

Assignment	2023 - 2024
Title	Motodynamics Hackathon Phase 1 Data Set
Training data file	sixt_01.csv, sixt_02.csv, ..., sixt_25.csv
Test data file	sixt_Test_Dataset.zip



This assignment is based on data that describe the rentals of SIXT, a member of the Motodynamics group. The data are generously provided by the Motodynamics group for use in the “Data Analysis” course of the M.Sc. in Statistics of AUEB. This assignment also constitutes the 1st Phase of the competition organized for AUEB students by Motodynamics in collaboration with the Department of Statistics. Each student will receive a different subset of the data and a common test dataset to perform an out-of-sample evaluation of the final model(s).

The dataset (file SixtData4AUEB.xlsx) consists of records that represent reservations along with all the products that the customer purchased online. There are also extra products that can be sold with a reservation, known as incremental. The incremental are divided into two categories: insurance incremental and non-insurance incremental. The objective of this project is to forecast whether a customer will buy additional incremental at the desk and the net revenue that will be generated from them.

The main variable of the study is the total **On Desk Net Revenue** calculated as the sum of the **OnDesk Insurance Net Revenue** and the **OnDesk Non-Insurance Net Revenue** (the last two columns of the dataset). We are interested in describing the general customer profiles and understanding and predicting the on-desk total revenue of each rental in order to offer competitive prices and offers/discounts or increase the probability of a customer buying at a given cost.

Each student will handle a random sub-sample of 5000 observations to use it for training their model and for inference. All students will use a common evaluation/test dataset of 10000 observations.

1. You should first do some exploratory data analysis. Visualizing the data should give you some insight into certain particularities of this dataset. Pairwise comparisons will also help you learn about the association implied by the data.
2. The main aim is to identify the best model for predicting the revenue of the incremental of a reservation (total). Select the appropriate features to predict your model. Be careful, your model should not be over-parameterized.
3. Check the assumptions of the model and revise your procedure.
4. Use 10-fold cross-validation to select your model and assess the out-of-sample predictive ability of the model or finally selected models.
5. Compare results obtained by different methods under 2, 3 and 4.

6. Select your final model and features and justify your choice.
7. Interpret the parameters and the predicted performance of the final model.
8. Describe the typical profile of a post and the characteristics of a viral post.
9. Write a report summarizing your results (see attached directions for this)

Attribute Information:

Number of Attributes: 50 (48 explanatory attributes, 2 response variables: On Desk Revenues)

Attribute Information:

1. Res no : Reservation number
2. Agr. No: Agreement number
3. Driver ID
4. Days: Reservation days
5. Agent group: Booking source (Corporate, Leisure, Sixt, Walkin, NULL, Online Broker, Travel Corporate Agencies)
6. Driver Country_Dis: Country origin of driver
7. Driver Age
8. Pre-paid Amount
9. First Licence Year
10. Check-out Date: The day that the customer took the car
11. Check-out Time
12. Booking Date: The day that the customer booked the car
13. Booking Time
14. AD: Incremental | AD-Additional Driver / Επιπλέον Οδηγός - binary
15. B: Incremental | B-GARS fee - binary
16. BC: Incremental | BC-Roadside Protection - binary
17. BE: Incremental | BE-Loss Damage Waiver reduced excess - binary
18. BF: Incremental | BF-Loss Damage Waiver minimum - binary
19. BO: Incremental | BO-Booster Seat / Παιδικό κάθισμα (15-36kg) - binary
20. BR: Incremental | BR-Interior Protection (excess: EUR 50) - binary
21. BS: Incremental | BS-Baby Seat / Παιδικό κάθισμα (0-13kg) - binary
22. CS: Incremental | CS-Child Seat/Παιδικό κάθισμα (0-10kg, 9-18kg) – Binary
23. DI: Incremental | DI-Diesel engine – Binary
24. FDW: Incremental | FDW-Full Damage Waiver – Binary
25. LD: Incremental | LD-Loss Damage Waiver – Binary
26. NV: Incremental | NV-Navigation System / GPS – Binary
27. PAI: Incremental | PAI-Personal Accident Insurance – Binary
28. SC: Incremental | SC-Snow Chains / Αλυσίδες Χιονιού – Binary
29. SS: Incremental | Seasonal Supplement – Binary
30. SUB: Incremental | Sub-Subscription fee Sixt plus – Binary
31. TF: Incremental | TF-Prepaid Fuel – Binary
32. TG: Incremental | TG-Tyre and Windscreen Coverage – Binary
33. UPS: Incremental | UPS-Up Sell – Binary

