21f1000886-notebook-t32023

January 7, 2024

[1]:
```python
# This Python 3 environment comes with many helpful analytics libraries␣
↪installed
# It is defined by the kaggle/python Docker image: https://github.com/kaggle/
↪docker-python
# For example, here's several helpful packages to load

import numpy as np # linear algebra
import pandas as pd # data processing, CSV file I/O (e.g. pd.read_csv)

# Input data files are available in the read-only "../input/" directory
# For example, running this (by clicking run or pressing Shift+Enter) will list␣
↪all files under the input directory

import os
for dirname, _, filenames in os.walk('/kaggle/input'):
    for filename in filenames:
        print(os.path.join(dirname, filename))

# You can write up to 20GB to the current directory (/kaggle/working/) that␣
↪gets preserved as output when you create a version using "Save & Run All"
# You can also write temporary files to /kaggle/temp/, but they won't be saved␣
↪outside of the current session
```

```
/kaggle/input/taxi-fare-guru-total-amount-prediction-challenge/sample.csv.csv
/kaggle/input/taxi-fare-guru-total-amount-prediction-challenge/train.csv
/kaggle/input/taxi-fare-guru-total-amount-prediction-challenge/test.csv
```

1 About Project

- **Name** : Taxi Fare Guru: Total Amount Prediction Challenge
- **Aim** : To build the most accurate model for predicting the `total_amount` paid by travelers for taxi rides.
- **Type** : Regression

2 Features & their significance

Columns	Significance
'VendorID'	An identifier for taxi vendors.
'tpep_pickup_datetime'	Timestamp indicating pickup time.
'tpep_dropoff_datetime'	Timestamp indicating dropoff time.
'passenger_count'	The number of passengers during the ride.
'trip_distance'	The distance travelled during the trip.
'RatecodeID'	Rate code for the ride (Set of rules which define how much they pay for what facilities).
'store_and_fwd_flag'	A flag indicating whether the trip data was stored and forwarded.
'PULocationID'	Pickup location identifier.
'DOLocationID'	Drop off location identifier.
'payment_type'	Payment type used for ride.
'extra'	Extra charge for something.
'tip_amount'	Tip amount given to vendor by passengers.
'tolls_amount'	Amount paid on tolls during ride.
'improvement_surcharge'	Extra amount for any kind of improvement.
'total_amount' (Target variable)	Total amount for ride.
'congestion_surcharge'	Extra amount for driving a vehicle during charging hours.
'Airport_fee'	Airport Fee.

3 Dummy Regressor - For Sample Submission

[2]:
```
# Loading data
dummy_train_data = pd.read_csv("/kaggle/input/
 ↪taxi-fare-guru-total-amount-prediction-challenge/train.csv")
dummy_test_data = pd.read_csv("/kaggle/input/
 ↪taxi-fare-guru-total-amount-prediction-challenge/test.csv")
```

[3]:
```
# Sample train data
dummy_train_data.head()
```

[3]:
```
   VendorID tpep_pickup_datetime tpep_dropoff_datetime  passenger_count  \
0         1   2023-06-28 17:20:21   2023-06-28 16:34:45              1.0
1         0   2023-06-29 23:05:01   2023-06-29 22:01:35              1.0
2         1   2023-06-30 10:19:31   2023-06-30 11:13:10              1.0
3         0   2023-06-29 13:23:09   2023-06-29 14:20:01              1.0
4         1   2023-06-29 22:03:32   2023-06-29 22:22:22              3.0

   trip_distance  RatecodeID store_and_fwd_flag  PULocationID  DOLocationID  \
0           2.14         1.0                  N           120             9
1           2.70         1.0                  N            15           215
2           1.15         1.0                  N           167           223
3           0.40         1.0                  N           128           239
```

```
4          1.10         1.0                  N           203            52

  payment_type  extra  tip_amount  tolls_amount  improvement_surcharge  \
0  Credit Card    2.5    7.165589           0.0                    1.0
1  Credit Card    3.5    6.067401           0.0                    1.0
2  Credit Card    0.0    4.111547           0.0                    1.0
3  Credit Card    2.5    6.411079           0.0                    1.0
4  Credit Card    1.0    4.769377           0.0                    1.0

   total_amount  congestion_surcharge  Airport_fee
0         20.64                   2.5          0.0
1         25.55                   2.5          0.0
2         17.64                   2.5          0.0
3         12.80                   2.5          0.0
4         18.00                   2.5          0.0
```

[4]:
```
# train data columns
dummy_train_data.columns
```

[4]:
```
Index(['VendorID', 'tpep_pickup_datetime', 'tpep_dropoff_datetime',
       'passenger_count', 'trip_distance', 'RatecodeID', 'store_and_fwd_flag',
       'PULocationID', 'DOLocationID', 'payment_type', 'extra', 'tip_amount',
       'tolls_amount', 'improvement_surcharge', 'total_amount',
       'congestion_surcharge', 'Airport_fee'],
      dtype='object')
```

[5]:
```
# Splitting features and target variables.
features = ['VendorID', 'tpep_pickup_datetime', 'tpep_dropoff_datetime',
       'passenger_count', 'trip_distance', 'RatecodeID', 'store_and_fwd_flag',
       'PULocationID', 'DOLocationID', 'payment_type', 'extra', 'tip_amount',
       'tolls_amount', 'improvement_surcharge',
       'congestion_surcharge', 'Airport_fee']
target = ['total_amount']
```

[6]:
```
# Applying DummyRegressor Model
'''
from sklearn.dummy import DummyRegressor
dummy_rlf = DummyRegressor(strategy="mean")
dummy_rlf.fit(dummy_train_data[features], dummy_train_data[target])
dummy_prediction = dummy_rlf.predict(dummy_test_data)
'''
```

[6]:
```
'\nfrom sklearn.dummy import DummyRegressor\ndummy_rlf =
DummyRegressor(strategy="mean")\ndummy_rlf.fit(dummy_train_data[features],
dummy_train_data[target])\ndummy_prediction =
dummy_rlf.predict(dummy_test_data)\n'
```

[7]:
```
# Predicting and submitting
"""
dummy_len = len(dummy_prediction)
id = np.array([ i for i in range(1,dummy_len+1)])
dummy_sample = pd.DataFrame({"ID" : id, "total_amount" : dummy_prediction})
dummy_sample.to_csv("submission.csv", index=False)
#dummy_submission = pd.read_csv("/kaggle/working/submission.csv")
#dummy_submission.head()
"""
```

[7]:
```
'\ndummy_len = len(dummy_prediction)\nid = np.array([ i for i in
range(1,dummy_len+1)])\ndummy_sample = pd.DataFrame({"ID" : id, "total_amount" :
dummy_prediction})\ndummy_sample.to_csv("submission.csv",
index=False)\n#dummy_submission =
pd.read_csv("/kaggle/working/submission.csv")\n#dummy_submission.head()\n'
```

4 Imports

[8]:
```
import matplotlib.pyplot as plt
import seaborn as sns
from sklearn.compose import ColumnTransformer
from sklearn.impute import SimpleImputer
from sklearn.preprocessing import OneHotEncoder, LabelEncoder, StandardScaler,␣
↪MinMaxScaler, RobustScaler
from sklearn.pipeline import Pipeline,make_pipeline
from sklearn.model_selection import train_test_split, ShuffleSplit,␣
↪cross_validate, cross_val_score, GridSearchCV,RandomizedSearchCV
from sklearn.dummy import DummyRegressor
from sklearn.linear_model import LinearRegression
from sklearn.neighbors import KNeighborsRegressor
from sklearn.svm import SVR
from sklearn.tree import DecisionTreeRegressor
from sklearn import tree
from sklearn.tree import export_text
from sklearn.ensemble import BaggingRegressor,␣
↪RandomForestRegressor,GradientBoostingRegressor,AdaBoostRegressor
from sklearn.neural_network import MLPRegressor
from sklearn.metrics import r2_score,mean_absolute_error
```

5 Used Important Functions

[9]:
```
# Function 01 : For plotting Missing values
def plot_missing_values(train_data):
    """ For each column with missing values plot proportion that is missing."""
    data = [(col, train_data[col].isnull().sum() / len(train_data))
```

```python
            for col in train_data.columns if train_data[col].isnull().sum() > 0]
    col_names = ['columns', 'percent_missing']
    missing_data = pd.DataFrame(data, columns=col_names).
 ↪sort_values('percent_missing')
    missing_data.plot(kind='barh', x='columns', y='percent_missing');
    plt.title('Percent of missing values in columns');


# Function 02 : For applying label encoding on multiple columns.
class MultiColumnLabelEncoder:
    def __init__(self,columns = None):
        self.columns = columns

    def fit(self,X,y=None):
        return self # not relevant here

    def transform(self,X):
        '''
        Transforming columns of X specified in self.columns using
        LabelEncoder(). If no columns specified, transforms all
        columns in X.
        '''
        output = X.copy()
        if self.columns is not None:
            for col in self.columns:
                output[col] = LabelEncoder().fit_transform(output[col])
        else:
            for colname,col in output.iteritems():
                output[colname] = LabelEncoder().fit_transform(col)
        return output

    def fit_transform(self,X,y=None):
        return self.fit(X,y).transform(X)

# Function 03 : For plotting Actual vs Predicted
def act_vs_predict(act,pre):
    plt.scatter(act,pre,c='#BDB76B')
    plt.plot(act,act,'g-')
    plt.legend(['Predicted','Actual'])
    font1 = {'family':'serif','color':'black','size':20}
    font2 = {'family':'serif','color':'darkred','size':15}
    plt.title("Actual vs Predicted", fontdict=font1)
    plt.xlabel('Actual total_amount', fontdict=font2)
    plt.ylabel('Predicted total_amount', fontdict=font2)


# Function 04 : For determining what time of the day the ride was taken
```

```python
def time_of_day(x):
    if x in range(6,12):
        return ('Morning')
    elif x in range(12,16):
        return ('Afternoon')
    elif x in range(16,22):
        return ('Evening')
    else:
        return ('Late night')

# Function 05 : For Detecting Outliers using the Inter Quantile Range(IQR)
def detect_outliers_iqr(data):
    outliers = []
    data = sorted(data)
    q1 = np.percentile(data, 25)
    q3 = np.percentile(data, 75)
    # print(q1, q3)
    IQR = q3-q1
    lwr_bound = q1-(1.5*IQR)
    upr_bound = q3+(1.5*IQR)
    # print(lwr_bound, upr_bound)
    for i in data:
        if (i<lwr_bound or i>upr_bound):
            outliers.append(i)
    return outliers# Driver code
```

6 Data Loading, Visualization and Preprocessing

`sample.csv.csv` : /kaggle/input/taxi-fare-guru-total-amount-prediction-challenge/sample.csv.csv

`train.csv` : /kaggle/input/taxi-fare-guru-total-amount-prediction-challenge/train.csv

`test.csv` : /kaggle/input/taxi-fare-guru-total-amount-prediction-challenge/test.csv

6.1 Data Loading

[10]:
```python
train_data = pd.read_csv("/kaggle/input/
 ↪taxi-fare-guru-total-amount-prediction-challenge/train.csv")
test_data = pd.read_csv("/kaggle/input/
 ↪taxi-fare-guru-total-amount-prediction-challenge/test.csv")
sample_data = pd.read_csv("/kaggle/input/
 ↪taxi-fare-guru-total-amount-prediction-challenge/sample.csv.csv")
```

[11]:
```python
print("Shape of `train.csv` file :",train_data.shape)
```

```
Shape of `train.csv` file : (175000, 17)
```

[12]:
```
print("Sample train data:")
train_data.head()
```

```
Sample train data:
```

[12]:
```
   VendorID tpep_pickup_datetime tpep_dropoff_datetime  passenger_count  \
0         1  2023-06-28 17:20:21   2023-06-28 16:34:45              1.0
1         0  2023-06-29 23:05:01   2023-06-29 22:01:35              1.0
2         1  2023-06-30 10:19:31   2023-06-30 11:13:10              1.0
3         0  2023-06-29 13:23:09   2023-06-29 14:20:01              1.0
4         1  2023-06-29 22:03:32   2023-06-29 22:22:22              3.0

   trip_distance  RatecodeID store_and_fwd_flag  PULocationID  DOLocationID  \
0           2.14         1.0                  N           120             9
1           2.70         1.0                  N            15           215
2           1.15         1.0                  N           167           223
3           0.40         1.0                  N           128           239
4           1.10         1.0                  N           203            52

  payment_type  extra  tip_amount  tolls_amount  improvement_surcharge  \
0  Credit Card    2.5    7.165589           0.0                    1.0
1  Credit Card    3.5    6.067401           0.0                    1.0
2  Credit Card    0.0    4.111547           0.0                    1.0
3  Credit Card    2.5    6.411079           0.0                    1.0
4  Credit Card    1.0    4.769377           0.0                    1.0

   total_amount  congestion_surcharge  Airport_fee
0         20.64                   2.5          0.0
1         25.55                   2.5          0.0
2         17.64                   2.5          0.0
3         12.80                   2.5          0.0
4         18.00                   2.5          0.0
```

[13]:
```
print("Shape of 'test.csv` file :",test_data.shape)
```

```
Shape of 'test.csv` file : (50000, 16)
```

[14]:
```
print("Sample test data:")
test_data.head()
```

```
Sample test data:
```

[14]:
```
   VendorID tpep_pickup_datetime tpep_dropoff_datetime  passenger_count  \
0         1  2023-06-29 00:21:20   2023-06-29 00:25:20              1.0
1         1  2023-06-30 17:44:43   2023-06-30 17:53:13              1.0
2         1  2023-06-29 18:17:04   2023-06-29 19:23:48              1.0
3         0  2023-06-30 21:33:53   2023-06-30 21:46:20              1.0
4         1  2023-06-29 14:53:54   2023-06-29 15:22:17              1.0
```

```
   trip_distance  RatecodeID store_and_fwd_flag  PULocationID  DOLocationID  \
0           4.95         1.0                  N            20             3
1           2.10         1.0                  N             9            81
2           0.95         1.0                  N            92            90
3           0.80         1.0                  N            19           102
4           4.01         1.0                  N           131           229

  payment_type  extra  tip_amount  tolls_amount  improvement_surcharge  \
0  Credit Card    1.0    6.067612           0.0                    1.0
1  Credit Card    2.5    6.191269           0.0                    1.0
2         Cash    2.5    3.983872           0.0                    1.0
3  Credit Card    3.5    6.839341           0.0                    1.0
4         Cash    0.0    1.468943           0.0                    1.0

   congestion_surcharge  Airport_fee
0                   2.5          0.0
1                   2.5          0.0
2                   2.5          0.0
3                   2.5          0.0
4                   0.0          0.0
```

[15]:
```
print("Shape of 'sample.csv.csv' file :",sample_data.shape)
```

```
Shape of 'sample.csv.csv' file : (1000, 2)
```

[16]:
```
print("Sample `submission.csv` file:")
sample_data.head()
```

```
Sample `submission.csv` file:
```

[16]:
```
   ID  total_amount
0   1     24.456348
1   2     24.374058
2   3     19.878154
3   4     25.015569
4   5     22.252489
```

- **Copying original data and storing it for future references.**

[17]:
```
or_train_data = train_data.copy()
or_test_data = test_data.copy()
```

6.2 Data Visualization & EDA-Exploratory data analysis

6.2.1 1. Overview

[18]:
```
#shape
train_data.shape
```

[18]:
```
(175000, 17)
```

[19]:
```
#info
train_data.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 175000 entries, 0 to 174999
Data columns (total 17 columns):
 #   Column                 Non-Null Count   Dtype
---  ------                 --------------   -----
 0   VendorID               175000 non-null  int64
 1   tpep_pickup_datetime   175000 non-null  object
 2   tpep_dropoff_datetime  175000 non-null  object
 3   passenger_count        168923 non-null  float64
 4   trip_distance          175000 non-null  float64
 5   RatecodeID             168923 non-null  float64
 6   store_and_fwd_flag     168923 non-null  object
 7   PULocationID           175000 non-null  int64
 8   DOLocationID           175000 non-null  int64
 9   payment_type           175000 non-null  object
 10  extra                  175000 non-null  float64
 11  tip_amount             175000 non-null  float64
 12  tolls_amount           175000 non-null  float64
 13  improvement_surcharge  175000 non-null  float64
 14  total_amount           175000 non-null  float64
 15  congestion_surcharge   168923 non-null  float64
 16  Airport_fee            168923 non-null  float64
dtypes: float64(10), int64(3), object(4)
memory usage: 22.7+ MB
```

[20]:
```
# Numerical attribute statistics
train_data.describe()
```

[20]:
```
            VendorID  passenger_count  trip_distance     RatecodeID  \
count  175000.000000    168923.000000  175000.000000  168923.000000
mean        0.728377         1.357678       5.145930       1.518307
std         0.445606         0.891283     394.971052       6.514678
min         0.000000         0.000000       0.000000       1.000000
25%         0.000000         1.000000       1.080000       1.000000
50%         1.000000         1.000000       1.840000       1.000000
75%         1.000000         1.000000       3.610000       1.000000
```

```
max          2.000000         9.000000  135182.060000      99.000000

         PULocationID   DOLocationID          extra     tip_amount  \
count   175000.000000  175000.000000  175000.000000  175000.000000
mean       132.710349     132.701429       1.932143       6.127497
std         76.148799      76.192493       1.948497       4.610834
min          1.000000       1.000000      -7.500000       0.000079
25%         67.000000      67.000000       0.000000       3.473321
50%        133.000000     133.000000       1.000000       5.286217
75%        199.000000     199.000000       2.500000       7.502746
max        264.000000     264.000000      11.750000     484.876151

         tolls_amount  improvement_surcharge   total_amount  \
count   175000.000000          175000.000000  175000.000000
mean         0.646816               0.979689      29.633901
std          2.328274               0.198775      25.425206
min        -29.300000              -1.000000    -576.750000
25%          0.000000               1.000000      16.300000
50%          0.000000               1.000000      21.450000
75%          0.000000               1.000000      31.800000
max         80.000000               1.000000     587.250000

        congestion_surcharge    Airport_fee
count          168923.000000  168923.000000
mean                2.246971       0.158825
std                 0.819216       0.511968
min                -2.500000      -1.750000
25%                 2.500000       0.000000
50%                 2.500000       0.000000
75%                 2.500000       0.000000
max                 2.500000       1.750000
```

[21]:
```
# Categorical attribute statistics
train_data.describe(include='object')
```

[21]:
```
        tpep_pickup_datetime tpep_dropoff_datetime store_and_fwd_flag  \
count                 175000                175000             168923
unique                109877                109713                  2
top      2023-06-28 18:11:16   2023-06-29 19:08:22                  N
freq                       8                    10             167729

        payment_type
count         175000
unique             5
top      Credit Card
freq          135257
```

Observation

- There are 175000 rows (Observations) and 17 columns (variables).
- There are 10 columns having type `float64`, 3 columns having type `int64` and 4 columns having type `object`.
- Statistics for numerical attributes can be seen above.
- `store_and_fwd_flag` has two unique values. (most_frequent = 'N') i.e 'N' (No) & 'Y' (Yes)
- `payment_type` has 5 unique values. (most_frequent = 'Credit Card')

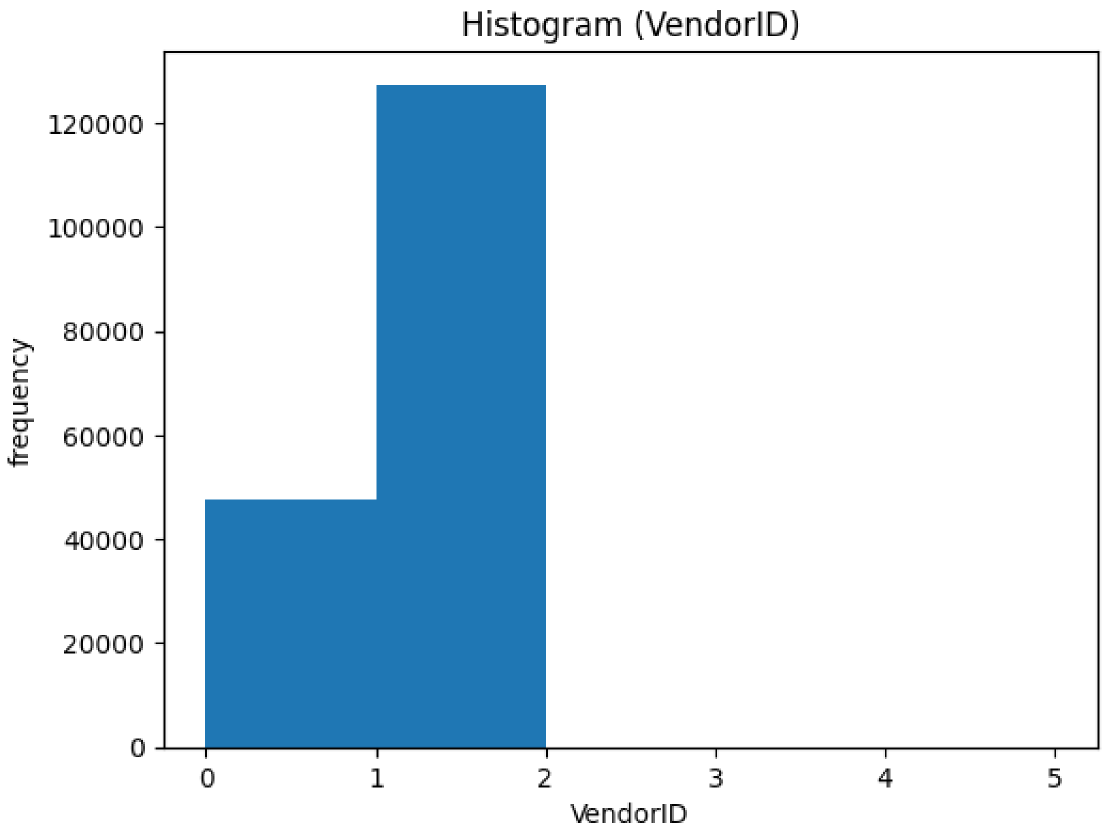
6.2.2 2. Columns/Attributes

1. VendorID

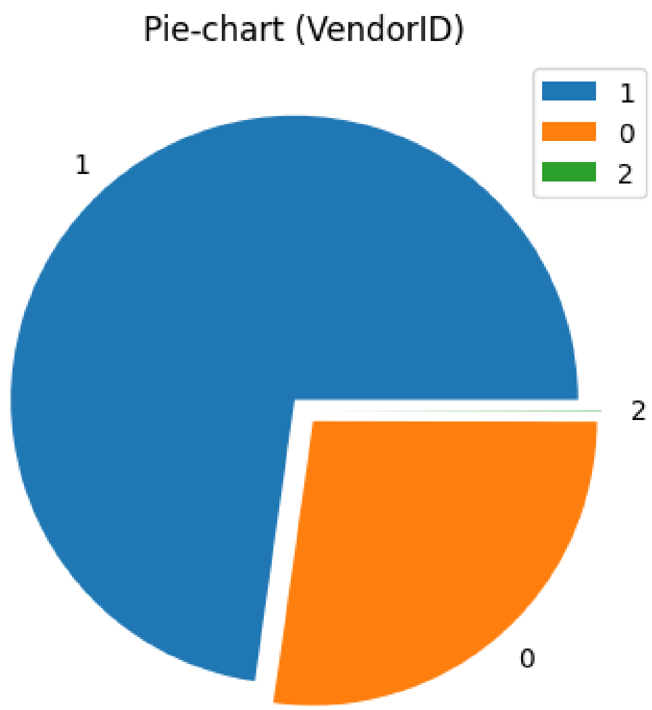
[22]:
```
print("Unique values :", pd.unique(train_data['VendorID']))
print("No. of distinct values :", len(pd.unique(train_data['VendorID'])))
print("No. of missing values :",train_data['VendorID'].isnull().sum(),␣
↪"[","Percentage(%) :", (train_data['VendorID'].isnull().sum())*(100/
↪175000),"]")
```

```
Unique values : [1 0 2]
No. of distinct values : 3
No. of missing values : 0 [ Percentage(%) : 0.0 ]
```

[23]:
```
plt.hist(train_data['VendorID'],bins=[0,1,2,3,4,5])
plt.xlabel("VendorID")
plt.ylabel("frequency")
plt.title('Histogram (VendorID)')
plt.show()
```



[24]:
```
Unique_values = [1,0,2]
value_count = []
for i in Unique_values:
    value_count.append(train_data['VendorID'].value_counts()[i])
#print(value_count)
plt.pie(value_count,labels=Unique_values,explode=[0.05,0.05,0.05])
plt.title('Pie-chart (VendorID)')
plt.legend(Unique_values)
plt.show()
```



Observations

- There are 3 distinct values.
- It doesn't contain any null value.
- Most frequent `VendorID` value is 1.

2. tpep_pickup_datetime

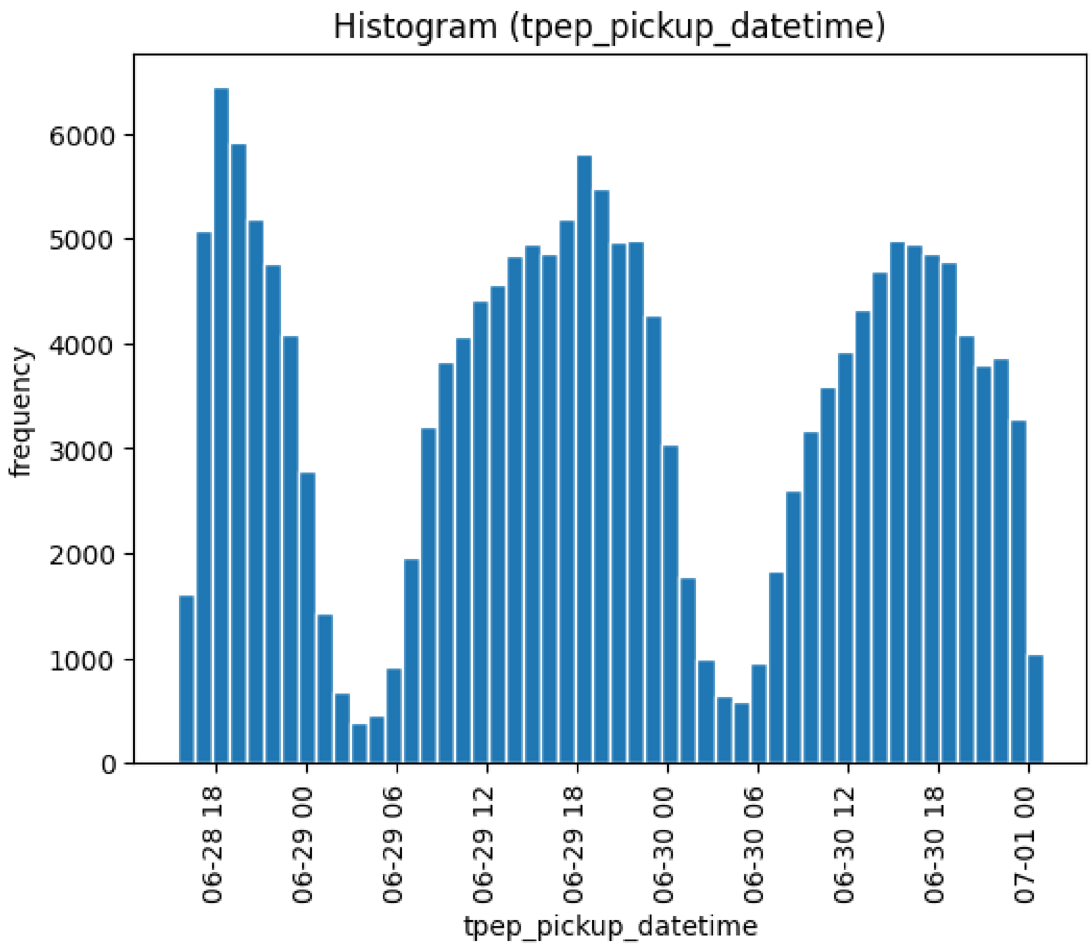
[25]:
```
train_data['tpep_pickup_datetime'] = pd.
 ↪to_datetime(train_data['tpep_pickup_datetime'])
```

[26]:
```
print("Maximum Value :",train_data['tpep_pickup_datetime'].max())
print("Minimum Value :",train_data['tpep_pickup_datetime'].min())
print("No. of missing values :",train_data['tpep_pickup_datetime'].isnull().
 ↪sum(), "[","Percentage(%) :", (train_data['tpep_pickup_datetime'].isnull().
 ↪sum())*(100/175000),"]")
```

```
Maximum Value : 2023-07-01 00:58:11
Minimum Value : 2023-06-28 15:26:39
No. of missing values : 0 [ Percentage(%) : 0.0 ]
```

[27]:
```
plt.hist(train_data['tpep_pickup_datetime'],bins=50,ec='white')
plt.xlabel("tpep_pickup_datetime")
```

```
plt.ylabel("frequency")
plt.title('Histogram (tpep_pickup_datetime)')
plt.xticks(rotation='vertical')
plt.show()
```



Observations

- There are no missing values.
- `Maximum Value : 2023-07-01 00:58:11`
- `Minimum Value : 2023-06-28 15:26:39`

3. tpep_dropoff_datetime

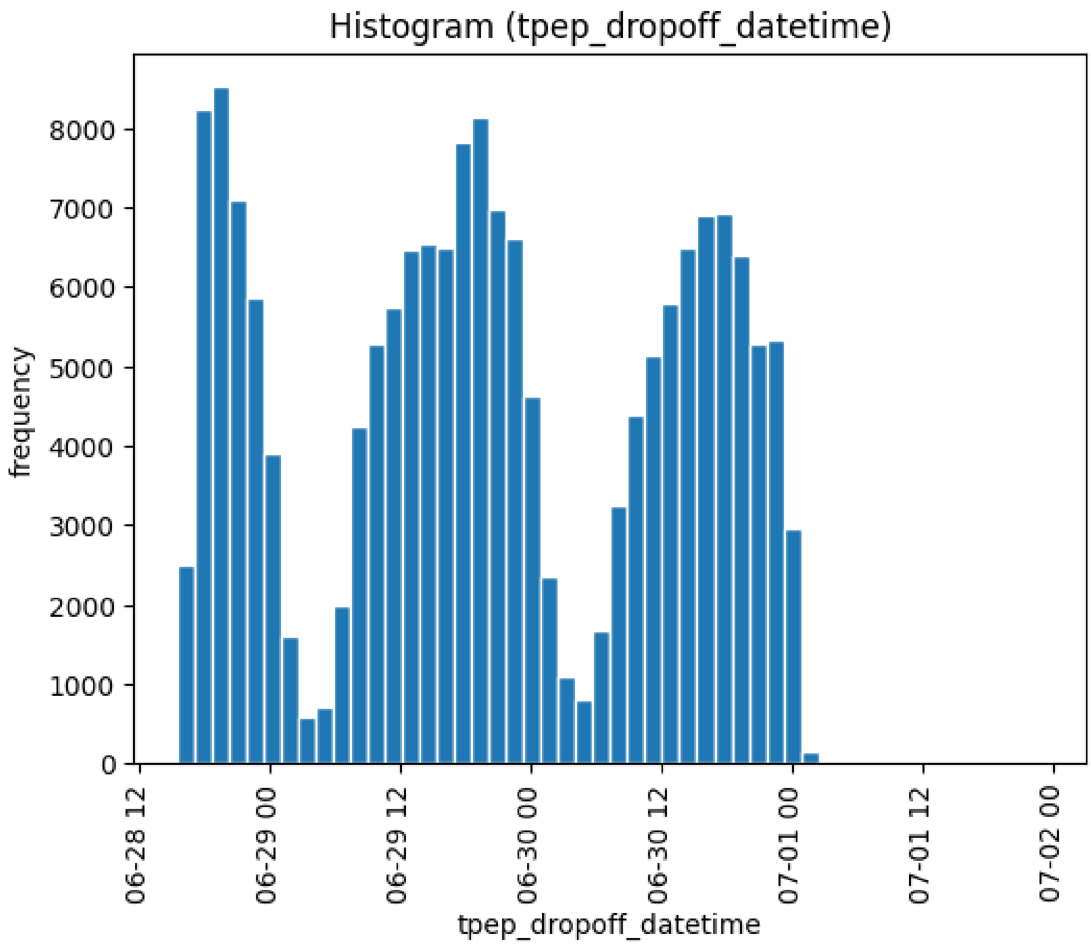
[28]:
```
train_data['tpep_dropoff_datetime'] = pd.
 ↪to_datetime(train_data['tpep_dropoff_datetime'])
```

[29]:
```
print("Maximum Value :",train_data['tpep_dropoff_datetime'].max())
print("Minimum Value :",train_data['tpep_dropoff_datetime'].min())
```

```
print("No. of missing values :",train_data['tpep_dropoff_datetime'].isnull().
↪sum(), "[","Percentage(%) :", (train_data['tpep_dropoff_datetime'].isnull().
↪sum())*(100/175000),"]")
```

```
Maximum Value : 2023-07-01 23:10:43
Minimum Value : 2023-06-28 15:32:43
No. of missing values : 0 [ Percentage(%) : 0.0 ]
```

[30]:
```
plt.hist(train_data['tpep_dropoff_datetime'],bins=50,ec='white')
plt.xlabel("tpep_dropoff_datetime")
plt.ylabel("frequency")
plt.title('Histogram (tpep_dropoff_datetime)')
plt.xticks(rotation='vertical')
plt.show()
```



Observations

- There are no missing values.

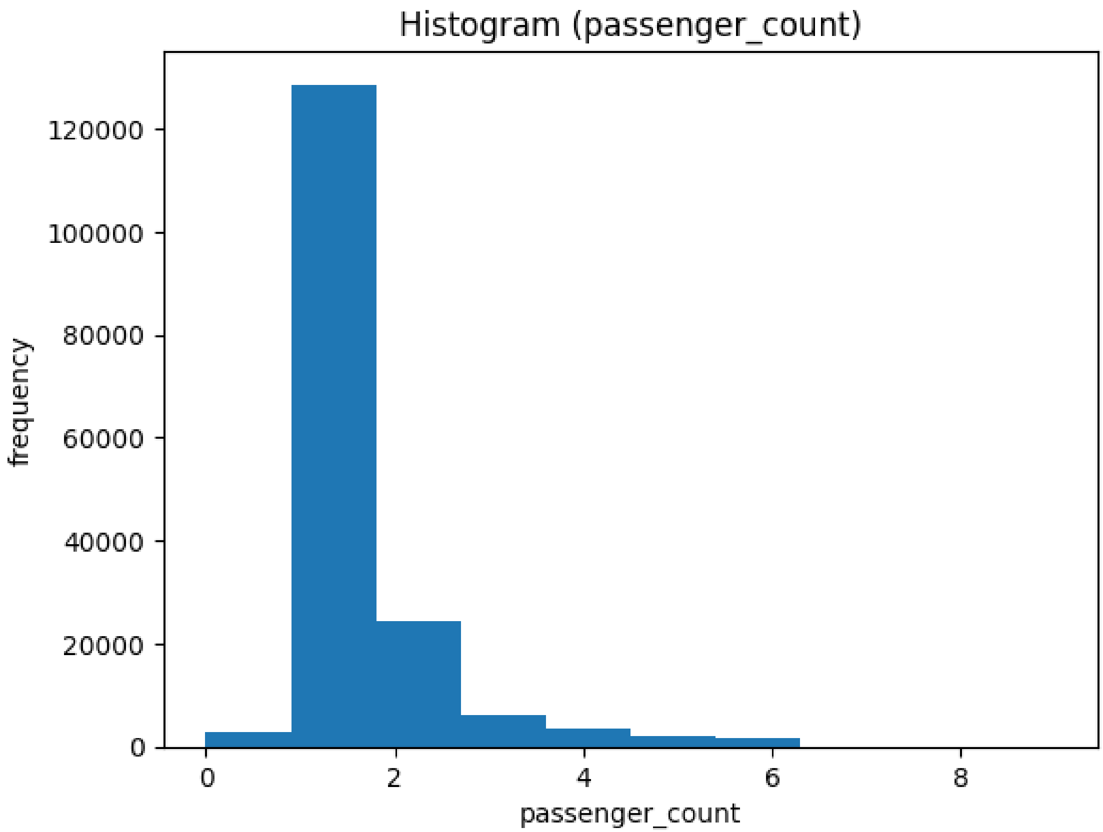
- Maximum Value : 2023-07-01 23:10:43
- Minimum Value : 2023-06-28 15:32:43

4. passenger_count

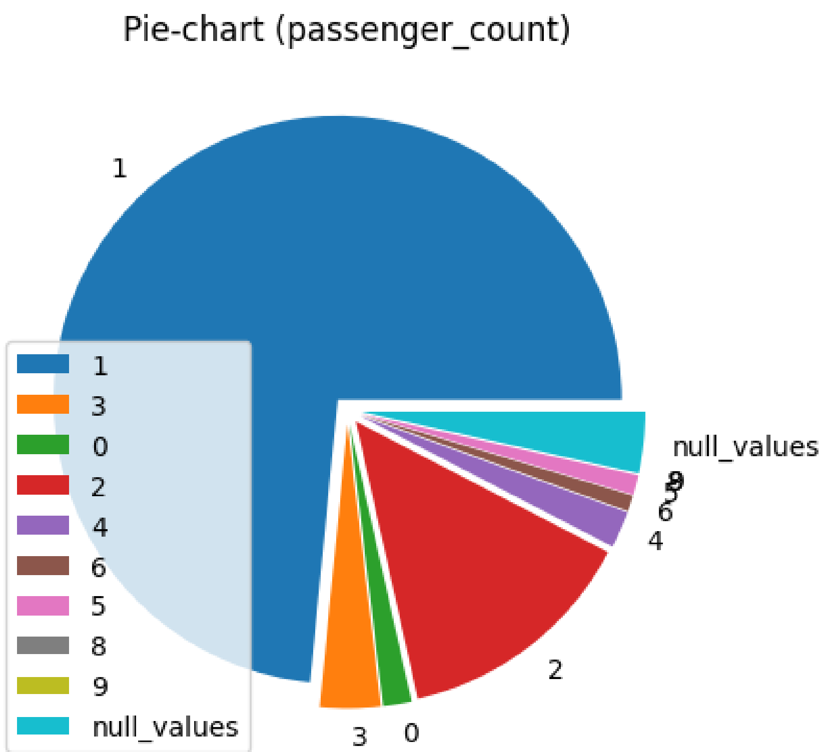
[31]:
```python
print("Unique values :", pd.unique(train_data['passenger_count']))
print("Value Counts :",train_data['passenger_count'].value_counts())
print("No. of distinct values :", len(pd.unique(train_data['passenger_count'])))
print("No. of missing values :",train_data['passenger_count'].isnull().sum(),␣
 ↪"[","Percentage(%) :", (train_data['passenger_count'].isnull().sum())*(100/
 ↪175000),"]")
print("No. of 0 values :
 ↪",len(train_data[train_data['passenger_count']==0]),"[","Percentage(%) :",␣
 ↪len(train_data[train_data['passenger_count']==0])*(100/175000),"]")
print("No. of -ve values :
 ↪",len(train_data[train_data['passenger_count']<0]),"[","Percentage(%) :",␣
 ↪len(train_data[train_data['passenger_count']<0])*(100/175000),"]")
print("Maximum Value :",train_data['passenger_count'].max())
print("Minimum Value :",train_data['passenger_count'].min())
```

```
Unique values : [ 1.   3.   0.   2.  nan  4.   6.   5.   8.   9.]
Value Counts : passenger_count
1.0    128534
2.0     24316
3.0      6018
4.0      3668
0.0      2818
5.0      1970
6.0      1596
8.0         2
9.0         1
Name: count, dtype: int64
No. of distinct values : 10
No. of missing values : 6077 [ Percentage(%) : 3.472571428571429 ]
No. of 0 values : 2818 [ Percentage(%) : 1.6102857142857143 ]
No. of -ve values : 0 [ Percentage(%) : 0.0 ]
Maximum Value : 9.0
Minimum Value : 0.0
```

[32]:
```python
plt.hist(train_data['passenger_count'])
plt.xlabel("passenger_count")
plt.ylabel("frequency")
plt.title('Histogram (passenger_count)')
plt.show()
```



[33]:
```
Unique_values = [ 1,  3,  0,  2, 4,  6,  5,  8,  9]
value_count = []
for i in Unique_values:
    value_count.append(train_data['passenger_count'].value_counts()[i])
Unique_values.append('null_values')
value_count.append(train_data['passenger_count'].isnull().sum())
#print(value_count)
plt.pie(value_count,labels=Unique_values,explode=[0.05,0.05,0.05,0.05,0.05,0.
↪05,0.05,0.05,0.05,0.05,])
plt.title('Pie-chart (passenger_count)')
plt.legend(Unique_values)
plt.show()
```



[34]:
```
p_count_outliers = detect_outliers_iqr(train_data['passenger_count'])
print("Outliers :", p_count_outliers)
```

```
Outliers : []
```

Observations

- `passenger_count` contains 6077 missing values which is approx 3.5% of total number of values.
- `passenger_count` contains 2818 zero values which is approx 1.6% of total number of values.
- There are no negative values.
- There are 10 distinct values (including null values).
- Most Frequent value is 1.
- There are 2 with 8 & 1 with 9 passengers count.
- `Maximum Value : 9.0`
- `Minimum Value : 0.0`
- There is no outliers.

