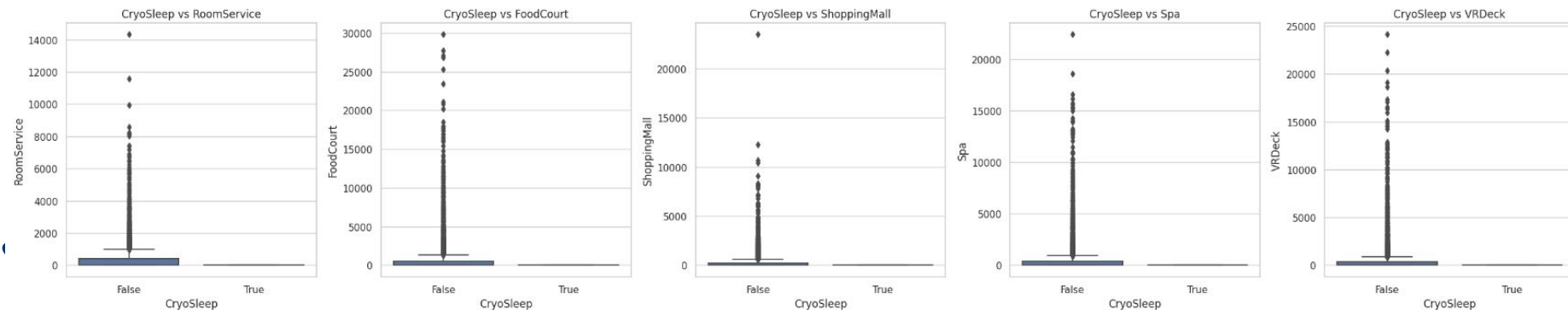
- HomePlanet為Earth的乘客, VIP皆為False



雙變數EDA-離散vs連續



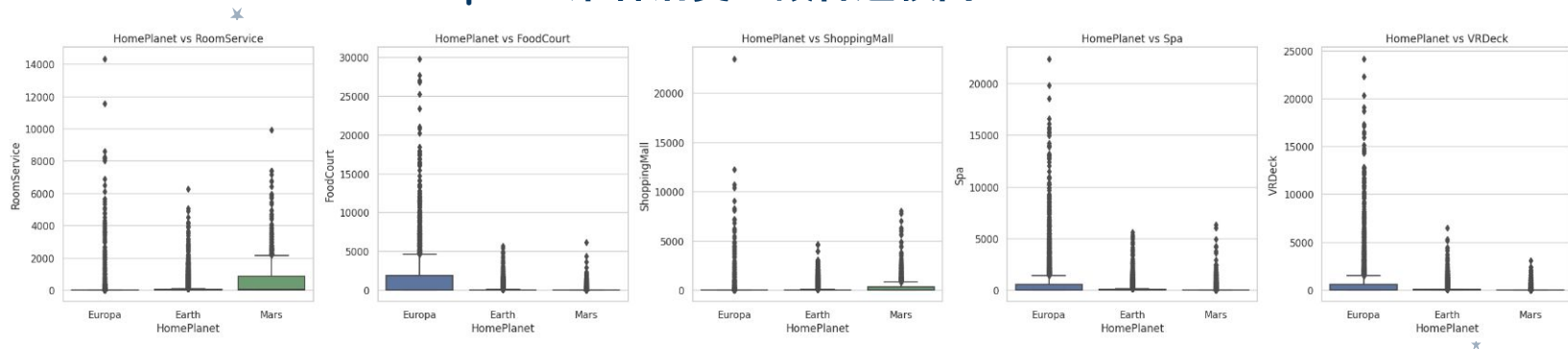
- Cryosleep與5個消費變數的boxplot,
發現CryoSleep = True的乘客不會有任何消費



