Phase 1 - Exploratory data analysis (EDA) + Feature importance with Random Forest

BUSINESS REQUIREMENT detailed in phase 0

** The public dataset proviced by IBM will present revenue information related to some products and countries for specific years (2004 to 2007)

The Business question are:

- 1. Can we predict our revenue in 2008 ?
- 1. What is the confidence of this prediction ?
- 1. And finally, if we sell the same products from 2007, what are the divergence expected on revenue in 2008 ?

Info

- In this notebook we are going to evaluate and profile the dataset
- Run a Random Forest Regressor to plot the feature importance and evaluate one initial prediction

In [1]:

```
import pandas as pd
import pandas_profiling as pp
```

Dataset

the dataset used in this process can be accessed trought IBM website below

https://www.ibm.com/communities/analytics/watson-analytics-blog/guide-to-sample-datasets/ (https://www.ibm.com/communities/analytics/watson-analytics-blog/guide-to-sample-datasets/)

In [2]:

```
df = pd.read_csv('../data/WA_Retail-SalesMarketing_-ProfitCost.csv')

## fill NaN com zero

df.fillna(0, inplace=True)

## Predict Revenue - columns used
df = df [['Year' ,'Product line' ,'Product type' ,'Product' ,'Order method type' ,'Retailer country' ,'Revenue' ,'Planned revenue']]

df.head().T
```

Out[2]:

	0	1	2	3	4
Year	2004	2004	2004	2004	2004
Product line	Camping Equipment	Camping Equipment	Camping Equipment	Camping Equipment	Camping Equipment
Product type	Cooking Gear	Cooking Gear	Cooking Gear	Cooking Gear	Cooking Gear
Product	TrailChef Water Bag	TrailChef Water Bag	TrailChef Water Bag	TrailChef Water Bag	TrailChef Water Bag
Order method type	Telephone	Telephone	Telephone	Telephone	Telephone
Retailer country	United States	Canada	Mexico	Brazil	Japan
Revenue	315044	13444.7	0	0	181120
Planned revenue	437477	14313.5	0	0	235237

Profile the data

```
In [3]: # pp.ProfileReport(df, check_correlation=False)

        pp.ProfileReport(df, check_correlation=True)
```

Out[3]:

Overview

Dataset info

Number of variables	8
Number of observations	84672
Total Missing (%)	0.0%
Total size in memory	5.2 MiB
Average record size in memory	64.0 B

Variables types

Numeric	2
Categorical	5
Boolean	0
Date	0
Text (Unique)	0
Rejected	1
Unsupported	0

Warnings

- `Planned revenue` is highly correlated with `Revenue` (ρ = 0.99917) **Rejected**
- `Product` has a high cardinality: 144 distinct values **Warning**
- `Revenue` has 60005 / 70.9% zeros **Zeros**

Variables

Order method type

Categorical

Distinct count	7
Unique (%)	0.0%

Missing (%)	0.0%
Missing (n)	0

Fax	12096	
E-mail	12096	
Telephone	12096	
Other values (4)		48384

Toggle details

~~Planned revenue~~

Highly correlated

This variable is highly correlated with *Revenue* *and should be ignored for analysis*

Correlation	0.99917

Product

Categorical

Distinct count	144
Unique (%)	0.2%
Missing (%)	0.0%
Missing (n)	0

Polar Ice	588	
Polar Wave	588	
TrailChef Cup	588	
Other values (141)		82908

Toggle details

Product line

Categorical

Distinct count	5
Unique (%)	0.0%

Toggle details

Revenue

Numeric

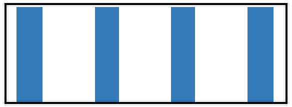
Distinct count	24009	**Mean**	55352
Unique (%)	28.4%	**Minimum**	0
Missing (%)	0.0%	**Maximum**	10054000
Missing (n)	0	**Zeros (%)**	70.9%
Infinite (%)	0.0%		
Infinite (n)	0		