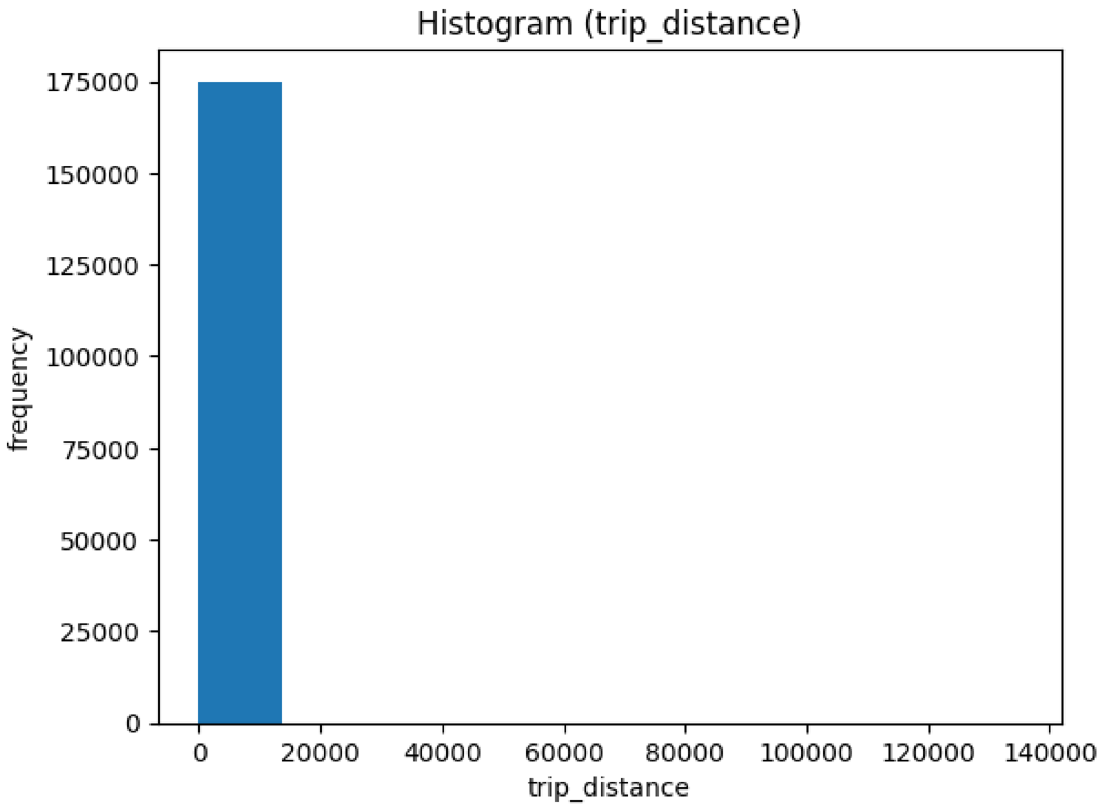
5. trip_distance

[35]:
```
print("Unique values :", pd.unique(train_data['trip_distance']))
print("Value Counts :",train_data['trip_distance'].value_counts())
```

```
print("No. of missing values :",train_data['trip_distance'].isnull().sum(),␣
↪"[","Percentage(%) :", (train_data['trip_distance'].isnull().sum())*(100/
↪175000),"]")
print("No. of 0 values :
↪",len(train_data[train_data['trip_distance']==0]),"[","Percentage(%) :",␣
↪len(train_data[train_data['trip_distance']==0])*(100/175000),"]")
print("No. of -ve values :
↪",len(train_data[train_data['trip_distance']<0]),"[","Percentage(%) :",␣
↪len(train_data[train_data['trip_distance']<0])*(100/175000),"]")
print("Maximum Value :",train_data['trip_distance'].max())
print("Minimum Value :",train_data['trip_distance'].min())
print("Value Counts (> 200) :",len(train_data[train_data['trip_distance']>200]))
```

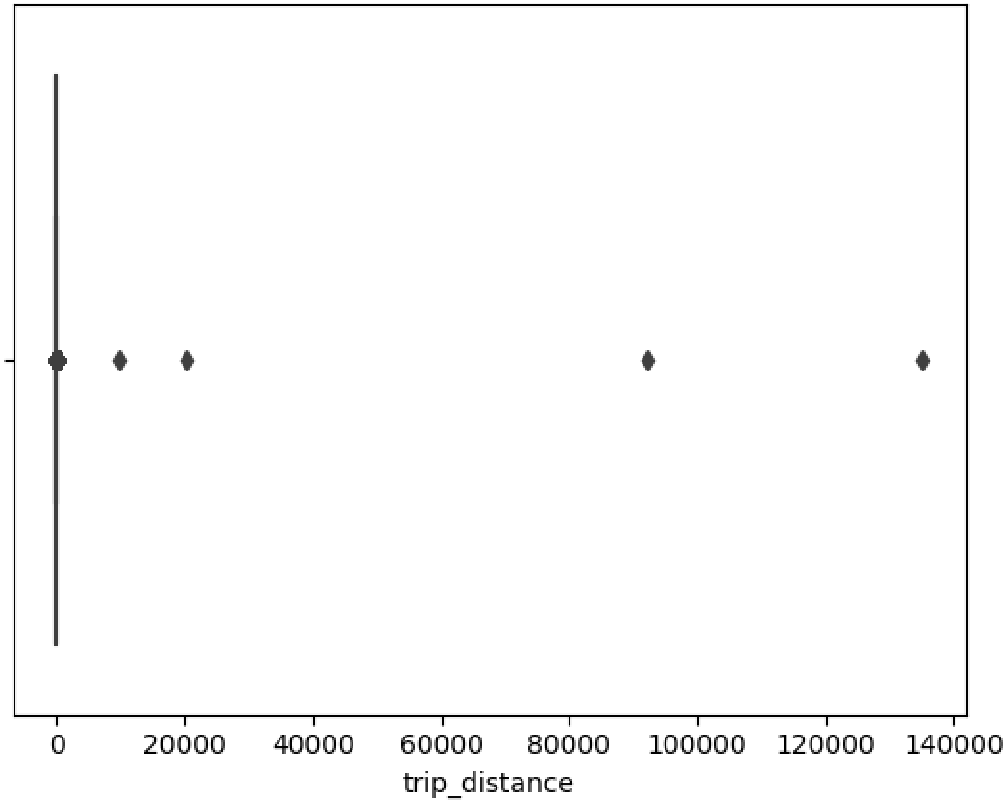
```
Unique values : [ 2.14  2.7   1.15 … 22.34 26.12 15.17]
Value Counts : trip_distance
0.00     2632
1.00     2431
0.90     2383
1.20     2363
1.10     2297
         …
31.42       1
26.80       1
27.53       1
13.29       1
15.17       1
Name: count, Length: 2929, dtype: int64
No. of missing values : 0 [ Percentage(%) : 0.0 ]
No. of 0 values : 2632 [ Percentage(%) : 1.504 ]
No. of -ve values : 0 [ Percentage(%) : 0.0 ]
Maximum Value : 135182.06
Minimum Value : 0.0
Value Counts (> 200) : 4
```

[36]:
```
plt.hist(train_data['trip_distance'])
plt.xlabel("trip_distance")
plt.ylabel("frequency")
plt.title('Histogram (trip_distance)')
plt.show()
```

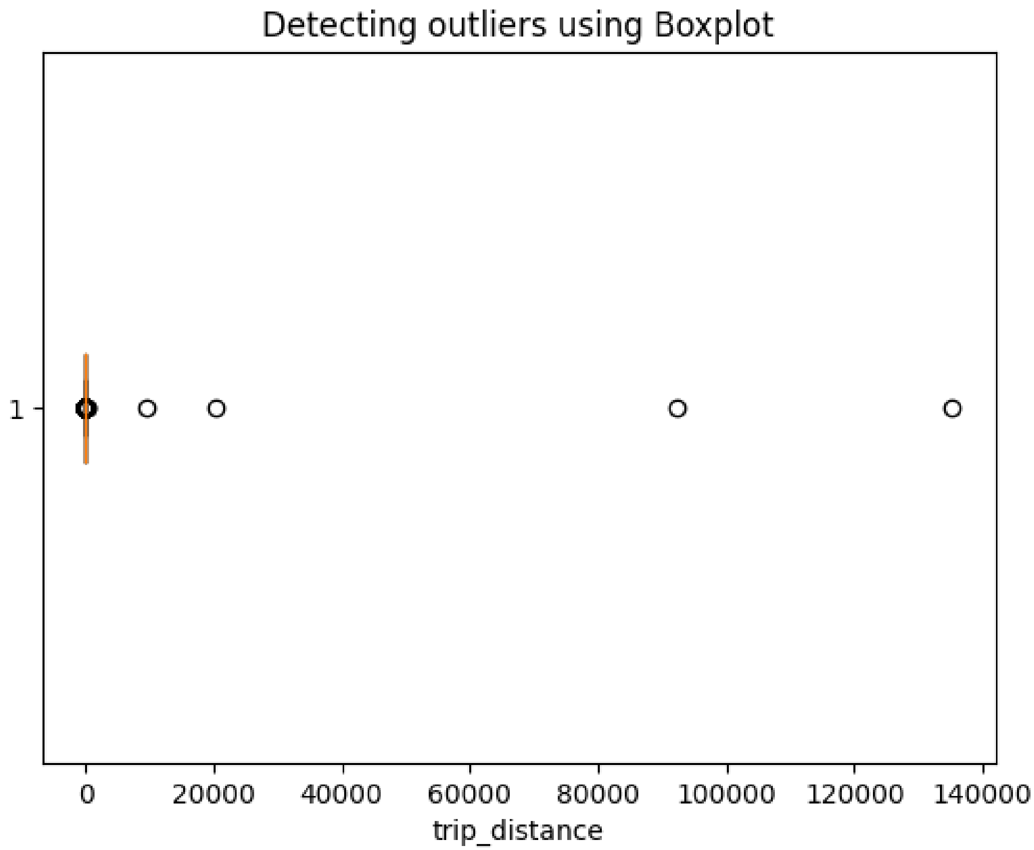


[37]:
```python
sns.boxplot(x='trip_distance', data=train_data)
```

[37]: <Axes: xlabel='trip_distance'>



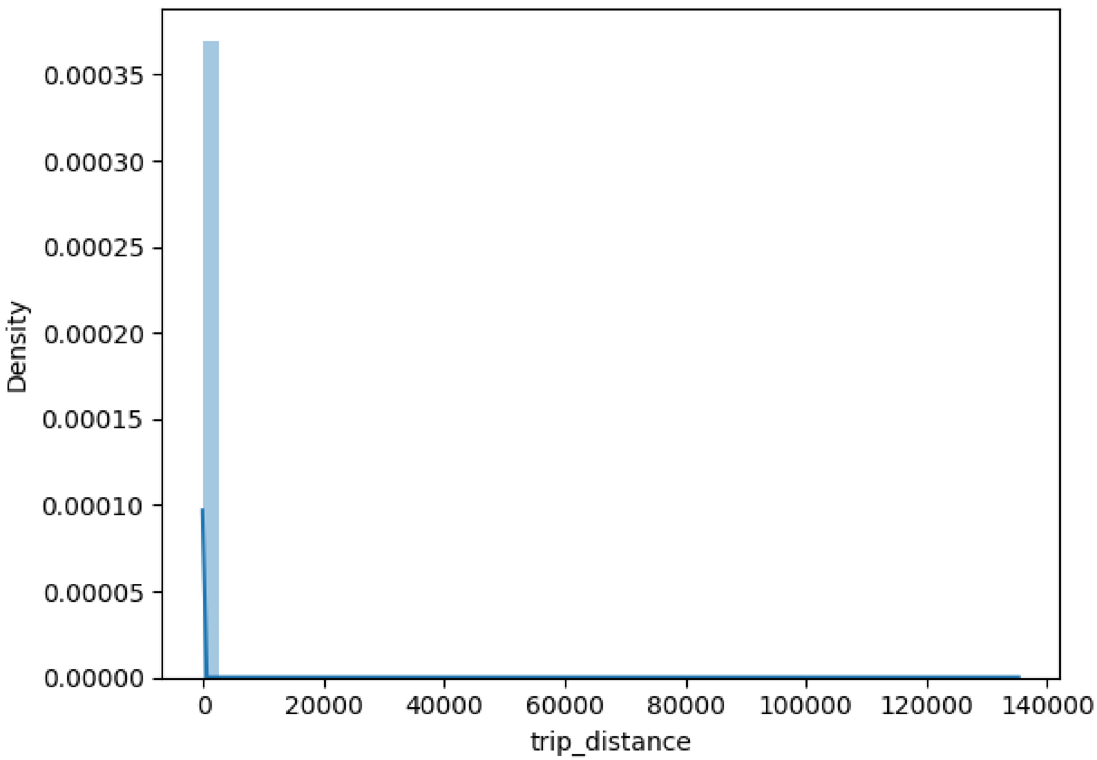
[38]:
```
plt.boxplot(train_data['trip_distance'], vert=False)
plt.title("Detecting outliers using Boxplot")
plt.xlabel('trip_distance')
plt.show()
```



[39]:
```
sns.distplot(train_data['trip_distance'])
```

```
/tmp/ipykernel_20/1761663903.py:1: 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(train_data['trip_distance'])
```

[39]: <Axes: xlabel='trip_distance', ylabel='Density'>



[40]:
```
td_outliers = detect_outliers_iqr(train_data['trip_distance'])
print("Outliers Count :", len(td_outliers))
```

```
Outliers Count : 24133
```

Observations

- There are no missing values but it seems that there are 24133 outliers in it.
- `trip_distance` contains 2632 zero values which is approx 1.5% of total number of values.
- There are no negative values.
- `Maximum Value : 135182.06`
- `Minimum Value : 0.0`

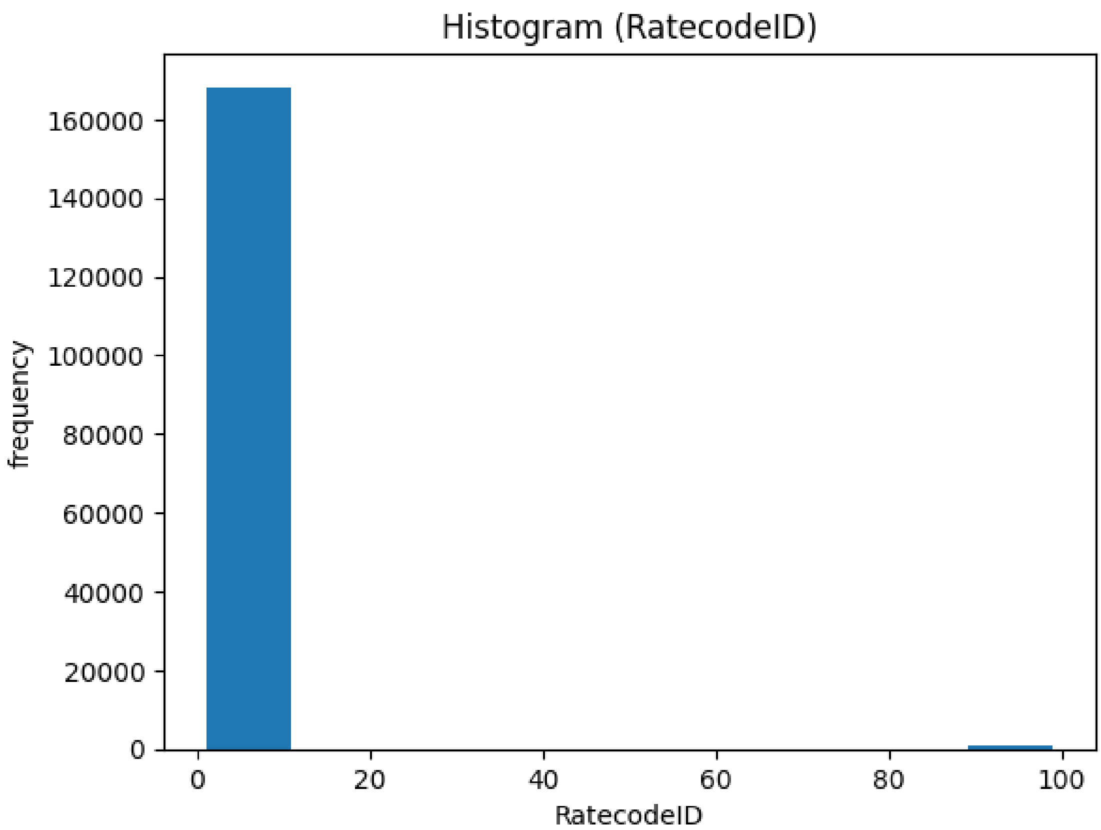
6. RatecodeID

[41]:
```
print("Unique values :", pd.unique(train_data['RatecodeID']))
print("No. of distinct values :", len(pd.unique(train_data['RatecodeID'])))
print("No. of missing values :",train_data['RatecodeID'].isnull().sum(),␣
 ↪"[","Percentage(%) :", (train_data['RatecodeID'].isnull().sum())*(100/
 ↪175000),"]")
print("No. of 0 values :
 ↪",len(train_data[train_data['RatecodeID']==0]),"[","Percentage(%) :",␣
 ↪len(train_data[train_data['RatecodeID']==0])*(100/175000),"]")
```

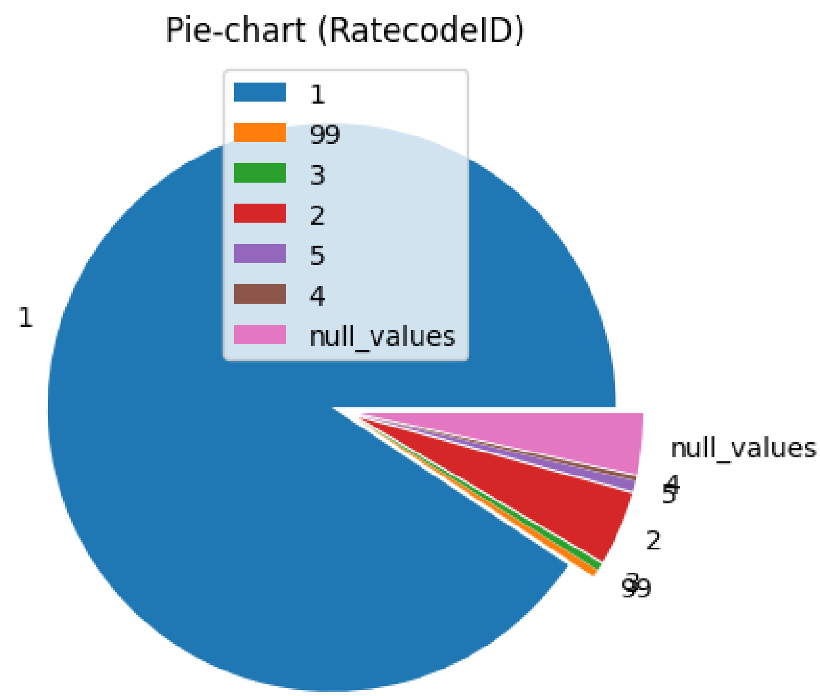
```
print("No. of -ve values :
↪",len(train_data[train_data['RatecodeID']<0]),"[","Percentage(%) :",␣
↪len(train_data[train_data['RatecodeID']<0])*(100/175000),"]")
print("Maximum Value :",train_data['RatecodeID'].max())
print("Minimum Value :",train_data['RatecodeID'].min())
print("Value Counts (=99) :",len(train_data[train_data['RatecodeID']==99]))
```

```
Unique values : [ 1. 99.  3. nan  2.  5.  4.]
No. of distinct values : 7
No. of missing values : 6077 [ Percentage(%) : 3.472571428571429 ]
No. of 0 values : 0 [ Percentage(%) : 0.0 ]
No. of -ve values : 0 [ Percentage(%) : 0.0 ]
Maximum Value : 99.0
Minimum Value : 1.0
Value Counts (=99) : 748
```

[42]:
```
plt.hist(train_data['RatecodeID'])
plt.xlabel("RatecodeID")
plt.ylabel("frequency")
plt.title('Histogram (RatecodeID)')
plt.show()
```



[43]:
```
Unique_values = [1, 99,  3, 2, 5, 4]
value_count = []
for i in Unique_values:
    value_count.append(train_data['RatecodeID'].value_counts()[i])
Unique_values.append('null_values')
value_count.append(train_data['RatecodeID'].isnull().sum())
#print(value_count)
plt.pie(value_count,labels=Unique_values,explode=[0.05,0.05,0.05,0.05,0.05,0.
↪05,0.05])
plt.title('Pie-chart (RatecodeID)')
plt.legend(Unique_values)
plt.show()
```



Observations

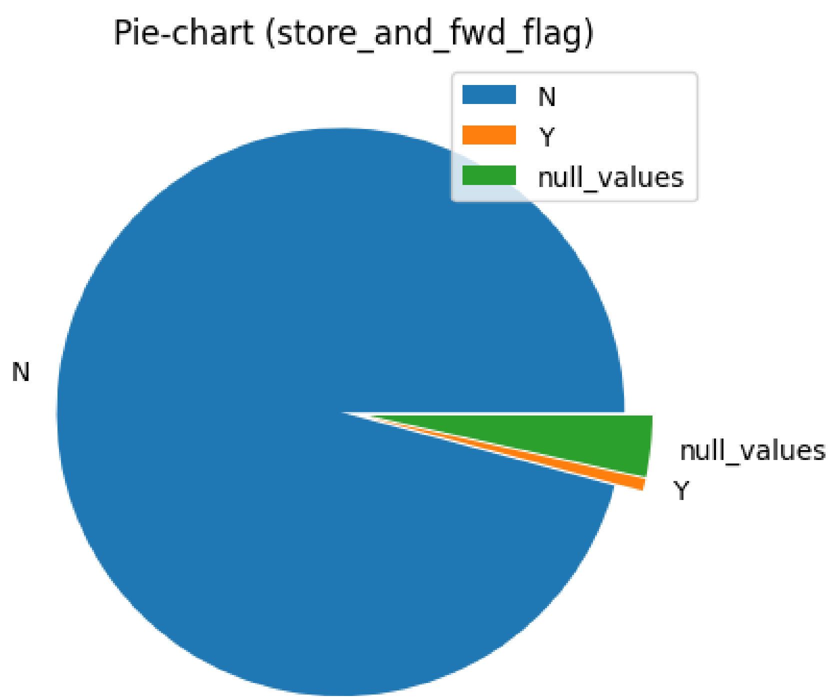
- `RatecodeID` contains 6077 missing values which is approx 3.5% of total number of values.
- There are no negative and zero values.
- There are 7 distinct values (including null values).
- Most Frequent value is 1.

7. store_and_fwd_flag

```
[44]: print("Unique values :", pd.unique(train_data['store_and_fwd_flag']))
print("No. of distinct values :", len(pd.
 ↪unique(train_data['store_and_fwd_flag'])))
print("No. of missing values :",train_data['store_and_fwd_flag'].isnull().
 ↪sum(), "[","Percentage(%) :", (train_data['store_and_fwd_flag'].isnull().
 ↪sum())*(100/175000),"]")
```

```
Unique values : ['N' nan 'Y']
No. of distinct values : 3
No. of missing values : 6077 [ Percentage(%) : 3.472571428571429 ]
```

```
[45]: Unique_values = ['N','Y']
value_count = []
for i in Unique_values:
    value_count.append(train_data['store_and_fwd_flag'].value_counts()[i])
Unique_values.append('null_values')
value_count.append(train_data['store_and_fwd_flag'].isnull().sum())
#print(value_count)
plt.pie(value_count,labels=Unique_values,explode=[0.05,0.05,0.05])
plt.title('Pie-chart (store_and_fwd_flag)')
plt.legend(Unique_values)
plt.show()
```



Observations

- `store_and_fwd_flag` contains 6077 missing values which is approx 3.5% of total number of values.
- There are 3 distinct values (including null values).
- Most Frequent value is `'N'`.

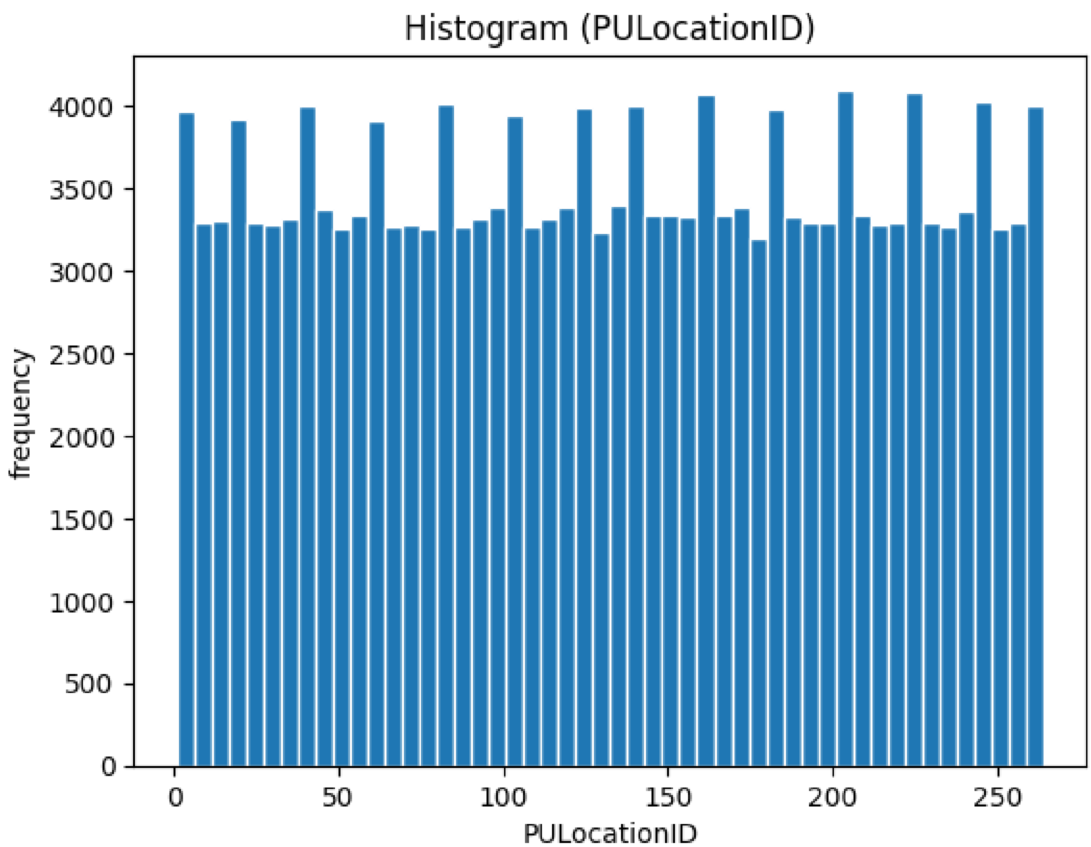
8. PULocationID

[46]:
```
print("Unique values :", pd.unique(train_data['PULocationID']))
print("No. of missing values :",train_data['PULocationID'].isnull().sum(),␣
 ↪"[","Percentage(%) :", (train_data['PULocationID'].isnull().sum())*(100/
 ↪175000),"]")
print("No. of 0 values :
 ↪",len(train_data[train_data['PULocationID']==0]),"[","Percentage(%) :",␣
 ↪len(train_data[train_data['PULocationID']==0])*(100/175000),"]")
print("No. of -ve values :
 ↪",len(train_data[train_data['PULocationID']<0]),"[","Percentage(%) :",␣
 ↪len(train_data[train_data['PULocationID']<0])*(100/175000),"]")
print("Maximum Value :",train_data['PULocationID'].max())
print("Minimum Value :",train_data['PULocationID'].min())
```

```
Unique values : [120  15 167 128 203 225 214 176 196 138  40 215  55  77   1   3
207   9
 127  31 126 187  17 140  34  25  89 223 239 210 200  73 216 192  80  93
  22 133 110 193 232  27  49  74 119 189 163  16  72 202  84 116   4  35
  13 159 142 253  56 114  20 122  58 141  71  32 160 139 181 246  78 125
 260 169 102 264  76 209 106 149  90 118 151  26 197 113 199  75  95  50
  97  53  18  19 168  29 185 150 183 258 217 164  42   8 226 179 144 252
 124 244  51 241  99 182  38 186 107  64 177  47 194 222 204 111 236 243
  41 218 240 143  67 137 190 117 100 195 256 262  14 251 248 152  91  60
 158 134 221 170 115 208 263 249  10  85 101  39 230 235 112 242  79  81
  68  46 104 129 173 237 103  96  83  33 130 257  62 247 255  52 245 135
 213 145 147 220   5 212 136 211  23 228 229 219 131 121 178 108 154  43
 233  57 109  82 250 166  61   7  63  98  45 254  66 153 148  37  70 161
 201  28 180 146  11 156 188 205  92  12 259 123 172 155  87  48 191 132
  24   6  59 227 171 157  44  65  86  69 174 224  21 231  54 198 238 105
 234 261  30 206  36 162 175 165   2  88 184  94]
No. of missing values : 0 [ Percentage(%) : 0.0 ]
No. of 0 values : 0 [ Percentage(%) : 0.0 ]
No. of -ve values : 0 [ Percentage(%) : 0.0 ]
Maximum Value : 264
Minimum Value : 1
```

[47]:
```
plt.hist(train_data['PULocationID'],ec='white',bins=50)
plt.xlabel("PULocationID")
plt.ylabel("frequency")
plt.title('Histogram (PULocationID)')
```

```
plt.show()
```



Observations

- `PULocationID` doesn't contain any missing, zero or -ve values.
- `Maximum Value : 264`
- `Minimum Value : 1`

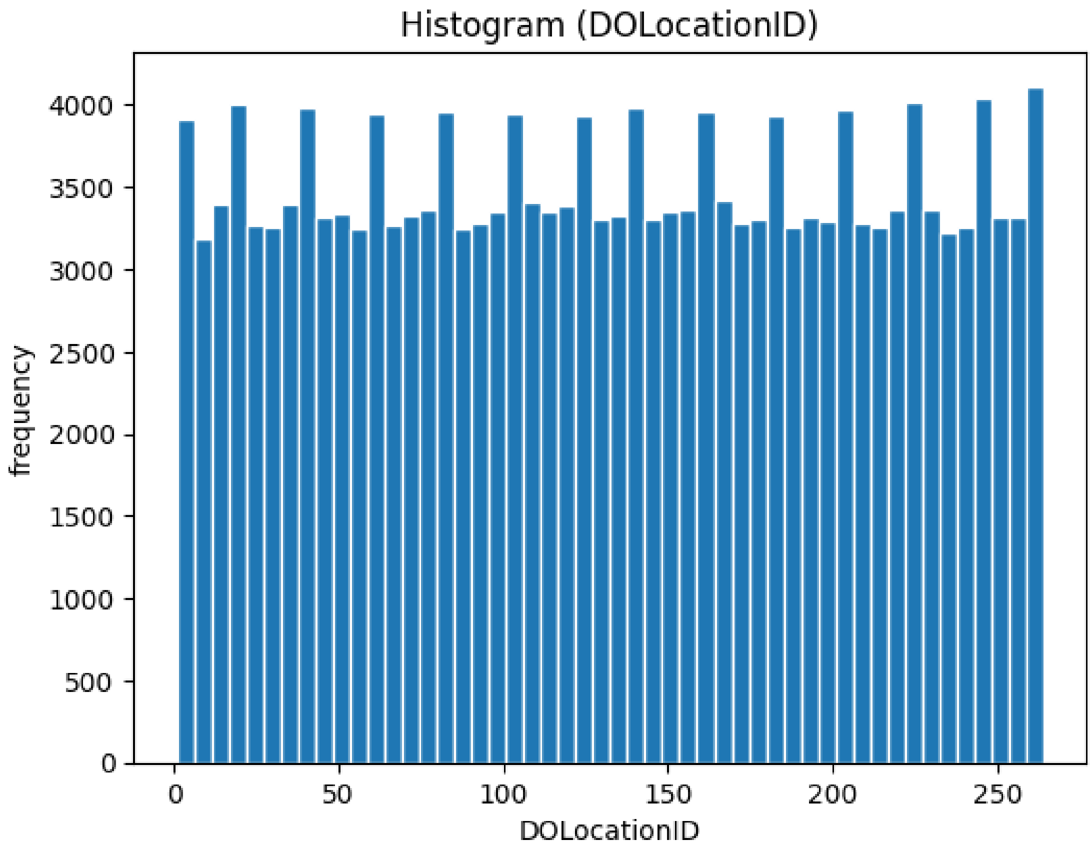
9. DOLocationID

[48]:
```
print("Unique values :", pd.unique(train_data['DOLocationID']))
print("No. of missing values :",train_data['DOLocationID'].isnull().sum(),␣
 ↪"[","Percentage(%) :", (train_data['DOLocationID'].isnull().sum())*(100/
 ↪175000),"]")
print("No. of 0 values :
 ↪",len(train_data[train_data['DOLocationID']==0]),"[","Percentage(%) :",␣
 ↪len(train_data[train_data['DOLocationID']==0])*(100/175000),"]")
print("No. of -ve values :
 ↪",len(train_data[train_data['DOLocationID']<0]),"[","Percentage(%) :",␣
 ↪len(train_data[train_data['DOLocationID']<0])*(100/175000),"]")
```

```python
print("Maximum Value :",train_data['DOLocationID'].max())
print("Minimum Value :",train_data['DOLocationID'].min())
```

```
Unique values : [  9 215 223 239  52 256 240 227 139 196 153 125  64  27 181  53
40 111
  37 257 151 225  36 152 224 222  47 158 203  59  21 113 220  14 254 124
  97  13 182 206 148  65 248 236 221 192 241 128 147   7 263 217  68 160
 185  30 106  29 218  80 232  22 184 180 229 137 150 260 242  16  15 117
  70 109 183  73  48 231 159  91 189 207  11 179 255  35  23  84 154 165
  50 135 243  45 247 249 104 191 112 172  43 176 108 149 102 170 136  61
  34 210 230 127   5  85 264 118  92 233   2 156 208  94 107 261 100  81
  33  10 134 155  93 245 119 115  89  20 163   1 173 145 175  51 237 202
 262  75  19 130 204 123 169 228 200  90 238 253  79 121  72 252 258 212
  74 246 178 174 162 105  17 164 197 186  86 216   4 101  26 122  54 219
  63  98  44 103  38  31  18   3 157 193  28 141 209 190 116 226 166  24
 142 143  66 140 250  55  42  57 138 129  96  99 168  39 194 132  46 131
 171  78 244 195 214 133  77  41 177  56 120 146 114  76 110   8   6  49
 211  88  25  83  82  95  12 251 205 259  58 161  32 201 235  67  62 199
  69 167 187 213 234 188  60 144  71  87 198 126]
No. of missing values : 0 [ Percentage(%) : 0.0 ]
No. of 0 values : 0 [ Percentage(%) : 0.0 ]
No. of -ve values : 0 [ Percentage(%) : 0.0 ]
Maximum Value : 264
Minimum Value : 1
```

[49]:
```python
plt.hist(train_data['DOLocationID'],ec='white',bins=50)
plt.xlabel("DOLocationID")
plt.ylabel("frequency")
plt.title('Histogram (DOLocationID)')
plt.show()
```



Observations

- `DULocationID` doesn't contain any missing, zero or -ve values.
- `Maximum Value : 264`
- `Minimum Value : 1`

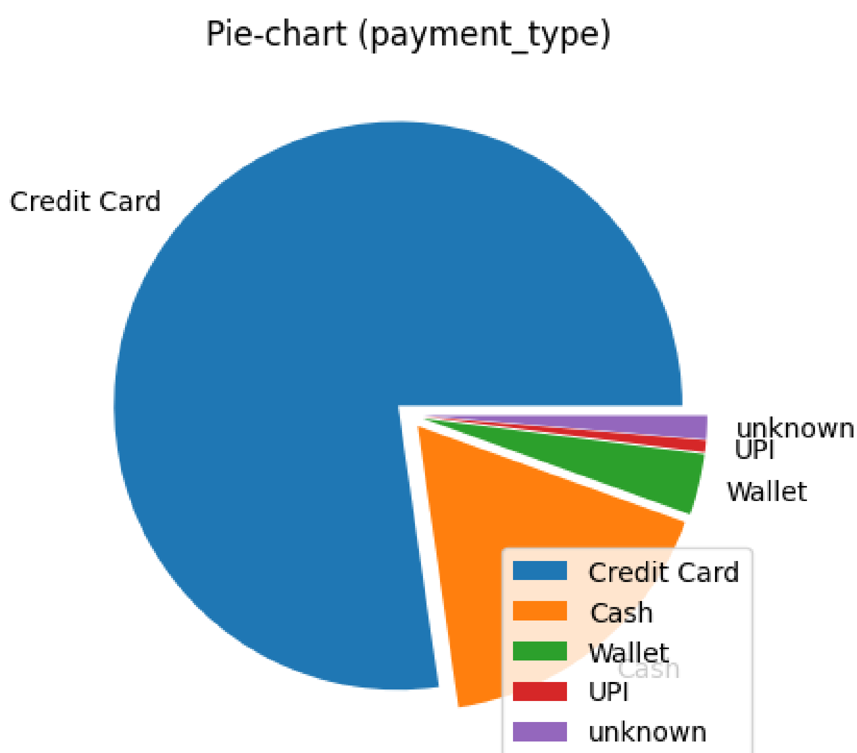
10. payment_type

[50]:
```
print("Unique values :", pd.unique(train_data['payment_type']))
print("Values Count :", train_data['payment_type'].value_counts())
print("No. of distinct values :", len(pd.unique(train_data['payment_type'])))
print("No. of missing values :",train_data['payment_type'].isnull().sum(),
 ↪"[","Percentage(%) :", (train_data['payment_type'].isnull().sum())*(100/
 ↪175000),"]")
```

```
Unique values : ['Credit Card' 'Cash' 'Wallet' 'UPI' 'unknown']
Values Count : payment_type
Credit Card    135257
Cash            30141
Wallet           6077
unknown          2333
```

```
UPI               1192
Name: count, dtype: int64
No. of distinct values : 5
No. of missing values : 0 [ Percentage(%) : 0.0 ]
```

[51]:
```python
Unique_values = ['Credit Card', 'Cash', 'Wallet', 'UPI', 'unknown']
value_count = []
for i in Unique_values:
    value_count.append(train_data['payment_type'].value_counts()[i])
#Unique_values.append('null_values')
#value_count.append(train_data['store_and_fwd_flag'].isnull().sum())
#print(value_count)
plt.pie(value_count,labels=Unique_values,explode=[0.05,0.05,0.05,0.05,0.05])
plt.title('Pie-chart (payment_type)')
plt.legend(Unique_values)
plt.show()
```



Observations

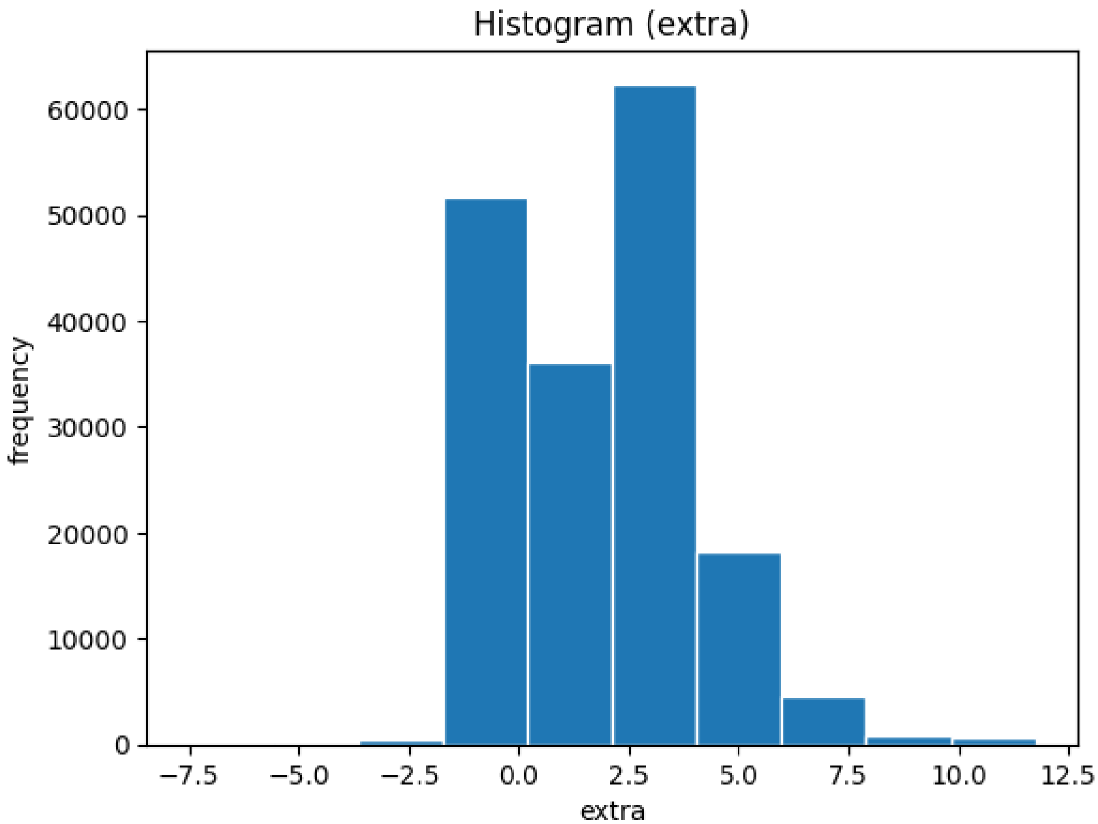
- There are no missing values.
- There are 5 distinct values which are `'Credit Card'`, `'Cash'`, `'Wallet'`, `'UPI'`, `'unknown'`
- There are 2333 `unknown` values.