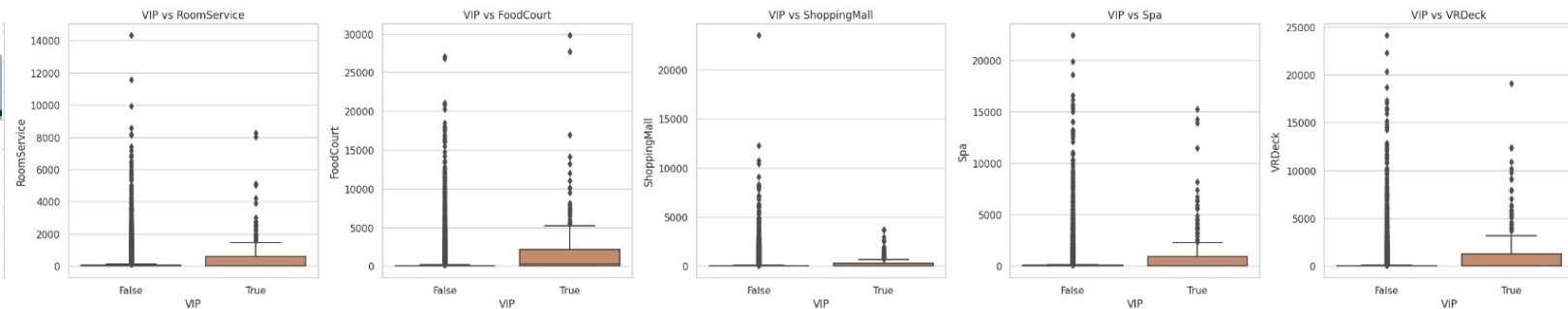


雙變數EDA-離散vs連續

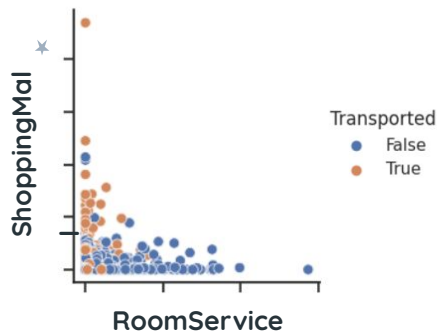
● HomePlanet = Europa 的乘客消費金額普遍較高



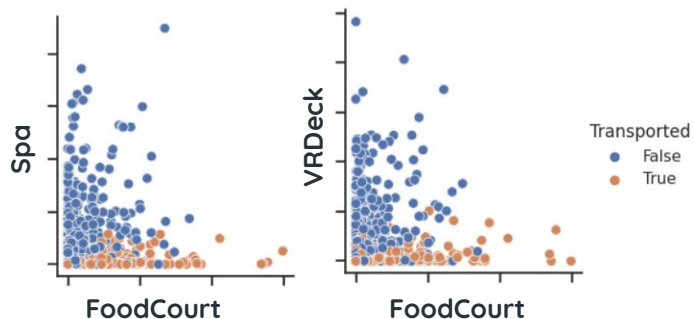
● VIP = True 的乘客普遍消費金額較高



雙變數EDA-各變數vs “Transported”