Toggle details

Year

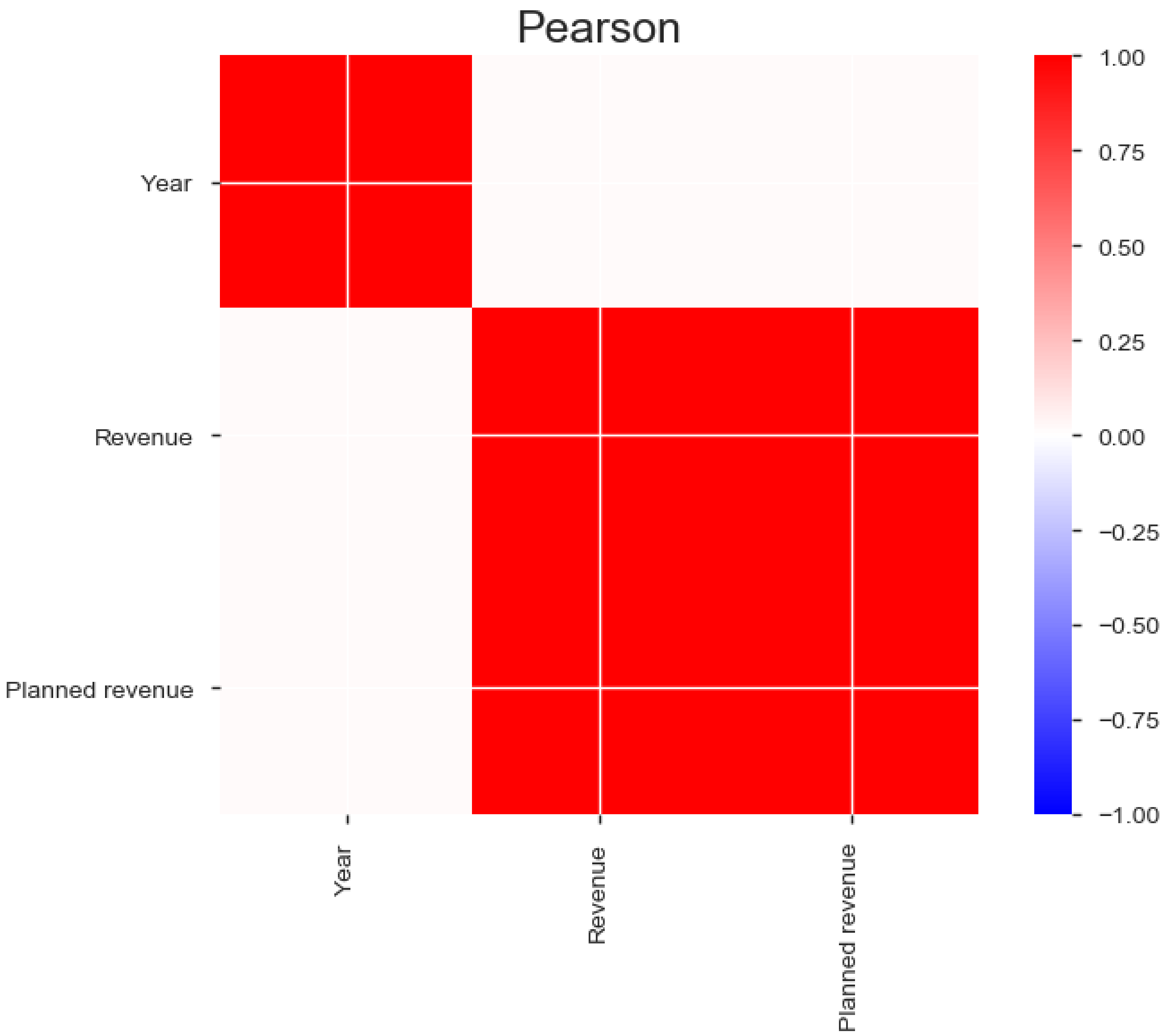
Numeric

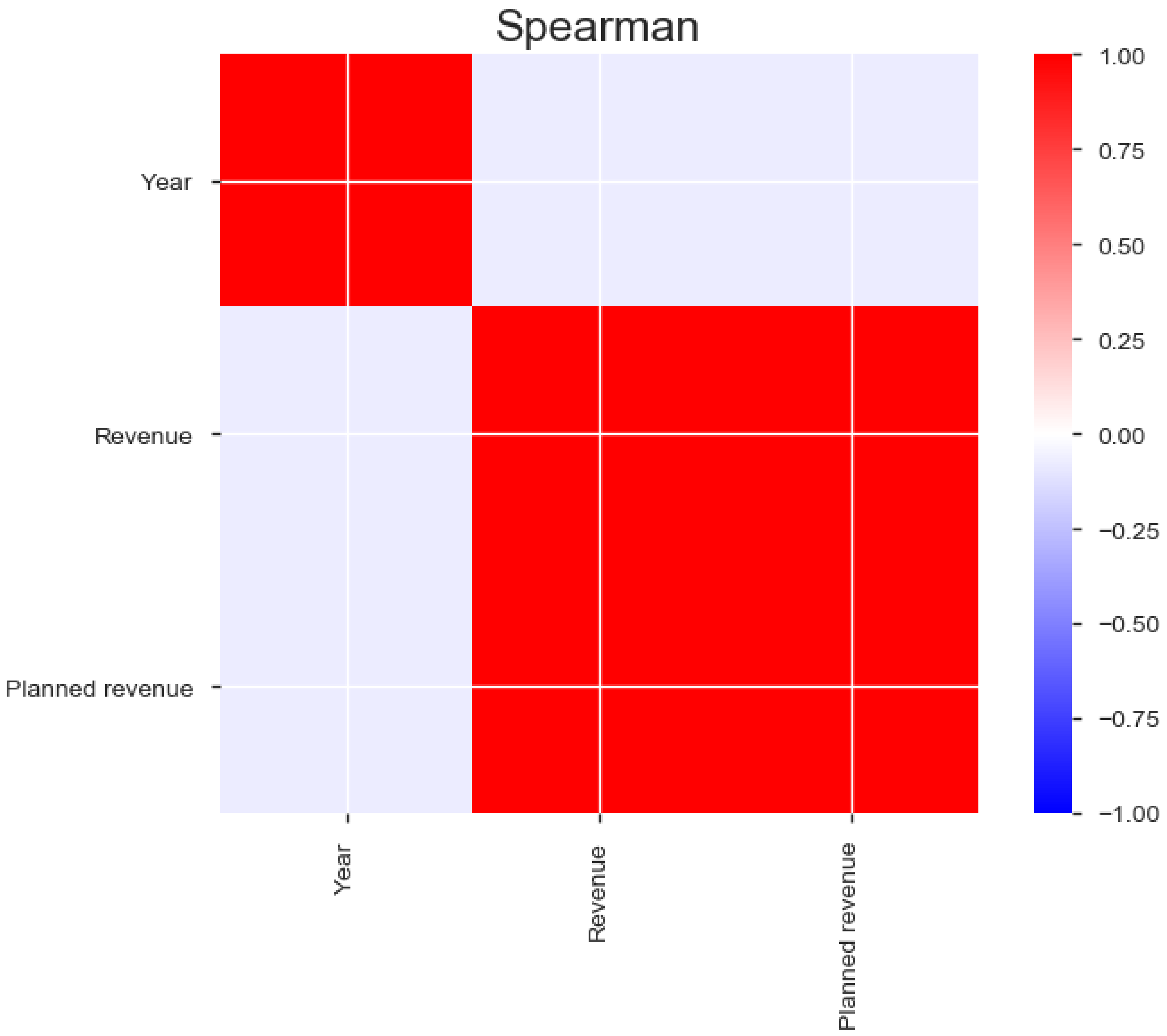
Distinct count	4	**Mean**	2005.5
Unique (%)	0.0%	**Minimum**	2004
Missing (%)	0.0%	**Maximum**	2007
Missing (n)	0	**Zeros (%)**	0.0%
Infinite (%)	0.0%		
Infinite (n)	0		



Toggle details

Correlations


Pearson
Year
Revenue
Planned revenue
Year
Revenue
Planned revenue
1.00
0.75
0.50
0.25
0.00
−0.25
−0.50
−0.75
−1.00