11. extra

[52]:
```
print("Unique values :", pd.unique(train_data['extra']))
print("No. of missing values :",train_data['extra'].isnull().sum(),␣
 ↪"[","Percentage(%) :", (train_data['extra'].isnull().sum())*(100/175000),"]")
print("No. of 0 values :
 ↪",len(train_data[train_data['extra']==0]),"[","Percentage(%) :",␣
 ↪len(train_data[train_data['extra']==0])*(100/175000),"]")
print("No. of -ve values :
 ↪",len(train_data[train_data['extra']<0]),"[","Percentage(%) :",␣
 ↪len(train_data[train_data['extra']<0])*(100/175000),"]")
print("Maximum Value :",train_data['extra'].max())
print("Minimum Value :",train_data['extra'].min())
print("Mean Value :",train_data['extra'].mean())
```

```
Unique values : [ 2.5   3.5   0.    1.    9.25  7.5   5.    4.25  6.75 -5.    6.
-2.5
  7.75 -1.   10.25  2.75  1.75 10.   11.75  8.5  -7.5  -6.    0.25  0.11
  5.25  0.75  1.5   3.25]
No. of missing values : 0 [ Percentage(%) : 0.0 ]
No. of 0 values : 51247 [ Percentage(%) : 29.284000000000002 ]
No. of -ve values : 1105 [ Percentage(%) : 0.6314285714285715 ]
Maximum Value : 11.75
Minimum Value : -7.5
Mean Value : 1.9321434857142856
```

[53]:
```
plt.hist(train_data['extra'],ec='white')
plt.xlabel("extra")
plt.ylabel("frequency")
plt.title('Histogram (extra)')
plt.show()
```



[54]:
```
ex_outliers = detect_outliers_iqr(train_data['extra'])
print("Outliers Count :", len(ex_outliers))
```

```
Outliers Count : 4406
```

Observations

- `extra` contains no missing values.
- It has 4406 outliers.
- `extra` contains 51247 zero values which is approx 29.3% of total number of value.
- `extra` contains 1105 -ve values which is approx 0.6% of total number of value.
- `Maximum Value : 11.75`
- `Minimum Value : -7.5`
- `Mean Value : 1.9321434857142856`

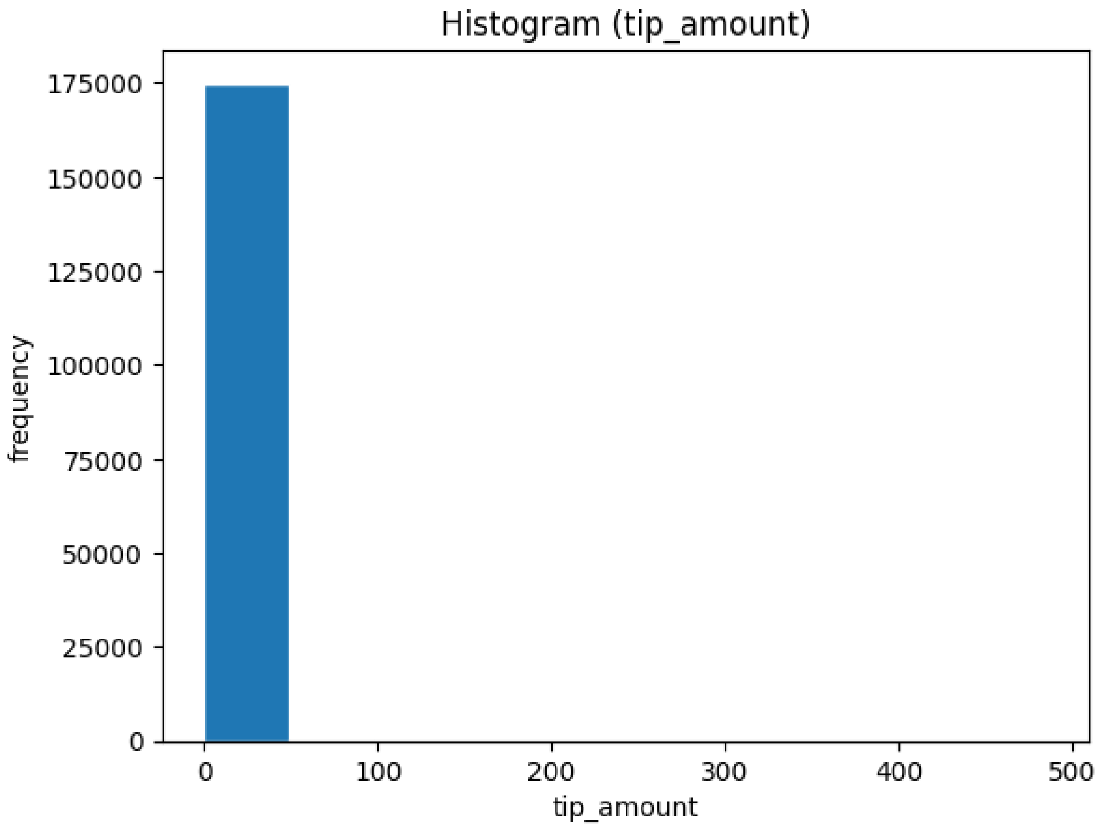
12. tip_amount

[55]:
```
print("Unique values :", pd.unique(train_data['tip_amount']))
print("Value Counts :",train_data['tip_amount'].value_counts())
```

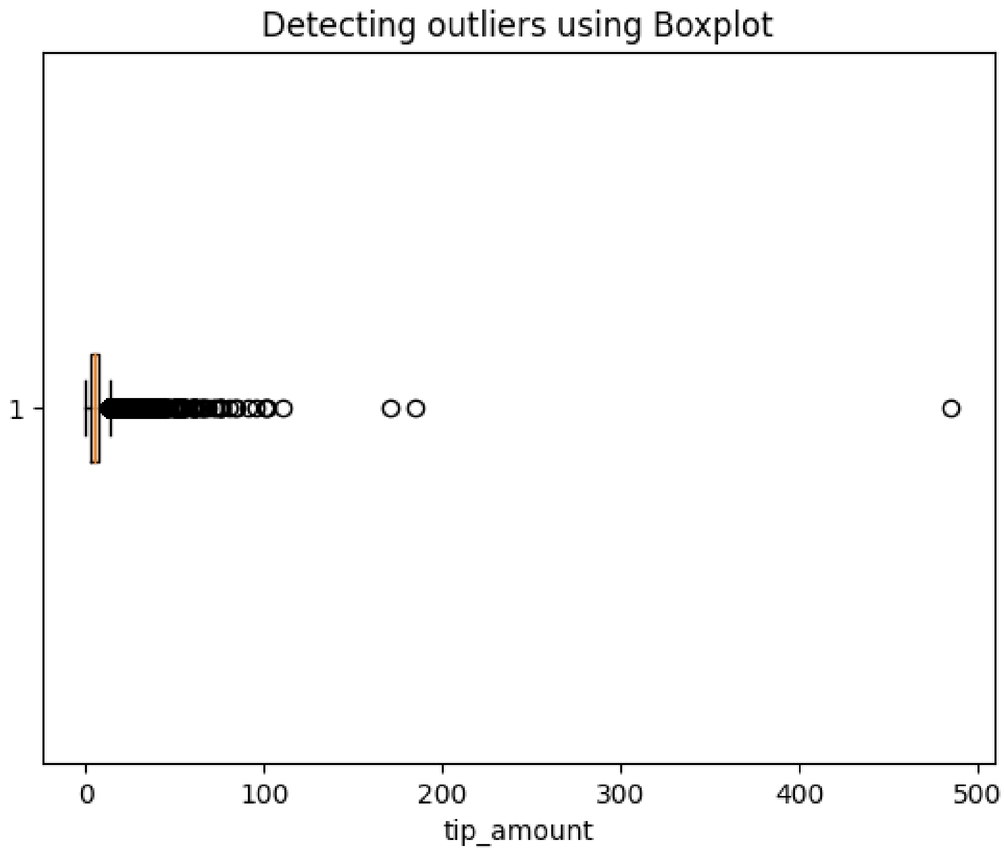
```
print("No. of missing values :",train_data['tip_amount'].isnull().sum(),␣
↪"[","Percentage(%) :", (train_data['tip_amount'].isnull().sum())*(100/
↪175000),"]")
print("No. of 0 values :
↪",len(train_data[train_data['tip_amount']==0]),"[","Percentage(%) :",␣
↪len(train_data[train_data['tip_amount']==0])*(100/175000),"]")
print("No. of -ve values :
↪",len(train_data[train_data['tip_amount']<0]),"[","Percentage(%) :",␣
↪len(train_data[train_data['tip_amount']<0])*(100/175000),"]")
print("Maximum Value :",train_data['tip_amount'].max())
print("Minimum Value :",train_data['tip_amount'].min())
print("Mean Value :",train_data['tip_amount'].mean())
print("Value Counts (> 180) :",len(train_data[train_data['tip_amount']>=180]))
print("Value Counts (> 400) :",len(train_data[train_data['tip_amount']>=400]))
```

```
Unique values : [ 7.16558861  6.0674008   4.11154749 …  4.24535387 10.47977632
  6.54169878]
Value Counts : tip_amount
7.165589     1
3.850730     1
5.311822     1
9.137562     1
6.716744     1
            ..
11.560123    1
3.256321     1
6.093614     1
1.099215     1
6.541699     1
Name: count, Length: 175000, dtype: int64
No. of missing values : 0 [ Percentage(%) : 0.0 ]
No. of 0 values : 0 [ Percentage(%) : 0.0 ]
No. of -ve values : 0 [ Percentage(%) : 0.0 ]
Maximum Value : 484.876150598094
Minimum Value : 7.907626361047804e-05
Mean Value : 6.127497228407633
Value Counts (> 180) : 2
Value Counts (> 400) : 1
```

[56]:
```
plt.hist(train_data['tip_amount'],ec='white')
plt.xlabel("tip_amount")
plt.ylabel("frequency")
plt.title('Histogram (tip_amount)')
plt.show()
```



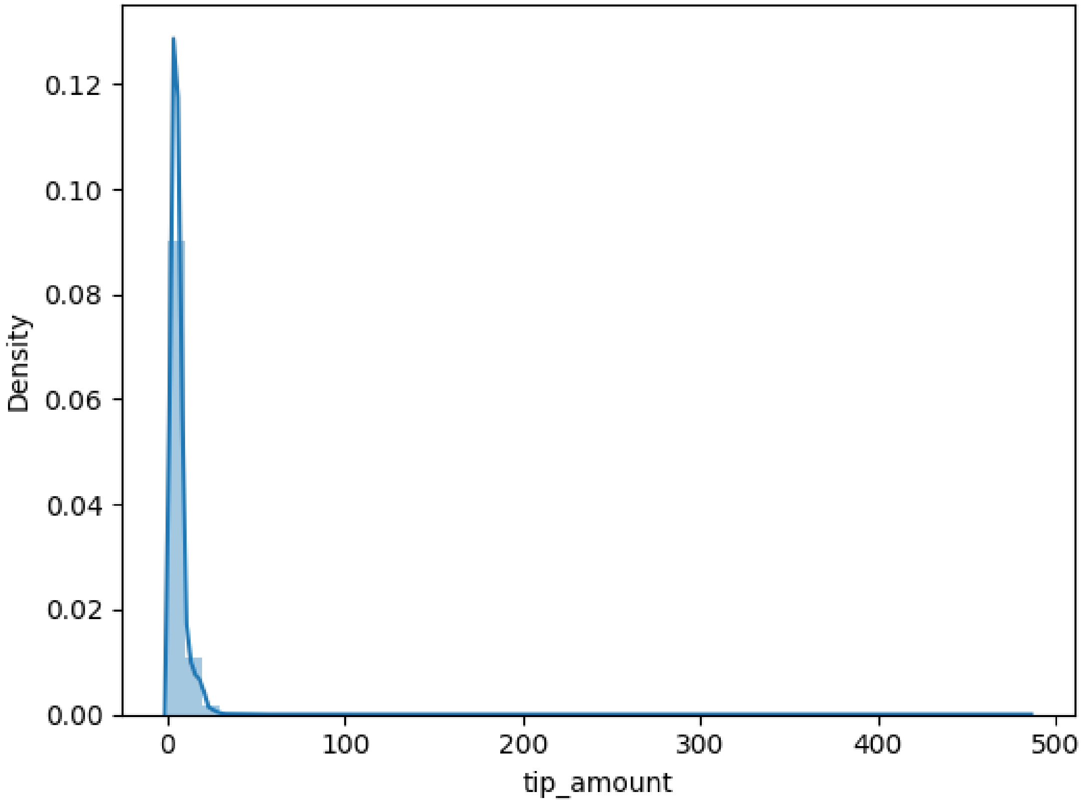
[57]:
```
plt.boxplot(train_data['tip_amount'], vert=False)
plt.title("Detecting outliers using Boxplot")
plt.xlabel('tip_amount')
plt.show()
```



[58]:
```
sns.distplot(train_data['tip_amount'])
```

```
/tmp/ipykernel_20/1792431322.py:1: 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(train_data['tip_amount'])
```

[58]:
```
<Axes: xlabel='tip_amount', ylabel='Density'>
```



[59]:
```
tip_outliers = detect_outliers_iqr(train_data['tip_amount'])
print("Outliers Count :", len(tip_outliers))
```

```
Outliers Count : 11218
```

Observations

- `extra` doesn't contains any missing,zero or -ve values.
- It has 11218 outliers.
- `Maximum Value : 484.876150598094`
- `Minimum Value : 7.907626361047804e-05`
- `Mean Value : 6.127497228407633`

13. tolls_amount

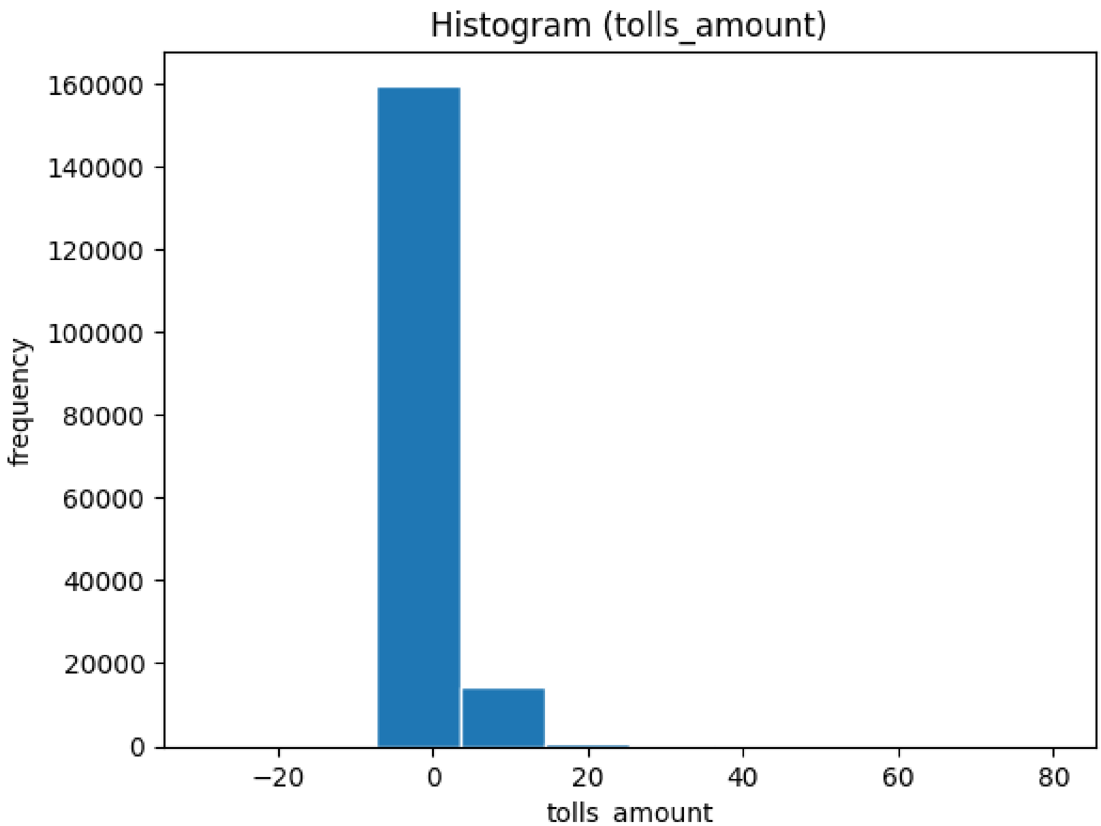
[60]:
```
print("Unique values :", pd.unique(train_data['tolls_amount']))
print("No. of missing values :",train_data['tolls_amount'].isnull().sum(),␣
↪"[","Percentage(%) :", (train_data['tolls_amount'].isnull().sum())*(100/
↪175000),"]")
print("No. of 0 values :
↪",len(train_data[train_data['tolls_amount']==0]),"[","Percentage(%) :",␣
↪len(train_data[train_data['tolls_amount']==0])*(100/175000),"]")
```

```
print("No. of -ve values :
↪",len(train_data[train_data['tolls_amount']<0]),"[","Percentage(%) :",␣
↪len(train_data[train_data['tolls_amount']<0])*(100/175000),"]")
print("Maximum Value :",train_data['tolls_amount'].max())
print("Minimum Value :",train_data['tolls_amount'].min())
print("Mean Value :",train_data['tolls_amount'].mean())
```

```
Unique values : [ 0.000e+00  6.550e+00  2.900e+01  1.275e+01  1.580e+01
-6.550e+00
  2.175e+01  2.475e+01  1.930e+01  1.520e+01  1.475e+01  1.310e+01
  2.450e+00  6.750e+00  3.000e+00  1.975e+01  2.025e+01  3.230e+01
  1.965e+01  2.155e+01  9.550e+00  2.325e+01  3.200e+01  2.000e+01
  1.675e+01  1.875e+01  1.305e+01  2.100e+01  1.550e+01  1.775e+01
  2.130e+01  3.135e+01  8.550e+00  4.900e+00  1.500e+01  1.055e+01
  2.075e+01  2.500e+01  1.155e+01  1.017e+01  3.585e+01  8.300e+00
  9.050e+00  2.145e+01  5.300e+01  7.600e+01  1.585e+01  1.300e+01
  5.000e+00  1.830e+01  2.275e+01  5.340e+00  2.011e+01  3.030e+01
  2.455e+01  1.750e+00  1.375e+01  2.717e+01  2.255e+01  9.000e+00
  1.855e+01  2.225e+01  1.795e+01  2.030e+01 -5.000e+00  3.053e+01
  2.195e+01  8.360e+00  4.250e+00  1.575e+01  2.550e+01 -1.930e+01
  2.110e+01  8.720e+00  1.650e+01  1.175e+01  2.400e+01  1.955e+01
  1.000e+00  1.805e+01  2.200e+01  1.900e+01  1.970e+01  2.585e+01
  1.785e+01  2.300e+01  1.780e+01  2.095e+01  2.760e+01  7.750e+00
  1.765e+01  1.390e+01  8.210e+00  1.455e+01  2.125e+01  1.330e+01
  2.573e+01  2.451e+01  3.000e+01  2.250e+01  2.600e+01  2.060e+01
  2.000e+00  2.135e+01  7.000e+00  1.720e+01  2.050e+01  2.575e+01
  1.510e+01  1.864e+01  6.300e+01  2.675e+01  2.465e+01 -2.130e+01
 -8.300e+00  4.255e+01  1.700e+01  1.230e+01 -2.655e+01 -8.500e+00
  2.930e+01  2.956e+01  1.825e+01  6.600e+00  3.605e+01  1.000e+01
  2.330e+01  1.750e+01  1.625e+01  1.725e+01  2.950e+01  5.200e+00
  1.355e+01  2.673e+01  1.050e+01  3.590e+01  2.500e+00  1.145e+01
  3.205e+01  8.400e+00 -1.050e+01  2.775e+01  2.222e+01  1.925e+01
  6.000e+00  2.230e+01  3.250e+01  1.810e+01  1.835e+01  1.850e+01
  8.500e+00 -1.000e+01  2.630e+01  3.800e+01  2.085e+01  8.000e+01
 -1.500e+01  8.460e+00  5.700e+00  1.080e+01  2.975e+01  2.340e+01
  2.430e+01  1.565e+01  5.450e+00  2.020e+01  2.055e+01 -2.930e+01
  1.200e+01  4.000e+00  2.985e+01  1.515e+01  4.492e+01  2.375e+01
 -1.255e+01  4.725e+01  1.410e+01  1.783e+01  5.600e+01  1.030e+01
  1.704e+01  2.525e+01  3.300e+01  1.615e+01  2.815e+01  1.280e+01
  8.750e+00  4.200e+01  1.895e+01  1.600e+01 -8.550e+00 -1.475e+01
  1.574e+01  1.311e+01  8.710e+00  2.150e+01  2.309e+01 -1.275e+01
  2.264e+01  1.554e+01 -3.000e+00  4.000e+01  1.000e-02  3.825e+01
  8.000e+00  4.515e+01  2.087e+01  1.915e+01  1.792e+01  2.730e+01
  2.350e+01  1.405e+01  1.695e+01  1.499e+01]
No. of missing values : 0 [ Percentage(%) : 0.0 ]
No. of 0 values : 159328 [ Percentage(%) : 91.04457142857143 ]
No. of -ve values : 126 [ Percentage(%) : 0.07200000000000001 ]
```

```
Maximum Value : 80.0
Minimum Value : -29.3
Mean Value : 0.6468162857142857
```

[61]:
```
plt.hist(train_data['tolls_amount'],ec='white')
plt.xlabel("tolls_amount")
plt.ylabel("frequency")
plt.title('Histogram (tolls_amount)')
plt.show()
```



[62]:
```
toll_outliers = detect_outliers_iqr(train_data['tolls_amount'])
print("Outliers Count :", len(toll_outliers))
```

```
Outliers Count : 15672
```

Observations

- `tolls_amount` contains no missing values.
- It has 15672 outliers.
- `tolls_amount` contains 159328 zero values which is approx 91.0% of total number of value.
- `tolls_amount` contains 126 -ve values which is approx 0.1% of total number of value.

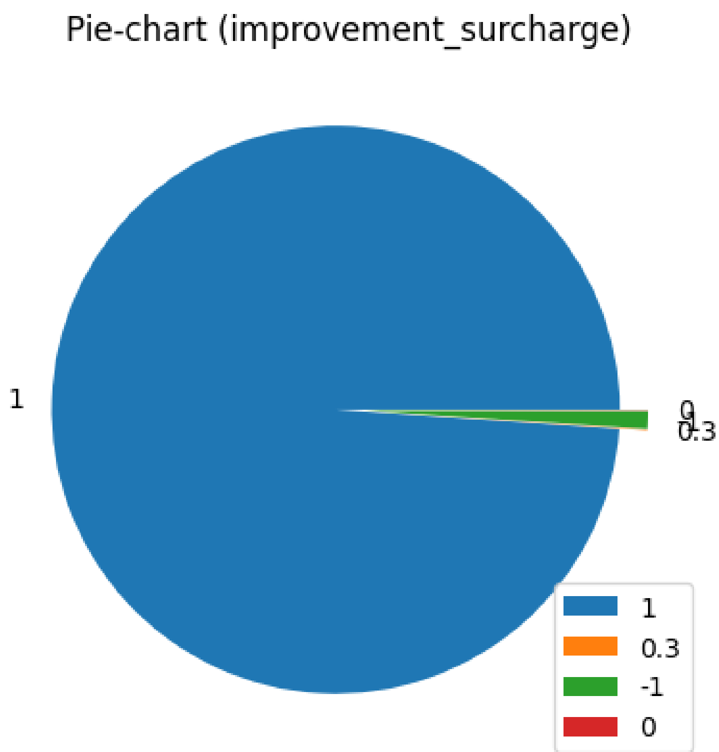
- Maximum Value : 80.0
- Minimum Value : -29.3
- Mean Value : 0.6468162857142857

14. improvement_surcharge

[63]:
```
print("Unique values :", pd.unique(train_data['improvement_surcharge']))
print("No. of distinct values :", len(pd.
 ↪unique(train_data['improvement_surcharge'])))
print("No. of missing values :",train_data['improvement_surcharge'].isnull().
 ↪sum(), "[","Percentage(%) :", (train_data['improvement_surcharge'].isnull().
 ↪sum())*(100/175000),"]")
```

```
Unique values : [ 1.   0.3 -1.   0. ]
No. of distinct values : 4
No. of missing values : 0 [ Percentage(%) : 0.0 ]
```

[64]:
```
Unique_values = [1, 0.3, -1, 0]
value_count = []
for i in Unique_values:
    value_count.append(train_data['improvement_surcharge'].value_counts()[i])
#Unique_values.append('null_values')
#value_count.append(train_data['store_and_fwd_flag'].isnull().sum())
#print(value_count)
plt.pie(value_count,labels=Unique_values,explode=[0.05,0.05,0.05,0.05])
plt.title('Pie-chart (improvement_surcharge)')
plt.legend(Unique_values)
plt.show()
```



Observations

- There are no missing values.
- There are 4 distinct values.
- Most Frequent is 1.

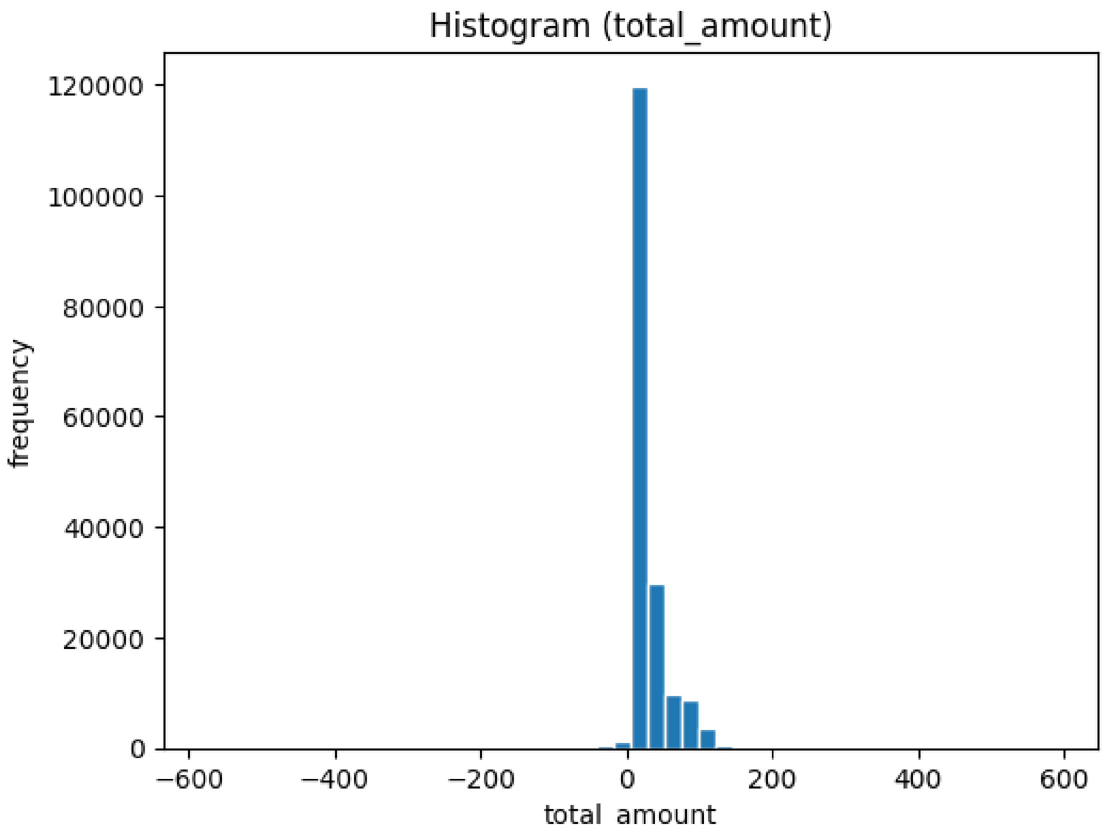
15. total_amount (Target variable)

[65]:
```
print("No. of missing values :",train_data['total_amount'].isnull().sum(),␣
↪"[","Percentage(%) :", (train_data['total_amount'].isnull().sum())*(100/
↪175000),"]")
print("No. of 0 values :
↪",len(train_data[train_data['total_amount']==0]),"[","Percentage(%) :",␣
↪len(train_data[train_data['total_amount']==0])*(100/175000),"]")
print("No. of -ve values :
↪",len(train_data[train_data['total_amount']<0]),"[","Percentage(%) :",␣
↪len(train_data[train_data['total_amount']<0])*(100/175000),"]")
print("Maximum Value :",train_data['total_amount'].max())
print("Minimum Value :",train_data['total_amount'].min())
print("Mean Value :",train_data['total_amount'].mean())
```

```
No. of missing values : 0 [ Percentage(%) : 0.0 ]
No. of 0 values : 22 [ Percentage(%) : 0.012571428571428572 ]
```

```
No. of -ve values : 1725 [ Percentage(%) : 0.9857142857142858 ]
Maximum Value : 587.25
Minimum Value : -576.75
Mean Value : 29.633900971428567
```

[66]:
```python
plt.hist(train_data['total_amount'],ec='white',bins=50)
plt.xlabel("total_amount")
plt.ylabel("frequency")
plt.title('Histogram (total_amount)')
plt.show()
```



Observations

- `total_amount` doesn't contain any missing value.
- `total_amount` contain 22 zero values which is approx 0.1% of the total number of values.
- `total_amount` contain 1725 zero values which is approx 1.0% of the total number of values.
- `Maximum Value : 587.25`
- `Minimum Value : -576.75`
- `Mean Value : 29.633900971428567`

16. congestion_surcharge

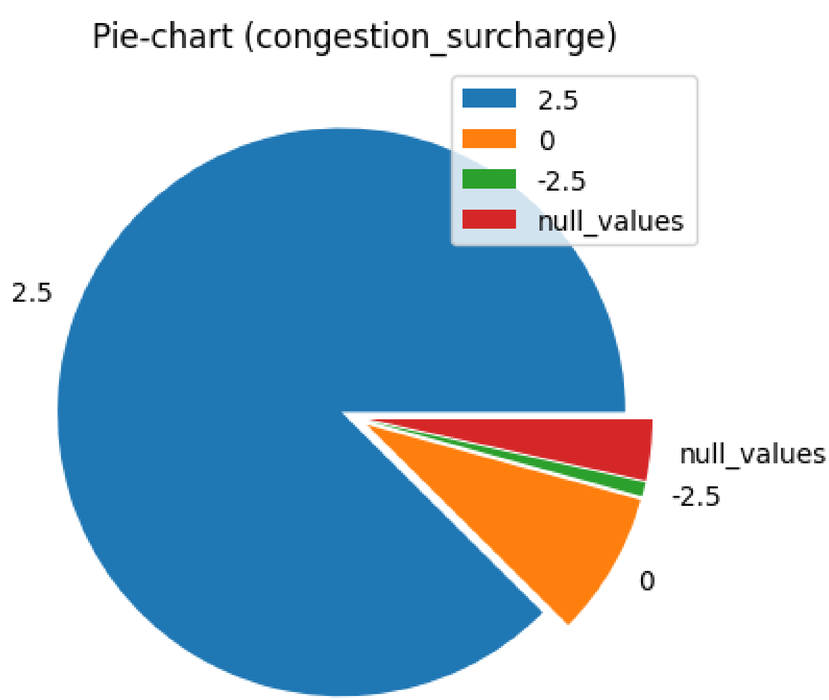
[67]:

```
print("Unique values :", pd.unique(train_data['congestion_surcharge']))
print("No. of distinct values :", len(pd.
 ↪unique(train_data['congestion_surcharge'])))
print("No. of missing values :",train_data['congestion_surcharge'].isnull().
 ↪sum(), "[","Percentage(%) :", (train_data['congestion_surcharge'].isnull().
 ↪sum())*(100/175000),"]")
print("Mean Value :",train_data['congestion_surcharge'].mean())
```

```
Unique values : [ 2.5  0.   nan -2.5]
No. of distinct values : 4
No. of missing values : 6077 [ Percentage(%) : 3.472571428571429 ]
Mean Value : 2.246970513192401
```

[68]:

```
Unique_values = [2.5,  0, -2.5]
value_count = []
for i in Unique_values:
    value_count.append(train_data['congestion_surcharge'].value_counts()[i])
Unique_values.append('null_values')
value_count.append(train_data['congestion_surcharge'].isnull().sum())
#print(value_count)
plt.pie(value_count,labels=Unique_values,explode=[0.05,0.05,0.05,0.05])
plt.title('Pie-chart (congestion_surcharge)')
plt.legend(Unique_values)
plt.show()
```



Observations

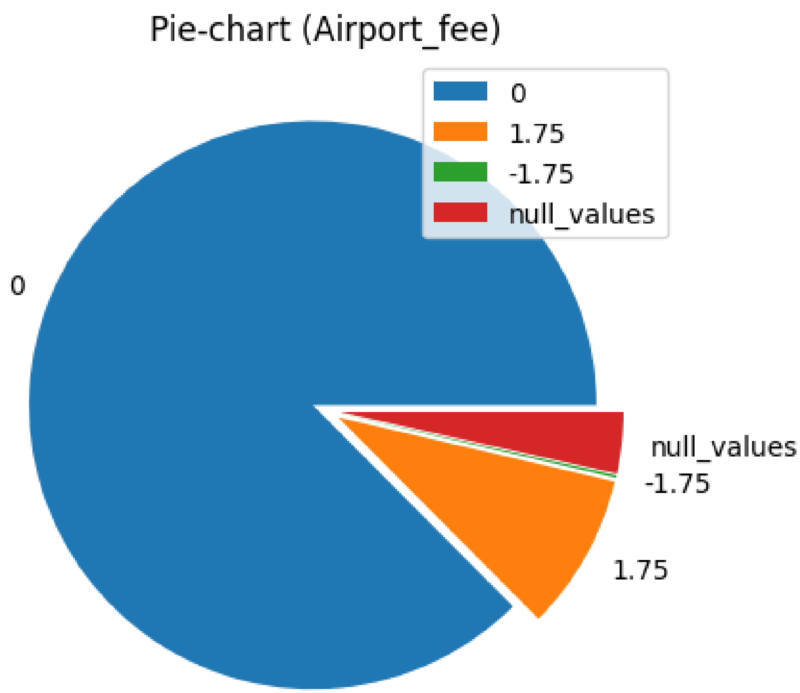
- There are 4 distinct values (including null values as type).
- `congestion_surcharge` contains 6077 missing values which is approx 3.5% of total number of values.
- Most Frequent is 2.5
- `Mean Value : 2.246970513192401`

17. Airport_fee

[69]:
```
print("Unique values :", pd.unique(train_data['Airport_fee']))
print("No. of distinct values :", len(pd.unique(train_data['Airport_fee'])))
print("No. of missing values :",train_data['Airport_fee'].isnull().sum(),␣
↪"[","Percentage(%) :", (train_data['Airport_fee'].isnull().sum())*(100/
↪175000),"]")
print("Mean Value :",train_data['Airport_fee'].mean())
```

```
Unique values : [ 0.    1.75   nan -1.75]
No. of distinct values : 4
No. of missing values : 6077 [ Percentage(%) : 3.472571428571429 ]
Mean Value : 0.15882532278020162
```

[70]:
```
Unique_values = [0, 1.75, -1.75]
value_count = []
for i in Unique_values:
    value_count.append(train_data['Airport_fee'].value_counts()[i])
Unique_values.append('null_values')
value_count.append(train_data['Airport_fee'].isnull().sum())
#print(value_count)
plt.pie(value_count,labels=Unique_values,explode=[0.05,0.05,0.05,0.05])
plt.title('Pie-chart (Airport_fee)')
plt.legend(Unique_values)
plt.show()
```



Observations

- There are 4 distinct values (including null values as type).
- `Airport_fee` contains 6077 missing values which is approx 3.5% of total number of values.
- Most Frequent is 1.
- `Mean Value : 0.15882532278020162`

6.3 Overall Observations

- **There are 5 attributes having missing values. (`passenger_count`,`RatecodeID`,`store_and_fwd_flag`, `congestion_surcharge`, `Airport_fee`)**
  - These can be filled by the corresponding **most_frequent values**.
  - `Airport_fee` & `congestion_surcharge` can be checked by imputing their corresponding mean values.
- **Two attributes (`store_and_fwd_flag`, `payment_type`) are of Categorical type**. It can be encoded using `Label Encoder`. We will not use `Ordinal Encoder` because labels are not having some order.
- **We have also observed that some attributes have -ve value. We will check our scores in both cases (by keeping and removing it) and compare them.**
- `payment_type` has some `unknown` values.
- `passenger_count` & `trip_distance` has some 0 values.

