Importing the Dependencies

In [ ]:
```
!pip install numpy
!pip install pandas
!pip install matplotlib
!pip install seaborn
!pip install scikit-learn
!pip install xgboost
```

```
Defaulting to user installation because normal site-packages is not writeable
Requirement already satisfied: numpy in /home/yash/.local/lib/python3.10/site-packages (1.26.3)
Defaulting to user installation because normal site-packages is not writeable
Requirement already satisfied: pandas in /home/yash/.local/lib/python3.10/site-packages (2.2.0)
Requirement already satisfied: pytz>=2020.1 in /usr/lib/python3/dist-packages (from pandas) (2022.1)
Requirement already satisfied: numpy<2,>=1.22.4 in /home/yash/.local/lib/python3.10/site-packages (from pandas) (1.2
6.3)
Requirement already satisfied: tzdata>=2022.7 in /home/yash/.local/lib/python3.10/site-packages (from pandas) (2023.
4)
Requirement already satisfied: python-dateutil>=2.8.2 in /home/yash/.local/lib/python3.10/site-packages (from panda
s) (2.8.2)
Requirement already satisfied: six>=1.5 in /usr/lib/python3/dist-packages (from python-dateutil>=2.8.2->pandas) (1.1
6.0)
Defaulting to user installation because normal site-packages is not writeable
Requirement already satisfied: matplotlib in /home/yash/.local/lib/python3.10/site-packages (3.8.2)
Requirement already satisfied: contourpy>=1.0.1 in /home/yash/.local/lib/python3.10/site-packages (from matplotlib)
(1.2.0)
Requirement already satisfied: python-dateutil>=2.7 in /home/yash/.local/lib/python3.10/site-packages (from matplotl
ib) (2.8.2)
Requirement already satisfied: packaging>=20.0 in /home/yash/.local/lib/python3.10/site-packages (from matplotlib)
(23.2)
Requirement already satisfied: pyparsing>=2.3.1 in /usr/lib/python3/dist-packages (from matplotlib) (2.4.7)
Requirement already satisfied: numpy<2,>=1.21 in /home/yash/.local/lib/python3.10/site-packages (from matplotlib)
(1.26.3)
Requirement already satisfied: fonttools>=4.22.0 in /home/yash/.local/lib/python3.10/site-packages (from matplotlib)
(4.47.2)
Requirement already satisfied: cycler>=0.10 in /home/yash/.local/lib/python3.10/site-packages (from matplotlib) (0.1
2.1)
Requirement already satisfied: pillow>=8 in /usr/lib/python3/dist-packages (from matplotlib) (9.0.1)
Requirement already satisfied: kiwisolver>=1.3.1 in /home/yash/.local/lib/python3.10/site-packages (from matplotlib)
(1.4.5)
Requirement already satisfied: six>=1.5 in /usr/lib/python3/dist-packages (from python-dateutil>=2.7->matplotlib)
(1.16.0)
Defaulting to user installation because normal site-packages is not writeable
Requirement already satisfied: seaborn in /home/yash/.local/lib/python3.10/site-packages (0.13.2)
Requirement already satisfied: pandas>=1.2 in /home/yash/.local/lib/python3.10/site-packages (from seaborn) (2.2.0)
Requirement already satisfied: numpy!=1.24.0,>=1.20 in /home/yash/.local/lib/python3.10/site-packages (from seaborn)
(1.26.3)
Requirement already satisfied: matplotlib!=3.6.1,>=3.4 in /home/yash/.local/lib/python3.10/site-packages (from seabo
rn) (3.8.2)
Requirement already satisfied: cycler>=0.10 in /home/yash/.local/lib/python3.10/site-packages (from matplotlib!=3.6.
```

```
1,>=3.4->seaborn) (0.12.1)
Requirement already satisfied: kiwisolver>=1.3.1 in /home/yash/.local/lib/python3.10/site-packages (from matplotlib!
=3.6.1,>=3.4->seaborn) (1.4.5)
Requirement already satisfied: pillow>=8 in /usr/lib/python3/dist-packages (from matplotlib!=3.6.1,>=3.4->seaborn)
(9.0.1)
Requirement already satisfied: contourpy>=1.0.1 in /home/yash/.local/lib/python3.10/site-packages (from matplotlib!=
3.6.1,>=3.4->seaborn) (1.2.0)
Requirement already satisfied: python-dateutil>=2.7 in /home/yash/.local/lib/python3.10/site-packages (from matplotl
ib!=3.6.1,>=3.4->seaborn) (2.8.2)
Requirement already satisfied: fonttools>=4.22.0 in /home/yash/.local/lib/python3.10/site-packages (from matplotlib!
=3.6.1,>=3.4->seaborn) (4.47.2)
Requirement already satisfied: packaging>=20.0 in /home/yash/.local/lib/python3.10/site-packages (from matplotlib!=
3.6.1,>=3.4->seaborn) (23.2)
Requirement already satisfied: pyparsing>=2.3.1 in /usr/lib/python3/dist-packages (from matplotlib!=3.6.1,>=3.4->sea
born) (2.4.7)
Requirement already satisfied: pytz>=2020.1 in /usr/lib/python3/dist-packages (from pandas>=1.2->seaborn) (2022.1)
Requirement already satisfied: tzdata>=2022.7 in /home/yash/.local/lib/python3.10/site-packages (from pandas>=1.2->s
eaborn) (2023.4)
Requirement already satisfied: six>=1.5 in /usr/lib/python3/dist-packages (from python-dateutil>=2.7->matplotlib!=3.
6.1,>=3.4->seaborn) (1.16.0)
Defaulting to user installation because normal site-packages is not writeable
Requirement already satisfied: scikit-learn in /home/yash/.local/lib/python3.10/site-packages (1.4.0)
Requirement already satisfied: joblib>=1.2.0 in /home/yash/.local/lib/python3.10/site-packages (from scikit-learn)
(1.3.2)
Requirement already satisfied: threadpoolctl>=2.0.0 in /home/yash/.local/lib/python3.10/site-packages (from scikit-l
earn) (3.2.0)
Requirement already satisfied: scipy>=1.6.0 in /home/yash/.local/lib/python3.10/site-packages (from scikit-learn)
(1.12.0)
Requirement already satisfied: numpy<2.0,>=1.19.5 in /home/yash/.local/lib/python3.10/site-packages (from scikit-lea
rn) (1.26.3)
Defaulting to user installation because normal site-packages is not writeable
Requirement already satisfied: xgboost in /home/yash/.local/lib/python3.10/site-packages (2.0.3)
Requirement already satisfied: scipy in /home/yash/.local/lib/python3.10/site-packages (from xgboost) (1.12.0)
Requirement already satisfied: numpy in /home/yash/.local/lib/python3.10/site-packages (from xgboost) (1.26.3)
```