34. Upgra: Upgrade car category - binary
35. C/O Mileage: Checkout Mileage of the car – int
36. Check-out Station: Station ID
37. Group: Car Group Category the customer took (MDMR, CDMR, IFMR etc; see the attached file for details) – **TIP:** You can extract more features from this variable
38. Charged group: The charged CarGroup category
39. Internet Insurance Net Revenue: Insurance Products bought online
40. Internet Non-Insurance Net Revenue: Non-Insurance Products bought online
41. Rental_Cost_Res: Total Rental Cost Reservation Online with incrementals
42. Sales Channel 2: From which channel did the reservation come from (Corporate-Brokers-Call Center, Corporate-Call center-Call center, Corporate-Sixt-Sixt, Retail Brokers Sixt, Retail-Call center-Call center, Retail-Sixt-Sixt, Retail-Station-Station)
43. Segment Type of reservation (Corporate, Retail, Null)
44. Past Rentals Entry: Customer's bought history
45. Manufacturer: Car's Manufacturer
46. Color: Car's Color
47. Rate title: Reservation's cost rate category. Each category corresponds to a specific multiplier that determines the price rate of the rental (e.g. Walk In Rates, Travel Corpo Rates, LOCAL FDW etc.) - They do not affect the price of incrementals.
48. Status:
 - IN | The car has been returned
 - CNC | The reservation has been canceled
 - RUN | The reservation is still running
49. OnDesk Insurance Net Revenue: Insurance Products bought on desk
50. OnDesk Non-Insurance Net Revenue: Non-Insurance Net Revenue bought on desk

Your Vehicle Guide to Book Car Rental with Confidence

ACRISS Mission - To develop, implement and maintain standards for the car rental Industry for use in all distribution systems enabling customers to book with confidence.

European Fleet

Mini	Economy	Compact	Intermediate	Standard
MBMR - VW Up!	ECMR - Opel/Vauxhall Corsa	CDMR - Ford Focus	IDMR - Skoda Octavia	SDMR - Opel/Vauxhall Insignia
				
Elite - NBMR - Abarth 595	Elite EV - HDAE - Renault Zoe	Elite - DDMR - BMW 1 Series	Elite - JDMR - Mercedes B-Class	Elite SUV - RFAR - Land Rover Discovery Sport
				
 X2  X2  X2	 X2  X2  X1  X1	 X2  X3  X1  X2	 X4  X1  X1  X2	 X5  X2  X1
Fullsize	Premium	Luxury	Special	Symbols
FFAR - DS DS7 Crossback	PDAR - BMW 3 Series	LDAR - Mercedes E-Class	XDAR - Mercedes S-Class	 Adult
				 Child
Elite SUV - GFAR - Alfa Romeo Stelvio	Elite - UDAR - Audi A5	Elite SUV EV-WGAC Tesla Model X	SUV - XFAR - Land Rover Range Rover	 *Checked size baggage 78 x 53 x 34 cm = 150L
				 *Cabin size baggage 52 x 35 x 24 cm = 50L
 X5  X2  X1	 X5  X2  X1	 X5  X2  X2	 X5  X2  X2	*: the luggage capacity are only guidelines and can vary by model

North American Fleet

Economy	Compact	Compact SUV	Intermediate	Intermediate SUV
ECAR - Ford Fiesta	CCAR - KIA Soul	CFAR - Ford EcoSport	ICAR - Hyundai Elantra	IFAR - Toyota RAV4
				
 X2  X2  X1  X1	 X2  X3  X1  X2	 X2  X3  X1  X2	 X4  X1  X1  X2	 X4  X1  X1  X2
Standard	Standard SUV	Fullsize	Fullsize SUV	Premium
SCAR - VW Jetta	SFAR - Ford Edge	FCAR - Chevrolet Malibu	FFAR - Ford Expedition	PCAR - Acura TLX
				
 X4  X1  X2  X1	 X4  X1  X2  X1	 X5  X2  X1	 X5  X2  X1	 X5  X2  X1
Premium SUV	Luxury	Luxury SUV	Standard Convertible	Symbols
PFAR - Chevrolet Suburban	LCAR - Chrysler 300C	LFAR - Lincoln Navigator	STAR - Ford Mustang	 Adult  Child
				 Checked size baggage 78 x 53 x 34 cm = 150L
 X5  X2  X1	 X5  X2  X2	 X5  X2  X2	 X2  X2  X1  X1	 Cabin size baggage 52 x 35 x 24 cm = 50L

The term 'Elite' has been selected by ACRISS to identify a category of vehicle that is superior to another of equal body size. Examples shown are representative of vehicle categories. Car rental companies will provide a vehicle of a similar standard according to ACRISS specifications; please refer to the provider for examples.