- **We have also two `datetime` type columns.We will drop it after creating new features from it.**

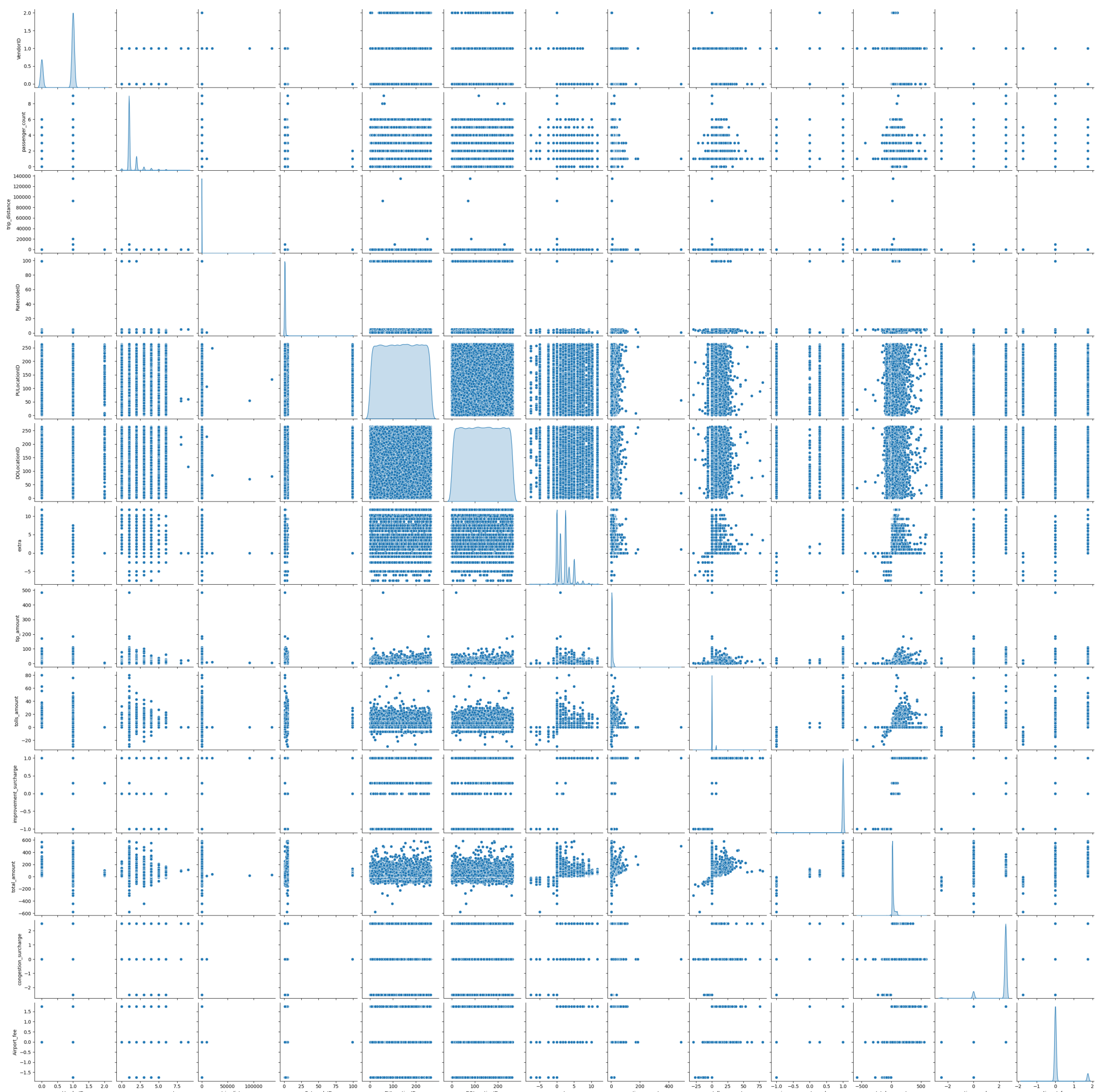
6.4 Bivariate Analysis

- Using `pairplot`

[71]:
```python
sns.pairplot(train_data, diag_kind='kde')
```

```
/opt/conda/lib/python3.10/site-packages/seaborn/axisgrid.py:118: UserWarning:
The figure layout has changed to tight
  self._figure.tight_layout(*args, **kwargs)
```

[71]: `<seaborn.axisgrid.PairGrid at 0x7d704390d8d0>`



6.5 Data Preprocessing

Extract and creating new features from the datetime features

[72]:
```
#train_data['pickup_day'] = train_data['tpep_pickup_datetime'].dt.day_name()
#train_data['dropoff_day'] = train_data['tpep_dropoff_datetime'].dt.day_name()
train_data['pickup_day_no'] = train_data['tpep_pickup_datetime'].dt.weekday
train_data['dropoff_day_no'] = train_data['tpep_dropoff_datetime'].dt.weekday
train_data['pickup_hour'] = train_data['tpep_pickup_datetime'].dt.hour
train_data['dropoff_hour'] = train_data['tpep_dropoff_datetime'].dt.hour
train_data['pickup_month'] = train_data['tpep_pickup_datetime'].dt.month
train_data['dropoff_month'] = train_data['tpep_dropoff_datetime'].dt.month
```

[73]:
```
train_data['pickup_timeofday'] = train_data['pickup_hour'].apply(time_of_day)
train_data['dropoff_timeofday'] = train_data['dropoff_hour'].apply(time_of_day)
```

[74]:
```
train_data.head()
```

[74]:
```
   VendorID tpep_pickup_datetime tpep_dropoff_datetime  passenger_count  \
0         1  2023-06-28 17:20:21   2023-06-28 16:34:45              1.0
1         0  2023-06-29 23:05:01   2023-06-29 22:01:35              1.0
2         1  2023-06-30 10:19:31   2023-06-30 11:13:10              1.0
3         0  2023-06-29 13:23:09   2023-06-29 14:20:01              1.0
4         1  2023-06-29 22:03:32   2023-06-29 22:22:22              3.0

   trip_distance  RatecodeID store_and_fwd_flag  PULocationID  DOLocationID  \
0           2.14         1.0                  N           120             9
1           2.70         1.0                  N            15           215
2           1.15         1.0                  N           167           223
3           0.40         1.0                  N           128           239
4           1.10         1.0                  N           203            52

  payment_type  …  congestion_surcharge  Airport_fee  pickup_day_no  \
0  Credit Card  …                   2.5          0.0              2
1  Credit Card  …                   2.5          0.0              3
2  Credit Card  …                   2.5          0.0              4
3  Credit Card  …                   2.5          0.0              3
4  Credit Card  …                   2.5          0.0              3

   dropoff_day_no  pickup_hour  dropoff_hour  pickup_month  dropoff_month  \
0               2           17            16             6              6
1               3           23            22             6              6
2               4           10            11             6              6
3               3           13            14             6              6
4               3           22            22             6              6

   pickup_timeofday  dropoff_timeofday
0           Evening            Evening
```

```
1        Late night         Late night
2           Morning            Morning
3         Afternoon          Afternoon
4        Late night         Late night

[5 rows x 25 columns]
```

6.5.1 Handling Outliers

[75]:
```
'''
# trip_distance
trip_percentile25 = train_data['trip_distance'].quantile(0.25)
trip_percentile75 = train_data['trip_distance'].quantile(0.75)
trip_iqr = trip_percentile75 - trip_percentile25

print("25th Percentile (Trip distance) :", trip_percentile25)
print("75th Percentile (Trip distance) :", trip_percentile75)
print("IQR (Trip distance) :", trip_iqr)

trip_upper_limit = trip_percentile75 + (trip_iqr*1.5)
trip_lower_limit = trip_percentile25 - (trip_iqr*1.5)

print("Upper Limit (Trip distance) :", trip_upper_limit)
print("Lower Limit (Trip distance) :", trip_lower_limit)

train_data['trip_distance']=np.where(
train_data['trip_distance']>trip_upper_limit, trip_upper_limit,np.where(
train_data['trip_distance']<trip_lower_limit,trip_lower_limit,␣
↪train_data['trip_distance']))

print("---------------------------------------------------")

# tip_amount
tip_percentile25 = train_data['tip_amount'].quantile(0.25)
tip_percentile75 = train_data['tip_amount'].quantile(0.75)
tip_iqr = tip_percentile75 - tip_percentile25

print("25th Percentile (Tip Amount) :", tip_percentile25)
print("75th Percentile (Tip Amount) :", tip_percentile75)
print("IQR (Tip Amount) :", tip_iqr)

tip_upper_limit = tip_percentile75 + (tip_iqr*1.5)
tip_lower_limit = tip_percentile25 - (tip_iqr*1.5)

print("Upper Limit (Tip amount) :", tip_upper_limit)
print("Lower Limit (Tip amount) :", tip_lower_limit)
```

```
train_data['tip_amount']=np.where(
train_data['tip_amount']>tip_upper_limit, tip_upper_limit,np.where(
train_data['tip_amount']<tip_lower_limit,tip_lower_limit,␣
↪train_data['tip_amount']))
'''
```

[75]: '\n# trip_distance\ntrip_percentile25 = train_data[\'trip_distance\'].quantile(0.25)\ntrip_percentile75 = train_data[\'trip_distance\'].quantile(0.75)\ntrip_iqr = trip_percentile75 - trip_percentile25\n\nprint("25th Percentile (Trip distance) :", trip_percentile25)\nprint("75th Percentile (Trip distance) :", trip_percentile75)\nprint("IQR (Trip distance) :", trip_iqr)\n\ntrip_upper_limit = trip_percentile75 + (trip_iqr*1.5)\ntrip_lower_limit = trip_percentile25 - (trip_iqr*1.5)\n\nprint("Upper Limit (Trip distance) :", trip_upper_limit)\nprint("Lower Limit (Trip distance) :", trip_lower_limit)\n\ntrain_data[\'trip_distance\']=np.where(\ntrain_data[\'trip_distance\']>trip_upper_limit, trip_upper_limit,np.where(\ntrain_data[\'trip_distance\']<trip_lower_limit,trip_lower_limit, train_data[\'trip_distance\']))\n\nprint("--")\n\n# tip_amount\ntip_percentile25 = train_data[\'tip_amount\'].quantile(0.25)\ntip_percentile75 = train_data[\'tip_amount\'].quantile(0.75)\ntip_iqr = tip_percentile75 - tip_percentile25\n\nprint("25th Percentile (Tip Amount) :", tip_percentile25)\nprint("75th Percentile (Tip Amount) :", tip_percentile75)\nprint("IQR (Tip Amount) :", tip_iqr)\n\ntip_upper_limit = tip_percentile75 + (tip_iqr*1.5)\ntip_lower_limit = tip_percentile25 - (tip_iqr*1.5)\n\nprint("Upper Limit (Tip amount) :", tip_upper_limit)\nprint("Lower Limit (Tip amount) :", tip_lower_limit)\n\ntrain_data[\'tip_amount\']=np.where(\ntrain_data[\'tip_amount\']>tip_upper_limit, tip_upper_limit,np.where(\ntrain_data[\'tip_amount\']<tip_lower_limit,tip_lower_limit, train_data[\'tip_amount\']))\n'

[76]:
```
#sns.boxplot(train_data['trip_distance'])
```

[77]:
```
#sns.boxplot(train_data['tip_amount'])
```

[78]:
```
index_pcount = train_data[(train_data['passenger_count']>=8)].index
train_data.drop(index_pcount , axis='index', inplace=True)
#index_datecount =␣
↪train_data[(train_data['tpep_pickup_datetime']==train_data['tpep_dropoff_datetime'])].
↪index
#train_data.drop(index_datecount , axis='index', inplace=True)
train_data['extra'] = train_data['extra'].abs()
#train_data['tolls_amount'] = train_data['tolls_amount'].abs()
#toll_mean = train_data['tolls_amount'][train_data['tolls_amount']>0].mean()
train_data['tolls_amount'].mask(train_data['tolls_amount'] <0.0, 0.0,␣
↪inplace=True)
#index_tripcount = train_data[(train_data['trip_distance']==0.0)].index
```

```python
#train_data.drop(index_tripcount , axis='index', inplace=True)
#print("Most_frequent Value :",train_data['trip_distance'].mode())
#index_p1count = train_data[(train_data['passenger_count']==0)].index
train_data['trip_distance'].mask(train_data['trip_distance'] == 0.0, 1.0,␣
 ↪inplace=True)
train_data['Airport_fee'].mask(train_data['Airport_fee'] == -1.75, 1.75,␣
 ↪inplace=True)
train_data['congestion_surcharge'].mask(train_data['congestion_surcharge'] ==␣
 ↪-2.5, 2.5, inplace=True)
train_data['passenger_count'].mask(train_data['passenger_count'] == 0, 1,␣
 ↪inplace=True)
#train_data['passenger_count'].mask(train_data['passenger_count'] < 0, 1,␣
 ↪inplace=True)
#tip_5th_per = np.percentile(train_data['tip_amount'], 5)
#tip_95th_per = np.percentile(train_data['tip_amount'], 95)
#train_data['tip_amount'].mask(train_data['tip_amount']<tip_5th_per,␣
 ↪tip_5th_per, inplace=True)
#train_data['tip_amount'].mask(train_data['tip_amount']>tip_95th_per,␣
 ↪tip_95th_per, inplace=True)
#index_tcount = train_data[(train_data['trip_distance']>200)].index
#index_ridcount = train_data[(train_data['RatecodeID']==99)].index
#index_tipcount = train_data[(train_data['tip_amount']>400)].index
#index_tollcount = train_data[(train_data['tolls_amount']<0)].index
#index_excount = train_data[(train_data['extra']<0)].index


#train_data.drop(index_p1count , axis='index', inplace=True)
#train_data.drop(index_ridcount , axis='index', inplace=True)
#train_data.drop(index_tcount , axis='index', inplace=True)
#train_data.drop(index_tipcount , axis='index', inplace=True)
#train_data.drop(index_tollcount , axis='index', inplace=True)
#train_data.drop(index_excount , axis='index', inplace=True)
train_data.reset_index()
train_data.info()
```

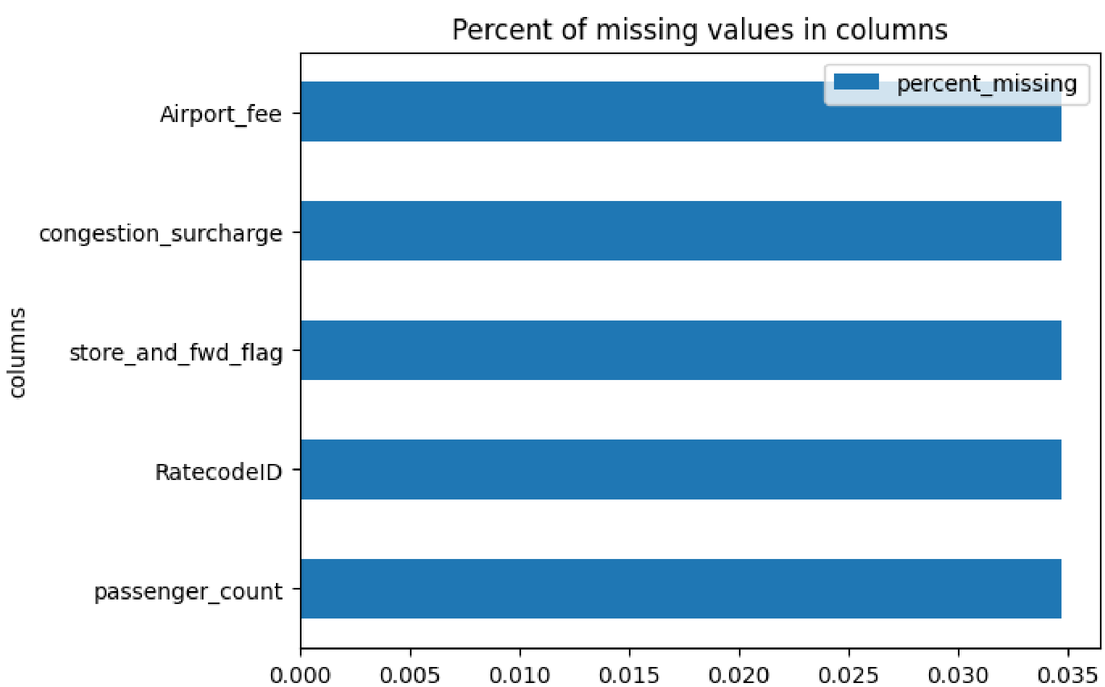
```
<class 'pandas.core.frame.DataFrame'>
Index: 174997 entries, 0 to 174999
Data columns (total 25 columns):
 #   Column                 Non-Null Count   Dtype
---  ------                 --------------   -----
 0   VendorID               174997 non-null  int64
 1   tpep_pickup_datetime   174997 non-null  datetime64[ns]
 2   tpep_dropoff_datetime  174997 non-null  datetime64[ns]
 3   passenger_count        168920 non-null  float64
 4   trip_distance          174997 non-null  float64
 5   RatecodeID             168920 non-null  float64
 6   store_and_fwd_flag     168920 non-null  object
```

```
 7   PULocationID           174997 non-null  int64
 8   DOLocationID           174997 non-null  int64
 9   payment_type           174997 non-null  object
 10  extra                  174997 non-null  float64
 11  tip_amount             174997 non-null  float64
 12  tolls_amount           174997 non-null  float64
 13  improvement_surcharge  174997 non-null  float64
 14  total_amount           174997 non-null  float64
 15  congestion_surcharge   168920 non-null  float64
 16  Airport_fee            168920 non-null  float64
 17  pickup_day_no          174997 non-null  int32
 18  dropoff_day_no         174997 non-null  int32
 19  pickup_hour            174997 non-null  int32
 20  dropoff_hour           174997 non-null  int32
 21  pickup_month           174997 non-null  int32
 22  dropoff_month          174997 non-null  int32
 23  pickup_timeofday       174997 non-null  object
 24  dropoff_timeofday      174997 non-null  object
dtypes: datetime64[ns](2), float64(10), int32(6), int64(3), object(4)
memory usage: 30.7+ MB
```

6.5.2 Handling Missing Values

- **Visualizing Missing Values**

[79]:
```
# Plotting missing value percentage for train data columns.
plot_missing_values(train_data)
```



[80]:
```
mis_val_att = ["passenger_count","RatecodeID","store_and_fwd_flag",␣
↪"congestion_surcharge","Airport_fee"]
imp = SimpleImputer(missing_values=np.nan, strategy='most_frequent')
imp.fit(train_data)
train_data = pd.DataFrame(imp.transform(train_data), columns = train_data.
↪columns)
train_data.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 174997 entries, 0 to 174996
Data columns (total 25 columns):
 #   Column                 Non-Null Count   Dtype
---  ------                 --------------   -----
 0   VendorID               174997 non-null  object
 1   tpep_pickup_datetime   174997 non-null  datetime64[ns]
 2   tpep_dropoff_datetime  174997 non-null  datetime64[ns]
 3   passenger_count        174997 non-null  object
 4   trip_distance          174997 non-null  object
 5   RatecodeID             174997 non-null  object
 6   store_and_fwd_flag     174997 non-null  object
 7   PULocationID           174997 non-null  object
 8   DOLocationID           174997 non-null  object
 9   payment_type           174997 non-null  object
 10  extra                  174997 non-null  object
 11  tip_amount             174997 non-null  object
 12  tolls_amount           174997 non-null  object
 13  improvement_surcharge  174997 non-null  object
 14  total_amount           174997 non-null  object
 15  congestion_surcharge   174997 non-null  object
 16  Airport_fee            174997 non-null  object
 17  pickup_day_no          174997 non-null  object
 18  dropoff_day_no         174997 non-null  object
 19  pickup_hour            174997 non-null  object
 20  dropoff_hour           174997 non-null  object
 21  pickup_month           174997 non-null  object
 22  dropoff_month          174997 non-null  object
 23  pickup_timeofday       174997 non-null  object
 24  dropoff_timeofday      174997 non-null  object
dtypes: datetime64[ns](2), object(23)
memory usage: 33.4+ MB
```

6.5.3 Handling Payment type unknown values

- Replacing it by cash value.

[81]:
```
train_data['payment_type'].mask(train_data['payment_type'] == 'unknown',␣
↪"Cash", inplace=True)
```

[82]:
```
train_data['payment_type'].value_counts()
```

[82]:
```
payment_type
Credit Card    135254
Cash            32474
Wallet           6077
UPI              1192
Name: count, dtype: int64
```

6.5.4 Handling Categorical Variable

- Applying `Label Encoding` for attributes `store_and_fwd_flag` & `payment_type`

[83]:
```
train_data = MultiColumnLabelEncoder(columns =␣
↪['store_and_fwd_flag','payment_type','pickup_timeofday','dropoff_timeofday']).
↪fit_transform(train_data)
```

[84]:
```
train_data.head()
```

[84]:
```
   VendorID tpep_pickup_datetime tpep_dropoff_datetime passenger_count  \
0         1  2023-06-28 17:20:21   2023-06-28 16:34:45             1.0
1         0  2023-06-29 23:05:01   2023-06-29 22:01:35             1.0
2         1  2023-06-30 10:19:31   2023-06-30 11:13:10             1.0
3         0  2023-06-29 13:23:09   2023-06-29 14:20:01             1.0
4         1  2023-06-29 22:03:32   2023-06-29 22:22:22             3.0

  trip_distance RatecodeID  store_and_fwd_flag PULocationID DOLocationID  \
0          2.14        1.0                  0          120            9
1           2.7        1.0                  0           15          215
2          1.15        1.0                  0          167          223
3           0.4        1.0                  0          128          239
4           1.1        1.0                  0          203           52

   payment_type  … congestion_surcharge Airport_fee pickup_day_no  \
0             1  …                  2.5         0.0             2
1             1  …                  2.5         0.0             3
2             1  …                  2.5         0.0             4
3             1  …                  2.5         0.0             3
4             1  …                  2.5         0.0             3

  dropoff_day_no pickup_hour dropoff_hour pickup_month dropoff_month  \
0              2          17           16            6             6
1              3          23           22            6             6
2              4          10           11            6             6
```

```
3                3          13           14           6            6
4                3          22           22           6            6

  pickup_timeofday dropoff_timeofday
0                1                 1
1                2                 2
2                3                 3
3                0                 0
4                2                 2

[5 rows x 25 columns]
```

6.5.5 Handling Negative Values

[85]:
```
#print("No. of rows having -ve 'improvement_surcharge' value :
↪",train_data[train_data["improvement_surcharge"]<0].shape[0])
#print("No. of rows having -ve 'total_amount' value :
↪",train_data[train_data["total_amount"]<0].shape[0])
#print("No. of rows having -ve 'congestion_surcharge' value :
↪",train_data[train_data["congestion_surcharge"]<0].shape[0])
#print("No. of rows having -ve 'extra' value :
↪",train_data[train_data["extra"]<0].shape[0])
#print("No. of rows having -ve 'Airport_fee' value :
↪",train_data[train_data["Airport_fee"]<0].shape[0])
#print("No. of rows having -ve 'tolls_amount' value :
↪",train_data[train_data["tolls_amount"]<0].shape[0])
```

- Removing rows having -ve `improvement_surcharge` value

[86]:
```
#train_data.drop(train_data[train_data["improvement_surcharge"]<0].index,␣
↪inplace=True)
#train_data.shape
```

- Scores have been checked by keeping -ve values as it is as well as by removing it. Score after keeping it as given in dataset is good one.
- Now, Checking Negative values after running the above cell.

[87]:
```
#print("No. of rows having -ve 'improvement_surcharge' value :
↪",train_data[train_data["improvement_surcharge"]<0].shape[0])
#print("No. of rows having -ve 'total_amount' value :
↪",train_data[train_data["total_amount"]<0].shape[0])
#print("No. of rows having -ve 'congestion_surcharge' value :
↪",train_data[train_data["congestion_surcharge"]<0].shape[0])
#print("No. of rows having -ve 'extra' value :
↪",train_data[train_data["extra"]<0].shape[0])
```

```
#print("No. of rows having -ve 'Airport_fee' value :
↪",train_data[train_data["Airport_fee"]<0].shape[0])
#print("No. of rows having -ve 'tolls_amount' value :
↪",train_data[train_data["tolls_amount"]<0].shape[0])
```

6.5.6 Dropping tpep_pickup_datetime & tpep_dropoff_datetime columns

[88]:
```
train_data = train_data.drop(['tpep_pickup_datetime', 'tpep_dropoff_datetime'],␣
↪axis=1)
```

[89]:
```
train_data.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 174997 entries, 0 to 174996
Data columns (total 23 columns):
 #   Column                 Non-Null Count   Dtype
---  ------                 --------------   -----
 0   VendorID               174997 non-null  object
 1   passenger_count        174997 non-null  object
 2   trip_distance          174997 non-null  object
 3   RatecodeID             174997 non-null  object
 4   store_and_fwd_flag     174997 non-null  int64
 5   PULocationID           174997 non-null  object
 6   DOLocationID           174997 non-null  object
 7   payment_type           174997 non-null  int64
 8   extra                  174997 non-null  object
 9   tip_amount             174997 non-null  object
 10  tolls_amount           174997 non-null  object
 11  improvement_surcharge  174997 non-null  object
 12  total_amount           174997 non-null  object
 13  congestion_surcharge   174997 non-null  object
 14  Airport_fee            174997 non-null  object
 15  pickup_day_no          174997 non-null  object
 16  dropoff_day_no         174997 non-null  object
 17  pickup_hour            174997 non-null  object
 18  dropoff_hour           174997 non-null  object
 19  pickup_month           174997 non-null  object
 20  dropoff_month          174997 non-null  object
 21  pickup_timeofday       174997 non-null  int64
 22  dropoff_timeofday      174997 non-null  int64
dtypes: int64(4), object(19)
memory usage: 30.7+ MB
```

6.5.7 Coverting columns having type 'object' to 'float64' for further smooth processing.

[90]:
```
train_data[['VendorID','passenger_count','trip_distance','RatecodeID','PULocationID','DOLocati
↪=␣
↪train_data[['VendorID','passenger_count','trip_distance','RatecodeID','PULocationID','DOLoc
↪astype('float64')
```

[91]:
```
train_data.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 174997 entries, 0 to 174996
Data columns (total 23 columns):
 #   Column                 Non-Null Count   Dtype
---  ------                 --------------   -----
 0   VendorID               174997 non-null  float64
 1   passenger_count        174997 non-null  float64
 2   trip_distance          174997 non-null  float64
 3   RatecodeID             174997 non-null  float64
 4   store_and_fwd_flag     174997 non-null  int64
 5   PULocationID           174997 non-null  float64
 6   DOLocationID           174997 non-null  float64
 7   payment_type           174997 non-null  int64
 8   extra                  174997 non-null  float64
 9   tip_amount             174997 non-null  float64
 10  tolls_amount           174997 non-null  float64
 11  improvement_surcharge  174997 non-null  float64
 12  total_amount           174997 non-null  float64
 13  congestion_surcharge   174997 non-null  float64
 14  Airport_fee            174997 non-null  float64
 15  pickup_day_no          174997 non-null  float64
 16  dropoff_day_no         174997 non-null  float64
 17  pickup_hour            174997 non-null  float64
 18  dropoff_hour           174997 non-null  float64
 19  pickup_month           174997 non-null  float64
 20  dropoff_month          174997 non-null  float64
 21  pickup_timeofday       174997 non-null  float64
 22  dropoff_timeofday      174997 non-null  float64
dtypes: float64(21), int64(2)
memory usage: 30.7 MB
```

- **At this point, We have train data having 23 Columns with no missing values. Also, Catgorical variables have been label encoded.**

7 Newly Added Features & their significance (After Preprocessing)

Newly added columns	Significance
pickup_day_no	Pickup day number.
dropoff_day_no	Dropoff day number.
pickup_hour	Pickup day hour.
dropoff_hour	Dropoff day hour.
pickup_month	Pickup month.
dropoff_month	Dropoff month.
pickup_timeofday	Pickup Time (Morning, Afternoon, Evening, Late night)
dropoff_timeofday	Dropoff Time (Morning, Afternoon, Evening, Late night)

[92]:
```
train_data.head()
```

[92]:
```
   VendorID  passenger_count  trip_distance  RatecodeID  store_and_fwd_flag  \
0       1.0              1.0           2.14         1.0                   0
1       0.0              1.0           2.70         1.0                   0
2       1.0              1.0           1.15         1.0                   0
3       0.0              1.0           0.40         1.0                   0
4       1.0              3.0           1.10         1.0                   0

   PULocationID  DOLocationID  payment_type  extra  tip_amount  …  \
0         120.0           9.0             1    2.5    7.165589  …
1          15.0         215.0             1    3.5    6.067401  …
2         167.0         223.0             1    0.0    4.111547  …
3         128.0         239.0             1    2.5    6.411079  …
4         203.0          52.0             1    1.0    4.769377  …

   congestion_surcharge  Airport_fee  pickup_day_no  dropoff_day_no  \
0                   2.5          0.0            2.0             2.0
1                   2.5          0.0            3.0             3.0
2                   2.5          0.0            4.0             4.0
3                   2.5          0.0            3.0             3.0
4                   2.5          0.0            3.0             3.0

   pickup_hour  dropoff_hour  pickup_month  dropoff_month  pickup_timeofday  \
0         17.0          16.0           6.0            6.0               1.0
1         23.0          22.0           6.0            6.0               2.0
2         10.0          11.0           6.0            6.0               3.0
3         13.0          14.0           6.0            6.0               0.0
4         22.0          22.0           6.0            6.0               2.0

   dropoff_timeofday
0                1.0
1                2.0
2                3.0
3                0.0
4                2.0
```

[5 rows x 23 columns]

7.1 Correlation

- **Table**

[93]:
```
train_data.corr()
```

[93]:

	VendorID	passenger_count	trip_distance	RatecodeID	\
VendorID	1.000000	0.066871	0.002844	-0.105156	
passenger_count	0.066871	1.000000	-0.000981	-0.023677	
trip_distance	0.002844	-0.000981	1.000000	0.000613	
RatecodeID	-0.105156	-0.023677	0.000613	1.000000	
store_and_fwd_flag	-0.126133	-0.007919	-0.000415	-0.004460	
PULocationID	-0.001305	-0.001053	-0.000958	-0.001102	
DOLocationID	-0.003953	-0.001017	-0.002497	-0.000644	
payment_type	0.012329	-0.084540	0.013834	0.010634	
extra	-0.529015	-0.009888	-0.001917	-0.068949	
tip_amount	0.043925	0.013730	0.005840	-0.031890	
tolls_amount	0.025171	0.037280	0.006894	0.061082	
improvement_surcharge	-0.063198	-0.002000	0.000434	0.002403	
total_amount	0.039668	0.047310	0.009915	0.054011	
congestion_surcharge	0.010394	-0.004634	-0.003366	-0.236278	
Airport_fee	0.040261	0.046014	0.006563	-0.003678	
pickup_day_no	-0.001655	0.029937	-0.000384	0.021791	
dropoff_day_no	-0.000171	0.031953	0.000137	0.021426	
pickup_hour	0.015398	0.026094	-0.006237	-0.046879	
dropoff_hour	0.012620	0.022100	-0.007443	-0.039506	
pickup_month	0.000609	0.009196	-0.000132	-0.002939	
dropoff_month	0.006810	0.016975	0.003445	-0.002302	
pickup_timeofday	-0.001298	-0.019541	0.002390	0.030660	
dropoff_timeofday	-0.001876	-0.019645	0.002523	0.028460	

	store_and_fwd_flag	PULocationID	DOLocationID	\
VendorID	-0.126133	-0.001305	-0.003953	
passenger_count	-0.007919	-0.001053	-0.001017	
trip_distance	-0.000415	-0.000958	-0.002497	
RatecodeID	-0.004460	-0.001102	-0.000644	
store_and_fwd_flag	1.000000	0.000315	0.001457	
PULocationID	0.000315	1.000000	-0.000150	
DOLocationID	0.001457	-0.000150	1.000000	
payment_type	-0.019223	0.002478	0.000891	
extra	0.069603	0.001737	0.003519	
tip_amount	-0.013222	0.000781	-0.000253	
tolls_amount	-0.004787	-0.001246	-0.002177	
improvement_surcharge	0.006723	-0.000499	-0.002812	

```
total_amount              -0.007607    0.000763    -0.002980
congestion_surcharge      -0.005385    0.001212     0.002671
Airport_fee               -0.004629   -0.001367    -0.003778
pickup_day_no             -0.000769    0.002208    -0.000277
dropoff_day_no            -0.000907    0.001927    -0.000076
pickup_hour               -0.003078   -0.001890     0.001253
dropoff_hour              -0.002698   -0.001288    -0.000323
pickup_month              -0.003282    0.000909    -0.001634
dropoff_month             -0.003354    0.001804     0.001944
pickup_timeofday          -0.006747    0.002754     0.000346
dropoff_timeofday         -0.006335    0.003602     0.001102

                       payment_type     extra  tip_amount  …  \
VendorID                   0.012329 -0.529015    0.043925  …
passenger_count           -0.084540 -0.009888    0.013730  …
trip_distance              0.013834 -0.001917    0.005840  …
RatecodeID                 0.010634 -0.068949   -0.031890  …
store_and_fwd_flag        -0.019223  0.069603   -0.013222  …
PULocationID               0.002478  0.001737    0.000781  …
DOLocationID               0.000891  0.003519   -0.000253  …
payment_type               1.000000 -0.097800    0.257282  …
extra                     -0.097800  1.000000    0.152204  …
tip_amount                 0.257282  0.152204    1.000000  …
tolls_amount               0.041060  0.195803    0.412287  …
improvement_surcharge      0.094835  0.033142    0.076438  …
total_amount               0.091613  0.202118    0.638644  …
congestion_surcharge       0.098832 -0.036869   -0.112180  …
Airport_fee               -0.076869  0.331879    0.322474  …
pickup_day_no             -0.029555 -0.144289   -0.020564  …
dropoff_day_no            -0.027878 -0.146177   -0.014274  …
pickup_hour                0.003442  0.217579    0.012336  …
dropoff_hour               0.000990  0.224008    0.011563  …
pickup_month              -0.002437 -0.005252   -0.003099  …
dropoff_month              0.000449 -0.010876    0.008753  …
pickup_timeofday           0.029535 -0.134802   -0.016744  …
dropoff_timeofday          0.033762 -0.122072   -0.011030  …

                       congestion_surcharge  Airport_fee  pickup_day_no  \
VendorID                           0.010394     0.040261      -0.001655
passenger_count                   -0.004634     0.046014       0.029937
trip_distance                     -0.003366     0.006563      -0.000384
RatecodeID                        -0.236278    -0.003678       0.021791
store_and_fwd_flag                -0.005385    -0.004629      -0.000769
PULocationID                       0.001212    -0.001367       0.002208
DOLocationID                       0.002671    -0.003778      -0.000277
payment_type                       0.098832    -0.076869      -0.029555
extra                             -0.036869     0.331879      -0.144289
```

tip_amount	-0.112180	0.322474	-0.020564
tolls_amount	-0.178327	0.412501	0.021941
improvement_surcharge	0.044364	-0.019741	-0.008899
total_amount	-0.291446	0.551649	-0.005710
congestion_surcharge	1.000000	-0.451312	-0.019419
Airport_fee	-0.451312	1.000000	0.002588
pickup_day_no	-0.019419	0.002588	1.000000
dropoff_day_no	-0.023257	0.012691	0.971569
pickup_hour	0.029209	0.007696	-0.334416
dropoff_hour	0.031966	-0.003169	-0.257509
pickup_month	-0.000033	0.006310	0.158735
dropoff_month	-0.007200	0.023292	0.127287
pickup_timeofday	-0.008272	-0.007747	0.065932
dropoff_timeofday	-0.013903	-0.002283	0.054711

	dropoff_day_no	pickup_hour	dropoff_hour \
VendorID	-0.000171	0.015398	0.012620
passenger_count	0.031953	0.026094	0.022100
trip_distance	0.000137	-0.006237	-0.007443
RatecodeID	0.021426	-0.046879	-0.039506
store_and_fwd_flag	-0.000907	-0.003078	-0.002698
PULocationID	0.001927	-0.001890	-0.001288
DOLocationID	-0.000076	0.001253	-0.000323
payment_type	-0.027878	0.003442	0.000990
extra	-0.146177	0.217579	0.224008
tip_amount	-0.014274	0.012336	0.011563
tolls_amount	0.027275	-0.040111	-0.033586
improvement_surcharge	-0.008613	0.007047	0.007456
total_amount	0.005944	-0.003871	-0.006740
congestion_surcharge	-0.023257	0.029209	0.031966
Airport_fee	0.012691	0.007696	-0.003169
pickup_day_no	0.971569	-0.334416	-0.257509
dropoff_day_no	1.000000	-0.261133	-0.346011
pickup_hour	-0.261133	1.000000	0.752649
dropoff_hour	-0.346011	0.752649	1.000000
pickup_month	0.111536	-0.171130	-0.035032
dropoff_month	0.211769	0.019072	-0.215792
pickup_timeofday	0.076008	-0.354925	-0.379114
dropoff_timeofday	0.065267	-0.321060	-0.346945

	pickup_month	dropoff_month	pickup_timeofday \
VendorID	0.000609	0.006810	-0.001298
passenger_count	0.009196	0.016975	-0.019541
trip_distance	-0.000132	0.003445	0.002390
RatecodeID	-0.002939	-0.002302	0.030660
store_and_fwd_flag	-0.003282	-0.003354	-0.006747
PULocationID	0.000909	0.001804	0.002754

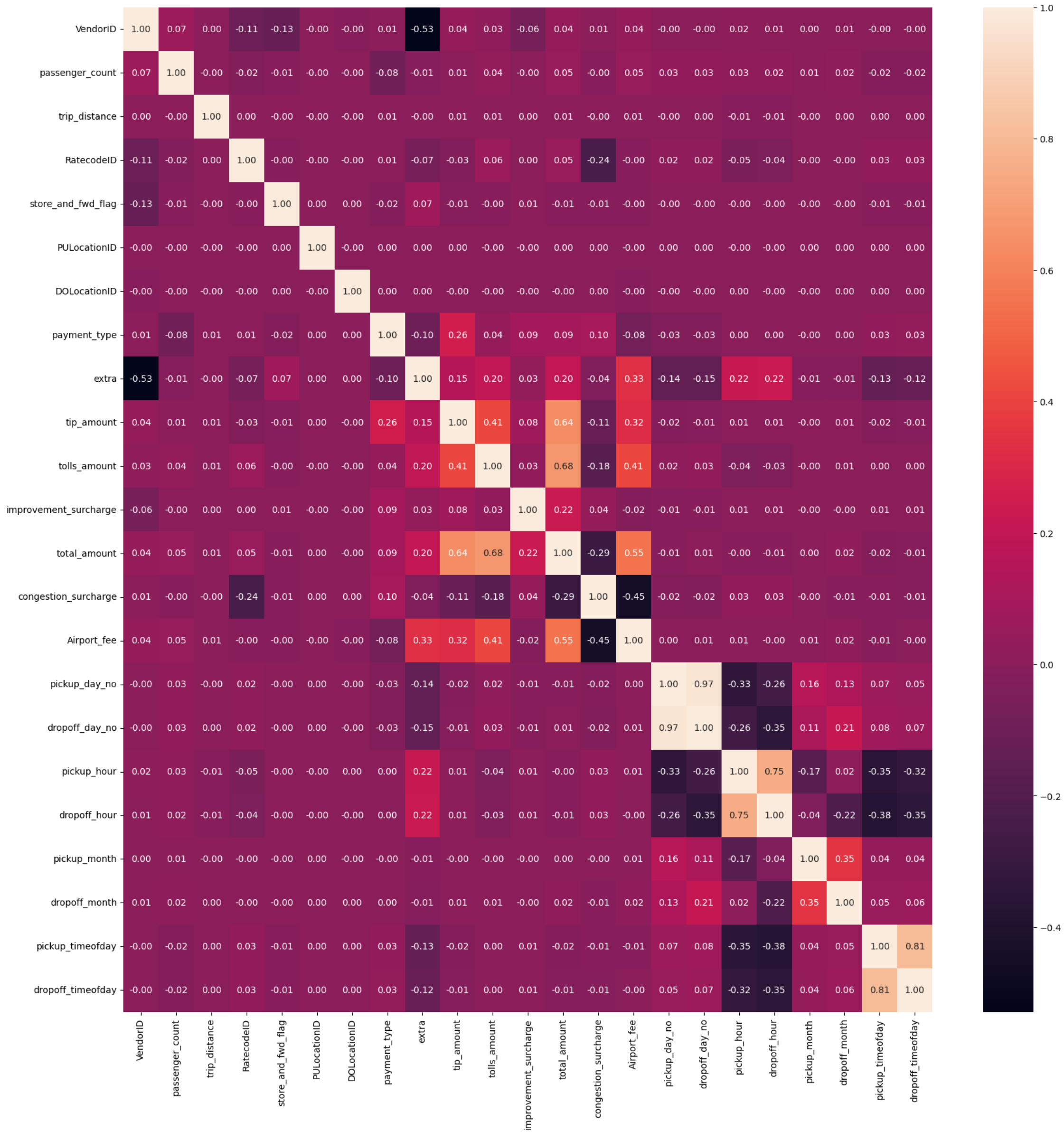
```
DOLocationID           -0.001634      0.001944          0.000346
payment_type           -0.002437      0.000449          0.029535
extra                  -0.005252     -0.010876         -0.134802
tip_amount             -0.003099      0.008753         -0.016744
tolls_amount           -0.000327      0.008207          0.001027
improvement_surcharge  -0.000392     -0.000498          0.006804
total_amount            0.000915      0.022208         -0.020684
congestion_surcharge   -0.000033     -0.007200         -0.008272
Airport_fee             0.006310      0.023292         -0.007747
pickup_day_no           0.158735      0.127287          0.065932
dropoff_day_no          0.111536      0.211769          0.076008
pickup_hour            -0.171130      0.019072         -0.354925
dropoff_hour           -0.035032     -0.215792         -0.379114
pickup_month            1.000000      0.353202          0.042488
dropoff_month           0.353202      1.000000          0.054884
pickup_timeofday        0.042488      0.054884          1.000000
dropoff_timeofday       0.043180      0.056583          0.805571

                       dropoff_timeofday
VendorID                       -0.001876
passenger_count                -0.019645
trip_distance                   0.002523
RatecodeID                      0.028460
store_and_fwd_flag             -0.006335
PULocationID                    0.003602
DOLocationID                    0.001102
payment_type                    0.033762
extra                          -0.122072
tip_amount                     -0.011030
tolls_amount                    0.004301
improvement_surcharge           0.005616
total_amount                   -0.013259
congestion_surcharge           -0.013903
Airport_fee                    -0.002283
pickup_day_no                   0.054711
dropoff_day_no                  0.065267
pickup_hour                    -0.321060
dropoff_hour                   -0.346945
pickup_month                    0.043180
dropoff_month                   0.056583
pickup_timeofday                0.805571
dropoff_timeofday               1.000000

[23 rows x 23 columns]
```

- **Heatmap**

[94]:

```python
plt.subplots(figsize=(20,20))
sns.heatmap(train_data.corr(),annot=True,fmt=".2f")
```

[94]: <Axes: >



Observation

- Attributes `store_and_pwd_flag`, `PULocationID`, `DOLocationID`, `payment_type` and `congestion_surcharge`, `pickup_day_no`, `dropoff_day_no`, `pickup_hour`, `dropff_hour`, `pickup_month`, `dropoff_month`, `pickup_timeofday`, `dropoff_timeofday` has negative value or very near to zero..

