Winter 2022 Data Science Intern Challenge

September 17, 2021

1 Q.1

On Shopify, we have exactly 100 sneaker shops, and each of these shops sells only one model of shoe. We want to do some analysis of the average order value (AOV). When we look at orders data over a 30 day window, we naively calculate an AOV of $3145.13. Given that we know these shops are selling sneakers, a relatively affordable item, something seems wrong with our analysis.

a. Think about what could be going wrong with our calculation. Think about a better way to evaluate this data.

b. What metric would you report for this dataset?

c. What is its value?

1.1 My process

1. High level overview of data
2. Explore outliers
3. Identify alternatives

1.1.1 High level overview

First, I import that data and display the first 5 rows and some basic statistics of the features

[8]:
```
import pandas as pd
import numpy as np
import seaborn as sns
import matplotlib.pyplot as plt
%matplotlib inline
```

[9]:
```
df = pd.read_csv("2019 Winter Data Science Intern Challenge Data Set - Sheet1.
↪csv")
display(df.head(), df.describe())
```

```
   order_id  shop_id  user_id  order_amount  total_items payment_method  \
0         1       53      746           224            2           cash
1         2       92      925            90            1           cash
2         3       44      861           144            1           cash
3         4       18      935           156            1    credit_card
```

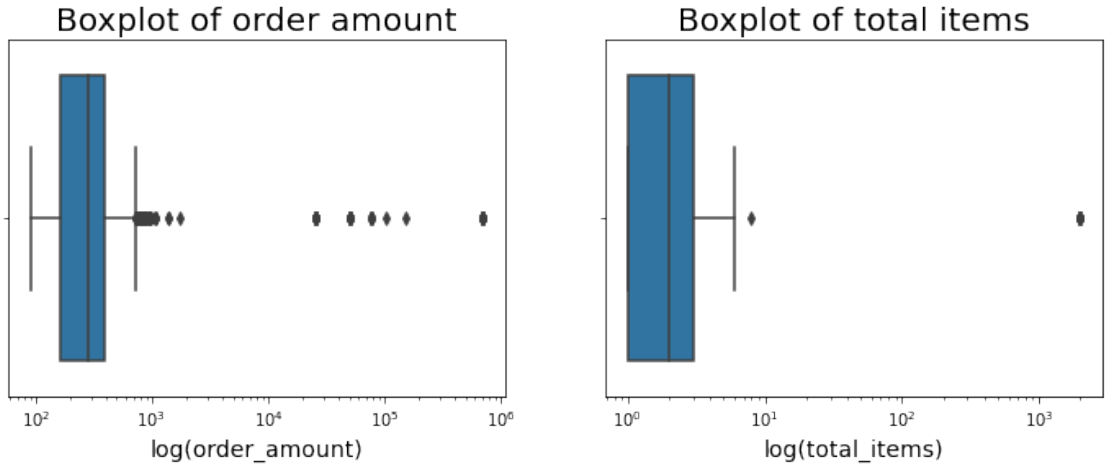
```
4         5       18      883           156            1    credit_card

            created_at
0  2017-03-13 12:36:56
1  2017-03-03 17:38:52
2   2017-03-14 4:23:56
3  2017-03-26 12:43:37
4   2017-03-01 4:35:11
```

	order_id	shop_id	user_id	order_amount	total_items
count	5000.000000	5000.000000	5000.000000	5000.000000	5000.00000
mean	2500.500000	50.078800	849.092400	3145.128000	8.78720
std	1443.520003	29.006118	87.798982	41282.539349	116.32032
min	1.000000	1.000000	607.000000	90.000000	1.00000
25%	1250.750000	24.000000	775.000000	163.000000	1.00000
50%	2500.500000	50.000000	849.000000	284.000000	2.00000
75%	3750.250000	75.000000	925.000000	390.000000	3.00000
max	5000.000000	100.000000	999.000000	704000.000000	2000.00000

I confirm the strangely high mean value for 'order_amount'.
I also notice the extremely high max values for 'order_amount' and 'total_items'.
Plotting a boxplot of both features, it is clear that there are many high valued outliers.