In [ ]:
```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
from sklearn.preprocessing import LabelEncoder
from sklearn.model_selection import train_test_split
```

```
from xgboost import XGBRegressor
from sklearn import metrics
```

Data Collection and Processing

In [ ]:
```
# loading the data from csv file to Pandas DataFrame
big_mart_data = pd.read_csv('./Train.csv')
```

In [ ]:
```
# first 5 rows of the dataframe
big_mart_data.head()
```

Out[ ]:

	Item_Identifier	Item_Weight	Item_Fat_Content	Item_Visibility	Item_Type	Item_MRP	Outlet_Identifier	Outlet_Establishment_Year
0	FDA15	9.30	Low Fat	0.016047	Dairy	249.8092	OUT049	1999
1	DRC01	5.92	Regular	0.019278	Soft Drinks	48.2692	OUT018	2009
2	FDN15	17.50	Low Fat	0.016760	Meat	141.6180	OUT049	1999
3	FDX07	19.20	Regular	0.000000	Fruits and Vegetables	182.0950	OUT010	1998
4	NCD19	8.93	Low Fat	0.000000	Household	53.8614	OUT013	1987

In [ ]:
```
# number of data points & number of features
big_mart_data.shape
```

Out[ ]:
```
(8523, 12)
```

In [ ]:
```
# getting some information about thye dataset
big_mart_data.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 8523 entries, 0 to 8522
Data columns (total 12 columns):
 #   Column                     Non-Null Count  Dtype  
---  ------                     --------------  -----  
 0   Item_Identifier            8523 non-null   object 
 1   Item_Weight                7060 non-null   float64
 2   Item_Fat_Content           8523 non-null   object 
 3   Item_Visibility            8523 non-null   float64
 4   Item_Type                  8523 non-null   object 
 5   Item_MRP                   8523 non-null   float64
 6   Outlet_Identifier          8523 non-null   object 
 7   Outlet_Establishment_Year  8523 non-null   int64  
 8   Outlet_Size                6113 non-null   object 
 9   Outlet_Location_Type       8523 non-null   object 
 10  Outlet_Type                8523 non-null   object 
 11  Item_Outlet_Sales          8523 non-null   float64
dtypes: float64(4), int64(1), object(7)
memory usage: 799.2+ KB
```

Categorical Features:

- Item_Identifier
- Item_Fat_Content
- Item_Type
- Outlet_Identifier
- Outlet_Size
- Outlet_Location_Type
- Outlet_Type

In [ ]:
```
# checking for missing values
big_mart_data.isnull().sum()
```

Out[ ]:
```
Item_Identifier               0
Item_Weight                1463
Item_Fat_Content              0
Item_Visibility               0
Item_Type                     0
Item_MRP                      0
Outlet_Identifier             0
Outlet_Establishment_Year     0
Outlet_Size                2410
Outlet_Location_Type          0
Outlet_Type                   0
Item_Outlet_Sales             0
dtype: int64
```

Handling Missing Values

In [ ]:
```
# mean value of "Item_Weight" column
big_mart_data['Item_Weight'].mean()
```

Out[ ]:
```
12.857645184135976
```

In [ ]:
```
# filling the missing values in "Item_weight column" with "Mean" value
big_mart_data['Item_Weight'].fillna(big_mart_data['Item_Weight'].mean(), inplace=True)
```

```
/tmp/ipykernel_13701/2509980927.py:2: FutureWarning: A value is trying to be set on a copy of a DataFrame or Series
through chained assignment using an inplace method.
The behavior will change in pandas 3.0. This inplace method will never work because the intermediate object on which
we are setting values always behaves as a copy.

For example, when doing 'df[col].method(value, inplace=True)', try using 'df.method({col: value}, inplace=True)' or
df[col] = df[col].method(value) instead, to perform the operation inplace on the original object.
```

```
big_mart_data['Item_Weight'].fillna(big_mart_data['Item_Weight'].mean(), inplace=True)
```

In [ ]:
```
# mode of "Outlet_Size" column
big_mart_data['Outlet_Size'].mode()
```

Out[ ]:
```
0    Medium
Name: Outlet_Size, dtype: object
```

In [ ]:
```
# filling the missing values in "Outlet_Size" column with Mode
mode_of_Outlet_size = big_mart_data.pivot_table(values='Outlet_Size', columns='Outlet_Type', aggfunc=(lambda x: x.m
```

In [ ]:
```
print(mode_of_Outlet_size)
```

```
Outlet_Type Grocery Store Supermarket Type1 Supermarket Type2  \
Outlet_Size         Small             Small            Medium

Outlet_Type Supermarket Type3
Outlet_Size            Medium
```

In [ ]:
```
miss_values = big_mart_data['Outlet_Size'].isnull()
```

In [ ]:
```
print(miss_values)
```

```
0       False
1       False
2       False
3        True
4       False
        ...
8518    False
8519     True
8520    False
8521    False
8522    False
Name: Outlet_Size, Length: 8523, dtype: bool
```

In [ ]:
```
big_mart_data.loc[miss_values, 'Outlet_Size'] = big_mart_data.loc[miss_values,'Outlet_Type'].apply(lambda x: mode_o
```

In [ ]:
```
# checking for missing values
big_mart_data.isnull().sum()
```

Out[ ]:
```
Item_Identifier              0
Item_Weight                  0
Item_Fat_Content             0
Item_Visibility              0
Item_Type                    0
Item_MRP                     0
Outlet_Identifier            0
Outlet_Establishment_Year    0
Outlet_Size                  0
Outlet_Location_Type         0
Outlet_Type                  0
Item_Outlet_Sales            0
dtype: int64
```

Data Analysis

In [ ]:
```
big_mart_data.describe()
```

Out[ ]:

	Item_Weight	Item_Visibility	Item_MRP	Outlet_Establishment_Year	Item_Outlet_Sales
count	8523.000000	8523.000000	8523.000000	8523.000000	8523.000000
mean	12.857645	0.066132	140.992782	1997.831867	2181.288914
std	4.226124	0.051598	62.275067	8.371760	1706.499616
min	4.555000	0.000000	31.290000	1985.000000	33.290000
25%	9.310000	0.026989	93.826500	1987.000000	834.247400
50%	12.857645	0.053931	143.012800	1999.000000	1794.331000
75%	16.000000	0.094585	185.643700	2004.000000	3101.296400
max	21.350000	0.328391	266.888400	2009.000000	13086.964800

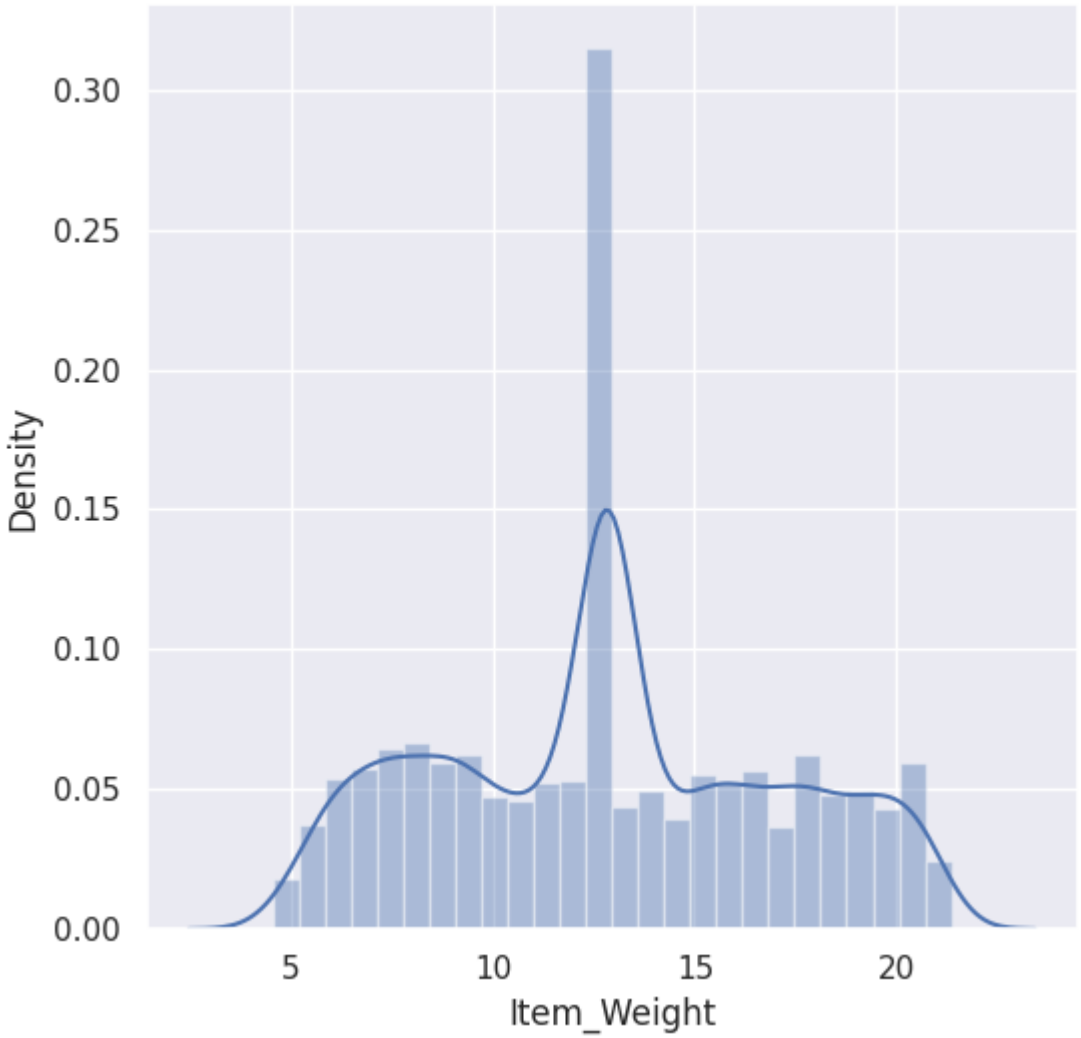
Numerical Features

In [ ]:
```
sns.set()
```

In [ ]:
```
# Item_Weight distribution
```

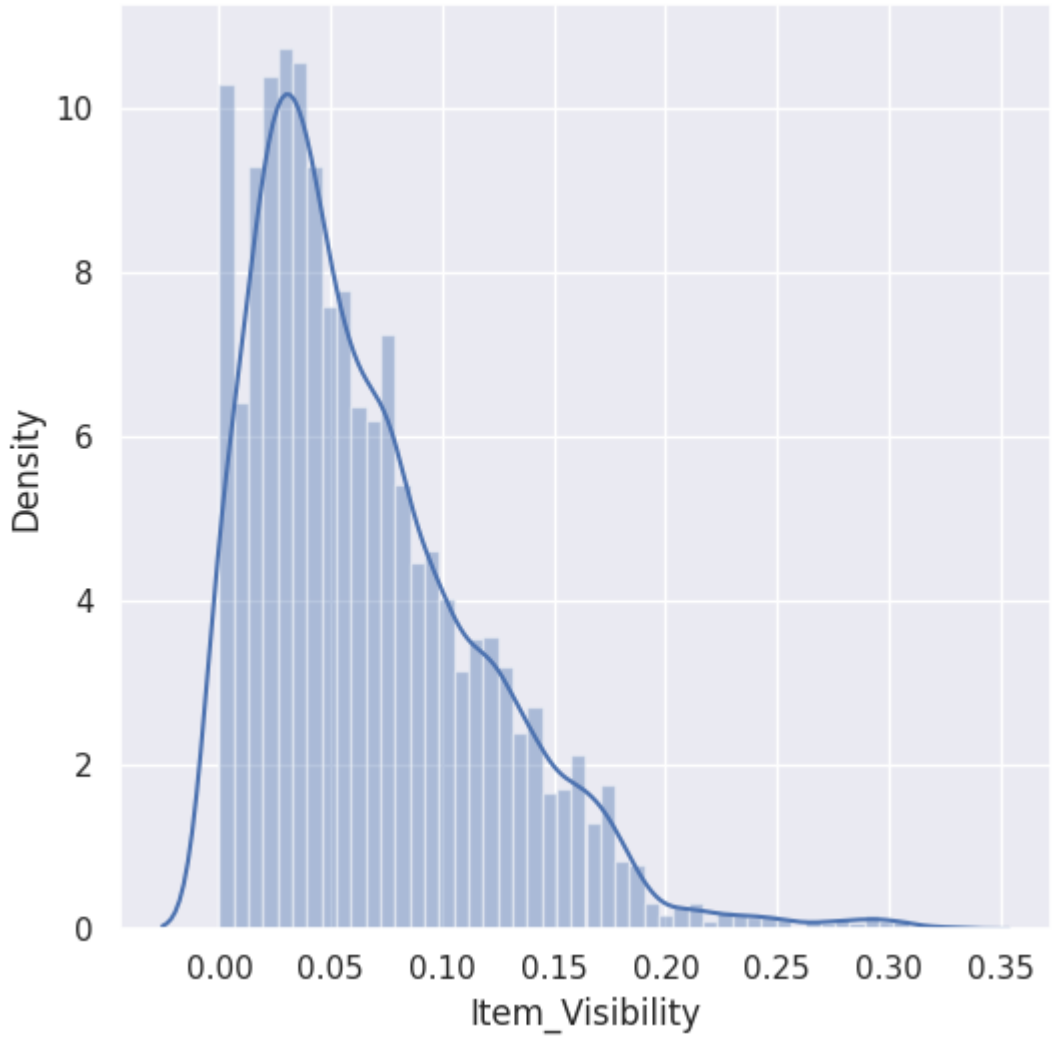
```
plt.figure(figsize=(6,6))
sns.distplot(big_mart_data['Item_Weight'])
plt.show()
```

```
/tmp/ipykernel_13701/1330319193.py:3: UserWarning:

`distplot` is a deprecated function and will be removed in seaborn v0.14.0.

Please adapt your code to use either `displot` (a figure-level function with
similar flexibility) or `histplot` (an axes-level function for histograms).

For a guide to updating your code to use the new functions, please see
https://gist.github.com/mwaskom/de44147ed2974457ad6372750bbe5751

  sns.distplot(big_mart_data['Item_Weight'])
```