- Attributes VendorID, passenger_count, trip_distance and RateCodeID showing less value. (near to 0).
- Attributes extra, tip_amount, tolls_amount, improvement_surcharge and Airport_fee showing high value. (near to 1).

7.2 Visualizing whole Dataset at a time.

7.2.1 Using Histogram

[95]:
```
train_data.hist(bins=50,figsize=(20,20),color='green')
# displaying histogram
plt.show()
```

7.3 Scaling

- Using `StandardScaler()`

[96]:
```
train_data.head()
```

[96]:
```
   VendorID  passenger_count  trip_distance  RatecodeID  store_and_fwd_flag  \
0       1.0              1.0           2.14         1.0                   0
1       0.0              1.0           2.70         1.0                   0
2       1.0              1.0           1.15         1.0                   0
3       0.0              1.0           0.40         1.0                   0
4       1.0              3.0           1.10         1.0                   0

   PULocationID  DOLocationID  payment_type  extra  tip_amount  …  \
0         120.0           9.0             1    2.5    7.165589  …
1          15.0         215.0             1    3.5    6.067401  …
2         167.0         223.0             1    0.0    4.111547  …
3         128.0         239.0             1    2.5    6.411079  …
4         203.0          52.0             1    1.0    4.769377  …

   congestion_surcharge  Airport_fee  pickup_day_no  dropoff_day_no  \
0                   2.5          0.0            2.0             2.0
1                   2.5          0.0            3.0             3.0
2                   2.5          0.0            4.0             4.0
3                   2.5          0.0            3.0             3.0
4                   2.5          0.0            3.0             3.0

   pickup_hour  dropoff_hour  pickup_month  dropoff_month  pickup_timeofday  \
0         17.0          16.0           6.0            6.0               1.0
1         23.0          22.0           6.0            6.0               2.0
2         10.0          11.0           6.0            6.0               3.0
3         13.0          14.0           6.0            6.0               0.0
4         22.0          22.0           6.0            6.0               2.0

   dropoff_timeofday
0                1.0
1                2.0
2                3.0
3                0.0
4                2.0

[5 rows x 23 columns]
```

[97]:
```
scaler = StandardScaler()
scaler.
↪fit(train_data[['PULocationID','DOLocationID','trip_distance','extra','tip_amount','tolls_a
```

```
train_data[['PULocationID','DOLocationID','trip_distance','extra','tip_amount','tolls_amount',
↪= pd.DataFrame(scaler.
↪transform(train_data[['PULocationID','DOLocationID','trip_distance','extra','tip_amount','t
↪columns =␣
↪['PULocationID','DOLocationID','trip_distance','extra','tip_amount','tolls_amount','pickup_
train_data.head()
```

[97]:

```
   VendorID  passenger_count  trip_distance  RatecodeID  store_and_fwd_flag  \
0       1.0              1.0      -0.007649         1.0                   0
1       0.0              1.0      -0.006231         1.0                   0
2       1.0              1.0      -0.010155         1.0                   0
3       0.0              1.0      -0.012054         1.0                   0
4       1.0              3.0      -0.010282         1.0                   0

   PULocationID  DOLocationID  payment_type     extra  tip_amount  …  \
0     -0.166932     -1.623529             1  0.281471    0.225187  …
1     -1.545814      1.080152             1  0.801949   -0.013003  …
2      0.450282      1.185149             1 -1.019723   -0.437214  …
3     -0.061874      1.395144             1  0.281471    0.061539  …
4      0.923042     -1.059168             1 -0.499245   -0.294535  …

   congestion_surcharge  Airport_fee  pickup_day_no  dropoff_day_no  \
0                   2.5          0.0      -1.594167       -1.603084
1                   2.5          0.0      -0.253021       -0.269033
2                   2.5          0.0       1.088124        1.065018
3                   2.5          0.0      -0.253021       -0.269033
4                   2.5          0.0      -0.253021       -0.269033

   pickup_hour  dropoff_hour  pickup_month  dropoff_month  pickup_timeofday  \
0     0.326177      0.150673     -0.065343      -0.088271         -0.363187
1     1.365637      1.158848     -0.065343      -0.088271          0.650232
2    -0.886528     -0.689473     -0.065343      -0.088271          1.663651
3    -0.366797     -0.185385     -0.065343      -0.088271         -1.376605
4     1.192394      1.158848     -0.065343      -0.088271          0.650232

   dropoff_timeofday
0          -0.369946
1           0.660823
2           1.691592
3          -1.400716
4           0.660823

[5 rows x 23 columns]
```

8 Features and Target (Train Data)

[98]:
```
att = np.array(train_data.columns)
att
```

[98]:
```
array(['VendorID', 'passenger_count', 'trip_distance', 'RatecodeID',
       'store_and_fwd_flag', 'PULocationID', 'DOLocationID',
       'payment_type', 'extra', 'tip_amount', 'tolls_amount',
       'improvement_surcharge', 'total_amount', 'congestion_surcharge',
       'Airport_fee', 'pickup_day_no', 'dropoff_day_no', 'pickup_hour',
       'dropoff_hour', 'pickup_month', 'dropoff_month',
       'pickup_timeofday', 'dropoff_timeofday'], dtype=object)
```

[99]:
```
features = np.concatenate((att[0:12],att[-10:]))
print("feature_variables :",features)
```

```
feature_variables : ['VendorID' 'passenger_count' 'trip_distance' 'RatecodeID'
 'store_and_fwd_flag' 'PULocationID' 'DOLocationID' 'payment_type' 'extra'
 'tip_amount' 'tolls_amount' 'improvement_surcharge'
 'congestion_surcharge' 'Airport_fee' 'pickup_day_no' 'dropoff_day_no'
 'pickup_hour' 'dropoff_hour' 'pickup_month' 'dropoff_month'
 'pickup_timeofday' 'dropoff_timeofday']
```

[100]:
```
target = att[-11]
print("target_variable :",target)
```

```
target_variable : total_amount
```

[101]:
```
X = train_data[features]
y = train_data[target]
```

8.0.1 splitting the dataset in training and validation sets with train_test_split

[102]:
```
X_train, X_val, y_train, y_val = train_test_split(X, y, test_size=0.2,␣
↪random_state=42)
```

[103]:
```
X_train.info()
```

```
<class 'pandas.core.frame.DataFrame'>
Index: 139997 entries, 127124 to 121958
Data columns (total 22 columns):
 #   Column                 Non-Null Count   Dtype
---  ------                 --------------   -----
 0   VendorID               139997 non-null  float64
 1   passenger_count        139997 non-null  float64
 2   trip_distance          139997 non-null  float64
 3   RatecodeID             139997 non-null  float64
```

```
 4   store_and_fwd_flag     139997 non-null  int64
 5   PULocationID           139997 non-null  float64
 6   DOLocationID           139997 non-null  float64
 7   payment_type           139997 non-null  int64
 8   extra                  139997 non-null  float64
 9   tip_amount             139997 non-null  float64
 10  tolls_amount           139997 non-null  float64
 11  improvement_surcharge  139997 non-null  float64
 12  congestion_surcharge   139997 non-null  float64
 13  Airport_fee            139997 non-null  float64
 14  pickup_day_no          139997 non-null  float64
 15  dropoff_day_no         139997 non-null  float64
 16  pickup_hour            139997 non-null  float64
 17  dropoff_hour           139997 non-null  float64
 18  pickup_month           139997 non-null  float64
 19  dropoff_month          139997 non-null  float64
 20  pickup_timeofday       139997 non-null  float64
 21  dropoff_timeofday      139997 non-null  float64
dtypes: float64(20), int64(2)
memory usage: 24.6 MB
```

9 Building Baseline Model

9.1 Dummy Regressor

[104]:
```
dummy=DummyRegressor()
dummy.fit(X_train,y_train)
dummy_predict = dummy.predict(X_val)
print(dummy_predict)
print("R2_Score (Dummy Regression) :",r2_score(y_val,dummy_predict))
```

```
[29.6158677 29.6158677 29.6158677 … 29.6158677 29.6158677 29.6158677]
R2_Score (Dummy Regression) : -1.071278978659329e-05
```

10 Linear Regression

- **Simple Multiple Linear Regeression**

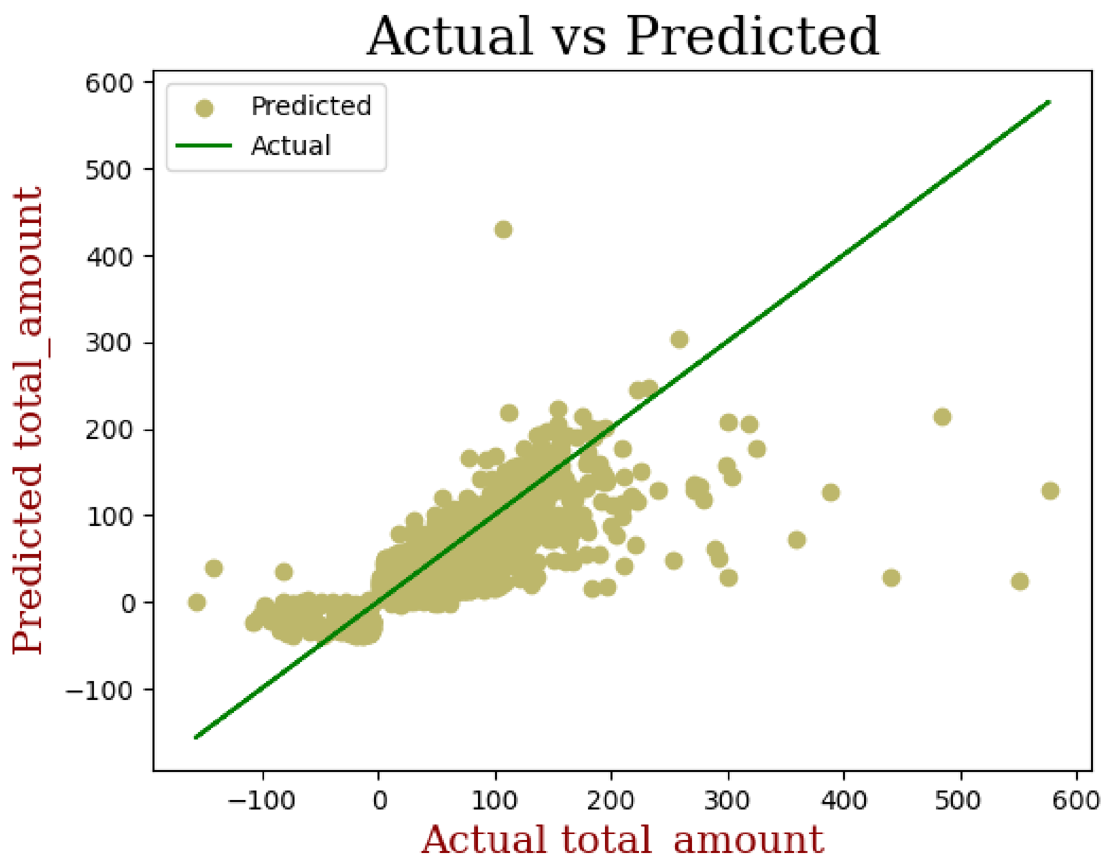
[105]:
```
lin_reg = LinearRegression()
lin_reg.fit(X_train,y_train)
lin_predict = lin_reg.predict(X_val)
print(lin_predict)
lr_score = r2_score(y_val,lin_predict)
print("R2_Score (Multiple Linear Regression) :",lr_score)
```

```
[23.21419414 23.07504325 98.0870896  … 18.368978   28.50271672
 28.38644094]
```

```
R2_Score (Multiple Linear Regression) : 0.7170910000191486
```

- **Plotting Actual vs Predicted**

[106]:
```
act_vs_predict(y_val,lin_predict)
```



10.1 LinearRegression with Cross Validation

[107]:
```
shuffle_split_cv = ShuffleSplit(n_splits=10, test_size=0.2, random_state=0)
lin_reg_cv_results = cross_validate(LinearRegression(),
X_train,
y_train,
cv=shuffle_split_cv,
scoring="r2",
return_train_score=True,
return_estimator=True)

print(lin_reg_cv_results)
```

```
{'fit_time': array([0.19916511, 0.23253131, 0.23891759, 0.24089932, 0.23528385,
```

```
       0.23438215, 0.22892332, 0.23520708, 0.23659492, 0.2272234 ]),
'score_time': array([0.01334071, 0.0130651 , 0.01314497, 0.01413488, 0.01970792,
       0.01293159, 0.01337528, 0.01927209, 0.01322579, 0.01494288]),
'estimator': [LinearRegression(), LinearRegression(), LinearRegression(),
LinearRegression(), LinearRegression(), LinearRegression(), LinearRegression(),
LinearRegression(), LinearRegression(), LinearRegression()], 'test_score':
array([ 0.71016979,  0.70956151,  0.7091698 ,  0.71672728,  0.72148536,
        0.7059929 ,  0.70930828,  0.67863734, -0.73687575,  0.7293165 ]),
'train_score': array([0.71177755, 0.71167873, 0.71244755, 0.71019117,
0.70942454,
       0.71322688, 0.71196848, 0.72066845, 0.71212874, 0.70772944])}
```

[108]:
```python
lin_test_score = lin_reg_cv_results['test_score']
lin_test_score
```

[108]:
```
array([ 0.71016979,  0.70956151,  0.7091698 ,  0.71672728,  0.72148536,
        0.7059929 ,  0.70930828,  0.67863734, -0.73687575,  0.7293165 ])
```

- **Selecting best model**

[109]:
```python
lin_best_model_index = np.argmax(lin_test_score)
lin_selected_model = lin_reg_cv_results['estimator'][lin_best_model_index]
lin_selected_model
```

[109]:
```
LinearRegression()
```

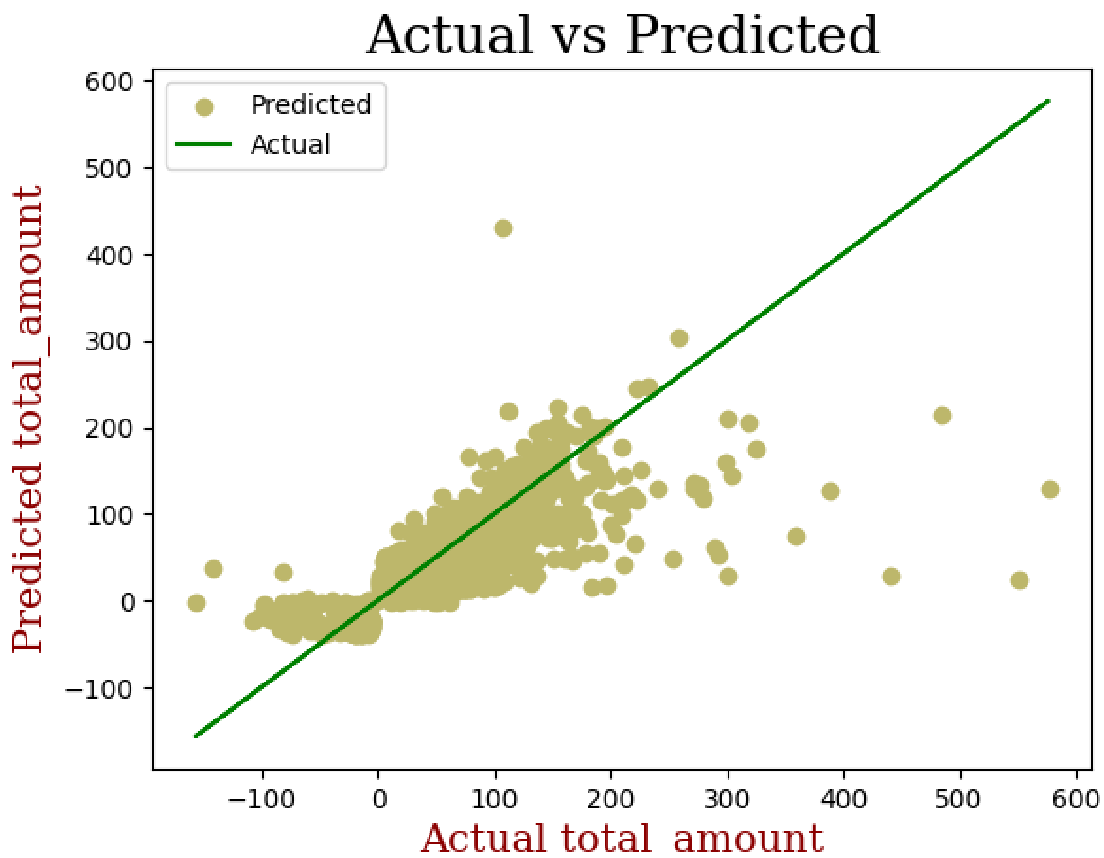
- **Prediction**

[110]:
```python
lin_cv_predict = lin_selected_model.predict(X_val)
lin_cv_predict
```

[110]:
```
array([23.2234771 , 23.15166472, 97.88447242, …, 18.50375644,
       28.45476118, 28.22431032])
```

- **Plotting Actual vs Predicted**

[111]:
```python
act_vs_predict(y_val,lin_cv_predict)
```



- **R2 Score**

[112]:
```
lr_cv_score = r2_score(y_val,lin_cv_predict)
print("R2_Score (Multiple Linear Regression with Cross Validation) :
 ↪",lr_cv_score)
```

```
R2_Score (Multiple Linear Regression with Cross Validation) : 0.7170388309370268
```

11 Applying KNN and SVM Models

11.1 KNN (KNeighborsRegressor)

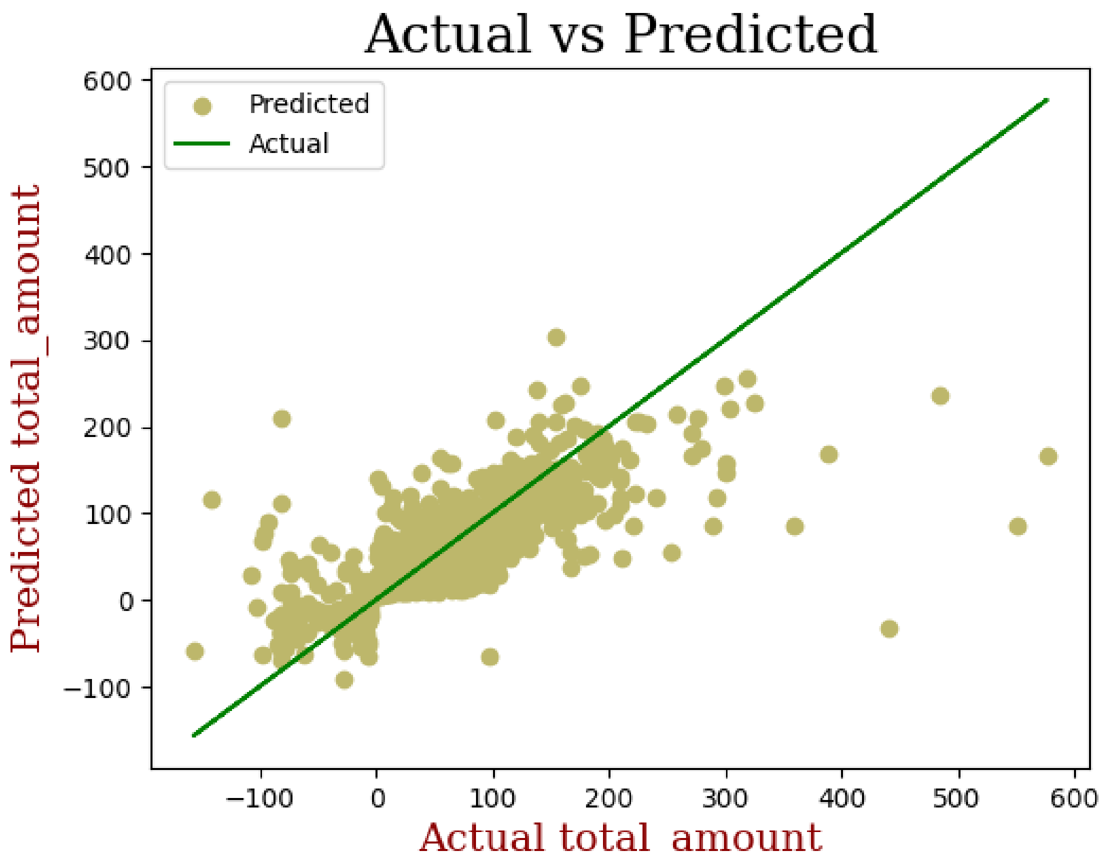
11.1.1 Simple KNeighborsRegressor

[113]:
```
simp_KNN = KNeighborsRegressor()
simp_KNN.fit(X_train, y_train)
simp_KNN_predict = simp_KNN.predict(X_val)
print(simp_KNN_predict)
knn_score = r2_score(y_val,simp_KNN_predict)
print("R2_Score (KNN) :",knn_score)
```

```
[17.94  18.312 98.328 … 17.16  22.224 26.29 ]
R2_Score (KNN) : 0.7629675702761719
```

- **Plotting Actual vs Predicted**

[114]:
```
act_vs_predict(y_val,simp_KNN_predict)
```



11.1.2 Tunning Hyperparameters & Training as well as evaluating on the same.

- **Using `GridSearchCV`**

[115]:
```
'''
params = {'n_neighbors' : [i for i in range(1,31)]}
gs = GridSearchCV(estimator=simp_KNN,
                  param_grid=params,
                  cv=10,
                  n_jobs=-1)

gs.fit(X_train,y_train)

simp_KNN_gs = gs.best_estimator_
```

```
print("The best parameters using GridSearchCV is :",simp_KNN_gs)
'''
```

[115]:
```
'\nparams = {\'n_neighbors\' : [i for i in range(1,31)]}\ngs =
GridSearchCV(estimator=simp_KNN,\n                 param_grid=params,\n
cv=10,\n                 n_jobs=-1)\n\ngs.fit(X_train,y_train)\n\nsimp_KNN_gs =
gs.best_estimator_\nprint("The best parameters using GridSearchCV is
:",simp_KNN_gs)\n'
```

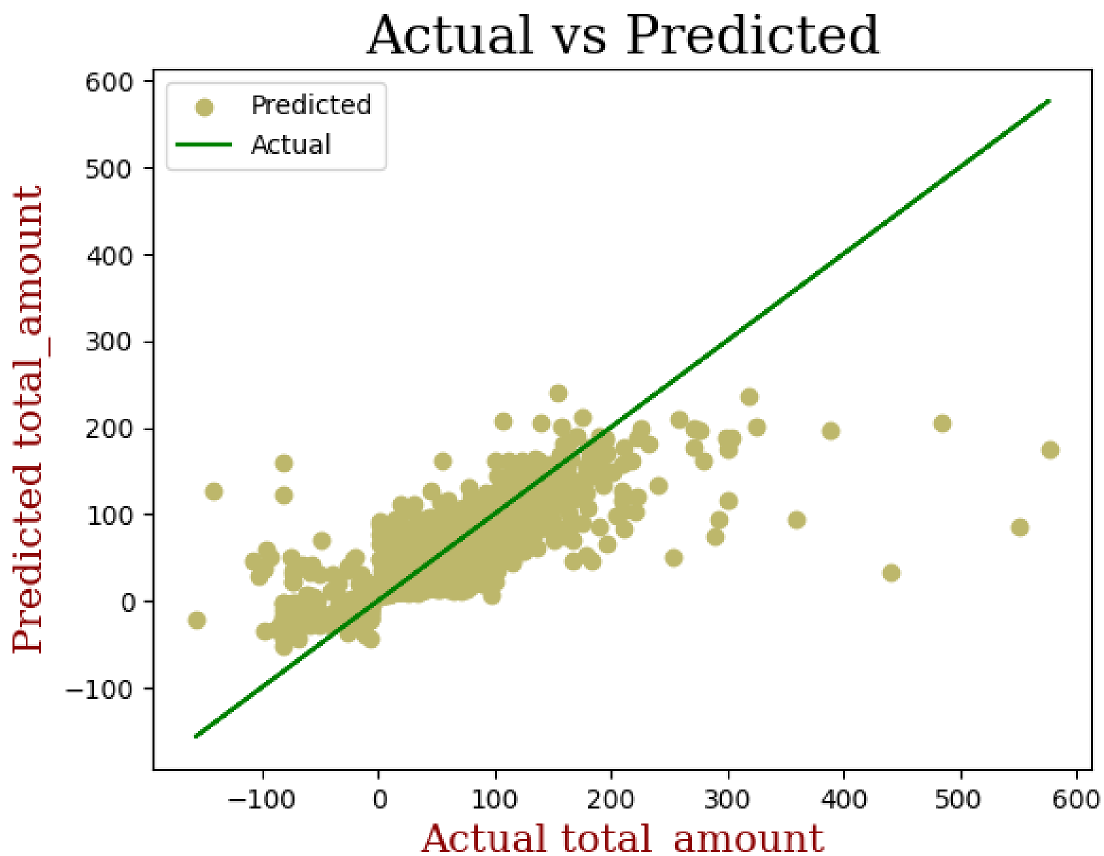
- **Result**
  - KNeighborsRegressor(n_neighbors=12)

[116]:
```
simp_KNN_gs = KNeighborsRegressor(n_neighbors=12)
simp_KNN_gs.fit(X_train, y_train)
simp_KNN_gs_predict = simp_KNN_gs.predict(X_val)
print(simp_KNN_gs_predict)
knn_gs_score = r2_score(y_val,simp_KNN_gs_predict)
print("R2_Score (KNN_GridSearchCV) :",knn_gs_score)
```

```
[21.04583333 18.24583333 98.29666667 … 16.585      20.84916667
 26.98083333]
R2_Score (KNN_GridSearchCV) : 0.7737493592887047
```

- **Plotting Actual vs Predicted**

[117]:
```
act_vs_predict(y_val,simp_KNN_gs_predict)
```



- Using `RandomizedSearchCV`

[118]:
```
'''
params = {'n_neighbors' : [i for i in range(1,31)]}
param_grid = params
rs = RandomizedSearchCV(simp_KNN,
                  param_grid,
                  cv=10,
                  n_jobs=-1)

rs.fit(X_train,y_train)

simp_KNN_rs = rs.best_estimator_
print("The best parameters using RandomizedSearchCV is :",simp_KNN_rs)
'''
```

[118]:
```
'\nparams = {\'n_neighbors\' : [i for i in range(1,31)]}\nparam_grid =
params\nrs = RandomizedSearchCV(simp_KNN,\n                  param_grid,\n
cv=10,\n                  n_jobs=-1)\n\nrs.fit(X_train,y_train)\n\nsimp_KNN_rs =
rs.best_estimator_\nprint("The best parameters using RandomizedSearchCV is
```

```
:",simp_KNN_rs)\n'
```

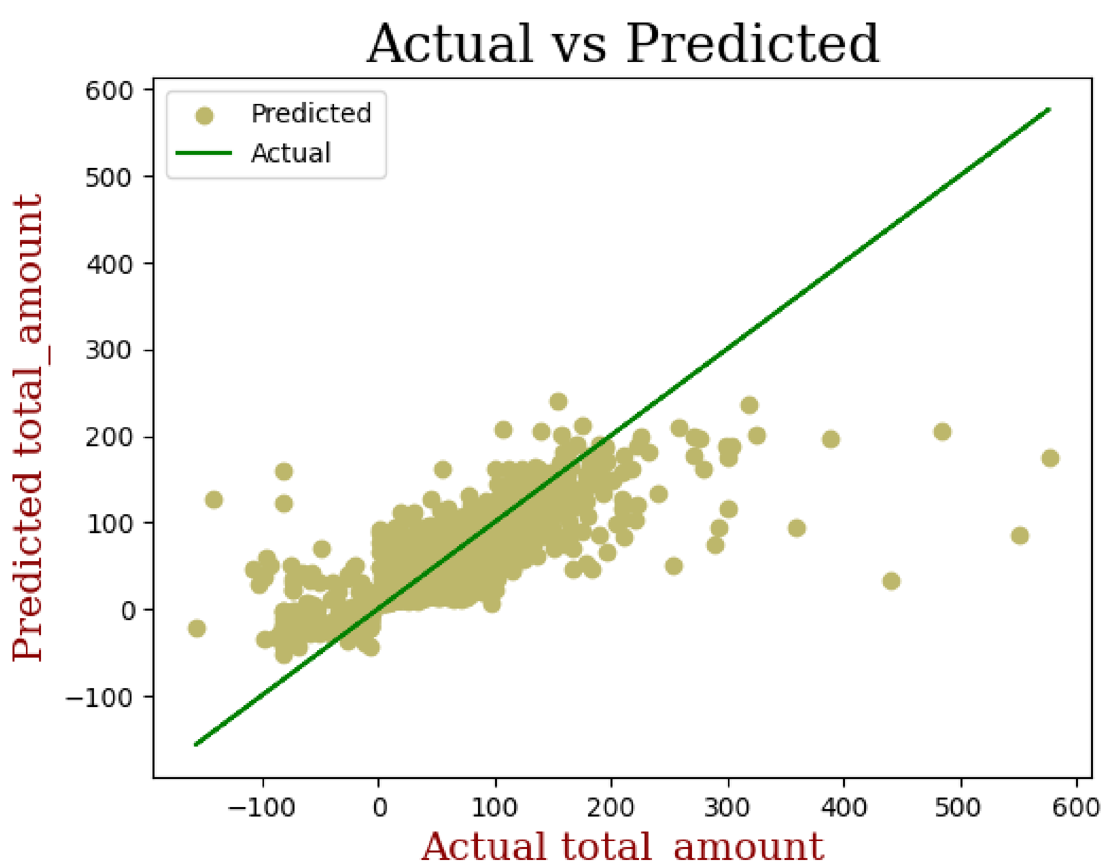
- **Result**
  - KNeighborsRegressor(n_neighbors=12)

[119]:
```
simp_KNN_rs = KNeighborsRegressor(n_neighbors=12)
simp_KNN_rs.fit(X_train, y_train)
simp_KNN_rs_predict = simp_KNN_rs.predict(X_val)
print(simp_KNN_rs_predict)
knn_rs_score = r2_score(y_val,simp_KNN_rs_predict)
print("R2_Score (KNN_RandomizedSearchCV) :",knn_rs_score)
```

```
[21.04583333 18.24583333 98.29666667 … 16.585      20.84916667
 26.98083333]
R2_Score (KNN_RandomizedSearchCV) : 0.7737493592887047
```

- **Plotting Actual vs Predicted**

[120]:
```
act_vs_predict(y_val,simp_KNN_rs_predict)
```



11.2 SVM (For Regression)

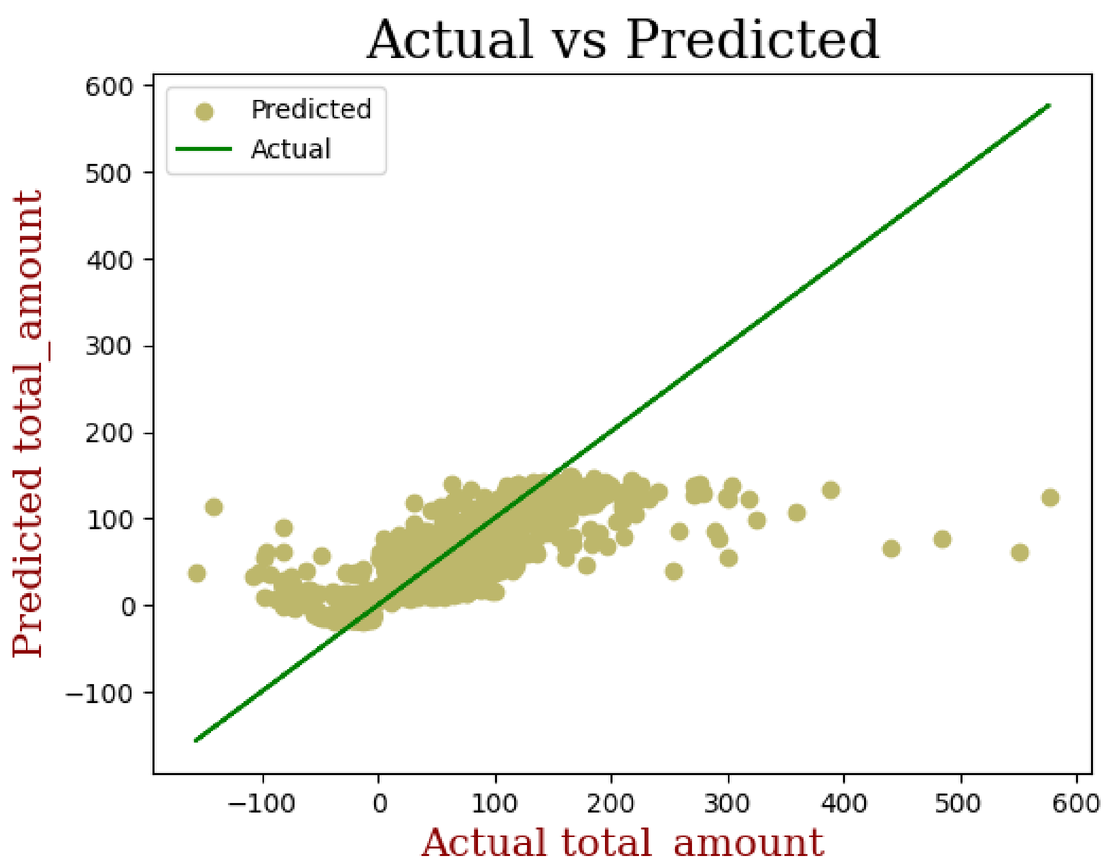
11.2.1 Simple SVR

[121]:
```
simp_SVR = SVR()
simp_SVR.fit(X_train,y_train)
simp_SVR_predict = simp_SVR.predict(X_val)
print(simp_SVR_predict)
svr_score = r2_score(y_val,simp_SVR_predict)
print("R2_Score (SVR) :",svr_score)
```

```
[19.96743266 19.67240913 96.56888457 … 14.76327008 24.04720859
 26.6116096 ]
R2_Score (SVR) : 0.7612822738273943
```

- **Plotting Actual vs Predicted**

[122]:
```
act_vs_predict(y_val,simp_SVR_predict)
```



12 Applying CART, Bagging and Boosting, and MLP.

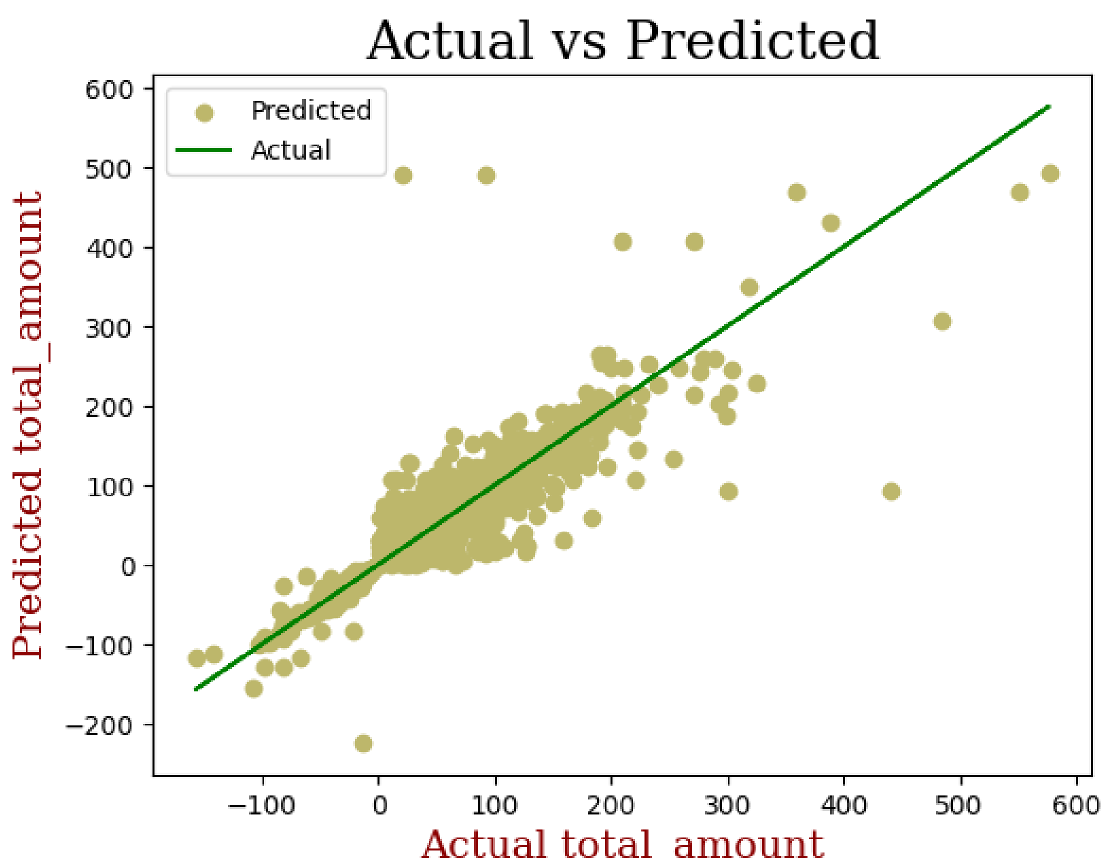
12.1 CART (DecisionTreeRegressor)

[123]:
```
dt_reg = DecisionTreeRegressor()
dt_reg.fit(X_train,y_train)
dt_reg_predict = dt_reg.predict(X_val)
print(dt_reg_predict)
dt_score = r2_score(y_val,dt_reg_predict)
print("R2_Score (DecisionTreeRegressor) :",dt_score)
```

```
[49.5   21.6   97.3   … 12.6   16.4   32.28]
R2_Score (DecisionTreeRegressor) : 0.9049938613771363
```

- **Plotting Actual vs Predicted**

[124]:
```
act_vs_predict(y_val,dt_reg_predict)
```



12.1.1 Tunning Hyperparameters & Training as well as evaluating on the same.

[125]:
```
'''
param_grid = {'max_depth': range(1, 20),
              'min_samples_split':range(2,17)}
dt_grid_search = GridSearchCV(DecisionTreeRegressor(),
                                 param_grid=param_grid,
                                 n_jobs=-1,
                                 cv=10,
                                 scoring="neg_mean_absolute_error",
                                 return_train_score=True)
dt_grid_search.fit(X_train, y_train)
print ("The best parameter value is:", dt_grid_search.best_params_)
'''
```

[125]:
```
'\nparam_grid = {\'max_depth\': range(1, 20),\n
\'min_samples_split\':range(2,17)}\ndt_grid_search =
GridSearchCV(DecisionTreeRegressor(),\n
param_grid=param_grid,\n                                 n_jobs=-1,\n
cv=10,\n                                 scoring="neg_mean_absolute_error",\n
return_train_score=True)\ndt_grid_search.fit(X_train, y_train)\nprint ("The best
parameter value is:", dt_grid_search.best_params_)\n'
```