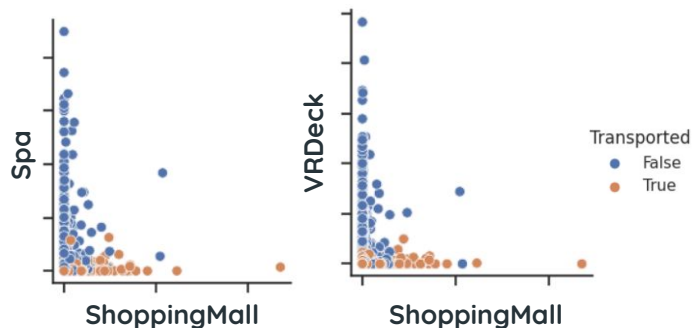


- ShoppingMall金額較高的旅客通常RoomService金額較低, 且大多Transported=True

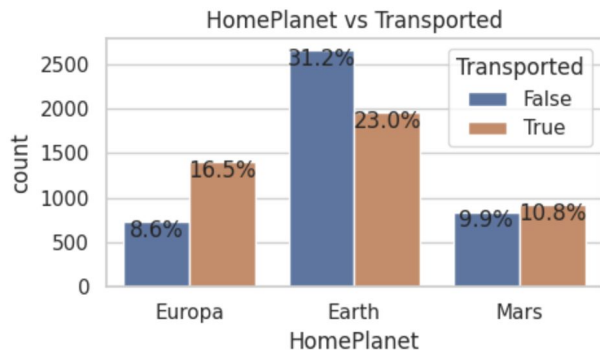


- Spa及VRDeck金額較高的旅客, 通常Transported=False
- FoodCourt消費金額若較高, 則Spa及VRDeck消費金額會較低, 且大多Transported=True

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

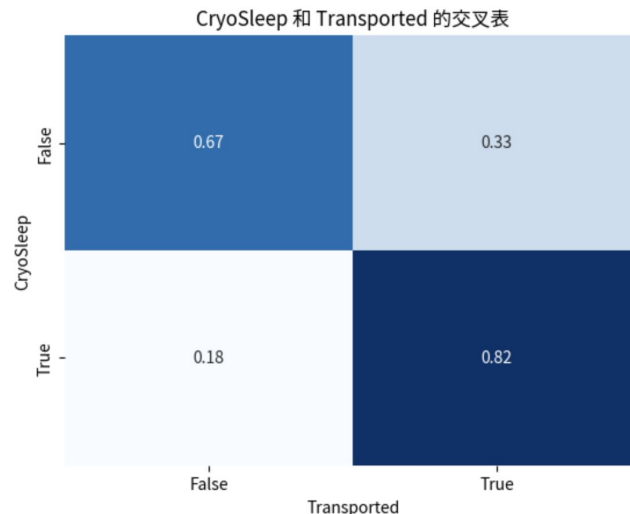
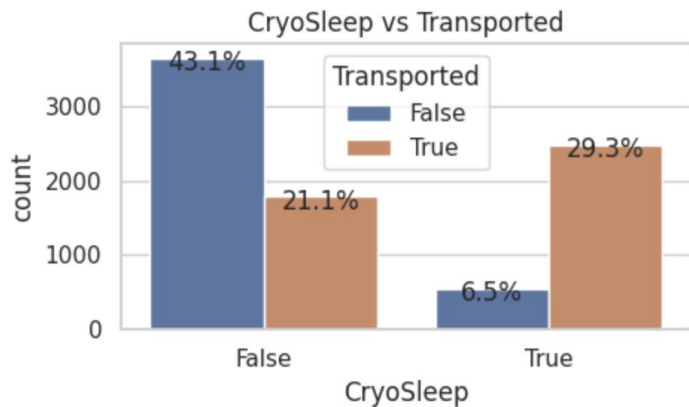


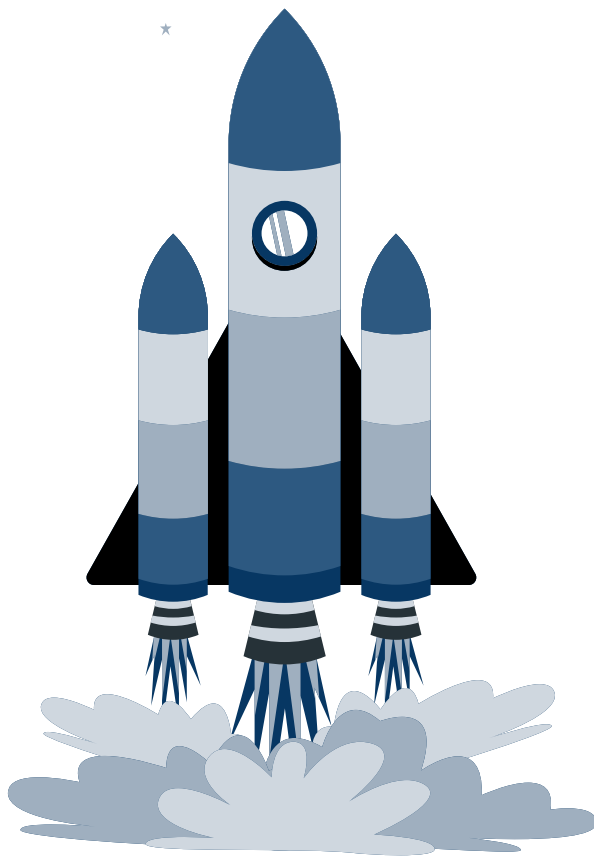
- HomePlanet為Europa及Mars的乘客，被傳送的比例較高；Earth的乘客則是沒有被傳送的比例較高