Our aim is for all ACRISS members to provide you a like for like comparison to make an informed choice with ease and confidence

Car Classification Code

CATEGORY	TYPE	TRANSMISSION/DRIVE	FUEL/AIR COND.
M Mini	B 2-3 Door	M Manual Unspecified Drive	R Unspecified Fuel/ Power With Air
N Mini Elite	C 2/4 Door	N Manual 4WD	N Unspecified Fuel/ Power Without Air
E Economy	D 4-5 Door	C Manual AWD	D Diesel Air
H Economy Elite	W Wagon/Estate	A Auto Unspecified Drive	Q Diesel No Air
C Compact	V Passenger Van	B Auto 4WD	H Hybrid Air
D Compact Elite	L Limousine/ Sedan	D Auto AWD	I Hybrid Plug In Air
I Intermediate	S Sport		E Electric (Distance < 250mi/400km) Air
J Intermediate Elite	T Convertible		C Electric Plus (Distance ≥ 250mi/400km) Air
S Standard	F SUV		L LPG/Compressed Gas Air
R Standard Elite	J Open Air All Terrain		S LPG/Compressed Gas No Air
F Fullsize	X Special		A Hydrogen Air
G Fullsize Elite	P Pick Up (Single/Extended Cab) - 2 Door		B Hydrogen No Air
P Premium	Q Pick Up (Double Cab) - 4 Door		M Multi Fuel/ Power Air
U Premium Elite	Z Special Offer Car		F Multi Fuel/ Power No Air
L Luxury	E Coupe		V Petrol Air
W Luxury Elite	M Monospace		Z Petrol No Air
O Oversize	R Recreational Vehicle		U Ethanol Air
X Special	H Motor Home		X Ethanol No Air
	Y 2 Wheel Vehicle		
	N Roadster		
	G Crossover		
	K Commercial Van/ Truck		

Example: IDMR = Intermediate/4-5 Door/Manual Unspecified Drive/Unspecified Fuel with Air Conditioning

Pseudo Codes

These codes are used to aid enhanced searches using criteria that may be common across vehicle categories and types, simply replace the vehicle code with the Pseudo code in your rate shop entries.

ACAR Any Standard Vehicle	AMNO Monospace
ALLB 2-3 Door	AVAN Passenger Van
ALLC 2 or 4 Door	ASIX Any 6+ Passenger Van
ALLD 4-5 Door	ASEV Any 7+ Passenger Van
AELT Any Elite	AEIG Any 8+ Passenger Van
AWGN Any Estate / Wagon	ANIN Any 9+ Passenger Van
ASUV Any SUV	AMAN All Manual Transmissions
ACRS Any Crossover	AUTO All Auto Transmissions
AFWD Any 4WD / AWD	APET All Petrol Powered Vehicles
ACNV Convertible	ADSL All Diesel Powered Vehicles
APUP Any Pick Up	AELC All Electric Powered Vehicles
ACGO Commercial Truck	AHXB All Hybrid Powered Vehicles
ALMO Limousine/Sedan	AMFP All Multi Fuel Powered Vehicles
ASPT Sport	AGRN All Lower Emission Vehicles**

** Green vehicle types defined currently as Hybrid, Electric, Ethanol,LPG, Hydrogen, Multi Fuel vehicles.

Passenger Van Seating

IV	6 Seats
JV	Elite 6 Seats or 5+2 Seats (2 fold down seats)
SV	7 Seats
RV	Elite 7 Seats
FV	7 Seats Plus More Space
GV	Elite 7 Seats Plus More Space
PV	8 Seats
UV	Elite 8 Seats
LV	9 Seats
WV	Elite 9 Seats
XV	12 Seats
OV	15 Seats

Our Members and Associates



For full up to date information and free downloads please refer to the ACRISS website:

WWW.ACRISS.ORG