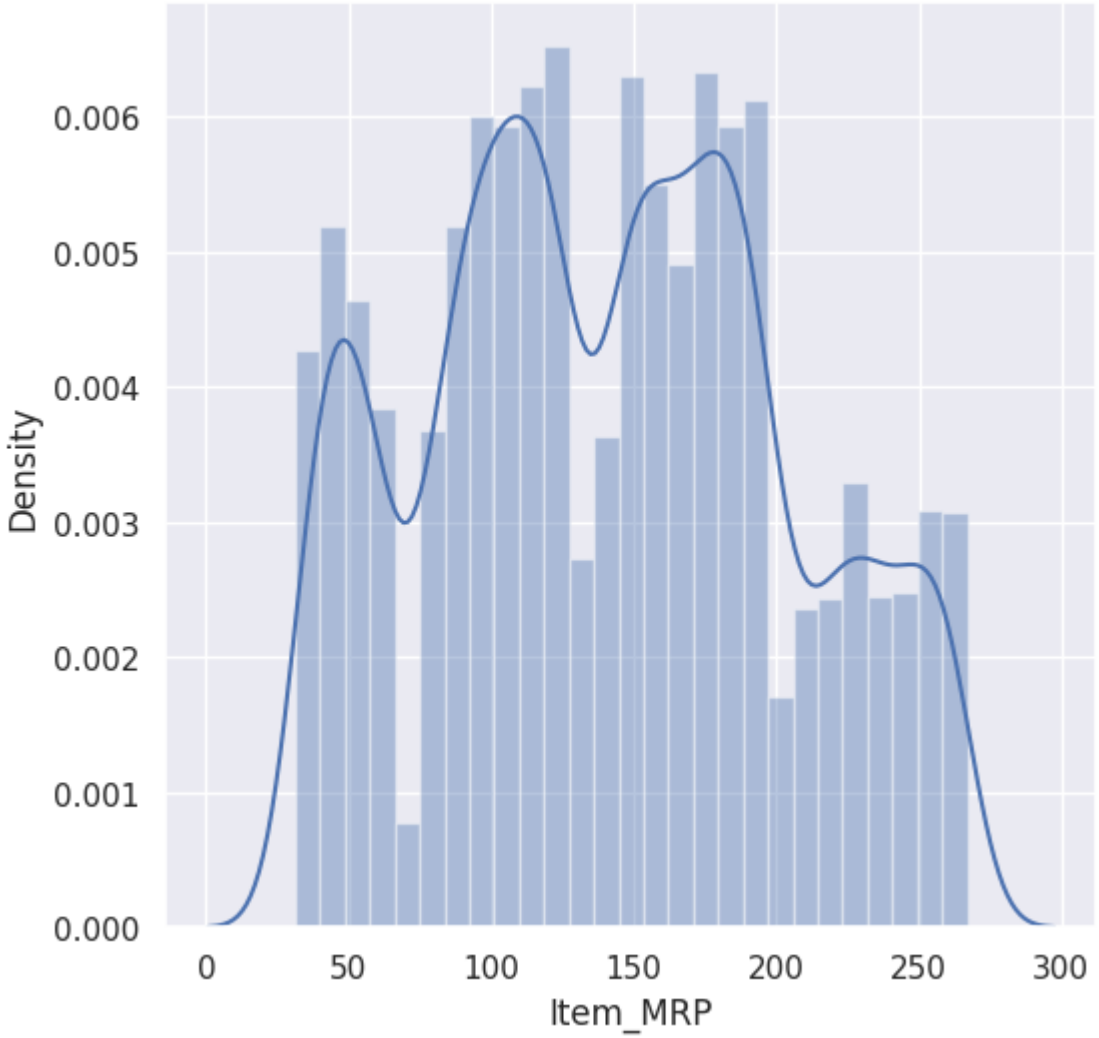
In [ ]:
```
# Item Visibility distribution
plt.figure(figsize=(6,6))
sns.distplot(big_mart_data['Item_Visibility'])
plt.show()
```

```
/tmp/ipykernel_13701/193435663.py:3: UserWarning:

`distplot` is a deprecated function and will be removed in seaborn v0.14.0.

Please adapt your code to use either `displot` (a figure-level function with
similar flexibility) or `histplot` (an axes-level function for histograms).

For a guide to updating your code to use the new functions, please see
https://gist.github.com/mwaskom/de44147ed2974457ad6372750bbe5751

  sns.distplot(big_mart_data['Item_Visibility'])
```