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



補值方法比較



Method 1
EDA



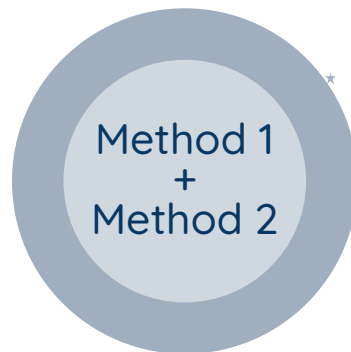
0.80687



Method 2
平均數眾數



0.80827



Method 1
+
Method 2



0.80734

Preprocessing

EDA

Imputation

Features

Model

Result

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

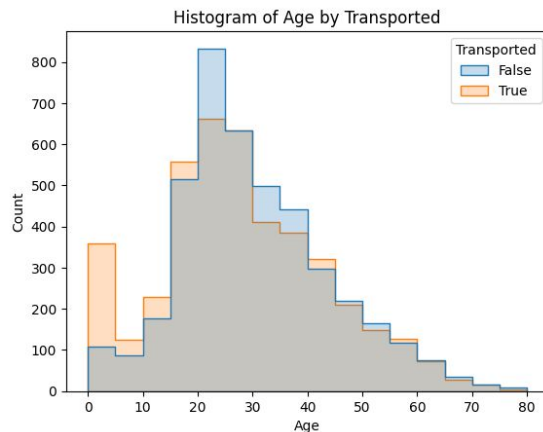
- ★ **One-Hot Encoding**

Deck, HomePlanet, Destination,
Group, Age_group

- ★ **Data Transformation**

log, minmax, standardize

- ★ **Clustering**

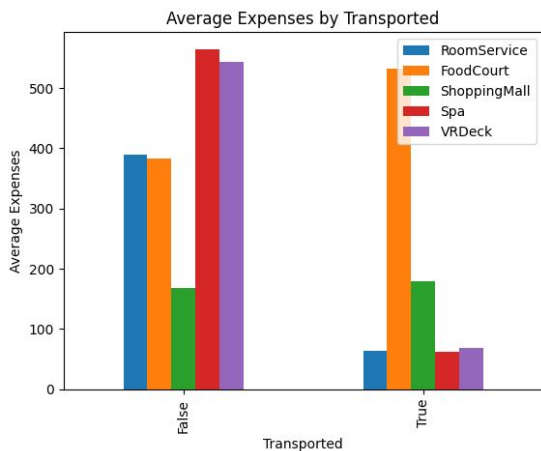


Age_group	Age
1	0~5
2	6~10
3	11~20
4	21~30
5	31~50
6	51~60
7	61~70
8	>70

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 Cancun, 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