Sample

Year	Product line	Product type	Product	Order method type	Retailer country

	Year	Product line	Product type	Product	Order method type	Retailer country
0	2004	Camping Equipment	Cooking Gear	TrailChef Water Bag	Telephone	United States
1	2004	Camping Equipment	Cooking Gear	TrailChef Water Bag	Telephone	Canada
2	2004	Camping Equipment	Cooking Gear	TrailChef Water Bag	Telephone	Mexico
3	2004	Camping Equipment	Cooking Gear	TrailChef Water Bag	Telephone	Brazil
4	2004	Camping Equipment	Cooking Gear	TrailChef Water Bag	Telephone	Japan

Exclude column with high correlation

- Planned Revenue

In [4]:
```
## drop items not used
drop_items = ['Planned revenue']

df.drop(drop_items, axis = 1, inplace = True)
```

Machine Learning model - Random Forest Regressor

- More info at sklearn website

  https://scikit-learn.org/stable/modules/generated/sklearn.ensemble.RandomForestRegressor.html (https://scikit-learn.org/stable/modules/generated/sklearn.ensemble.RandomForestRegressor.html)

In [5]:

```
## sklearn import
from sklearn.preprocessing import LabelEncoder
from sklearn.model_selection import train_test_split
from sklearn.ensemble import RandomForestRegressor

# LabelEncoder
le = LabelEncoder()

# apply "le.fit_transform"
df = df.apply(le.fit_transform)
```

In [6]:

```
target = 'Revenue'
features = df.columns.tolist()
features.remove(target)

X = df[features]
y = df[target]
```

In [7]:

```
# Generate train and test data
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.2, random_state=122345)


## This line instantiates the model.
fit_rf = RandomForestRegressor()

## Fit the model on your training data.
fit_rf.fit(X_train, y_train)

## And score it on your testing data.
fit_rf.score(X_test, y_test)


print('---------------------- The best score/coefficient of determination R^2 of the prediction is: ' + str(fit_rf.score(X_tes
t, y_test)))
fit_rf.score(X_test, y_test)
```

```
---------------------- The best score/coefficient of determination R^2 of the prediction is: 0.8442048767542322
```

Out[7]:

```
0.8442048767542322
```

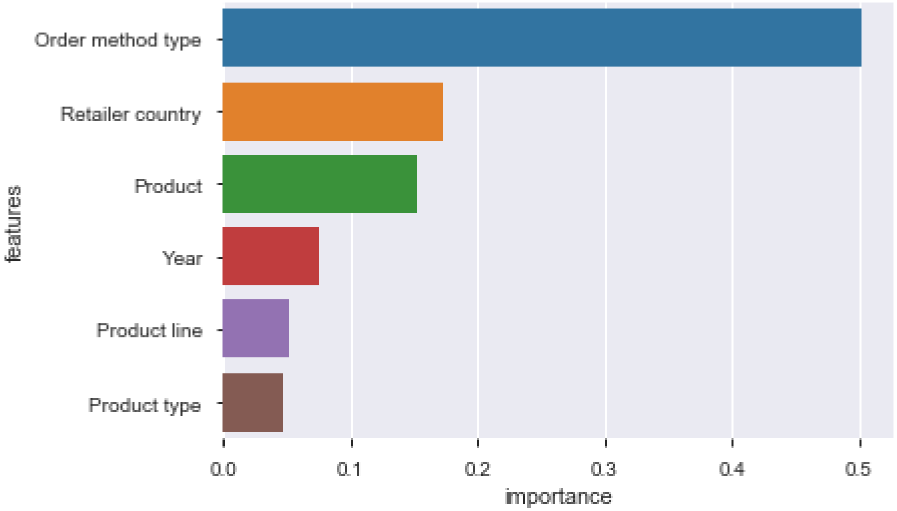
Plot Feature Importance

In [8]:

```
import seaborn as sns
import matplotlib.pyplot as plt
%matplotlib inline

# Plot feature importance
feature_importances = pd.DataFrame({'features': X_train.columns,
                                    'importance': fit_rf.feature_importances_}).sort_values('importance', ascending=False)

ax = sns.barplot(x="importance", y="features", data=feature_importances)
```



Summary - initial analysis

The 3 most important features that drives revenue are

- 1. Order method type
- 1. Retailer country and
- 1. Product