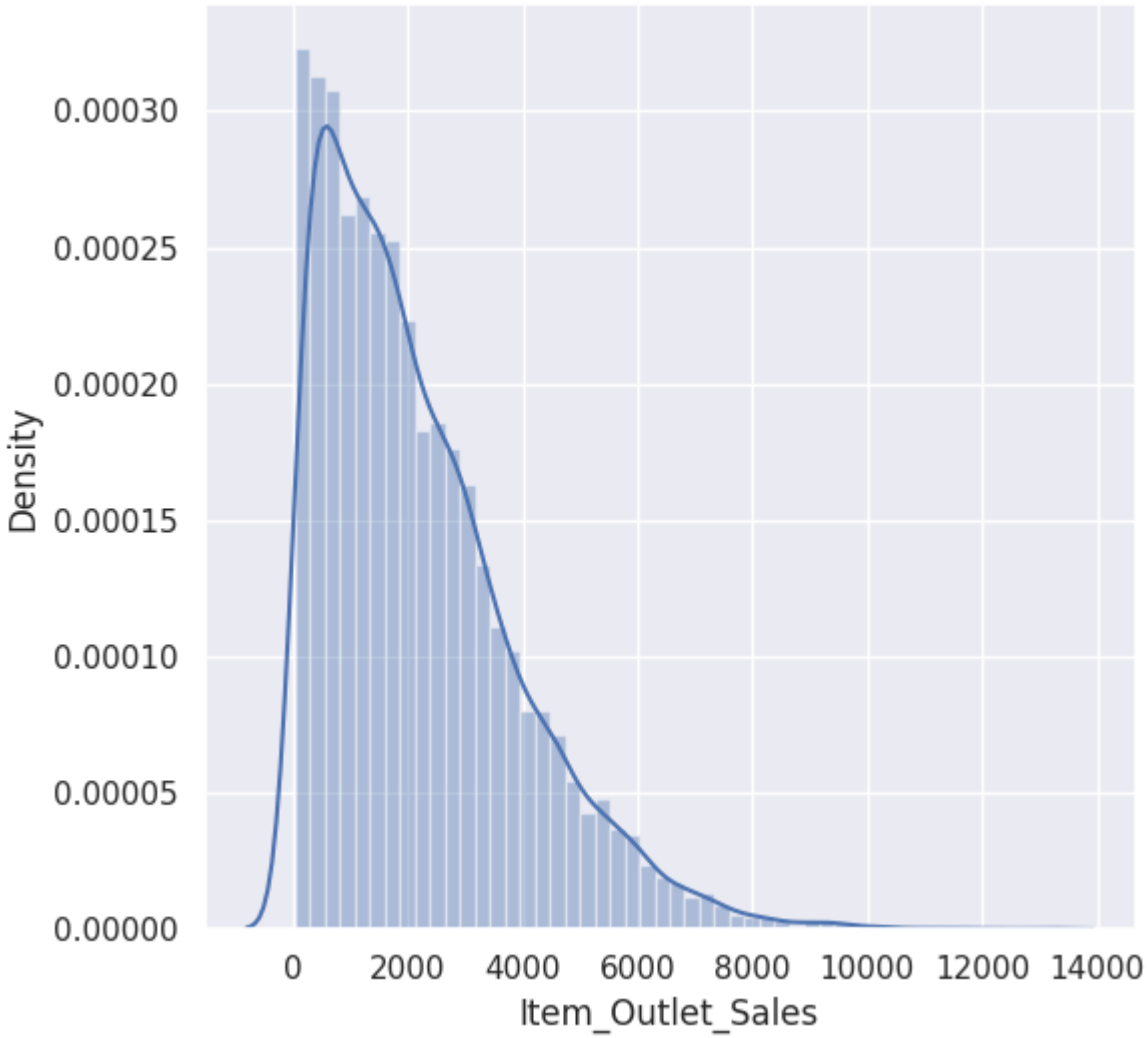
In [ ]:
```
# Item MRP distribution
plt.figure(figsize=(6,6))
sns.distplot(big_mart_data['Item_MRP'])
plt.show()
```

```
/tmp/ipykernel_13701/1610987680.py:3: UserWarning:

`distplot` is a deprecated function and will be removed in seaborn v0.14.0.

Please adapt your code to use either `displot` (a figure-level function with
similar flexibility) or `histplot` (an axes-level function for histograms).

For a guide to updating your code to use the new functions, please see
https://gist.github.com/mwaskom/de44147ed2974457ad6372750bbe5751

  sns.distplot(big_mart_data['Item_MRP'])
```