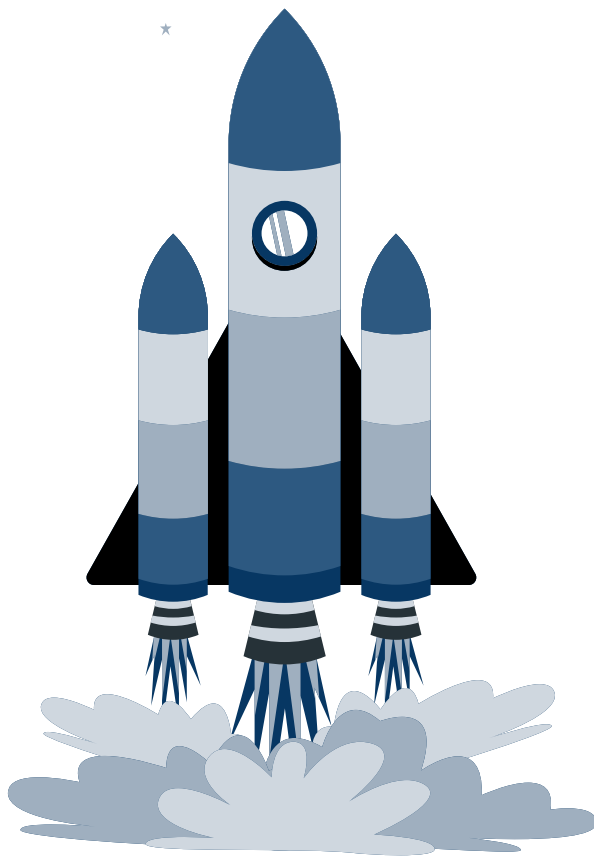
刪減變數



- 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 Cancr e, FoodCourt, HomePlanet_Earth

變數一	變數二	相關係數
Destination_55 Cancr 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	KNeighbors	0.760497	0.012738
5	XGBClassifier	0.803525	0.012524