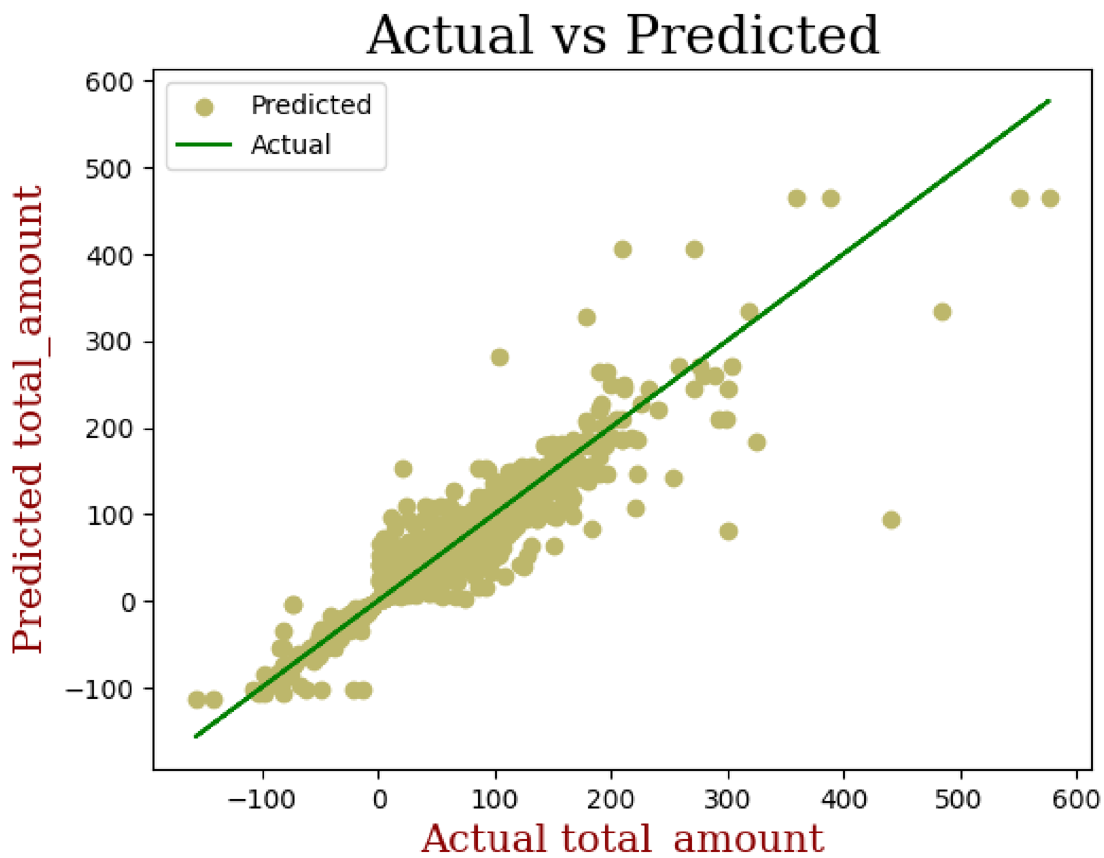
- **Result**
  - The best parameter value is: {'max_depth': 15, 'min_samples_split': 16}

[126]:
```
dt_reg_gs = DecisionTreeRegressor(max_depth = 15, min_samples_split = 16)
dt_reg_gs.fit(X_train,y_train)
dt_reg_gs_predict = dt_reg_gs.predict(X_val)
print(dt_reg_gs_predict)
dt_gs_score = r2_score(y_val,dt_reg_gs_predict)
print("R2_Score (DecisionTreeRegressor_GridSearchCV) :",dt_gs_score)
```

```
[40.10333333 24.3855102  98.53263905 … 11.90888889 17.68247093
 33.87054913]
R2_Score (DecisionTreeRegressor_GridSearchCV) : 0.9410002559982911
```

- **Plotting Actual vs Predicted**

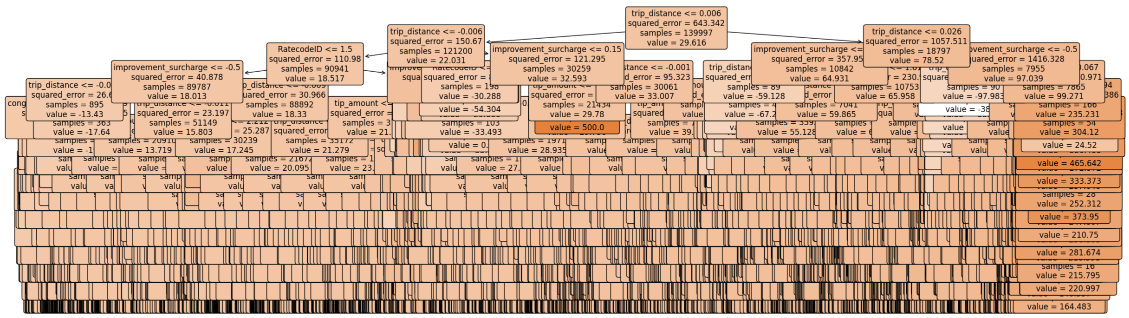
[127]:
```
act_vs_predict(y_val,dt_reg_gs_predict)
```



12.2 Visualizing the tree

- As a tree diagram

[128]:
```
plt.figure(figsize=(28,8), facecolor ='w')
#create the tree plot
a = tree.plot_tree(dt_reg_gs,
                   #use the feature names stored
                   feature_names = features,
                   rounded = True,
                   filled = True,
                   fontsize=12)
#show the plot
plt.show()
```



- Figure is very compact due to large number of depth and branches.
- `As a text-based diagram`

[129]:
```
#export the decision rules
tree_rules = export_text(dt_reg)
#print the result
print(tree_rules)
```

```
|--- feature_2 <= 0.01
|   |--- feature_2 <= -0.01
|   |   |--- feature_3 <= 1.50
|   |   |   |--- feature_11 <= -0.50
|   |   |   |   |--- feature_2 <= -0.01
|   |   |   |   |   |--- feature_12 <= 1.25
|   |   |   |   |   |   |--- feature_8 <= 0.93
|   |   |   |   |   |   |   |--- feature_8 <= -0.11
|   |   |   |   |   |   |   |   |--- feature_13 <= 0.88
|   |   |   |   |   |   |   |   |   |--- feature_2 <= -0.01
|   |   |   |   |   |   |   |   |   |   |--- feature_2 <= -0.01
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 4
|   |   |   |   |   |   |   |   |   |   |--- feature_2 >  -0.01
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 4
|   |   |   |   |   |   |   |   |   |--- feature_2 >  -0.01
|   |   |   |   |   |   |   |   |   |   |--- feature_8 <= -0.76
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 4
|   |   |   |   |   |   |   |   |   |   |--- feature_8 >  -0.76
|   |   |   |   |   |   |   |   |   |   |   |--- value: [-5.50]
|   |   |   |   |   |   |   |   |--- feature_13 >  0.88
|   |   |   |   |   |   |   |   |   |--- feature_8 <= -0.76
|   |   |   |   |   |   |   |   |   |   |--- feature_5 <= -0.23
|   |   |   |   |   |   |   |   |   |   |   |--- value: [-6.95]
|   |   |   |   |   |   |   |   |   |   |--- feature_5 >  -0.23
|   |   |   |   |   |   |   |   |   |   |   |--- value: [-6.25]
|   |   |   |   |   |   |   |   |   |--- feature_8 >  -0.76
|   |   |   |   |   |   |   |   |   |   |--- feature_5 <= 1.22
|   |   |   |   |   |   |   |   |   |   |   |--- value: [-7.25]
```

```
|   |   |   |   |   |   |   |   |   |   |--- feature_5 >  1.22
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 2
|   |   |   |   |   |   |   |--- feature_8 >  -0.11
|   |   |   |   |   |   |   |   |--- feature_13 <= 0.88
|   |   |   |   |   |   |   |   |   |--- feature_16 <= 0.24
|   |   |   |   |   |   |   |   |   |   |--- feature_2 <= -0.01
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 2
|   |   |   |   |   |   |   |   |   |   |--- feature_2 >  -0.01
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 3
|   |   |   |   |   |   |   |   |   |--- feature_16 >  0.24
|   |   |   |   |   |   |   |   |   |   |--- feature_9 <= -0.44
|   |   |   |   |   |   |   |   |   |   |   |--- value: [-7.00]
|   |   |   |   |   |   |   |   |   |   |--- feature_9 >  -0.44
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 3
|   |   |   |   |   |   |   |   |--- feature_13 >  0.88
|   |   |   |   |   |   |   |   |   |--- feature_6 <= 1.01
|   |   |   |   |   |   |   |   |   |   |--- value: [-8.75]
|   |   |   |   |   |   |   |   |   |--- feature_6 >  1.01
|   |   |   |   |   |   |   |   |   |   |--- value: [-10.85]
|   |   |   |   |   |   |--- feature_8 >  0.93
|   |   |   |   |   |   |   |--- feature_17 <= 0.15
|   |   |   |   |   |   |   |   |--- feature_6 <= 0.29
|   |   |   |   |   |   |   |   |   |--- value: [-11.25]
|   |   |   |   |   |   |   |   |--- feature_6 >  0.29
|   |   |   |   |   |   |   |   |   |--- value: [-9.50]
|   |   |   |   |   |   |   |--- feature_17 >  0.15
|   |   |   |   |   |   |   |   |--- feature_17 <= 0.99
|   |   |   |   |   |   |   |   |   |--- feature_5 <= 0.02
|   |   |   |   |   |   |   |   |   |   |--- value: [-13.65]
|   |   |   |   |   |   |   |   |   |--- feature_5 >  0.02
|   |   |   |   |   |   |   |   |   |   |--- value: [-13.75]
|   |   |   |   |   |   |   |   |--- feature_17 >  0.99
|   |   |   |   |   |   |   |   |   |--- value: [-12.25]
|   |   |   |   |   |--- feature_12 >  1.25
|   |   |   |   |   |   |--- feature_2 <= -0.01
|   |   |   |   |   |   |   |--- feature_8 <= -0.11
|   |   |   |   |   |   |   |   |--- feature_2 <= -0.01
|   |   |   |   |   |   |   |   |   |--- feature_8 <= -0.76
|   |   |   |   |   |   |   |   |   |   |--- feature_9 <= -1.17
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 2
|   |   |   |   |   |   |   |   |   |   |--- feature_9 >  -1.17
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 7
|   |   |   |   |   |   |   |   |   |--- feature_8 >  -0.76
|   |   |   |   |   |   |   |   |   |   |--- feature_9 <= -1.25
|   |   |   |   |   |   |   |   |   |   |   |--- value: [-8.70]
|   |   |   |   |   |   |   |   |   |   |--- feature_9 >  -1.25
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 5
|   |   |   |   |   |   |   |   |--- feature_2 >  -0.01
```

```
|   |   |   |   |   |   |   |   |   |--- feature_2 <= -0.01
|   |   |   |   |   |   |   |   |   |   |--- feature_16 <= 0.07
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 10
|   |   |   |   |   |   |   |   |   |   |--- feature_16 >  0.07
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 5
|   |   |   |   |   |   |   |   |   |--- feature_2 >  -0.01
|   |   |   |   |   |   |   |   |   |   |--- feature_16 <= -0.80
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 4
|   |   |   |   |   |   |   |   |   |   |--- feature_16 >  -0.80
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 4
|   |   |   |   |   |   |   |--- feature_8 >  -0.11
|   |   |   |   |   |   |   |   |--- feature_2 <= -0.01
|   |   |   |   |   |   |   |   |   |--- feature_2 <= -0.01
|   |   |   |   |   |   |   |   |   |   |--- feature_13 <= 0.88
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 3
|   |   |   |   |   |   |   |   |   |   |--- feature_13 >  0.88
|   |   |   |   |   |   |   |   |   |   |   |--- value: [-11.25]
|   |   |   |   |   |   |   |   |   |--- feature_2 >  -0.01
|   |   |   |   |   |   |   |   |   |   |--- feature_16 <= 0.41
|   |   |   |   |   |   |   |   |   |   |   |--- value: [-10.20]
|   |   |   |   |   |   |   |   |   |   |--- feature_16 >  0.41
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 4
|   |   |   |   |   |   |   |   |--- feature_2 >  -0.01
|   |   |   |   |   |   |   |   |   |--- feature_9 <= -0.98
|   |   |   |   |   |   |   |   |   |   |--- feature_5 <= -0.10
|   |   |   |   |   |   |   |   |   |   |   |--- value: [-12.30]
|   |   |   |   |   |   |   |   |   |   |--- feature_5 >  -0.10
|   |   |   |   |   |   |   |   |   |   |   |--- value: [-11.60]
|   |   |   |   |   |   |   |   |   |--- feature_9 >  -0.98
|   |   |   |   |   |   |   |   |   |   |--- feature_9 <= -0.82
|   |   |   |   |   |   |   |   |   |   |   |--- value: [-13.00]
|   |   |   |   |   |   |   |   |   |   |--- feature_9 >  -0.82
|   |   |   |   |   |   |   |   |   |   |   |--- value: [-12.30]
|   |   |   |   |   |   |--- feature_2 >  -0.01
|   |   |   |   |   |   |   |--- feature_8 <= -0.11
|   |   |   |   |   |   |   |   |--- feature_5 <= -1.67
|   |   |   |   |   |   |   |   |   |--- feature_16 <= 0.15
|   |   |   |   |   |   |   |   |   |   |--- feature_6 <= -1.26
|   |   |   |   |   |   |   |   |   |   |   |--- value: [-18.20]
|   |   |   |   |   |   |   |   |   |   |--- feature_6 >  -1.26
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 4
|   |   |   |   |   |   |   |   |   |--- feature_16 >  0.15
|   |   |   |   |   |   |   |   |   |   |--- value: [-54.30]
|   |   |   |   |   |   |   |   |--- feature_5 >  -1.67
|   |   |   |   |   |   |   |   |   |--- feature_2 <= -0.01
|   |   |   |   |   |   |   |   |   |   |--- feature_2 <= -0.01
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 14
|   |   |   |   |   |   |   |   |   |   |--- feature_2 >  -0.01
```

```
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 14
|   |   |   |   |   |   |   |   |   |--- feature_2 >  -0.01
|   |   |   |   |   |   |   |   |   |   |--- feature_16 <= 0.50
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 4
|   |   |   |   |   |   |   |   |   |   |--- feature_16 >  0.50
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 3
|   |   |   |   |   |   |   |--- feature_8 >  -0.11
|   |   |   |   |   |   |   |   |--- feature_2 <= -0.01
|   |   |   |   |   |   |   |   |   |--- feature_5 <= -1.16
|   |   |   |   |   |   |   |   |   |   |--- feature_17 <= 0.40
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 4
|   |   |   |   |   |   |   |   |   |   |--- feature_17 >  0.40
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 6
|   |   |   |   |   |   |   |   |   |--- feature_5 >  -1.16
|   |   |   |   |   |   |   |   |   |   |--- feature_21 <= -0.89
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 2
|   |   |   |   |   |   |   |   |   |   |--- feature_21 >  -0.89
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 13
|   |   |   |   |   |   |   |   |--- feature_2 >  -0.01
|   |   |   |   |   |   |   |   |   |--- feature_5 <= 1.68
|   |   |   |   |   |   |   |   |   |   |--- feature_9 <= -0.42
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 4
|   |   |   |   |   |   |   |   |   |   |--- feature_9 >  -0.42
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 2
|   |   |   |   |   |   |   |   |   |--- feature_5 >  1.68
|   |   |   |   |   |   |   |   |   |   |--- value: [-16.50]
|   |   |   |   |--- feature_2 >  -0.01
|   |   |   |   |   |--- feature_2 <= -0.01
|   |   |   |   |   |   |--- feature_8 <= -0.11
|   |   |   |   |   |   |   |--- feature_2 <= -0.01
|   |   |   |   |   |   |   |   |--- feature_16 <= -0.80
|   |   |   |   |   |   |   |   |   |--- feature_9 <= -1.27
|   |   |   |   |   |   |   |   |   |   |--- value: [-18.20]
|   |   |   |   |   |   |   |   |   |--- feature_9 >  -1.27
|   |   |   |   |   |   |   |   |   |   |--- feature_6 <= 0.78
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 8
|   |   |   |   |   |   |   |   |   |   |--- feature_6 >  0.78
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 5
|   |   |   |   |   |   |   |   |--- feature_16 >  -0.80
|   |   |   |   |   |   |   |   |   |--- feature_6 <= 1.56
|   |   |   |   |   |   |   |   |   |   |--- feature_2 <= -0.01
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 11
|   |   |   |   |   |   |   |   |   |   |--- feature_2 >  -0.01
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 12
|   |   |   |   |   |   |   |   |   |--- feature_6 >  1.56
|   |   |   |   |   |   |   |   |   |   |--- feature_5 <= 0.95
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 3
|   |   |   |   |   |   |   |   |   |   |--- feature_5 >  0.95
```

```
|   |   |   |   |   |   |   |   |   |   |   |--- value: [-28.70]
|   |   |   |   |   |   |   |--- feature_2 >  -0.01
|   |   |   |   |   |   |   |   |--- feature_17 <= -1.19
|   |   |   |   |   |   |   |   |   |--- feature_12 <= 1.25
|   |   |   |   |   |   |   |   |   |   |--- value: [-10.80]
|   |   |   |   |   |   |   |   |   |--- feature_12 >  1.25
|   |   |   |   |   |   |   |   |   |   |--- feature_17 <= -1.95
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 3
|   |   |   |   |   |   |   |   |   |   |--- feature_17 >  -1.95
|   |   |   |   |   |   |   |   |   |   |   |--- value: [-16.80]
|   |   |   |   |   |   |   |   |--- feature_17 >  -1.19
|   |   |   |   |   |   |   |   |   |--- feature_21 <= -0.89
|   |   |   |   |   |   |   |   |   |   |--- feature_6 <= 0.34
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 5
|   |   |   |   |   |   |   |   |   |   |--- feature_6 >  0.34
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 4
|   |   |   |   |   |   |   |   |   |--- feature_21 >  -0.89
|   |   |   |   |   |   |   |   |   |   |--- feature_6 <= -0.75
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 4
|   |   |   |   |   |   |   |   |   |   |--- feature_6 >  -0.75
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 8
|   |   |   |   |   |   |--- feature_8 >  -0.11
|   |   |   |   |   |   |   |--- feature_20 <= -0.87
|   |   |   |   |   |   |   |   |--- feature_15 <= -0.94
|   |   |   |   |   |   |   |   |   |--- value: [-22.80]
|   |   |   |   |   |   |   |   |--- feature_15 >  -0.94
|   |   |   |   |   |   |   |   |   |--- value: [-33.30]
|   |   |   |   |   |   |   |--- feature_20 >  -0.87
|   |   |   |   |   |   |   |   |--- feature_2 <= -0.01
|   |   |   |   |   |   |   |   |   |--- feature_9 <= -0.29
|   |   |   |   |   |   |   |   |   |   |--- feature_12 <= 1.25
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 2
|   |   |   |   |   |   |   |   |   |   |--- feature_12 >  1.25
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 10
|   |   |   |   |   |   |   |   |   |--- feature_9 >  -0.29
|   |   |   |   |   |   |   |   |   |   |--- feature_6 <= 1.50
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 2
|   |   |   |   |   |   |   |   |   |   |--- feature_6 >  1.50
|   |   |   |   |   |   |   |   |   |   |   |--- value: [-10.80]
|   |   |   |   |   |   |   |   |--- feature_2 >  -0.01
|   |   |   |   |   |   |   |   |   |--- feature_12 <= 1.25
|   |   |   |   |   |   |   |   |   |   |--- feature_5 <= 0.17
|   |   |   |   |   |   |   |   |   |   |   |--- value: [-15.19]
|   |   |   |   |   |   |   |   |   |   |--- feature_5 >  0.17
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 2
|   |   |   |   |   |   |   |   |   |--- feature_12 >  1.25
|   |   |   |   |   |   |   |   |   |   |--- feature_6 <= 0.96
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 10
```

```
|   |   |   |   |   |   |   |   |   |   |--- feature_6 >  0.96
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 6
|   |   |   |   |   |--- feature_2 >  -0.01
|   |   |   |   |   |   |--- feature_21 <= 0.15
|   |   |   |   |   |   |   |--- feature_2 <= -0.01
|   |   |   |   |   |   |   |   |--- feature_17 <= -0.27
|   |   |   |   |   |   |   |   |   |--- feature_2 <= -0.01
|   |   |   |   |   |   |   |   |   |   |--- feature_16 <= -0.19
|   |   |   |   |   |   |   |   |   |   |   |--- value: [-16.10]
|   |   |   |   |   |   |   |   |   |   |--- feature_16 >  -0.19
|   |   |   |   |   |   |   |   |   |   |   |--- value: [-14.00]
|   |   |   |   |   |   |   |   |   |--- feature_2 >  -0.01
|   |   |   |   |   |   |   |   |   |   |--- feature_20 <= 0.14
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 4
|   |   |   |   |   |   |   |   |   |   |--- feature_20 >  0.14
|   |   |   |   |   |   |   |   |   |   |   |--- value: [-19.60]
|   |   |   |   |   |   |   |   |--- feature_17 >  -0.27
|   |   |   |   |   |   |   |   |   |--- feature_9 <= -1.27
|   |   |   |   |   |   |   |   |   |   |--- value: [-26.60]
|   |   |   |   |   |   |   |   |   |--- feature_9 >  -1.27
|   |   |   |   |   |   |   |   |   |   |--- feature_2 <= -0.01
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 7
|   |   |   |   |   |   |   |   |   |   |--- feature_2 >  -0.01
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 9
|   |   |   |   |   |   |   |--- feature_2 >  -0.01
|   |   |   |   |   |   |   |   |--- feature_6 <= -0.74
|   |   |   |   |   |   |   |   |   |--- feature_5 <= -0.38
|   |   |   |   |   |   |   |   |   |   |--- feature_6 <= -1.32
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 2
|   |   |   |   |   |   |   |   |   |   |--- feature_6 >  -1.32
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 3
|   |   |   |   |   |   |   |   |   |--- feature_5 >  -0.38
|   |   |   |   |   |   |   |   |   |   |--- feature_6 <= -1.59
|   |   |   |   |   |   |   |   |   |   |   |--- value: [-17.80]
|   |   |   |   |   |   |   |   |   |   |--- feature_6 >  -1.59
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 4
|   |   |   |   |   |   |   |   |--- feature_6 >  -0.74
|   |   |   |   |   |   |   |   |   |--- feature_9 <= -1.12
|   |   |   |   |   |   |   |   |   |   |--- feature_9 <= -1.31
|   |   |   |   |   |   |   |   |   |   |   |--- value: [-25.60]
|   |   |   |   |   |   |   |   |   |   |--- feature_9 >  -1.31
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 3
|   |   |   |   |   |   |   |   |   |--- feature_9 >  -1.12
|   |   |   |   |   |   |   |   |   |   |--- feature_5 <= -1.38
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 4
|   |   |   |   |   |   |   |   |   |   |--- feature_5 >  -1.38
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 7
|   |   |   |   |   |   |--- feature_21 >  0.15
```

```
|   |   |   |   |   |   |   |--- feature_2 <= -0.01
|   |   |   |   |   |   |   |   |--- feature_9 <= -0.52
|   |   |   |   |   |   |   |   |   |--- feature_6 <= -0.48
|   |   |   |   |   |   |   |   |   |   |--- feature_6 <= -0.63
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 3
|   |   |   |   |   |   |   |   |   |   |--- feature_6 >  -0.63
|   |   |   |   |   |   |   |   |   |   |   |--- value: [-23.40]
|   |   |   |   |   |   |   |   |   |--- feature_6 >  -0.48
|   |   |   |   |   |   |   |   |   |   |--- feature_17 <= -1.19
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 4
|   |   |   |   |   |   |   |   |   |   |--- feature_17 >  -1.19
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 6
|   |   |   |   |   |   |   |   |--- feature_9 >  -0.52
|   |   |   |   |   |   |   |   |   |--- feature_9 <= -0.40
|   |   |   |   |   |   |   |   |   |   |--- feature_12 <= 1.25
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 2
|   |   |   |   |   |   |   |   |   |   |--- feature_12 >  1.25
|   |   |   |   |   |   |   |   |   |   |   |--- value: [-15.70]
|   |   |   |   |   |   |   |   |   |--- feature_9 >  -0.40
|   |   |   |   |   |   |   |   |   |   |--- feature_15 <= 0.40
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 3
|   |   |   |   |   |   |   |   |   |   |--- feature_15 >  0.40
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 6
|   |   |   |   |   |   |   |--- feature_2 >  -0.01
|   |   |   |   |   |   |   |   |--- feature_5 <= -1.49
|   |   |   |   |   |   |   |   |   |--- feature_1 <= 1.50
|   |   |   |   |   |   |   |   |   |   |--- value: [-28.00]
|   |   |   |   |   |   |   |   |   |--- feature_1 >  1.50
|   |   |   |   |   |   |   |   |   |   |--- value: [-20.60]
|   |   |   |   |   |   |   |   |--- feature_5 >  -1.49
|   |   |   |   |   |   |   |   |   |--- feature_5 <= -0.02
|   |   |   |   |   |   |   |   |   |   |--- feature_2 <= -0.01
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 4
|   |   |   |   |   |   |   |   |   |   |--- feature_2 >  -0.01
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 2
|   |   |   |   |   |   |   |   |   |--- feature_5 >  -0.02
|   |   |   |   |   |   |   |   |   |   |--- feature_17 <= 0.23
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 3
|   |   |   |   |   |   |   |   |   |   |--- feature_17 >  0.23
|   |   |   |   |   |   |   |   |   |   |   |--- value: [-22.00]
|   |   |   |--- feature_11 >  -0.50
|   |   |   |   |--- feature_2 <= -0.01
|   |   |   |   |   |--- feature_2 <= -0.01
|   |   |   |   |   |   |--- feature_9 <= 0.27
|   |   |   |   |   |   |   |--- feature_7 <= 0.50
|   |   |   |   |   |   |   |   |--- feature_2 <= -0.01
|   |   |   |   |   |   |   |   |   |--- feature_8 <= 0.09
|   |   |   |   |   |   |   |   |   |   |--- feature_12 <= 1.25
```

```
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 20
|   |   |   |   |   |   |   |   |   |   |--- feature_12 >  1.25
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 20
|   |   |   |   |   |   |   |   |   |--- feature_8 >  0.09
|   |   |   |   |   |   |   |   |   |   |--- feature_17 <= -0.10
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 16
|   |   |   |   |   |   |   |   |   |   |--- feature_17 >  -0.10
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 27
|   |   |   |   |   |   |   |   |--- feature_2 >  -0.01
|   |   |   |   |   |   |   |   |   |--- feature_17 <= -0.10
|   |   |   |   |   |   |   |   |   |   |--- feature_12 <= 1.25
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 13
|   |   |   |   |   |   |   |   |   |   |--- feature_12 >  1.25
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 27
|   |   |   |   |   |   |   |   |   |--- feature_17 >  -0.10
|   |   |   |   |   |   |   |   |   |   |--- feature_8 <= -0.11
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 23
|   |   |   |   |   |   |   |   |   |   |--- feature_8 >  -0.11
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 28
|   |   |   |   |   |   |   |--- feature_7 >  0.50
|   |   |   |   |   |   |   |   |--- feature_17 <= -0.10
|   |   |   |   |   |   |   |   |   |--- feature_2 <= -0.01
|   |   |   |   |   |   |   |   |   |   |--- feature_12 <= 1.25
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 16
|   |   |   |   |   |   |   |   |   |   |--- feature_12 >  1.25
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 30
|   |   |   |   |   |   |   |   |   |--- feature_2 >  -0.01
|   |   |   |   |   |   |   |   |   |   |--- feature_12 <= 1.25
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 19
|   |   |   |   |   |   |   |   |   |   |--- feature_12 >  1.25
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 35
|   |   |   |   |   |   |   |   |--- feature_17 >  -0.10
|   |   |   |   |   |   |   |   |   |--- feature_2 <= -0.01
|   |   |   |   |   |   |   |   |   |   |--- feature_8 <= -0.11
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 28
|   |   |   |   |   |   |   |   |   |   |--- feature_8 >  -0.11
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 30
|   |   |   |   |   |   |   |   |   |--- feature_2 >  -0.01
|   |   |   |   |   |   |   |   |   |   |--- feature_8 <= -0.11
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 29
|   |   |   |   |   |   |   |   |   |   |--- feature_8 >  -0.11
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 27
|   |   |   |   |   |   |--- feature_9 >  0.27
|   |   |   |   |   |   |   |--- feature_9 <= 0.65
|   |   |   |   |   |   |   |   |--- feature_9 <= 0.40
|   |   |   |   |   |   |   |   |   |--- feature_16 <= -0.45
|   |   |   |   |   |   |   |   |   |   |--- feature_2 <= -0.01
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 9
```

```
|   |   |   |   |   |   |   |   |   |   |--- feature_2 >  -0.01
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 14
|   |   |   |   |   |   |   |   |   |--- feature_16 >  -0.45
|   |   |   |   |   |   |   |   |   |   |--- feature_17 <= 0.57
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 21
|   |   |   |   |   |   |   |   |   |   |--- feature_17 >  0.57
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 16
|   |   |   |   |   |   |   |   |--- feature_9 >  0.40
|   |   |   |   |   |   |   |   |   |--- feature_14 <= 0.42
|   |   |   |   |   |   |   |   |   |   |--- feature_9 <= 0.48
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 16
|   |   |   |   |   |   |   |   |   |   |--- feature_9 >  0.48
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 12
|   |   |   |   |   |   |   |   |   |--- feature_14 >  0.42
|   |   |   |   |   |   |   |   |   |   |--- feature_2 <= -0.01
|   |   |   |   |   |   |   |   |   |   |   |--- value: [30.06]
|   |   |   |   |   |   |   |   |   |   |--- feature_2 >  -0.01
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 11
|   |   |   |   |   |   |   |--- feature_9 >  0.65
|   |   |   |   |   |   |   |   |--- feature_10 <= 1.13
|   |   |   |   |   |   |   |   |   |--- feature_9 <= 9.49
|   |   |   |   |   |   |   |   |   |   |--- feature_7 <= 2.00
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 16
|   |   |   |   |   |   |   |   |   |   |--- feature_7 >  2.00
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 4
|   |   |   |   |   |   |   |   |   |--- feature_9 >  9.49
|   |   |   |   |   |   |   |   |   |   |--- value: [88.99]
|   |   |   |   |   |   |   |   |--- feature_10 >  1.13
|   |   |   |   |   |   |   |   |   |--- feature_20 <= 1.16
|   |   |   |   |   |   |   |   |   |   |--- value: [59.33]
|   |   |   |   |   |   |   |   |   |--- feature_20 >  1.16
|   |   |   |   |   |   |   |   |   |   |--- value: [84.84]
|   |   |   |   |   |--- feature_2 >  -0.01
|   |   |   |   |   |   |--- feature_10 <= 2.21
|   |   |   |   |   |   |   |--- feature_9 <= 0.37
|   |   |   |   |   |   |   |   |--- feature_7 <= 0.50
|   |   |   |   |   |   |   |   |   |--- feature_12 <= 1.25
|   |   |   |   |   |   |   |   |   |   |--- feature_2 <= -0.01
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 21
|   |   |   |   |   |   |   |   |   |   |--- feature_2 >  -0.01
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 15
|   |   |   |   |   |   |   |   |   |--- feature_12 >  1.25
|   |   |   |   |   |   |   |   |   |   |--- feature_2 <= -0.01
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 27
|   |   |   |   |   |   |   |   |   |   |--- feature_2 >  -0.01
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 32
|   |   |   |   |   |   |   |   |--- feature_7 >  0.50
|   |   |   |   |   |   |   |   |   |--- feature_21 <= 0.15
```

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|   |   |   |   |   |   |   |   |   |   |--- feature_2 <= -0.01
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 36
|   |   |   |   |   |   |   |   |   |   |--- feature_2 >  -0.01
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 38
|   |   |   |   |   |   |   |   |   |--- feature_21 >  0.15
|   |   |   |   |   |   |   |   |   |   |--- feature_2 <= -0.01
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 33
|   |   |   |   |   |   |   |   |   |   |--- feature_2 >  -0.01
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 37
|   |   |   |   |   |   |   |--- feature_9 >  0.37
|   |   |   |   |   |   |   |   |--- feature_9 <= 0.80
|   |   |   |   |   |   |   |   |   |--- feature_9 <= 0.53
|   |   |   |   |   |   |   |   |   |   |--- feature_21 <= 0.15
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 22
|   |   |   |   |   |   |   |   |   |   |--- feature_21 >  0.15
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 20
|   |   |   |   |   |   |   |   |   |--- feature_9 >  0.53
|   |   |   |   |   |   |   |   |   |   |--- feature_7 <= 2.00
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 20
|   |   |   |   |   |   |   |   |   |   |--- feature_7 >  2.00
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 5
|   |   |   |   |   |   |   |   |--- feature_9 >  0.80
|   |   |   |   |   |   |   |   |   |--- feature_9 <= 7.44
|   |   |   |   |   |   |   |   |   |   |--- feature_7 <= 2.00
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 18
|   |   |   |   |   |   |   |   |   |   |--- feature_7 >  2.00
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 10
|   |   |   |   |   |   |   |   |   |--- feature_9 >  7.44
|   |   |   |   |   |   |   |   |   |   |--- feature_9 <= 11.36
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 4
|   |   |   |   |   |   |   |   |   |   |--- feature_9 >  11.36
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 3
|   |   |   |   |   |   |--- feature_10 >  2.21
|   |   |   |   |   |   |   |--- feature_9 <= 2.25
|   |   |   |   |   |   |   |   |--- feature_10 <= 5.73
|   |   |   |   |   |   |   |   |   |--- feature_7 <= 0.50
|   |   |   |   |   |   |   |   |   |   |--- feature_5 <= -0.38
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 2
|   |   |   |   |   |   |   |   |   |   |--- feature_5 >  -0.38
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 3
|   |   |   |   |   |   |   |   |   |--- feature_7 >  0.50
|   |   |   |   |   |   |   |   |   |   |--- feature_16 <= 0.41
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 12
|   |   |   |   |   |   |   |   |   |   |--- feature_16 >  0.41
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 8
|   |   |   |   |   |   |   |   |--- feature_10 >  5.73
|   |   |   |   |   |   |   |   |   |--- feature_20 <= 1.16
|   |   |   |   |   |   |   |   |   |   |--- feature_9 <= 1.92
```

```
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 4
|   |   |   |   |   |   |   |   |   |   |--- feature_9 >  1.92
|   |   |   |   |   |   |   |   |   |   |   |--- value: [75.60]
|   |   |   |   |   |   |   |   |   |--- feature_20 >  1.16
|   |   |   |   |   |   |   |   |   |   |--- value: [42.92]
|   |   |   |   |   |   |   |--- feature_9 >  2.25
|   |   |   |   |   |   |   |   |--- feature_17 <= -0.19
|   |   |   |   |   |   |   |   |   |--- value: [171.91]
|   |   |   |   |   |   |   |   |--- feature_17 >  -0.19
|   |   |   |   |   |   |   |   |   |--- feature_10 <= 4.32
|   |   |   |   |   |   |   |   |   |   |--- feature_8 <= -0.37
|   |   |   |   |   |   |   |   |   |   |   |--- value: [100.58]
|   |   |   |   |   |   |   |   |   |   |--- feature_8 >  -0.37
|   |   |   |   |   |   |   |   |   |   |   |--- value: [102.26]
|   |   |   |   |   |   |   |   |   |--- feature_10 >  4.32
|   |   |   |   |   |   |   |   |   |   |--- value: [119.01]
|   |   |   |   |--- feature_2 >  -0.01
|   |   |   |   |   |--- feature_9 <= 0.53
|   |   |   |   |   |   |--- feature_2 <= -0.01
|   |   |   |   |   |   |   |--- feature_9 <= -0.26
|   |   |   |   |   |   |   |   |--- feature_21 <= 0.15
|   |   |   |   |   |   |   |   |   |--- feature_8 <= -0.11
|   |   |   |   |   |   |   |   |   |   |--- feature_12 <= 1.25
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 14
|   |   |   |   |   |   |   |   |   |   |--- feature_12 >  1.25
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 27
|   |   |   |   |   |   |   |   |   |--- feature_8 >  -0.11
|   |   |   |   |   |   |   |   |   |   |--- feature_7 <= 0.50
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 27
|   |   |   |   |   |   |   |   |   |   |--- feature_7 >  0.50
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 30
|   |   |   |   |   |   |   |   |--- feature_21 >  0.15
|   |   |   |   |   |   |   |   |   |--- feature_7 <= 0.50
|   |   |   |   |   |   |   |   |   |   |--- feature_2 <= -0.01
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 29
|   |   |   |   |   |   |   |   |   |   |--- feature_2 >  -0.01
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 19
|   |   |   |   |   |   |   |   |   |--- feature_7 >  0.50
|   |   |   |   |   |   |   |   |   |   |--- feature_2 <= -0.01
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 35
|   |   |   |   |   |   |   |   |   |   |--- feature_2 >  -0.01
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 28
|   |   |   |   |   |   |   |--- feature_9 >  -0.26
|   |   |   |   |   |   |   |   |--- feature_21 <= 0.15
|   |   |   |   |   |   |   |   |   |--- feature_2 <= -0.01
|   |   |   |   |   |   |   |   |   |   |--- feature_8 <= -0.11
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 27
|   |   |   |   |   |   |   |   |   |   |--- feature_8 >  -0.11
```

```
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 28
|   |   |   |   |   |   |   |   |   |--- feature_2 >  -0.01
|   |   |   |   |   |   |   |   |   |   |--- feature_16 <= 0.76
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 26
|   |   |   |   |   |   |   |   |   |   |--- feature_16 >  0.76
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 22
|   |   |   |   |   |   |   |   |--- feature_21 >  0.15
|   |   |   |   |   |   |   |   |   |--- feature_2 <= -0.01
|   |   |   |   |   |   |   |   |   |   |--- feature_17 <= -1.28
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 26
|   |   |   |   |   |   |   |   |   |   |--- feature_17 >  -1.28
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 34
|   |   |   |   |   |   |   |   |   |--- feature_2 >  -0.01
|   |   |   |   |   |   |   |   |   |   |--- feature_17 <= -1.11
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 24
|   |   |   |   |   |   |   |   |   |   |--- feature_17 >  -1.11
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 24
|   |   |   |   |   |   |--- feature_2 >  -0.01
|   |   |   |   |   |   |   |--- feature_9 <= -0.24
|   |   |   |   |   |   |   |   |--- feature_21 <= 0.15
|   |   |   |   |   |   |   |   |   |--- feature_7 <= 0.50
|   |   |   |   |   |   |   |   |   |   |--- feature_15 <= 0.40
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 25
|   |   |   |   |   |   |   |   |   |   |--- feature_15 >  0.40
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 23
|   |   |   |   |   |   |   |   |   |--- feature_7 >  0.50
|   |   |   |   |   |   |   |   |   |   |--- feature_2 <= -0.01
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 27
|   |   |   |   |   |   |   |   |   |   |--- feature_2 >  -0.01
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 26
|   |   |   |   |   |   |   |   |--- feature_21 >  0.15
|   |   |   |   |   |   |   |   |   |--- feature_7 <= 0.50
|   |   |   |   |   |   |   |   |   |   |--- feature_17 <= -1.11
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 17
|   |   |   |   |   |   |   |   |   |   |--- feature_17 >  -1.11
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 24
|   |   |   |   |   |   |   |   |   |--- feature_7 >  0.50
|   |   |   |   |   |   |   |   |   |   |--- feature_9 <= -0.51
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 22
|   |   |   |   |   |   |   |   |   |   |--- feature_9 >  -0.51
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 24
|   |   |   |   |   |   |   |--- feature_9 >  -0.24
|   |   |   |   |   |   |   |   |--- feature_21 <= 0.15
|   |   |   |   |   |   |   |   |   |--- feature_16 <= 0.76
|   |   |   |   |   |   |   |   |   |   |--- feature_14 <= 0.42
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 33
|   |   |   |   |   |   |   |   |   |   |--- feature_14 >  0.42
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 25
```