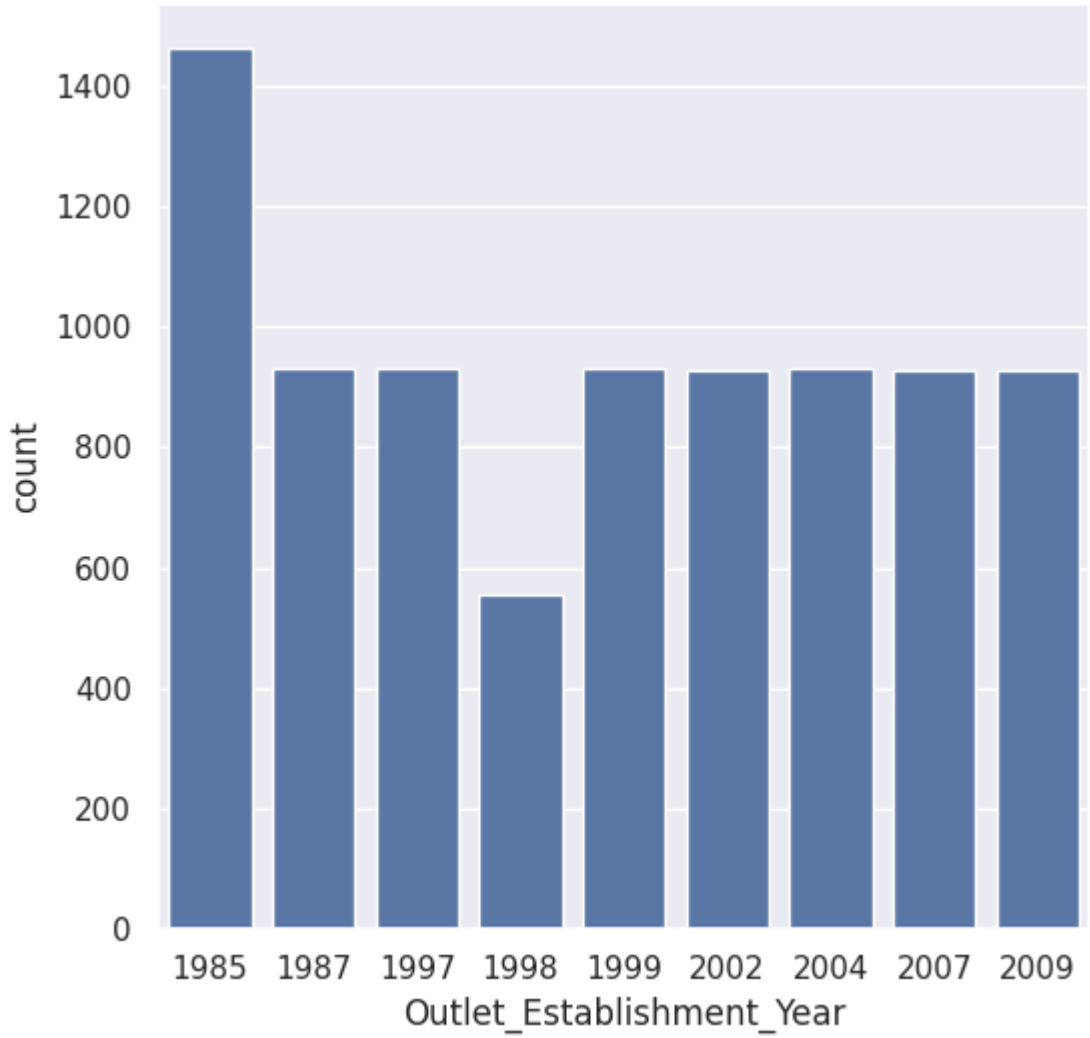


In [ ]:
```
# Item_Outlet_Sales distribution
plt.figure(figsize=(6,6))
sns.distplot(big_mart_data['Item_Outlet_Sales'])
plt.show()
```

```
/tmp/ipykernel_13701/1323853436.py:3: UserWarning:

`distplot` is a deprecated function and will be removed in seaborn v0.14.0.

Please adapt your code to use either `displot` (a figure-level function with
similar flexibility) or `histplot` (an axes-level function for histograms).

For a guide to updating your code to use the new functions, please see
https://gist.github.com/mwaskom/de44147ed2974457ad6372750bbe5751

  sns.distplot(big_mart_data['Item_Outlet_Sales'])
```

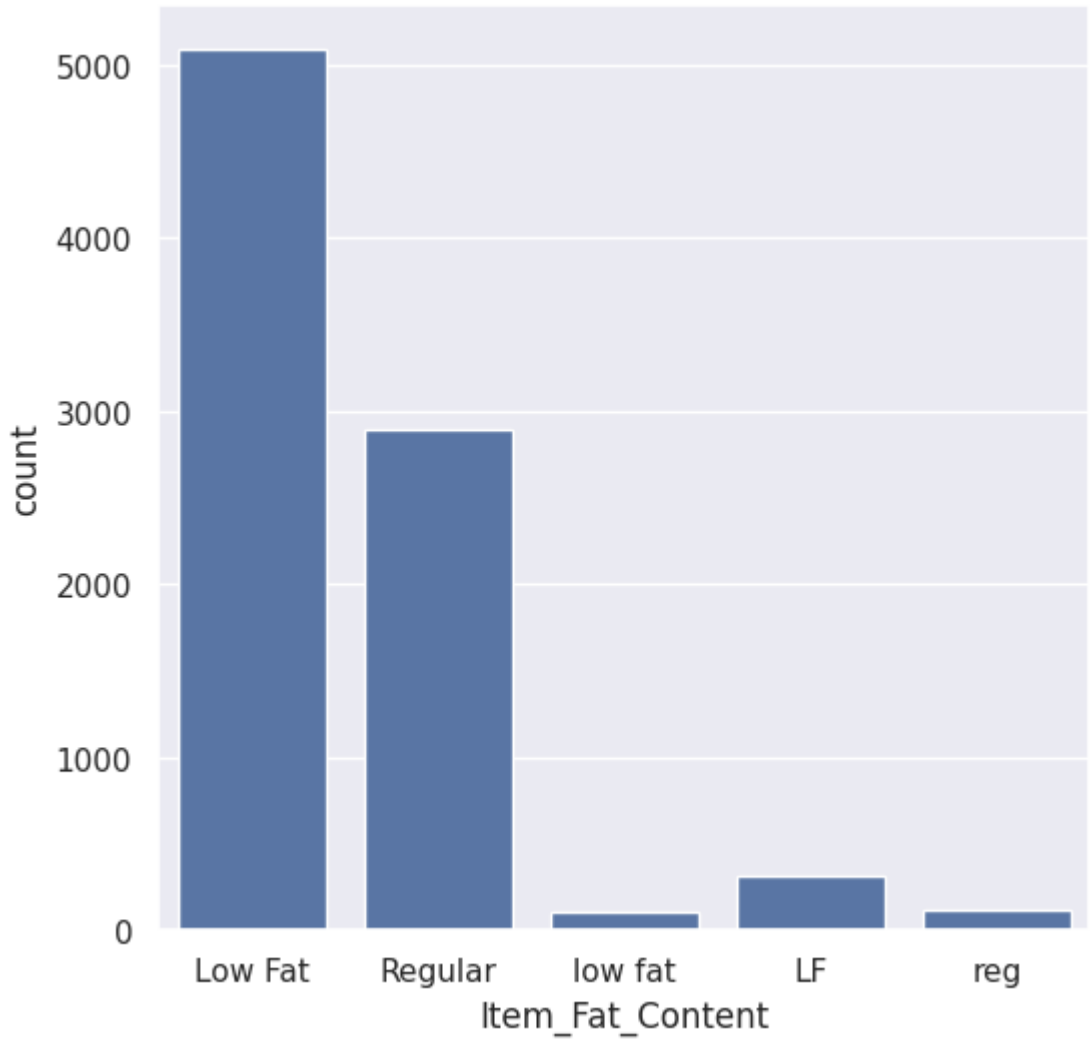


In [ ]:
```
# Outlet_Establishment_Year column
plt.figure(figsize=(6,6))
sns.countplot(x='Outlet_Establishment_Year', data=big_mart_data)
plt.show()
```