[13]:
```
fig, ax = plt.subplots(ncols=2)
fig.set_figwidth(12)
sns.boxplot(x=df['order_amount'], ax=ax[0]).set_xscale("log")
sns.boxplot(x=df['total_items'], ax=ax[1]).set_xscale("log")
ax[0].set_title("Boxplot of order amount", fontsize=20)
ax[1].set_title("Boxplot of total items", fontsize=20)
ax[0].set_xlabel('log(order_amount)', fontsize=14)
ax[1].set_xlabel('log(total_items)', fontsize=14)
plt.show()
```



1.1.2 Explore outliers

After filtering the data for order amounts that are above the aov, I see there are 63 of these rows.
However, there are only 6 unique combinations of ['shop_id', 'order_amount' and 'total_items'] composing these 63 rows.
All of them are clearly outliers with shop 42 selling 2000 shoes at a time and shop 78 selling shoes at $25725 each.

[11]:
```
aov = df['order_amount'].mean()
print("There are {} rows with order amount greater than the aov.".
 ↪format(len(df[df['order_amount'] > aov])))

# Display unique row combinations with order amount greater than aov
df[df['order_amount'] > aov][['shop_id','order_amount','total_items']].
 ↪drop_duplicates()
```

```
There are 63 rows with order amount greater than the aov.
```

[11]:

	shop_id	order_amount	total_items
15	42	704000	2000
160	78	25725	1
490	78	51450	2
691	78	154350	6
1259	78	77175	3
2492	78	102900	4

1.1.3 Identify alternatives

An average metric that is robust to outliers is the median. The median of the dataset is 284 and is more representative of a true average value. We can see that after removing the outliers the median value does not change but the mean is 302.58, a relatively similiar figure.

[12]:
```
print("The median of the order amount of the full dataset is {}".
 ↪format(df['order_amount'].median()))

df_outliers_removed = df[df['order_amount'] <= aov]
print("The median of the order amount without outliers is {}".
 ↪format(df_outliers_removed['order_amount'].median()))
print("The mean of the order amount without outliers is {:.2f}".
 ↪format(df_outliers_removed['order_amount'].mean()))
```

```
The median of the order amount of the full dataset is 284.0
The median of the order amount without outliers is 284.0
The mean of the order amount without outliers is 302.58
```

1.2 Summary

a. Think about what could be going wrong with our calculation. Think about a better way to evaluate this data.
Using the mean is not robust to outliers. It can be seen that removing them decreases the aov from 3145.15 to 302.58.

b. What metric would you report for this dataset?
I would use the median as the average metric instead.

c. What is its value?
The median is $284.

2 Q.2

a. How many orders were shipped by Speedy Express in total?
54

SQL:
```
SELECT COUNT(DISTINCT Orders.OrderID)
FROM Orders
JOIN Shippers ON Orders.ShipperID = Shippers.ShipperID
WHERE Shippers.ShipperName = 'Speedy Express'
```

b. What is the last name of the employee with the most orders?
Peacock

SQL:
```
SELECT Employees.LastName, COUNT(Orders.OrderID) AS NumOfOrders
FROM Employees
JOIN Orders ON Employees.EmployeeID = Orders.EmployeeID
GROUP BY Employees.LastName
ORDER BY NumOfOrders DESC
LIMIT 1
```

c. What product was ordered the most by customers in Germany?
Boston Crab Meat

SQL:
```
SELECT P.ProductID, P.ProductName, SUM(OD.Quantity) AS OrderCount
FROM ORDERS O
JOIN OrderDetails OD ON O.OrderID = OD.OrderID
JOIN Products P ON OD.ProductID = P.ProductID
JOIN Customers C ON O.CustomerID = C.CustomerID
WHERE C.Country = 'Germany'
GROUP BY P.ProductID, P.ProductName
ORDER BY OrderCount DESC
LIMIT 1
```