```
|   |   |   |   |   |   |   |   |   |--- feature_16 >  0.76
|   |   |   |   |   |   |   |   |   |   |--- feature_2 <= -0.01
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 24
|   |   |   |   |   |   |   |   |   |   |--- feature_2 >  -0.01
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 23
|   |   |   |   |   |   |   |   |--- feature_21 >  0.15
|   |   |   |   |   |   |   |   |   |--- feature_17 <= -1.28
|   |   |   |   |   |   |   |   |   |   |--- feature_2 <= -0.01
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 20
|   |   |   |   |   |   |   |   |   |   |--- feature_2 >  -0.01
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 20
|   |   |   |   |   |   |   |   |   |--- feature_17 >  -1.28
|   |   |   |   |   |   |   |   |   |   |--- feature_2 <= -0.01
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 24
|   |   |   |   |   |   |   |   |   |   |--- feature_2 >  -0.01
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 22
|   |   |   |   |   |--- feature_9 >  0.53
|   |   |   |   |   |   |--- feature_9 <= 0.98
|   |   |   |   |   |   |   |--- feature_9 <= 0.71
|   |   |   |   |   |   |   |   |--- feature_2 <= -0.01
|   |   |   |   |   |   |   |   |   |--- feature_16 <= 0.76
|   |   |   |   |   |   |   |   |   |   |--- feature_15 <= 0.40
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 25
|   |   |   |   |   |   |   |   |   |   |--- feature_15 >  0.40
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 18
|   |   |   |   |   |   |   |   |   |--- feature_16 >  0.76
|   |   |   |   |   |   |   |   |   |   |--- feature_9 <= 0.60
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 14
|   |   |   |   |   |   |   |   |   |   |--- feature_9 >  0.60
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 15
|   |   |   |   |   |   |   |   |--- feature_2 >  -0.01
|   |   |   |   |   |   |   |   |   |--- feature_16 <= 0.76
|   |   |   |   |   |   |   |   |   |   |--- feature_17 <= -0.94
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 12
|   |   |   |   |   |   |   |   |   |   |--- feature_17 >  -0.94
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 24
|   |   |   |   |   |   |   |   |   |--- feature_16 >  0.76
|   |   |   |   |   |   |   |   |   |   |--- feature_2 <= -0.01
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 13
|   |   |   |   |   |   |   |   |   |   |--- feature_2 >  -0.01
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 13
|   |   |   |   |   |   |   |--- feature_9 >  0.71
|   |   |   |   |   |   |   |   |--- feature_15 <= 0.40
|   |   |   |   |   |   |   |   |   |--- feature_16 <= 0.59
|   |   |   |   |   |   |   |   |   |   |--- feature_17 <= -0.77
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 12
|   |   |   |   |   |   |   |   |   |   |--- feature_17 >  -0.77
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 20
```

```
|   |   |   |   |   |   |   |   |   |--- feature_16 >  0.59
|   |   |   |   |   |   |   |   |   |   |--- feature_6 <= 1.67
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 14
|   |   |   |   |   |   |   |   |   |   |--- feature_6 >  1.67
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 3
|   |   |   |   |   |   |   |   |--- feature_15 >  0.40
|   |   |   |   |   |   |   |   |   |--- feature_2 <= -0.01
|   |   |   |   |   |   |   |   |   |   |--- feature_9 <= 0.93
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 14
|   |   |   |   |   |   |   |   |   |   |--- feature_9 >  0.93
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 6
|   |   |   |   |   |   |   |   |   |--- feature_2 >  -0.01
|   |   |   |   |   |   |   |   |   |   |--- feature_9 <= 0.85
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 20
|   |   |   |   |   |   |   |   |   |   |--- feature_9 >  0.85
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 12
|   |   |   |   |   |   |--- feature_9 >  0.98
|   |   |   |   |   |   |   |--- feature_9 <= 9.27
|   |   |   |   |   |   |   |   |--- feature_9 <= 1.92
|   |   |   |   |   |   |   |   |   |--- feature_15 <= 0.40
|   |   |   |   |   |   |   |   |   |   |--- feature_17 <= 0.74
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 19
|   |   |   |   |   |   |   |   |   |   |--- feature_17 >  0.74
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 7
|   |   |   |   |   |   |   |   |   |--- feature_15 >  0.40
|   |   |   |   |   |   |   |   |   |   |--- feature_2 <= -0.01
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 6
|   |   |   |   |   |   |   |   |   |   |--- feature_2 >  -0.01
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 10
|   |   |   |   |   |   |   |   |--- feature_9 >  1.92
|   |   |   |   |   |   |   |   |   |--- feature_5 <= 0.60
|   |   |   |   |   |   |   |   |   |   |--- feature_10 <= 2.90
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 10
|   |   |   |   |   |   |   |   |   |   |--- feature_10 >  2.90
|   |   |   |   |   |   |   |   |   |   |   |--- value: [82.27]
|   |   |   |   |   |   |   |   |   |--- feature_5 >  0.60
|   |   |   |   |   |   |   |   |   |   |--- feature_9 <= 2.00
|   |   |   |   |   |   |   |   |   |   |   |--- value: [75.90]
|   |   |   |   |   |   |   |   |   |   |--- feature_9 >  2.00
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 4
|   |   |   |   |   |   |   |--- feature_9 >  9.27
|   |   |   |   |   |   |   |   |--- feature_9 <= 14.83
|   |   |   |   |   |   |   |   |   |--- value: [94.50]
|   |   |   |   |   |   |   |   |--- feature_9 >  14.83
|   |   |   |   |   |   |   |   |   |--- value: [108.10]
|   |   |--- feature_3 >  1.50
|   |   |   |--- feature_11 <= -0.50
|   |   |   |   |--- feature_6 <= 0.33
```

```
|   |   |   |   |   |--- feature_3 <= 4.00
|   |   |   |   |   |   |--- feature_3 <= 2.50
|   |   |   |   |   |   |   |--- feature_5 <= 1.58
|   |   |   |   |   |   |   |   |--- feature_5 <= -1.30
|   |   |   |   |   |   |   |   |   |--- feature_2 <= -0.01
|   |   |   |   |   |   |   |   |   |   |--- feature_5 <= -1.39
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 4
|   |   |   |   |   |   |   |   |   |   |--- feature_5 >  -1.39
|   |   |   |   |   |   |   |   |   |   |   |--- value: [-4.00]
|   |   |   |   |   |   |   |   |   |--- feature_2 >  -0.01
|   |   |   |   |   |   |   |   |   |   |--- value: [-4.00]
|   |   |   |   |   |   |   |   |--- feature_5 >  -1.30
|   |   |   |   |   |   |   |   |   |--- feature_8 <= 0.28
|   |   |   |   |   |   |   |   |   |   |--- feature_12 <= 1.25
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 2
|   |   |   |   |   |   |   |   |   |   |--- feature_12 >  1.25
|   |   |   |   |   |   |   |   |   |   |   |--- value: [-74.00]
|   |   |   |   |   |   |   |   |   |--- feature_8 >  0.28
|   |   |   |   |   |   |   |   |   |   |--- feature_12 <= 1.25
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 2
|   |   |   |   |   |   |   |   |   |   |--- feature_12 >  1.25
|   |   |   |   |   |   |   |   |   |   |   |--- value: [-79.00]
|   |   |   |   |   |   |   |--- feature_5 >  1.58
|   |   |   |   |   |   |   |   |--- value: [-4.00]
|   |   |   |   |   |   |--- feature_3 >  2.50
|   |   |   |   |   |   |   |--- feature_17 <= 0.23
|   |   |   |   |   |   |   |   |--- value: [-24.00]
|   |   |   |   |   |   |   |--- feature_17 >  0.23
|   |   |   |   |   |   |   |   |--- value: [-26.50]
|   |   |   |   |   |--- feature_3 >  4.00
|   |   |   |   |   |   |--- feature_21 <= 0.15
|   |   |   |   |   |   |   |--- feature_5 <= -0.51
|   |   |   |   |   |   |   |   |--- feature_2 <= -0.01
|   |   |   |   |   |   |   |   |   |--- value: [-13.12]
|   |   |   |   |   |   |   |   |--- feature_2 >  -0.01
|   |   |   |   |   |   |   |   |   |--- value: [-54.30]
|   |   |   |   |   |   |   |--- feature_5 >  -0.51
|   |   |   |   |   |   |   |   |--- feature_12 <= 1.25
|   |   |   |   |   |   |   |   |   |--- value: [-441.00]
|   |   |   |   |   |   |   |   |--- feature_12 >  1.25
|   |   |   |   |   |   |   |   |   |--- value: [-223.50]
|   |   |   |   |   |   |--- feature_21 >  0.15
|   |   |   |   |   |   |   |--- feature_5 <= 1.13
|   |   |   |   |   |   |   |   |--- feature_5 <= 0.05
|   |   |   |   |   |   |   |   |   |--- value: [-82.50]
|   |   |   |   |   |   |   |   |--- feature_5 >  0.05
|   |   |   |   |   |   |   |   |   |--- feature_16 <= -0.45
|   |   |   |   |   |   |   |   |   |   |--- feature_1 <= 2.50
```

```
|   |   |   |   |   |   |   |   |   |   |   |--- value: [-20.00]
|   |   |   |   |   |   |   |   |   |   |--- feature_1 >  2.50
|   |   |   |   |   |   |   |   |   |   |   |--- value: [-26.00]
|   |   |   |   |   |   |   |   |   |--- feature_16 >  -0.45
|   |   |   |   |   |   |   |   |   |   |--- feature_2 <= -0.01
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 2
|   |   |   |   |   |   |   |   |   |   |--- feature_2 >  -0.01
|   |   |   |   |   |   |   |   |   |   |   |--- value: [-34.00]
|   |   |   |   |   |   |   |--- feature_5 >  1.13
|   |   |   |   |   |   |   |   |--- value: [-153.50]
|   |   |   |   |--- feature_6 >  0.33
|   |   |   |   |   |--- feature_3 <= 2.50
|   |   |   |   |   |   |--- feature_2 <= -0.01
|   |   |   |   |   |   |   |--- feature_16 <= -2.45
|   |   |   |   |   |   |   |   |--- value: [-4.00]
|   |   |   |   |   |   |   |--- feature_16 >  -2.45
|   |   |   |   |   |   |   |   |--- feature_9 <= -0.37
|   |   |   |   |   |   |   |   |   |--- feature_17 <= -1.95
|   |   |   |   |   |   |   |   |   |   |--- value: [-80.55]
|   |   |   |   |   |   |   |   |   |--- feature_17 >  -1.95
|   |   |   |   |   |   |   |   |   |   |--- feature_8 <= 0.28
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 2
|   |   |   |   |   |   |   |   |   |   |--- feature_8 >  0.28
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 2
|   |   |   |   |   |   |   |   |--- feature_9 >  -0.37
|   |   |   |   |   |   |   |   |   |--- feature_9 <= -0.34
|   |   |   |   |   |   |   |   |   |   |--- value: [-4.00]
|   |   |   |   |   |   |   |   |   |--- feature_9 >  -0.34
|   |   |   |   |   |   |   |   |   |   |--- feature_8 <= 0.28
|   |   |   |   |   |   |   |   |   |   |   |--- value: [-74.00]
|   |   |   |   |   |   |   |   |   |   |--- feature_8 >  0.28
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 2
|   |   |   |   |   |   |--- feature_2 >  -0.01
|   |   |   |   |   |   |   |--- value: [-3.25]
|   |   |   |   |   |--- feature_3 >  2.50
|   |   |   |   |   |   |--- feature_5 <= 1.51
|   |   |   |   |   |   |   |--- feature_17 <= -2.03
|   |   |   |   |   |   |   |   |--- feature_5 <= 0.45
|   |   |   |   |   |   |   |   |   |--- feature_9 <= 0.40
|   |   |   |   |   |   |   |   |   |   |--- value: [-43.50]
|   |   |   |   |   |   |   |   |   |--- feature_9 >  0.40
|   |   |   |   |   |   |   |   |   |   |--- value: [-44.80]
|   |   |   |   |   |   |   |   |--- feature_5 >  0.45
|   |   |   |   |   |   |   |   |   |--- value: [-66.50]
|   |   |   |   |   |   |   |--- feature_17 >  -2.03
|   |   |   |   |   |   |   |   |--- feature_6 <= 1.62
|   |   |   |   |   |   |   |   |   |--- feature_9 <= -1.21
|   |   |   |   |   |   |   |   |   |   |--- value: [-13.30]
```

```
|   |   |   |   |   |   |   |   |   |--- feature_9 >  -1.21
|   |   |   |   |   |   |   |   |   |   |--- feature_17 <= 0.65
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 3
|   |   |   |   |   |   |   |   |   |   |--- feature_17 >  0.65
|   |   |   |   |   |   |   |   |   |   |   |--- value: [-20.50]
|   |   |   |   |   |   |   |   |--- feature_6 >  1.62
|   |   |   |   |   |   |   |   |   |--- value: [-12.66]
|   |   |   |   |   |   |--- feature_5 >  1.51
|   |   |   |   |   |   |   |--- feature_8 <= -0.37
|   |   |   |   |   |   |   |   |--- value: [-97.75]
|   |   |   |   |   |   |   |--- feature_8 >  -0.37
|   |   |   |   |   |   |   |   |--- value: [-45.40]
|   |   |   |--- feature_11 >  -0.50
|   |   |   |   |--- feature_9 <= 1.86
|   |   |   |   |   |--- feature_3 <= 52.00
|   |   |   |   |   |   |--- feature_10 <= 15.15
|   |   |   |   |   |   |   |--- feature_3 <= 2.50
|   |   |   |   |   |   |   |   |--- feature_11 <= 0.50
|   |   |   |   |   |   |   |   |   |--- value: [0.00]
|   |   |   |   |   |   |   |   |--- feature_11 >  0.50
|   |   |   |   |   |   |   |   |   |--- feature_10 <= 1.13
|   |   |   |   |   |   |   |   |   |   |--- feature_2 <= -0.01
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 8
|   |   |   |   |   |   |   |   |   |   |--- feature_2 >  -0.01
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 4
|   |   |   |   |   |   |   |   |   |--- feature_10 >  1.13
|   |   |   |   |   |   |   |   |   |   |--- feature_9 <= -0.25
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 6
|   |   |   |   |   |   |   |   |   |   |--- feature_9 >  -0.25
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 6
|   |   |   |   |   |   |   |--- feature_3 >  2.50
|   |   |   |   |   |   |   |   |--- feature_12 <= 1.25
|   |   |   |   |   |   |   |   |   |--- feature_3 <= 4.50
|   |   |   |   |   |   |   |   |   |   |--- feature_10 <= 2.47
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 11
|   |   |   |   |   |   |   |   |   |   |--- feature_10 >  2.47
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 2
|   |   |   |   |   |   |   |   |   |--- feature_3 >  4.50
|   |   |   |   |   |   |   |   |   |   |--- feature_2 <= -0.01
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 6
|   |   |   |   |   |   |   |   |   |   |--- feature_2 >  -0.01
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 16
|   |   |   |   |   |   |   |   |--- feature_12 >  1.25
|   |   |   |   |   |   |   |   |   |--- feature_9 <= 0.75
|   |   |   |   |   |   |   |   |   |   |--- feature_9 <= -0.82
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 10
|   |   |   |   |   |   |   |   |   |   |--- feature_9 >  -0.82
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 12
```

```
|   |   |   |   |   |   |   |   |   |--- feature_9 >  0.75
|   |   |   |   |   |   |   |   |   |   |--- feature_17 <= 0.40
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 7
|   |   |   |   |   |   |   |   |   |   |--- feature_17 >  0.40
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 6
|   |   |   |   |   |   |--- feature_10 >  15.15
|   |   |   |   |   |   |   |--- value: [431.00]
|   |   |   |   |   |--- feature_3 >  52.00
|   |   |   |   |   |   |--- feature_10 <= 1.13
|   |   |   |   |   |   |   |--- feature_11 <= 0.50
|   |   |   |   |   |   |   |   |--- feature_16 <= -0.45
|   |   |   |   |   |   |   |   |   |--- feature_5 <= -0.11
|   |   |   |   |   |   |   |   |   |   |--- value: [19.60]
|   |   |   |   |   |   |   |   |   |--- feature_5 >  -0.11
|   |   |   |   |   |   |   |   |   |   |--- value: [23.50]
|   |   |   |   |   |   |   |   |--- feature_16 >  -0.45
|   |   |   |   |   |   |   |   |   |--- value: [129.60]
|   |   |   |   |   |   |   |--- feature_11 >  0.50
|   |   |   |   |   |   |   |   |--- feature_6 <= 0.31
|   |   |   |   |   |   |   |   |   |--- feature_9 <= -0.42
|   |   |   |   |   |   |   |   |   |   |--- feature_17 <= 0.40
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 12
|   |   |   |   |   |   |   |   |   |   |--- feature_17 >  0.40
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 5
|   |   |   |   |   |   |   |   |   |--- feature_9 >  -0.42
|   |   |   |   |   |   |   |   |   |   |--- feature_2 <= -0.01
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 2
|   |   |   |   |   |   |   |   |   |   |--- feature_2 >  -0.01
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 7
|   |   |   |   |   |   |   |   |--- feature_6 >  0.31
|   |   |   |   |   |   |   |   |   |--- feature_2 <= -0.01
|   |   |   |   |   |   |   |   |   |   |--- feature_9 <= -0.55
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 8
|   |   |   |   |   |   |   |   |   |   |--- feature_9 >  -0.55
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 6
|   |   |   |   |   |   |   |   |   |--- feature_2 >  -0.01
|   |   |   |   |   |   |   |   |   |   |--- feature_6 <= 0.34
|   |   |   |   |   |   |   |   |   |   |   |--- value: [48.00]
|   |   |   |   |   |   |   |   |   |   |--- feature_6 >  0.34
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 7
|   |   |   |   |   |   |--- feature_10 >  1.13
|   |   |   |   |   |   |   |--- feature_10 <= 8.05
|   |   |   |   |   |   |   |   |--- feature_16 <= 1.11
|   |   |   |   |   |   |   |   |   |--- feature_17 <= 1.07
|   |   |   |   |   |   |   |   |   |   |--- feature_16 <= 0.76
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 9
|   |   |   |   |   |   |   |   |   |   |--- feature_16 >  0.76
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 3
```

```
|   |   |   |   |   |   |   |   |   |--- feature_17 >  1.07
|   |   |   |   |   |   |   |   |   |   |--- value: [40.55]
|   |   |   |   |   |   |   |   |--- feature_16 >  1.11
|   |   |   |   |   |   |   |   |   |--- feature_15 <= 0.40
|   |   |   |   |   |   |   |   |   |   |--- value: [75.25]
|   |   |   |   |   |   |   |   |   |--- feature_15 >  0.40
|   |   |   |   |   |   |   |   |   |   |--- value: [72.55]
|   |   |   |   |   |   |   |--- feature_10 >  8.05
|   |   |   |   |   |   |   |   |--- feature_9 <= -0.93
|   |   |   |   |   |   |   |   |   |--- value: [92.20]
|   |   |   |   |   |   |   |   |--- feature_9 >  -0.93
|   |   |   |   |   |   |   |   |   |--- value: [94.20]
|   |   |   |   |--- feature_9 >  1.86
|   |   |   |   |   |--- feature_9 <= 5.72
|   |   |   |   |   |   |--- feature_9 <= 3.46
|   |   |   |   |   |   |   |--- feature_9 <= 1.87
|   |   |   |   |   |   |   |   |--- value: [176.00]
|   |   |   |   |   |   |   |--- feature_9 >  1.87
|   |   |   |   |   |   |   |   |--- feature_9 <= 2.00
|   |   |   |   |   |   |   |   |   |--- feature_6 <= -0.91
|   |   |   |   |   |   |   |   |   |   |--- feature_9 <= 1.89
|   |   |   |   |   |   |   |   |   |   |   |--- value: [81.50]
|   |   |   |   |   |   |   |   |   |   |--- feature_9 >  1.89
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 2
|   |   |   |   |   |   |   |   |   |--- feature_6 >  -0.91
|   |   |   |   |   |   |   |   |   |   |--- feature_9 <= 1.89
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 2
|   |   |   |   |   |   |   |   |   |   |--- feature_9 >  1.89
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 3
|   |   |   |   |   |   |   |   |--- feature_9 >  2.00
|   |   |   |   |   |   |   |   |   |--- feature_16 <= 0.59
|   |   |   |   |   |   |   |   |   |   |--- feature_9 <= 2.07
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 2
|   |   |   |   |   |   |   |   |   |   |--- feature_9 >  2.07
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 16
|   |   |   |   |   |   |   |   |   |--- feature_16 >  0.59
|   |   |   |   |   |   |   |   |   |   |--- feature_9 <= 2.76
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 8
|   |   |   |   |   |   |   |   |   |   |--- feature_9 >  2.76
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 6
|   |   |   |   |   |   |--- feature_9 >  3.46
|   |   |   |   |   |   |   |--- feature_16 <= 1.28
|   |   |   |   |   |   |   |   |--- feature_2 <= -0.01
|   |   |   |   |   |   |   |   |   |--- feature_9 <= 4.84
|   |   |   |   |   |   |   |   |   |   |--- feature_16 <= -2.36
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 3
|   |   |   |   |   |   |   |   |   |   |--- feature_16 >  -2.36
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 13
```

```
|   |   |   |   |   |   |   |   |   |--- feature_9 >  4.84
|   |   |   |   |   |   |   |   |   |   |--- feature_9 <= 5.58
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 5
|   |   |   |   |   |   |   |   |   |   |--- feature_9 >  5.58
|   |   |   |   |   |   |   |   |   |   |   |--- value: [56.40]
|   |   |   |   |   |   |   |   |--- feature_2 >  -0.01
|   |   |   |   |   |   |   |   |   |--- value: [27.51]
|   |   |   |   |   |   |   |--- feature_16 >  1.28
|   |   |   |   |   |   |   |   |--- value: [281.50]
|   |   |   |   |   |--- feature_9 >  5.72
|   |   |   |   |   |   |--- feature_6 <= 1.08
|   |   |   |   |   |   |   |--- feature_3 <= 4.00
|   |   |   |   |   |   |   |   |--- feature_16 <= 0.15
|   |   |   |   |   |   |   |   |   |--- value: [125.50]
|   |   |   |   |   |   |   |   |--- feature_16 >  0.15
|   |   |   |   |   |   |   |   |   |--- value: [76.50]
|   |   |   |   |   |   |   |--- feature_3 >  4.00
|   |   |   |   |   |   |   |   |--- feature_9 <= 6.58
|   |   |   |   |   |   |   |   |   |--- feature_6 <= 0.48
|   |   |   |   |   |   |   |   |   |   |--- feature_6 <= -0.21
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 3
|   |   |   |   |   |   |   |   |   |   |--- feature_6 >  -0.21
|   |   |   |   |   |   |   |   |   |   |   |--- value: [192.66]
|   |   |   |   |   |   |   |   |   |--- feature_6 >  0.48
|   |   |   |   |   |   |   |   |   |   |--- value: [137.80]
|   |   |   |   |   |   |   |   |--- feature_9 >  6.58
|   |   |   |   |   |   |   |   |   |--- feature_13 <= 0.88
|   |   |   |   |   |   |   |   |   |   |--- feature_5 <= -0.44
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 2
|   |   |   |   |   |   |   |   |   |   |--- feature_5 >  -0.44
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 3
|   |   |   |   |   |   |   |   |   |--- feature_13 >  0.88
|   |   |   |   |   |   |   |   |   |   |--- value: [175.95]
|   |   |   |   |   |   |--- feature_6 >  1.08
|   |   |   |   |   |   |   |--- feature_9 <= 10.18
|   |   |   |   |   |   |   |   |--- feature_14 <= -0.92
|   |   |   |   |   |   |   |   |   |--- value: [297.60]
|   |   |   |   |   |   |   |   |--- feature_14 >  -0.92
|   |   |   |   |   |   |   |   |   |--- value: [216.25]
|   |   |   |   |   |   |   |--- feature_9 >  10.18
|   |   |   |   |   |   |   |   |--- feature_5 <= 0.93
|   |   |   |   |   |   |   |   |   |--- feature_17 <= 0.57
|   |   |   |   |   |   |   |   |   |   |--- feature_9 <= 23.26
|   |   |   |   |   |   |   |   |   |   |   |--- value: [331.20]
|   |   |   |   |   |   |   |   |   |   |--- feature_9 >  23.26
|   |   |   |   |   |   |   |   |   |   |   |--- value: [333.00]
|   |   |   |   |   |   |   |   |   |--- feature_17 >  0.57
|   |   |   |   |   |   |   |   |   |   |--- value: [364.20]
```

```
|   |   |   |   |   |   |   |   |--- feature_5 >  0.93
|   |   |   |   |   |   |   |   |   |--- value: [421.20]
|   |--- feature_2 >  -0.01
|   |   |--- feature_11 <= 0.15
|   |   |   |--- feature_3 <= 1.50
|   |   |   |   |--- feature_2 <= -0.00
|   |   |   |   |   |--- feature_8 <= -0.11
|   |   |   |   |   |   |--- feature_9 <= -1.28
|   |   |   |   |   |   |   |--- feature_2 <= -0.00
|   |   |   |   |   |   |   |   |--- value: [-21.30]
|   |   |   |   |   |   |   |--- feature_2 >  -0.00
|   |   |   |   |   |   |   |   |--- value: [-4.00]
|   |   |   |   |   |   |--- feature_9 >  -1.28
|   |   |   |   |   |   |   |--- feature_6 <= 1.63
|   |   |   |   |   |   |   |   |--- feature_8 <= -0.76
|   |   |   |   |   |   |   |   |   |--- feature_7 <= 1.00
|   |   |   |   |   |   |   |   |   |   |--- feature_6 <= 0.56
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 7
|   |   |   |   |   |   |   |   |   |   |--- feature_6 >  0.56
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 4
|   |   |   |   |   |   |   |   |   |--- feature_7 >  1.00
|   |   |   |   |   |   |   |   |   |   |--- feature_16 <= -0.80
|   |   |   |   |   |   |   |   |   |   |   |--- value: [-30.80]
|   |   |   |   |   |   |   |   |   |   |--- feature_16 >  -0.80
|   |   |   |   |   |   |   |   |   |   |   |--- value: [-32.90]
|   |   |   |   |   |   |   |   |--- feature_8 >  -0.76
|   |   |   |   |   |   |   |   |   |--- feature_2 <= -0.00
|   |   |   |   |   |   |   |   |   |   |--- feature_17 <= 0.74
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 4
|   |   |   |   |   |   |   |   |   |   |--- feature_17 >  0.74
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 6
|   |   |   |   |   |   |   |   |   |--- feature_2 >  -0.00
|   |   |   |   |   |   |   |   |   |   |--- feature_17 <= -2.29
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 3
|   |   |   |   |   |   |   |   |   |   |--- feature_17 >  -2.29
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 7
|   |   |   |   |   |   |   |--- feature_6 >  1.63
|   |   |   |   |   |   |   |   |--- feature_20 <= 0.14
|   |   |   |   |   |   |   |   |   |--- value: [-4.00]
|   |   |   |   |   |   |   |   |--- feature_20 >  0.14
|   |   |   |   |   |   |   |   |   |--- feature_5 <= -0.67
|   |   |   |   |   |   |   |   |   |   |--- value: [-22.40]
|   |   |   |   |   |   |   |   |   |--- feature_5 >  -0.67
|   |   |   |   |   |   |   |   |   |   |--- value: [-22.70]
|   |   |   |   |   |--- feature_8 >  -0.11
|   |   |   |   |   |   |--- feature_2 <= -0.00
|   |   |   |   |   |   |   |--- feature_12 <= 1.25
|   |   |   |   |   |   |   |   |--- value: [-20.65]
```

```
|   |   |   |   |   |   |   |--- feature_12 >  1.25
|   |   |   |   |   |   |   |   |--- feature_1 <= 3.50
|   |   |   |   |   |   |   |   |   |--- feature_2 <= -0.01
|   |   |   |   |   |   |   |   |   |   |--- feature_16 <= 0.15
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 2
|   |   |   |   |   |   |   |   |   |   |--- feature_16 >  0.15
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 3
|   |   |   |   |   |   |   |   |   |--- feature_2 >  -0.01
|   |   |   |   |   |   |   |   |   |   |--- feature_5 <= -1.20
|   |   |   |   |   |   |   |   |   |   |   |--- value: [-22.10]
|   |   |   |   |   |   |   |   |   |   |--- feature_5 >  -1.20
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 6
|   |   |   |   |   |   |   |   |--- feature_1 >  3.50
|   |   |   |   |   |   |   |   |   |--- value: [-22.10]
|   |   |   |   |   |   |--- feature_2 >  -0.00
|   |   |   |   |   |   |   |--- feature_16 <= 0.41
|   |   |   |   |   |   |   |   |--- feature_15 <= -0.94
|   |   |   |   |   |   |   |   |   |--- value: [-27.70]
|   |   |   |   |   |   |   |   |--- feature_15 >  -0.94
|   |   |   |   |   |   |   |   |   |--- feature_9 <= -0.93
|   |   |   |   |   |   |   |   |   |   |--- feature_17 <= 0.32
|   |   |   |   |   |   |   |   |   |   |   |--- value: [-32.60]
|   |   |   |   |   |   |   |   |   |   |--- feature_17 >  0.32
|   |   |   |   |   |   |   |   |   |   |   |--- value: [-32.90]
|   |   |   |   |   |   |   |   |   |--- feature_9 >  -0.93
|   |   |   |   |   |   |   |   |   |   |--- feature_17 <= 0.23
|   |   |   |   |   |   |   |   |   |   |   |--- value: [-34.00]
|   |   |   |   |   |   |   |   |   |   |--- feature_17 >  0.23
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 2
|   |   |   |   |   |   |   |--- feature_16 >  0.41
|   |   |   |   |   |   |   |   |--- feature_9 <= -1.19
|   |   |   |   |   |   |   |   |   |--- value: [-35.10]
|   |   |   |   |   |   |   |   |--- feature_9 >  -1.19
|   |   |   |   |   |   |   |   |   |--- feature_14 <= -0.25
|   |   |   |   |   |   |   |   |   |   |--- value: [-29.05]
|   |   |   |   |   |   |   |   |   |--- feature_14 >  -0.25
|   |   |   |   |   |   |   |   |   |   |--- feature_17 <= 0.57
|   |   |   |   |   |   |   |   |   |   |   |--- value: [-25.60]
|   |   |   |   |   |   |   |   |   |   |--- feature_17 >  0.57
|   |   |   |   |   |   |   |   |   |   |   |--- value: [-24.90]
|   |   |   |   |--- feature_2 >  -0.00
|   |   |   |   |   |--- feature_0 <= 0.50
|   |   |   |   |   |   |--- value: [0.00]
|   |   |   |   |   |--- feature_0 >  0.50
|   |   |   |   |   |   |--- feature_2 <= 0.00
|   |   |   |   |   |   |   |--- feature_16 <= -1.41
|   |   |   |   |   |   |   |   |--- feature_2 <= -0.00
|   |   |   |   |   |   |   |   |   |--- feature_16 <= -2.27
```

```
|   |   |   |   |   |   |   |   |   |   |--- feature_9 <= -0.47
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 3
|   |   |   |   |   |   |   |   |   |   |--- feature_9 >  -0.47
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 2
|   |   |   |   |   |   |   |   |   |--- feature_16 >  -2.27
|   |   |   |   |   |   |   |   |   |   |--- value: [-23.70]
|   |   |   |   |   |   |   |   |--- feature_2 >  -0.00
|   |   |   |   |   |   |   |   |   |--- feature_6 <= -0.07
|   |   |   |   |   |   |   |   |   |   |--- value: [-32.55]
|   |   |   |   |   |   |   |   |   |--- feature_6 >  -0.07
|   |   |   |   |   |   |   |   |   |   |--- value: [-29.40]
|   |   |   |   |   |   |   |--- feature_16 >  -1.41
|   |   |   |   |   |   |   |   |--- feature_16 <= 0.59
|   |   |   |   |   |   |   |   |   |--- feature_6 <= 1.58
|   |   |   |   |   |   |   |   |   |   |--- feature_13 <= 0.88
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 8
|   |   |   |   |   |   |   |   |   |   |--- feature_13 >  0.88
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 4
|   |   |   |   |   |   |   |   |   |--- feature_6 >  1.58
|   |   |   |   |   |   |   |   |   |   |--- feature_20 <= 0.14
|   |   |   |   |   |   |   |   |   |   |   |--- value: [-39.40]
|   |   |   |   |   |   |   |   |   |   |--- feature_20 >  0.14
|   |   |   |   |   |   |   |   |   |   |   |--- value: [-49.00]
|   |   |   |   |   |   |   |   |--- feature_16 >  0.59
|   |   |   |   |   |   |   |   |   |--- feature_6 <= -0.01
|   |   |   |   |   |   |   |   |   |   |--- feature_5 <= -0.17
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 2
|   |   |   |   |   |   |   |   |   |   |--- feature_5 >  -0.17
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 4
|   |   |   |   |   |   |   |   |   |--- feature_6 >  -0.01
|   |   |   |   |   |   |   |   |   |   |--- feature_16 <= 1.28
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 4
|   |   |   |   |   |   |   |   |   |   |--- feature_16 >  1.28
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 2
|   |   |   |   |   |   |--- feature_2 >  0.00
|   |   |   |   |   |   |   |--- feature_8 <= -0.11
|   |   |   |   |   |   |   |   |--- feature_16 <= -0.71
|   |   |   |   |   |   |   |   |   |--- feature_17 <= -2.45
|   |   |   |   |   |   |   |   |   |   |--- value: [-41.85]
|   |   |   |   |   |   |   |   |   |--- feature_17 >  -2.45
|   |   |   |   |   |   |   |   |   |   |--- feature_6 <= -0.77
|   |   |   |   |   |   |   |   |   |   |   |--- value: [-28.25]
|   |   |   |   |   |   |   |   |   |   |--- feature_6 >  -0.77
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 4
|   |   |   |   |   |   |   |   |--- feature_16 >  -0.71
|   |   |   |   |   |   |   |   |   |--- feature_14 <= -0.92
|   |   |   |   |   |   |   |   |   |   |--- feature_13 <= 0.88
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 5
```

```
|   |   |   |   |   |   |   |   |   |   |--- feature_13 >  0.88
|   |   |   |   |   |   |   |   |   |   |   |--- value: [-27.55]
|   |   |   |   |   |   |   |   |   |--- feature_14 >  -0.92
|   |   |   |   |   |   |   |   |   |   |--- feature_2 <= 0.01
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 10
|   |   |   |   |   |   |   |   |   |   |--- feature_2 >  0.01
|   |   |   |   |   |   |   |   |   |   |   |--- value: [-43.40]
|   |   |   |   |   |   |   |--- feature_8 >  -0.11
|   |   |   |   |   |   |   |   |--- feature_2 <= 0.01
|   |   |   |   |   |   |   |   |   |--- feature_12 <= 1.25
|   |   |   |   |   |   |   |   |   |   |--- feature_9 <= -1.02
|   |   |   |   |   |   |   |   |   |   |   |--- value: [-31.85]
|   |   |   |   |   |   |   |   |   |   |--- feature_9 >  -1.02
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 4
|   |   |   |   |   |   |   |   |   |--- feature_12 >  1.25
|   |   |   |   |   |   |   |   |   |   |--- feature_1 <= 3.50
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 5
|   |   |   |   |   |   |   |   |   |   |--- feature_1 >  3.50
|   |   |   |   |   |   |   |   |   |   |   |--- value: [-34.70]
|   |   |   |   |   |   |   |   |--- feature_2 >  0.01
|   |   |   |   |   |   |   |   |   |--- feature_15 <= 0.40
|   |   |   |   |   |   |   |   |   |   |--- feature_14 <= -0.92
|   |   |   |   |   |   |   |   |   |   |   |--- value: [-43.85]
|   |   |   |   |   |   |   |   |   |   |--- feature_14 >  -0.92
|   |   |   |   |   |   |   |   |   |   |   |--- value: [-43.75]
|   |   |   |   |   |   |   |   |   |--- feature_15 >  0.40
|   |   |   |   |   |   |   |   |   |   |--- value: [-39.55]
|   |   |   |--- feature_3 >  1.50
|   |   |   |   |--- feature_17 <= -0.10
|   |   |   |   |   |--- value: [-4.77]
|   |   |   |   |--- feature_17 >  -0.10
|   |   |   |   |   |--- feature_9 <= -0.59
|   |   |   |   |   |   |--- feature_6 <= -0.90
|   |   |   |   |   |   |   |--- value: [-55.55]
|   |   |   |   |   |   |--- feature_6 >  -0.90
|   |   |   |   |   |   |   |--- value: [-52.40]
|   |   |   |   |   |--- feature_9 >  -0.59
|   |   |   |   |   |   |--- feature_13 <= 0.88
|   |   |   |   |   |   |   |--- value: [-85.55]
|   |   |   |   |   |   |--- feature_13 >  0.88
|   |   |   |   |   |   |   |--- value: [-73.25]
|   |   |--- feature_11 >  0.15
|   |   |   |--- feature_2 <= -0.00
|   |   |   |   |--- feature_9 <= 71.24
|   |   |   |   |   |--- feature_9 <= 0.83
|   |   |   |   |   |   |--- feature_2 <= -0.00
|   |   |   |   |   |   |   |--- feature_9 <= -0.16
|   |   |   |   |   |   |   |   |--- feature_21 <= 0.15
```

```
|   |   |   |   |   |   |   |   |   |--- feature_2 <= -0.01
|   |   |   |   |   |   |   |   |   |   |--- feature_16 <= 0.76
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 22
|   |   |   |   |   |   |   |   |   |   |--- feature_16 >  0.76
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 21
|   |   |   |   |   |   |   |   |   |--- feature_2 >  -0.01
|   |   |   |   |   |   |   |   |   |   |--- feature_16 <= 0.59
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 21
|   |   |   |   |   |   |   |   |   |   |--- feature_16 >  0.59
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 20
|   |   |   |   |   |   |   |   |--- feature_21 >  0.15
|   |   |   |   |   |   |   |   |   |--- feature_17 <= -1.28
|   |   |   |   |   |   |   |   |   |   |--- feature_3 <= 4.00
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 24
|   |   |   |   |   |   |   |   |   |   |--- feature_3 >  4.00
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 7
|   |   |   |   |   |   |   |   |   |--- feature_17 >  -1.28
|   |   |   |   |   |   |   |   |   |   |--- feature_2 <= -0.01
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 25
|   |   |   |   |   |   |   |   |   |   |--- feature_2 >  -0.01
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 24
|   |   |   |   |   |   |   |--- feature_9 >  -0.16
|   |   |   |   |   |   |   |   |--- feature_21 <= 0.15
|   |   |   |   |   |   |   |   |   |--- feature_16 <= 0.76
|   |   |   |   |   |   |   |   |   |   |--- feature_9 <= 0.19
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 28
|   |   |   |   |   |   |   |   |   |   |--- feature_9 >  0.19
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 30
|   |   |   |   |   |   |   |   |   |--- feature_16 >  0.76
|   |   |   |   |   |   |   |   |   |   |--- feature_2 <= -0.01
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 21
|   |   |   |   |   |   |   |   |   |   |--- feature_2 >  -0.01
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 24
|   |   |   |   |   |   |   |   |--- feature_21 >  0.15
|   |   |   |   |   |   |   |   |   |--- feature_17 <= -1.28
|   |   |   |   |   |   |   |   |   |   |--- feature_2 <= -0.01
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 22
|   |   |   |   |   |   |   |   |   |   |--- feature_2 >  -0.01
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 19
|   |   |   |   |   |   |   |   |   |--- feature_17 >  -1.28
|   |   |   |   |   |   |   |   |   |   |--- feature_2 <= -0.01
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 28
|   |   |   |   |   |   |   |   |   |   |--- feature_2 >  -0.01
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 26
|   |   |   |   |   |   |--- feature_2 >  -0.00
|   |   |   |   |   |   |   |--- feature_9 <= -0.06
|   |   |   |   |   |   |   |   |--- feature_16 <= -0.97
|   |   |   |   |   |   |   |   |   |--- feature_2 <= -0.00
```

```
|   |   |   |   |   |   |   |   |   |   |--- feature_9 <= -0.29
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 22
|   |   |   |   |   |   |   |   |   |   |--- feature_9 >  -0.29
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 16
|   |   |   |   |   |   |   |   |   |--- feature_2 >  -0.00
|   |   |   |   |   |   |   |   |   |   |--- feature_10 <= 1.66
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 21
|   |   |   |   |   |   |   |   |   |   |--- feature_10 >  1.66
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 4
|   |   |   |   |   |   |   |   |--- feature_16 >  -0.97
|   |   |   |   |   |   |   |   |   |--- feature_3 <= 1.50
|   |   |   |   |   |   |   |   |   |   |--- feature_2 <= -0.00
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 23
|   |   |   |   |   |   |   |   |   |   |--- feature_2 >  -0.00
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 28
|   |   |   |   |   |   |   |   |   |--- feature_3 >  1.50
|   |   |   |   |   |   |   |   |   |   |--- feature_5 <= 1.60
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 12
|   |   |   |   |   |   |   |   |   |   |--- feature_5 >  1.60
|   |   |   |   |   |   |   |   |   |   |   |--- value: [491.00]
|   |   |   |   |   |   |   |--- feature_9 >  -0.06
|   |   |   |   |   |   |   |   |--- feature_21 <= 0.15
|   |   |   |   |   |   |   |   |   |--- feature_2 <= -0.00
|   |   |   |   |   |   |   |   |   |   |--- feature_16 <= 0.76
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 24
|   |   |   |   |   |   |   |   |   |   |--- feature_16 >  0.76
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 19
|   |   |   |   |   |   |   |   |   |--- feature_2 >  -0.00
|   |   |   |   |   |   |   |   |   |   |--- feature_16 <= 0.76
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 25
|   |   |   |   |   |   |   |   |   |   |--- feature_16 >  0.76
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 21
|   |   |   |   |   |   |   |   |--- feature_21 >  0.15
|   |   |   |   |   |   |   |   |   |--- feature_2 <= -0.00
|   |   |   |   |   |   |   |   |   |   |--- feature_16 <= -1.32
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 22
|   |   |   |   |   |   |   |   |   |   |--- feature_16 >  -1.32
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 23
|   |   |   |   |   |   |   |   |   |--- feature_2 >  -0.00
|   |   |   |   |   |   |   |   |   |   |--- feature_3 <= 3.00
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 31
|   |   |   |   |   |   |   |   |   |   |--- feature_3 >  3.00
|   |   |   |   |   |   |   |   |   |   |   |--- value: [69.00]
|   |   |   |   |   |--- feature_9 >  0.83
|   |   |   |   |   |   |--- feature_9 <= 1.82
|   |   |   |   |   |   |   |--- feature_9 <= 1.21
|   |   |   |   |   |   |   |   |--- feature_3 <= 1.50
|   |   |   |   |   |   |   |   |   |--- feature_2 <= -0.00
```