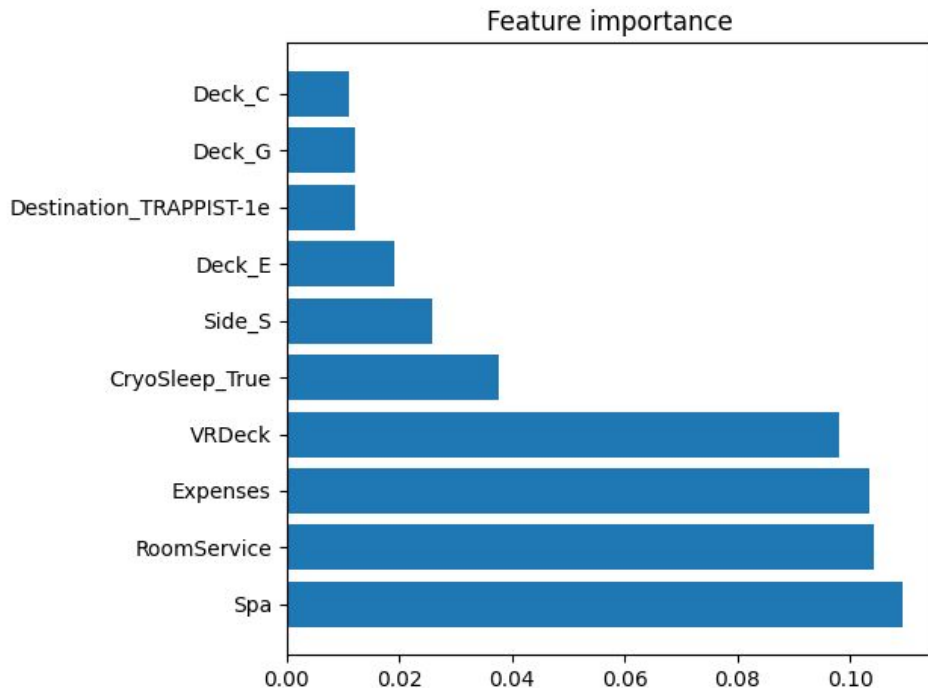
Feature Importance



- **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



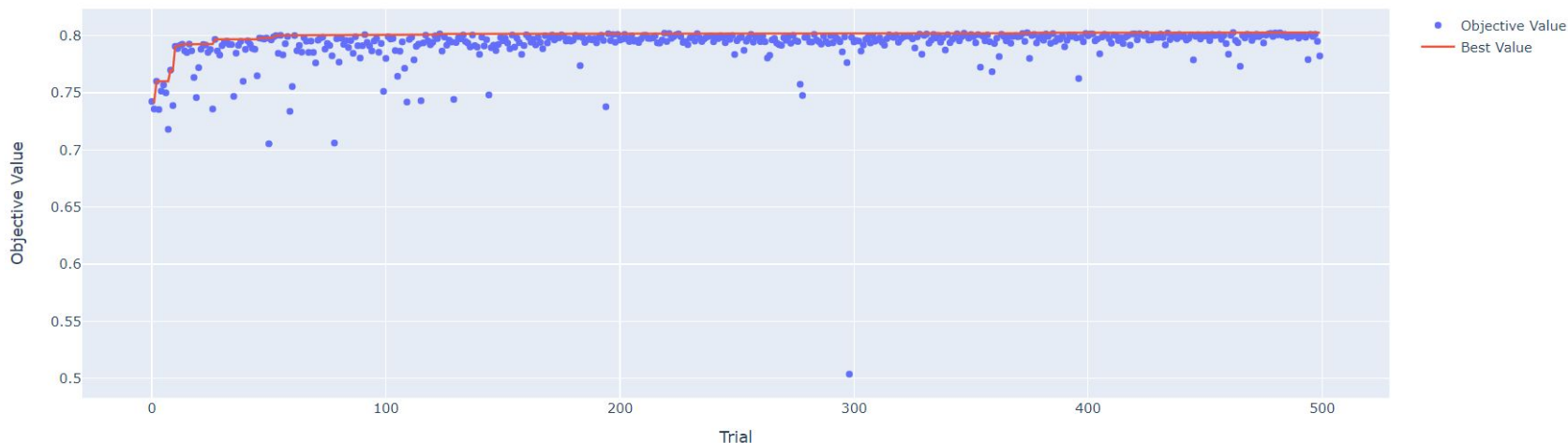
Hyperparameter Tuning



- **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
```

Optimization History Plot



An illustration featuring two men in a space-themed background. On the left, a man in a black tuxedo with a white shirt and black bow tie stands with his right arm raised in a celebratory gesture. On the right, a man in a white lab coat over a grey long-sleeved shirt and dark trousers stands holding a tablet displaying a circular logo with a stylized 'i'. The background is white with various celestial elements: a ringed planet in the top left, a crescent moon in the top right, a ringed planet in the middle right, a comet in the bottom right, and a globe showing the Americas in the bottom left. Several small grey stars are scattered throughout the scene.

06

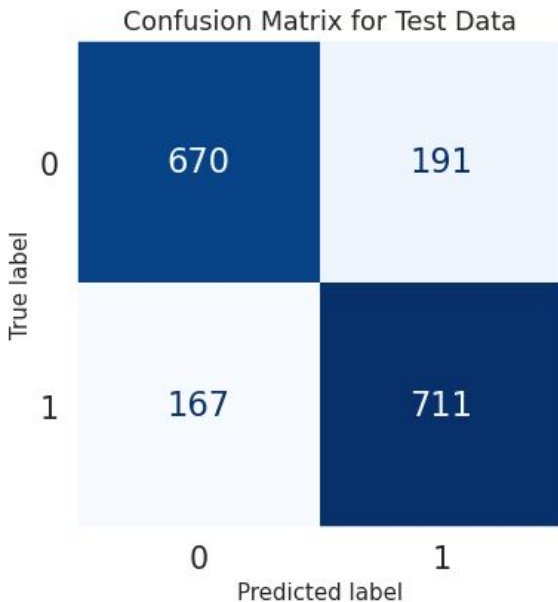
Result

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

Spaceship Titanic

[Submit Prediction](#)

[Overview](#) [Data](#) [Code](#) [Models](#) [Discussion](#) [Leaderboard](#) [Rules](#) [Team](#) [Submissions](#)

136

DM23-Team09



0.80827

28

16h



Your Best Entry!

Your submission scored 0.80687, which is not an improvement of your previous score. Keep trying!

Preprocessing

EDA

Imputation

Features

Model

Result



THANKS