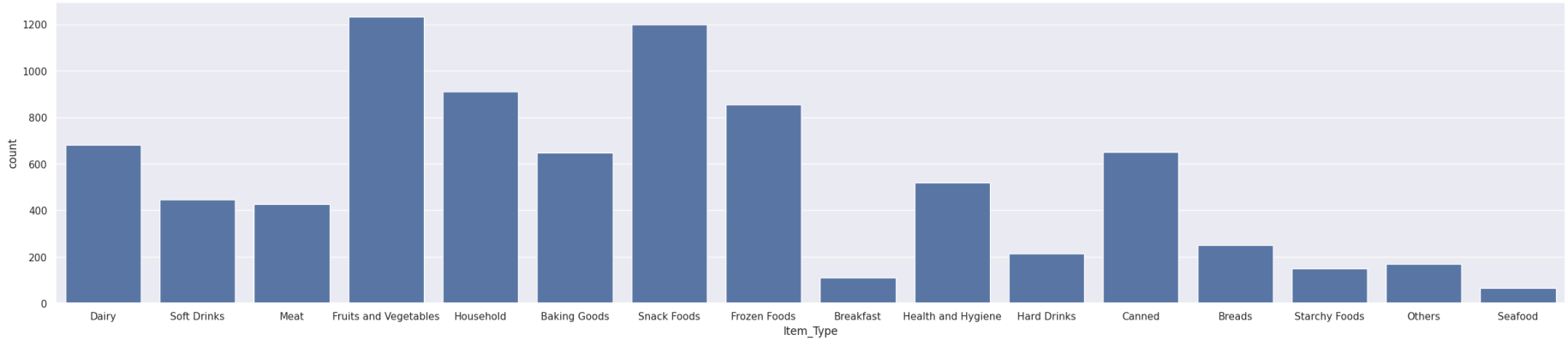


Categorical Features

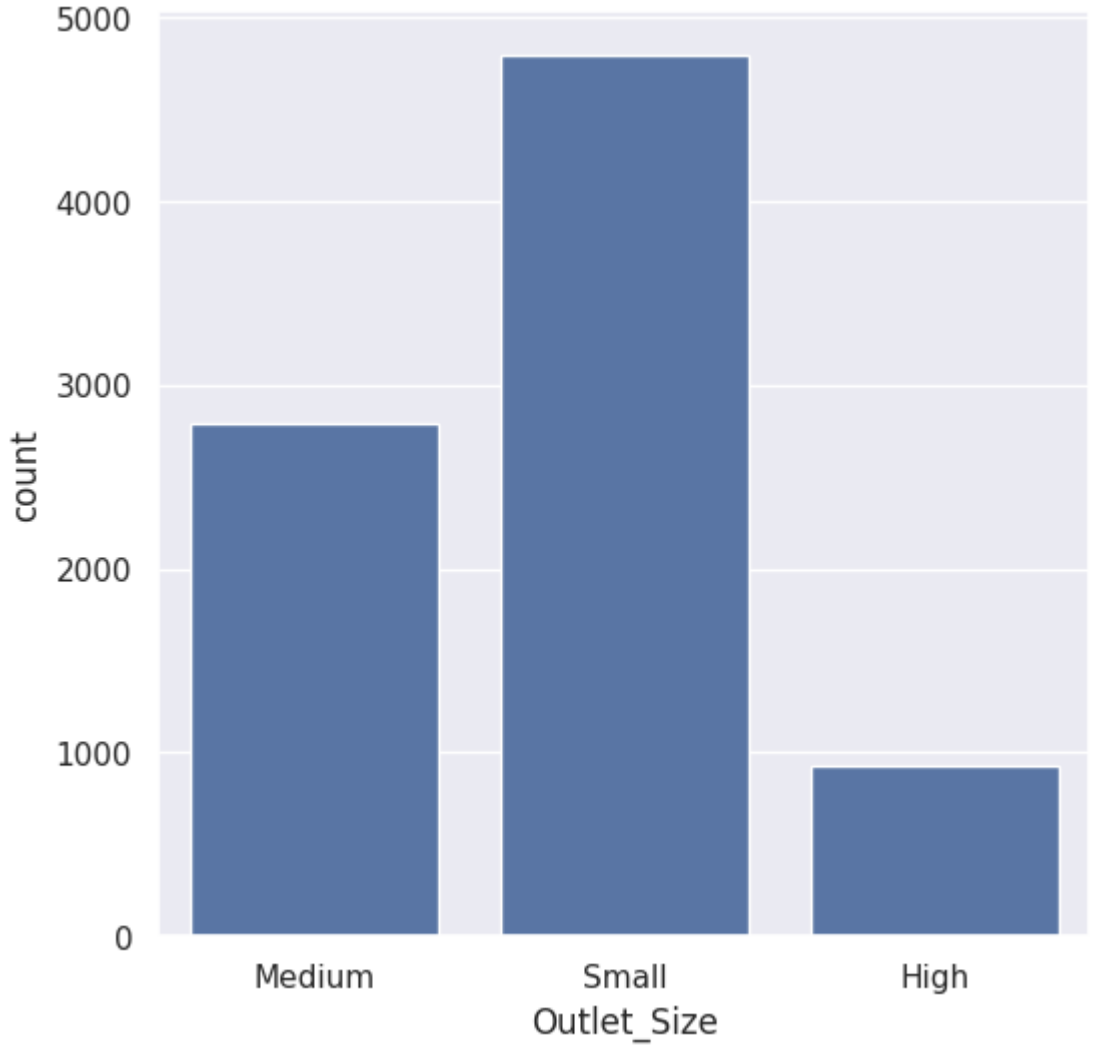
In [ ]:
```
# Item_Fat_Content column
plt.figure(figsize=(6,6))
sns.countplot(x='Item_Fat_Content', data=big_mart_data)
plt.show()
```



In [ ]:
```
# Item_Type column
plt.figure(figsize=(30,6))
sns.countplot(x='Item_Type', data=big_mart_data)
plt.show()
```



In [ ]:
```
# Outlet_Size column
plt.figure(figsize=(6,6))
sns.countplot(x='Outlet_Size', data=big_mart_data)
plt.show()
```



Data Pre-Processing

In [ ]:
```
big_mart_data.head()
```

Out[ ]:

	Item_Identifier	Item_Weight	Item_Fat_Content	Item_Visibility	Item_Type	Item_MRP	Outlet_Identifier	Outlet_Establishment_Year
0	FDA15	9.30	Low Fat	0.016047	Dairy	249.8092	OUT049	1999
1	DRC01	5.92	Regular	0.019278	Soft Drinks	48.2692	OUT018	2009
2	FDN15	17.50	Low Fat	0.016760	Meat	141.6180	OUT049	1999
3	FDX07	19.20	Regular	0.000000	Fruits and Vegetables	182.0950	OUT010	1998
4	NCD19	8.93	Low Fat	0.000000	Household	53.8614	OUT013	1987

In [ ]:
```
big_mart_data['Item_Fat_Content'].value_counts()
```

Out[ ]:
```
Item_Fat_Content
Low Fat    5089
Regular    2889
LF          316
reg         117
low fat     112
Name: count, dtype: int64
```

In [ ]:
```
big_mart_data.replace({'Item_Fat_Content': {'low fat':'Low Fat','LF':'Low Fat', 'reg':'Regular'}}, inplace=True)
```

In [ ]:
```
big_mart_data['Item_Fat_Content'].value_counts()
```

Out[ ]:
```
Item_Fat_Content
Low Fat    5517
Regular    3006
Name: count, dtype: int64
```

Label Encoding

In [ ]:
```
encoder = LabelEncoder()
```

In [ ]:
```
big_mart_data['Item_Identifier'] = encoder.fit_transform(big_mart_data['Item_Identifier'])

big_mart_data['Item_Fat_Content'] = encoder.fit_transform(big_mart_data['Item_Fat_Content'])

big_mart_data['Item_Type'] = encoder.fit_transform(big_mart_data['Item_Type'])

big_mart_data['Outlet_Identifier'] = encoder.fit_transform(big_mart_data['Outlet_Identifier'])

big_mart_data['Outlet_Size'] = encoder.fit_transform(big_mart_data['Outlet_Size'])

big_mart_data['Outlet_Location_Type'] = encoder.fit_transform(big_mart_data['Outlet_Location_Type'])

big_mart_data['Outlet_Type'] = encoder.fit_transform(big_mart_data['Outlet_Type'])
```

In [ ]:
```
big_mart_data.head()
```

Out[ ]:

	Item_Identifier	Item_Weight	Item_Fat_Content	Item_Visibility	Item_Type	Item_MRP	Outlet_Identifier	Outlet_Establishment_Year
0	156	9.30	0	0.016047	4	249.8092	9	1999
1	8	5.92	1	0.019278	14	48.2692	3	2009
2	662	17.50	0	0.016760	10	141.6180	9	1999
3	1121	19.20	1	0.000000	6	182.0950	0	1998
4	1297	8.93	0	0.000000	9	53.8614	1	1987

Splitting features and Target

In [ ]:
```
X = big_mart_data.drop(columns='Item_Outlet_Sales', axis=1)
Y = big_mart_data['Item_Outlet_Sales']
```

In [ ]:
```
print(X)
```

	Item_Identifier	Item_Weight	Item_Fat_Content	Item_Visibility	\
0	156	9.300	0	0.016047	
1	8	5.920	1	0.019278	
2	662	17.500	0	0.016760	
3	1121	19.200	1	0.000000	
4	1297	8.930	0	0.000000	
...	...	...	...	...	
8518	370	6.865	0	0.056783	
8519	897	8.380	1	0.046982	
8520	1357	10.600	0	0.035186	
8521	681	7.210	1	0.145221	
8522	50	14.800	0	0.044878	

	Item_Type	Item_MRP	Outlet_Identifier	Outlet_Establishment_Year	\
0	4	249.8092	9	1999	
1	14	48.2692	3	2009	
2	10	141.6180	9	1999	
3	6	182.0950	0	1998	
4	9	53.8614	1	1987	
...	...	...	...	...	
8518	13	214.5218	1	1987	
8519	0	108.1570	7	2002	
8520	8	85.1224	6	2004	
8521	13	103.1332	3	2009	
8522	14	75.4670	8	1997	

	Outlet_Size	Outlet_Location_Type	Outlet_Type
0	1	0	1
1	1	2	2
2	1	0	1
3	2	2	0
4	0	2	1
...	...	...	...
8518	0	2	1
8519	2	1	1
8520	2	1	1
8521	1	2	2
8522	2	0	1

[8523 rows x 11 columns]

In [ ]:
```
print(Y)
```

```
0       3735.1380
1        443.4228
2       2097.2700
3        732.3800
4        994.7052
          ...
8518    2778.3834
8519     549.2850
8520    1193.1136
8521    1845.5976
8522     765.6700
Name: Item_Outlet_Sales, Length: 8523, dtype: float64
```

Splitting the data into Training data & Testing Data

In [ ]:
```
X_train, X_test, Y_train, Y_test = train_test_split(X, Y, test_size=0.2, random_state=2)
```

In [ ]:
```
print(X.shape, X_train.shape, X_test.shape)
```

```
(8523, 11) (6818, 11) (1705, 11)
```

Machine Learning Model Training

XGBoost Regressor

In [ ]:
```
regressor = XGBRegressor()
```

In [ ]:
```
regressor.fit(X_train, Y_train)
```

Out[ ]:
```
XGBRegressor(base_score=None, booster=None, callbacks=None,
             colsample_bylevel=None, colsample_bynode=None,
             colsample_bytree=None, device=None, early_stopping_rounds=None,
             enable_categorical=False, eval_metric=None, feature_types=None,
             gamma=None, grow_policy=None, importance_type=None,
             interaction_constraints=None, learning_rate=None, max_bin=None,
             max_cat_threshold=None, max_cat_to_onehot=None,
             max_delta_step=None, max_depth=None, max_leaves=None,
             min_child_weight=None, missing=nan, monotone_constraints=None,
```

Evaluation

In [ ]:
```
# prediction on training data
training_data_prediction = regressor.predict(X_train)
```

In [ ]:
```
# R squared Value
r2_train = metrics.r2_score(Y_train, training_data_prediction)
```

In [ ]:
```
print('R Squared value = ', r2_train)
```

```
R Squared value =  0.8762174618111388
```

In [ ]:
```
# prediction on test data
test_data_prediction = regressor.predict(X_test)
```

In [ ]:
```
# R squared Value
r2_test = metrics.r2_score(Y_test, test_data_prediction)
```

In [ ]:
```
print('R Squared value = ', r2_test)
```

```
R Squared value =  0.5017253991620692
```