```
|   |   |   |   |   |   |   |   |   |   |--- feature_10 <= 3.88
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 27
|   |   |   |   |   |   |   |   |   |   |--- feature_10 >  3.88
|   |   |   |   |   |   |   |   |   |   |   |--- value: [84.66]
|   |   |   |   |   |   |   |   |   |--- feature_2 >  -0.00
|   |   |   |   |   |   |   |   |   |   |--- feature_21 <= 0.15
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 22
|   |   |   |   |   |   |   |   |   |   |--- feature_21 >  0.15
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 16
|   |   |   |   |   |   |   |   |--- feature_3 >  1.50
|   |   |   |   |   |   |   |   |   |--- feature_3 <= 2.50
|   |   |   |   |   |   |   |   |   |   |--- feature_5 <= 0.27
|   |   |   |   |   |   |   |   |   |   |   |--- value: [90.55]
|   |   |   |   |   |   |   |   |   |   |--- feature_5 >  0.27
|   |   |   |   |   |   |   |   |   |   |   |--- value: [95.55]
|   |   |   |   |   |   |   |   |   |--- feature_3 >  2.50
|   |   |   |   |   |   |   |   |   |   |--- value: [48.96]
|   |   |   |   |   |   |   |--- feature_9 >  1.21
|   |   |   |   |   |   |   |   |--- feature_3 <= 1.50
|   |   |   |   |   |   |   |   |   |--- feature_21 <= 0.15
|   |   |   |   |   |   |   |   |   |   |--- feature_9 <= 1.46
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 17
|   |   |   |   |   |   |   |   |   |   |--- feature_9 >  1.46
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 16
|   |   |   |   |   |   |   |   |   |--- feature_21 >  0.15
|   |   |   |   |   |   |   |   |   |   |--- feature_17 <= -1.28
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 7
|   |   |   |   |   |   |   |   |   |   |--- feature_17 >  -1.28
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 11
|   |   |   |   |   |   |   |   |--- feature_3 >  1.50
|   |   |   |   |   |   |   |   |   |--- feature_6 <= -1.24
|   |   |   |   |   |   |   |   |   |   |--- feature_0 <= 0.50
|   |   |   |   |   |   |   |   |   |   |   |--- value: [90.55]
|   |   |   |   |   |   |   |   |   |   |--- feature_0 >  0.50
|   |   |   |   |   |   |   |   |   |   |   |--- value: [88.48]
|   |   |   |   |   |   |   |   |   |--- feature_6 >  -1.24
|   |   |   |   |   |   |   |   |   |   |--- feature_16 <= 0.24
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 4
|   |   |   |   |   |   |   |   |   |   |--- feature_16 >  0.24
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 2
|   |   |   |   |   |   |--- feature_9 >  1.82
|   |   |   |   |   |   |   |--- feature_9 <= 23.43
|   |   |   |   |   |   |   |   |--- feature_3 <= 1.50
|   |   |   |   |   |   |   |   |   |--- feature_14 <= 0.42
|   |   |   |   |   |   |   |   |   |   |--- feature_20 <= -0.87
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 10
|   |   |   |   |   |   |   |   |   |   |--- feature_20 >  -0.87
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 9
```

```
|   |   |   |   |   |   |   |   |   |--- feature_14 >  0.42
|   |   |   |   |   |   |   |   |   |   |--- feature_9 <= 4.32
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 9
|   |   |   |   |   |   |   |   |   |   |--- feature_9 >  4.32
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 4
|   |   |   |   |   |   |   |   |--- feature_3 >  1.50
|   |   |   |   |   |   |   |   |   |--- feature_10 <= 8.46
|   |   |   |   |   |   |   |   |   |   |--- feature_9 <= 2.83
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 4
|   |   |   |   |   |   |   |   |   |   |--- feature_9 >  2.83
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 3
|   |   |   |   |   |   |   |   |   |--- feature_10 >  8.46
|   |   |   |   |   |   |   |   |   |   |--- value: [154.60]
|   |   |   |   |   |   |   |--- feature_9 >  23.43
|   |   |   |   |   |   |   |   |--- value: [198.80]
|   |   |   |   |--- feature_9 >  71.24
|   |   |   |   |   |--- value: [500.00]
|   |   |   |--- feature_2 >  -0.00
|   |   |   |   |--- feature_9 <= 1.18
|   |   |   |   |   |--- feature_9 <= 0.33
|   |   |   |   |   |   |--- feature_2 <= 0.00
|   |   |   |   |   |   |   |--- feature_9 <= -0.24
|   |   |   |   |   |   |   |   |--- feature_20 <= 0.14
|   |   |   |   |   |   |   |   |   |--- feature_10 <= 4.32
|   |   |   |   |   |   |   |   |   |   |--- feature_12 <= 1.25
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 15
|   |   |   |   |   |   |   |   |   |   |--- feature_12 >  1.25
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 20
|   |   |   |   |   |   |   |   |   |--- feature_10 >  4.32
|   |   |   |   |   |   |   |   |   |   |--- feature_14 <= -0.25
|   |   |   |   |   |   |   |   |   |   |   |--- value: [61.55]
|   |   |   |   |   |   |   |   |   |   |--- feature_14 >  -0.25
|   |   |   |   |   |   |   |   |   |   |   |--- value: [84.70]
|   |   |   |   |   |   |   |   |--- feature_20 >  0.14
|   |   |   |   |   |   |   |   |   |--- feature_10 <= 1.13
|   |   |   |   |   |   |   |   |   |   |--- feature_12 <= 1.25
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 21
|   |   |   |   |   |   |   |   |   |   |--- feature_12 >  1.25
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 24
|   |   |   |   |   |   |   |   |   |--- feature_10 >  1.13
|   |   |   |   |   |   |   |   |   |   |--- feature_9 <= -1.25
|   |   |   |   |   |   |   |   |   |   |   |--- value: [62.85]
|   |   |   |   |   |   |   |   |   |   |--- feature_9 >  -1.25
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 8
|   |   |   |   |   |   |   |--- feature_9 >  -0.24
|   |   |   |   |   |   |   |   |--- feature_21 <= 0.15
|   |   |   |   |   |   |   |   |   |--- feature_2 <= 0.00
|   |   |   |   |   |   |   |   |   |   |--- feature_9 <= 0.07
```

```
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 16
|   |   |   |   |   |   |   |   |   |   |--- feature_9 >  0.07
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 16
|   |   |   |   |   |   |   |   |   |--- feature_2 >  0.00
|   |   |   |   |   |   |   |   |   |   |--- feature_16 <= 0.41
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 13
|   |   |   |   |   |   |   |   |   |   |--- feature_16 >  0.41
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 17
|   |   |   |   |   |   |   |   |--- feature_21 >  0.15
|   |   |   |   |   |   |   |   |   |--- feature_2 <= 0.00
|   |   |   |   |   |   |   |   |   |   |--- feature_10 <= 1.13
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 22
|   |   |   |   |   |   |   |   |   |   |--- feature_10 >  1.13
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 5
|   |   |   |   |   |   |   |   |   |--- feature_2 >  0.00
|   |   |   |   |   |   |   |   |   |   |--- feature_9 <= 0.16
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 13
|   |   |   |   |   |   |   |   |   |   |--- feature_9 >  0.16
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 14
|   |   |   |   |   |   |--- feature_2 >  0.00
|   |   |   |   |   |   |   |--- feature_10 <= 2.21
|   |   |   |   |   |   |   |   |--- feature_17 <= -0.44
|   |   |   |   |   |   |   |   |   |--- feature_9 <= -0.32
|   |   |   |   |   |   |   |   |   |   |--- feature_2 <= 0.00
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 15
|   |   |   |   |   |   |   |   |   |   |--- feature_2 >  0.00
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 19
|   |   |   |   |   |   |   |   |   |--- feature_9 >  -0.32
|   |   |   |   |   |   |   |   |   |   |--- feature_2 <= 0.00
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 17
|   |   |   |   |   |   |   |   |   |   |--- feature_2 >  0.00
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 18
|   |   |   |   |   |   |   |   |--- feature_17 >  -0.44
|   |   |   |   |   |   |   |   |   |--- feature_2 <= 0.00
|   |   |   |   |   |   |   |   |   |   |--- feature_12 <= 1.25
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 17
|   |   |   |   |   |   |   |   |   |   |--- feature_12 >  1.25
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 22
|   |   |   |   |   |   |   |   |   |--- feature_2 >  0.00
|   |   |   |   |   |   |   |   |   |   |--- feature_9 <= -0.22
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 25
|   |   |   |   |   |   |   |   |   |   |--- feature_9 >  -0.22
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 17
|   |   |   |   |   |   |   |--- feature_10 >  2.21
|   |   |   |   |   |   |   |   |--- feature_2 <= 0.01
|   |   |   |   |   |   |   |   |   |--- feature_2 <= 0.01
|   |   |   |   |   |   |   |   |   |   |--- feature_10 <= 3.93
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 12
```

```
|   |   |   |   |   |   |   |   |   |   |--- feature_10 >  3.93
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 6
|   |   |   |   |   |   |   |   |   |--- feature_2 >  0.01
|   |   |   |   |   |   |   |   |   |   |--- value: [12.77]
|   |   |   |   |   |   |   |   |--- feature_2 >  0.01
|   |   |   |   |   |   |   |   |   |--- feature_16 <= -2.36
|   |   |   |   |   |   |   |   |   |   |--- feature_3 <= 3.00
|   |   |   |   |   |   |   |   |   |   |   |--- value: [49.25]
|   |   |   |   |   |   |   |   |   |   |--- feature_3 >  3.00
|   |   |   |   |   |   |   |   |   |   |   |--- value: [13.75]
|   |   |   |   |   |   |   |   |   |--- feature_16 >  -2.36
|   |   |   |   |   |   |   |   |   |   |--- feature_3 <= 3.00
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 13
|   |   |   |   |   |   |   |   |   |   |--- feature_3 >  3.00
|   |   |   |   |   |   |   |   |   |   |   |--- value: [97.55]
|   |   |   |   |   |--- feature_9 >  0.33
|   |   |   |   |   |   |--- feature_2 <= 0.00
|   |   |   |   |   |   |   |--- feature_21 <= 0.15
|   |   |   |   |   |   |   |   |--- feature_10 <= 1.78
|   |   |   |   |   |   |   |   |   |--- feature_16 <= 0.76
|   |   |   |   |   |   |   |   |   |   |--- feature_2 <= 0.00
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 24
|   |   |   |   |   |   |   |   |   |   |--- feature_2 >  0.00
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 22
|   |   |   |   |   |   |   |   |   |--- feature_16 >  0.76
|   |   |   |   |   |   |   |   |   |   |--- feature_2 <= 0.00
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 19
|   |   |   |   |   |   |   |   |   |   |--- feature_2 >  0.00
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 11
|   |   |   |   |   |   |   |   |--- feature_10 >  1.78
|   |   |   |   |   |   |   |   |   |--- feature_3 <= 3.00
|   |   |   |   |   |   |   |   |   |   |--- feature_6 <= 0.82
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 11
|   |   |   |   |   |   |   |   |   |   |--- feature_6 >  0.82
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 5
|   |   |   |   |   |   |   |   |   |--- feature_3 >  3.00
|   |   |   |   |   |   |   |   |   |   |--- feature_9 <= 0.66
|   |   |   |   |   |   |   |   |   |   |   |--- value: [76.75]
|   |   |   |   |   |   |   |   |   |   |--- feature_9 >  0.66
|   |   |   |   |   |   |   |   |   |   |   |--- value: [75.63]
|   |   |   |   |   |   |   |--- feature_21 >  0.15
|   |   |   |   |   |   |   |   |--- feature_2 <= 0.00
|   |   |   |   |   |   |   |   |   |--- feature_16 <= -1.15
|   |   |   |   |   |   |   |   |   |   |--- feature_10 <= 1.13
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 22
|   |   |   |   |   |   |   |   |   |   |--- feature_10 >  1.13
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 4
|   |   |   |   |   |   |   |   |   |--- feature_16 >  -1.15
```

```
|   |   |   |   |   |   |   |   |   |   |--- feature_10 <= 1.13
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 25
|   |   |   |   |   |   |   |   |   |   |--- feature_10 >  1.13
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 9
|   |   |   |   |   |   |   |   |--- feature_2 >  0.00
|   |   |   |   |   |   |   |   |   |--- feature_16 <= -1.32
|   |   |   |   |   |   |   |   |   |   |--- feature_10 <= 1.13
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 15
|   |   |   |   |   |   |   |   |   |   |--- feature_10 >  1.13
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 5
|   |   |   |   |   |   |   |   |   |--- feature_16 >  -1.32
|   |   |   |   |   |   |   |   |   |   |--- feature_9 <= 1.13
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 18
|   |   |   |   |   |   |   |   |   |   |--- feature_9 >  1.13
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 5
|   |   |   |   |   |   |--- feature_2 >  0.00
|   |   |   |   |   |   |   |--- feature_10 <= 0.37
|   |   |   |   |   |   |   |   |--- feature_2 <= 0.01
|   |   |   |   |   |   |   |   |   |--- feature_3 <= 4.50
|   |   |   |   |   |   |   |   |   |   |--- feature_21 <= 0.15
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 22
|   |   |   |   |   |   |   |   |   |   |--- feature_21 >  0.15
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 21
|   |   |   |   |   |   |   |   |   |--- feature_3 >  4.50
|   |   |   |   |   |   |   |   |   |   |--- value: [86.00]
|   |   |   |   |   |   |   |   |--- feature_2 >  0.01
|   |   |   |   |   |   |   |   |   |--- feature_3 <= 3.00
|   |   |   |   |   |   |   |   |   |   |--- feature_7 <= 2.00
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 16
|   |   |   |   |   |   |   |   |   |   |--- feature_7 >  2.00
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 11
|   |   |   |   |   |   |   |   |   |--- feature_3 >  3.00
|   |   |   |   |   |   |   |   |   |   |--- value: [80.00]
|   |   |   |   |   |   |   |--- feature_10 >  0.37
|   |   |   |   |   |   |   |   |--- feature_3 <= 1.50
|   |   |   |   |   |   |   |   |   |--- feature_8 <= -0.11
|   |   |   |   |   |   |   |   |   |   |--- feature_9 <= 0.46
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 4
|   |   |   |   |   |   |   |   |   |   |--- feature_9 >  0.46
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 10
|   |   |   |   |   |   |   |   |   |--- feature_8 >  -0.11
|   |   |   |   |   |   |   |   |   |   |--- feature_2 <= 0.00
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 7
|   |   |   |   |   |   |   |   |   |   |--- feature_2 >  0.00
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 13
|   |   |   |   |   |   |   |   |--- feature_3 >  1.50
|   |   |   |   |   |   |   |   |   |--- feature_5 <= -1.26
|   |   |   |   |   |   |   |   |   |   |--- value: [63.35]
```

```
|   |   |   |   |   |   |   |   |   |--- feature_5 >  -1.26
|   |   |   |   |   |   |   |   |   |   |--- value: [92.30]
|   |   |   |   |--- feature_9 >  1.18
|   |   |   |   |   |--- feature_9 <= 1.94
|   |   |   |   |   |   |--- feature_10 <= 1.13
|   |   |   |   |   |   |   |--- feature_9 <= 1.41
|   |   |   |   |   |   |   |   |--- feature_2 <= 0.00
|   |   |   |   |   |   |   |   |   |--- feature_20 <= 0.14
|   |   |   |   |   |   |   |   |   |   |--- feature_6 <= -1.68
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 2
|   |   |   |   |   |   |   |   |   |   |--- feature_6 >  -1.68
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 17
|   |   |   |   |   |   |   |   |   |--- feature_20 >  0.14
|   |   |   |   |   |   |   |   |   |   |--- feature_9 <= 1.35
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 17
|   |   |   |   |   |   |   |   |   |   |--- feature_9 >  1.35
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 9
|   |   |   |   |   |   |   |   |--- feature_2 >  0.00
|   |   |   |   |   |   |   |   |   |--- feature_20 <= 0.14
|   |   |   |   |   |   |   |   |   |   |--- feature_16 <= 0.41
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 11
|   |   |   |   |   |   |   |   |   |   |--- feature_16 >  0.41
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 13
|   |   |   |   |   |   |   |   |   |--- feature_20 >  0.14
|   |   |   |   |   |   |   |   |   |   |--- feature_5 <= 0.59
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 11
|   |   |   |   |   |   |   |   |   |   |--- feature_5 >  0.59
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 7
|   |   |   |   |   |   |   |--- feature_9 >  1.41
|   |   |   |   |   |   |   |   |--- feature_21 <= 0.15
|   |   |   |   |   |   |   |   |   |--- feature_3 <= 1.50
|   |   |   |   |   |   |   |   |   |   |--- feature_9 <= 1.68
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 22
|   |   |   |   |   |   |   |   |   |   |--- feature_9 >  1.68
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 13
|   |   |   |   |   |   |   |   |   |--- feature_3 >  1.50
|   |   |   |   |   |   |   |   |   |   |--- value: [88.80]
|   |   |   |   |   |   |   |   |--- feature_21 >  0.15
|   |   |   |   |   |   |   |   |   |--- feature_2 <= 0.00
|   |   |   |   |   |   |   |   |   |   |--- feature_6 <= -0.96
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 11
|   |   |   |   |   |   |   |   |   |   |--- feature_6 >  -0.96
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 10
|   |   |   |   |   |   |   |   |   |--- feature_2 >  0.00
|   |   |   |   |   |   |   |   |   |   |--- feature_16 <= -2.53
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 4
|   |   |   |   |   |   |   |   |   |   |--- feature_16 >  -2.53
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 13
```

```
|   |   |   |   |   |   |--- feature_10 >  1.13
|   |   |   |   |   |   |   |--- feature_3 <= 1.50
|   |   |   |   |   |   |   |   |--- feature_8 <= -0.11
|   |   |   |   |   |   |   |   |   |--- feature_2 <= 0.01
|   |   |   |   |   |   |   |   |   |   |--- feature_17 <= -0.77
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 6
|   |   |   |   |   |   |   |   |   |   |--- feature_17 >  -0.77
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 10
|   |   |   |   |   |   |   |   |   |--- feature_2 >  0.01
|   |   |   |   |   |   |   |   |   |   |--- feature_6 <= -0.40
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 4
|   |   |   |   |   |   |   |   |   |   |--- feature_6 >  -0.40
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 5
|   |   |   |   |   |   |   |   |--- feature_8 >  -0.11
|   |   |   |   |   |   |   |   |   |--- feature_2 <= 0.00
|   |   |   |   |   |   |   |   |   |   |--- feature_9 <= 1.61
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 4
|   |   |   |   |   |   |   |   |   |   |--- feature_9 >  1.61
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 2
|   |   |   |   |   |   |   |   |   |--- feature_2 >  0.00
|   |   |   |   |   |   |   |   |   |   |--- feature_17 <= 0.74
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 14
|   |   |   |   |   |   |   |   |   |   |--- feature_17 >  0.74
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 8
|   |   |   |   |   |   |   |--- feature_3 >  1.50
|   |   |   |   |   |   |   |   |--- feature_6 <= 0.25
|   |   |   |   |   |   |   |   |   |--- feature_16 <= -1.23
|   |   |   |   |   |   |   |   |   |   |--- value: [88.05]
|   |   |   |   |   |   |   |   |   |--- feature_16 >  -1.23
|   |   |   |   |   |   |   |   |   |   |--- value: [100.55]
|   |   |   |   |   |   |   |   |--- feature_6 >  0.25
|   |   |   |   |   |   |   |   |   |--- value: [113.75]
|   |   |   |   |   |--- feature_9 >  1.94
|   |   |   |   |   |   |--- feature_3 <= 1.50
|   |   |   |   |   |   |   |--- feature_9 <= 2.54
|   |   |   |   |   |   |   |   |--- feature_16 <= 0.24
|   |   |   |   |   |   |   |   |   |--- feature_16 <= -0.28
|   |   |   |   |   |   |   |   |   |   |--- feature_8 <= 0.15
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 9
|   |   |   |   |   |   |   |   |   |   |--- feature_8 >  0.15
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 5
|   |   |   |   |   |   |   |   |   |--- feature_16 >  -0.28
|   |   |   |   |   |   |   |   |   |   |--- feature_5 <= 1.36
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 10
|   |   |   |   |   |   |   |   |   |   |--- feature_5 >  1.36
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 4
|   |   |   |   |   |   |   |   |--- feature_16 >  0.24
|   |   |   |   |   |   |   |   |   |--- feature_2 <= 0.00
```

```
|   |   |   |   |   |   |   |   |   |   |--- feature_9 <= 2.47
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 3
|   |   |   |   |   |   |   |   |   |   |--- feature_9 >  2.47
|   |   |   |   |   |   |   |   |   |   |   |--- value: [56.03]
|   |   |   |   |   |   |   |   |   |--- feature_2 >  0.00
|   |   |   |   |   |   |   |   |   |   |--- feature_2 <= 0.00
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 4
|   |   |   |   |   |   |   |   |   |   |--- feature_2 >  0.00
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 15
|   |   |   |   |   |   |   |--- feature_9 >  2.54
|   |   |   |   |   |   |   |   |--- feature_8 <= 2.23
|   |   |   |   |   |   |   |   |   |--- feature_5 <= -0.02
|   |   |   |   |   |   |   |   |   |   |--- feature_8 <= -0.76
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 4
|   |   |   |   |   |   |   |   |   |   |--- feature_8 >  -0.76
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 6
|   |   |   |   |   |   |   |   |   |--- feature_5 >  -0.02
|   |   |   |   |   |   |   |   |   |   |--- feature_6 <= -1.20
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 2
|   |   |   |   |   |   |   |   |   |   |--- feature_6 >  -1.20
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 8
|   |   |   |   |   |   |   |   |--- feature_8 >  2.23
|   |   |   |   |   |   |   |   |   |--- feature_2 <= 0.00
|   |   |   |   |   |   |   |   |   |   |--- feature_2 <= 0.00
|   |   |   |   |   |   |   |   |   |   |   |--- value: [90.25]
|   |   |   |   |   |   |   |   |   |   |--- feature_2 >  0.00
|   |   |   |   |   |   |   |   |   |   |   |--- value: [94.50]
|   |   |   |   |   |   |   |   |   |--- feature_2 >  0.00
|   |   |   |   |   |   |   |   |   |   |--- feature_2 <= 0.00
|   |   |   |   |   |   |   |   |   |   |   |--- value: [113.23]
|   |   |   |   |   |   |   |   |   |   |--- feature_2 >  0.00
|   |   |   |   |   |   |   |   |   |   |   |--- value: [106.55]
|   |   |   |   |   |   |--- feature_3 >  1.50
|   |   |   |   |   |   |   |--- feature_6 <= -0.00
|   |   |   |   |   |   |   |   |--- feature_17 <= -1.61
|   |   |   |   |   |   |   |   |   |--- feature_6 <= -0.86
|   |   |   |   |   |   |   |   |   |   |--- value: [87.55]
|   |   |   |   |   |   |   |   |   |--- feature_6 >  -0.86
|   |   |   |   |   |   |   |   |   |   |--- value: [88.75]
|   |   |   |   |   |   |   |   |--- feature_17 >  -1.61
|   |   |   |   |   |   |   |   |   |--- feature_12 <= 1.25
|   |   |   |   |   |   |   |   |   |   |--- feature_9 <= 2.74
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 3
|   |   |   |   |   |   |   |   |   |   |--- feature_9 >  2.74
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 2
|   |   |   |   |   |   |   |   |   |--- feature_12 >  1.25
|   |   |   |   |   |   |   |   |   |   |--- feature_5 <= 0.35
|   |   |   |   |   |   |   |   |   |   |   |--- value: [98.70]
```

```
|   |   |   |   |   |   |   |   |   |   |   |--- feature_5 >  0.35
|   |   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 2
|   |   |   |   |   |   |   |--- feature_6 >  -0.00
|   |   |   |   |   |   |   |   |--- feature_2 <= 0.00
|   |   |   |   |   |   |   |   |   |--- feature_6 <= 0.84
|   |   |   |   |   |   |   |   |   |   |--- value: [68.95]
|   |   |   |   |   |   |   |   |   |--- feature_6 >  0.84
|   |   |   |   |   |   |   |   |   |   |--- value: [76.50]
|   |   |   |   |   |   |   |   |--- feature_2 >  0.00
|   |   |   |   |   |   |   |   |   |--- feature_16 <= -0.28
|   |   |   |   |   |   |   |   |   |   |--- value: [94.50]
|   |   |   |   |   |   |   |   |   |--- feature_16 >  -0.28
|   |   |   |   |   |   |   |   |   |   |--- value: [79.75]
|--- feature_2 >  0.01
|   |--- feature_2 <= 0.03
|   |   |--- feature_11 <= -0.35
|   |   |   |--- feature_2 <= 0.01
|   |   |   |   |--- feature_8 <= -0.11
|   |   |   |   |   |--- feature_20 <= -0.87
|   |   |   |   |   |   |--- feature_16 <= -0.45
|   |   |   |   |   |   |   |--- feature_15 <= 0.40
|   |   |   |   |   |   |   |   |--- value: [-43.35]
|   |   |   |   |   |   |   |--- feature_15 >  0.40
|   |   |   |   |   |   |   |   |--- value: [-46.90]
|   |   |   |   |   |   |--- feature_16 >  -0.45
|   |   |   |   |   |   |   |--- feature_2 <= 0.01
|   |   |   |   |   |   |   |   |--- feature_9 <= -0.40
|   |   |   |   |   |   |   |   |   |--- feature_6 <= -0.12
|   |   |   |   |   |   |   |   |   |   |--- value: [-52.45]
|   |   |   |   |   |   |   |   |   |--- feature_6 >  -0.12
|   |   |   |   |   |   |   |   |   |   |--- value: [-51.40]
|   |   |   |   |   |   |   |   |--- feature_9 >  -0.40
|   |   |   |   |   |   |   |   |   |--- feature_15 <= 0.40
|   |   |   |   |   |   |   |   |   |   |--- value: [-55.25]
|   |   |   |   |   |   |   |   |   |--- feature_15 >  0.40
|   |   |   |   |   |   |   |   |   |   |--- value: [-53.90]
|   |   |   |   |   |   |   |--- feature_2 >  0.01
|   |   |   |   |   |   |   |   |--- value: [-63.00]
|   |   |   |   |   |--- feature_20 >  -0.87
|   |   |   |   |   |   |--- feature_9 <= 1.25
|   |   |   |   |   |   |   |--- feature_2 <= 0.01
|   |   |   |   |   |   |   |   |--- feature_21 <= 1.18
|   |   |   |   |   |   |   |   |   |--- feature_16 <= 1.11
|   |   |   |   |   |   |   |   |   |   |--- feature_16 <= -2.53
|   |   |   |   |   |   |   |   |   |   |   |--- value: [-41.60]
|   |   |   |   |   |   |   |   |   |   |--- feature_16 >  -2.53
|   |   |   |   |   |   |   |   |   |   |   |--- value: [-40.90]
|   |   |   |   |   |   |   |   |   |--- feature_16 >  1.11
```

```
|   |   |   |   |   |   |   |   |   |   |--- value: [-42.30]
|   |   |   |   |   |   |   |   |--- feature_21 >  1.18
|   |   |   |   |   |   |   |   |   |--- value: [-43.65]
|   |   |   |   |   |   |   |--- feature_2 >  0.01
|   |   |   |   |   |   |   |   |--- feature_17 <= -2.12
|   |   |   |   |   |   |   |   |   |--- feature_2 <= 0.01
|   |   |   |   |   |   |   |   |   |   |--- feature_2 <= 0.01
|   |   |   |   |   |   |   |   |   |   |   |--- value: [-51.35]
|   |   |   |   |   |   |   |   |   |   |--- feature_2 >  0.01
|   |   |   |   |   |   |   |   |   |   |   |--- value: [-52.35]
|   |   |   |   |   |   |   |   |   |--- feature_2 >  0.01
|   |   |   |   |   |   |   |   |   |   |--- feature_17 <= -2.45
|   |   |   |   |   |   |   |   |   |   |   |--- value: [-50.00]
|   |   |   |   |   |   |   |   |   |   |--- feature_17 >  -2.45
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 3
|   |   |   |   |   |   |   |   |--- feature_17 >  -2.12
|   |   |   |   |   |   |   |   |   |--- feature_16 <= -1.67
|   |   |   |   |   |   |   |   |   |   |--- feature_15 <= 0.40
|   |   |   |   |   |   |   |   |   |   |   |--- value: [-42.95]
|   |   |   |   |   |   |   |   |   |   |--- feature_15 >  0.40
|   |   |   |   |   |   |   |   |   |   |   |--- value: [-40.20]
|   |   |   |   |   |   |   |   |   |--- feature_16 >  -1.67
|   |   |   |   |   |   |   |   |   |   |--- feature_15 <= -0.94
|   |   |   |   |   |   |   |   |   |   |   |--- value: [-45.05]
|   |   |   |   |   |   |   |   |   |   |--- feature_15 >  -0.94
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 2
|   |   |   |   |   |   |--- feature_9 >  1.25
|   |   |   |   |   |   |   |--- value: [-33.55]
|   |   |   |   |--- feature_8 >  -0.11
|   |   |   |   |   |--- feature_17 <= -2.20
|   |   |   |   |   |   |--- feature_5 <= 0.63
|   |   |   |   |   |   |   |--- value: [-53.25]
|   |   |   |   |   |   |--- feature_5 >  0.63
|   |   |   |   |   |   |   |--- value: [-91.05]
|   |   |   |   |   |--- feature_17 >  -2.20
|   |   |   |   |   |   |--- feature_2 <= 0.01
|   |   |   |   |   |   |   |--- feature_5 <= -0.22
|   |   |   |   |   |   |   |   |--- value: [-41.65]
|   |   |   |   |   |   |   |--- feature_5 >  -0.22
|   |   |   |   |   |   |   |   |--- value: [-43.15]
|   |   |   |   |   |   |--- feature_2 >  0.01
|   |   |   |   |   |   |   |--- feature_20 <= -0.87
|   |   |   |   |   |   |   |   |--- feature_2 <= 0.01
|   |   |   |   |   |   |   |   |   |--- feature_7 <= 1.00
|   |   |   |   |   |   |   |   |   |   |--- value: [-61.20]
|   |   |   |   |   |   |   |   |   |--- feature_7 >  1.00
|   |   |   |   |   |   |   |   |   |   |--- value: [-61.05]
|   |   |   |   |   |   |   |   |--- feature_2 >  0.01
```

```
|   |   |   |   |   |   |   |   |   |--- value: [-69.30]
|   |   |   |   |   |   |   |--- feature_20 >  -0.87
|   |   |   |   |   |   |   |   |--- feature_5 <= -1.43
|   |   |   |   |   |   |   |   |   |--- feature_2 <= 0.01
|   |   |   |   |   |   |   |   |   |   |--- value: [-42.35]
|   |   |   |   |   |   |   |   |   |--- feature_2 >  0.01
|   |   |   |   |   |   |   |   |   |   |--- value: [-52.85]
|   |   |   |   |   |   |   |   |--- feature_5 >  -1.43
|   |   |   |   |   |   |   |   |   |--- feature_2 <= 0.01
|   |   |   |   |   |   |   |   |   |   |--- feature_16 <= 0.24
|   |   |   |   |   |   |   |   |   |   |   |--- value: [-64.10]
|   |   |   |   |   |   |   |   |   |   |--- feature_16 >  0.24
|   |   |   |   |   |   |   |   |   |   |   |--- value: [-55.70]
|   |   |   |   |   |   |   |   |   |--- feature_2 >  0.01
|   |   |   |   |   |   |   |   |   |   |--- feature_9 <= -0.35
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 5
|   |   |   |   |   |   |   |   |   |   |--- feature_9 >  -0.35
|   |   |   |   |   |   |   |   |   |   |   |--- value: [-60.85]
|   |   |   |--- feature_2 >  0.01
|   |   |   |   |--- feature_1 <= 2.50
|   |   |   |   |   |--- feature_3 <= 4.50
|   |   |   |   |   |   |--- feature_2 <= 0.02
|   |   |   |   |   |   |   |--- feature_16 <= 0.59
|   |   |   |   |   |   |   |   |--- feature_9 <= -0.77
|   |   |   |   |   |   |   |   |   |--- feature_6 <= -0.95
|   |   |   |   |   |   |   |   |   |   |--- feature_9 <= -1.09
|   |   |   |   |   |   |   |   |   |   |   |--- value: [-70.25]
|   |   |   |   |   |   |   |   |   |   |--- feature_9 >  -1.09
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 2
|   |   |   |   |   |   |   |   |   |--- feature_6 >  -0.95
|   |   |   |   |   |   |   |   |   |   |--- feature_2 <= 0.02
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 4
|   |   |   |   |   |   |   |   |   |   |--- feature_2 >  0.02
|   |   |   |   |   |   |   |   |   |   |   |--- value: [-74.90]
|   |   |   |   |   |   |   |   |--- feature_9 >  -0.77
|   |   |   |   |   |   |   |   |   |--- feature_2 <= 0.02
|   |   |   |   |   |   |   |   |   |   |--- feature_5 <= -1.09
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 2
|   |   |   |   |   |   |   |   |   |   |--- feature_5 >  -1.09
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 4
|   |   |   |   |   |   |   |   |   |--- feature_2 >  0.02
|   |   |   |   |   |   |   |   |   |   |--- feature_8 <= -0.11
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 4
|   |   |   |   |   |   |   |   |   |   |--- feature_8 >  -0.11
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 2
|   |   |   |   |   |   |   |--- feature_16 >  0.59
|   |   |   |   |   |   |   |   |--- feature_5 <= 1.07
|   |   |   |   |   |   |   |   |   |--- feature_16 <= 0.93
```

```
|   |   |   |   |   |   |   |   |   |   |--- feature_6 <= 0.50
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 3
|   |   |   |   |   |   |   |   |   |   |--- feature_6 >  0.50
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 3
|   |   |   |   |   |   |   |   |   |--- feature_16 >  0.93
|   |   |   |   |   |   |   |   |   |   |--- feature_14 <= -0.92
|   |   |   |   |   |   |   |   |   |   |   |--- value: [-56.95]
|   |   |   |   |   |   |   |   |   |   |--- feature_14 >  -0.92
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 3
|   |   |   |   |   |   |   |   |--- feature_5 >  1.07
|   |   |   |   |   |   |   |   |   |--- feature_9 <= -0.36
|   |   |   |   |   |   |   |   |   |   |--- feature_2 <= 0.02
|   |   |   |   |   |   |   |   |   |   |   |--- value: [-54.95]
|   |   |   |   |   |   |   |   |   |   |--- feature_2 >  0.02
|   |   |   |   |   |   |   |   |   |   |   |--- value: [-58.40]
|   |   |   |   |   |   |   |   |   |--- feature_9 >  -0.36
|   |   |   |   |   |   |   |   |   |   |--- value: [-48.55]
|   |   |   |   |   |   |--- feature_2 >  0.02
|   |   |   |   |   |   |   |--- feature_2 <= 0.03
|   |   |   |   |   |   |   |   |--- feature_17 <= 0.74
|   |   |   |   |   |   |   |   |   |--- feature_21 <= 0.66
|   |   |   |   |   |   |   |   |   |   |--- value: [-73.45]
|   |   |   |   |   |   |   |   |   |--- feature_21 >  0.66
|   |   |   |   |   |   |   |   |   |   |--- value: [-75.75]
|   |   |   |   |   |   |   |   |--- feature_17 >  0.74
|   |   |   |   |   |   |   |   |   |--- value: [-80.20]
|   |   |   |   |   |   |   |--- feature_2 >  0.03
|   |   |   |   |   |   |   |   |--- value: [-86.80]
|   |   |   |   |   |--- feature_3 >  4.50
|   |   |   |   |   |   |--- value: [-97.85]
|   |   |   |   |--- feature_1 >  2.50
|   |   |   |   |   |--- feature_14 <= -0.25
|   |   |   |   |   |   |--- value: [-78.25]
|   |   |   |   |   |--- feature_14 >  -0.25
|   |   |   |   |   |   |--- value: [-117.55]
|   |   |--- feature_11 >  -0.35
|   |   |   |--- feature_9 <= 1.61
|   |   |   |   |--- feature_2 <= 0.01
|   |   |   |   |   |--- feature_8 <= 1.39
|   |   |   |   |   |   |--- feature_9 <= 0.42
|   |   |   |   |   |   |   |--- feature_10 <= 0.89
|   |   |   |   |   |   |   |   |--- feature_2 <= 0.01
|   |   |   |   |   |   |   |   |   |--- feature_7 <= 1.50
|   |   |   |   |   |   |   |   |   |   |--- feature_3 <= 52.00
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 21
|   |   |   |   |   |   |   |   |   |   |--- feature_3 >  52.00
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 8
|   |   |   |   |   |   |   |   |   |--- feature_7 >  1.50
```

```
|   |   |   |   |   |   |   |   |   |   |--- feature_20 <= -0.87
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 5
|   |   |   |   |   |   |   |   |   |   |--- feature_20 >  -0.87
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 14
|   |   |   |   |   |   |   |   |--- feature_2 >  0.01
|   |   |   |   |   |   |   |   |   |--- feature_3 <= 51.50
|   |   |   |   |   |   |   |   |   |   |--- feature_7 <= 1.50
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 17
|   |   |   |   |   |   |   |   |   |   |--- feature_7 >  1.50
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 14
|   |   |   |   |   |   |   |   |   |--- feature_3 >  51.50
|   |   |   |   |   |   |   |   |   |   |--- feature_17 <= -1.28
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 3
|   |   |   |   |   |   |   |   |   |   |--- feature_17 >  -1.28
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 8
|   |   |   |   |   |   |   |--- feature_10 >  0.89
|   |   |   |   |   |   |   |   |--- feature_10 <= 4.75
|   |   |   |   |   |   |   |   |   |--- feature_7 <= 2.50
|   |   |   |   |   |   |   |   |   |   |--- feature_9 <= -0.26
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 15
|   |   |   |   |   |   |   |   |   |   |--- feature_9 >  -0.26
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 12
|   |   |   |   |   |   |   |   |   |--- feature_7 >  2.50
|   |   |   |   |   |   |   |   |   |   |--- feature_6 <= -1.68
|   |   |   |   |   |   |   |   |   |   |   |--- value: [8.11]
|   |   |   |   |   |   |   |   |   |   |--- feature_6 >  -1.68
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 12
|   |   |   |   |   |   |   |   |--- feature_10 >  4.75
|   |   |   |   |   |   |   |   |   |--- feature_17 <= -1.70
|   |   |   |   |   |   |   |   |   |   |--- feature_6 <= 0.46
|   |   |   |   |   |   |   |   |   |   |   |--- value: [73.75]
|   |   |   |   |   |   |   |   |   |   |--- feature_6 >  0.46
|   |   |   |   |   |   |   |   |   |   |   |--- value: [66.25]
|   |   |   |   |   |   |   |   |   |--- feature_17 >  -1.70
|   |   |   |   |   |   |   |   |   |   |--- value: [83.75]
|   |   |   |   |   |   |--- feature_9 >  0.42
|   |   |   |   |   |   |   |--- feature_10 <= 1.45
|   |   |   |   |   |   |   |   |--- feature_16 <= -0.28
|   |   |   |   |   |   |   |   |   |--- feature_7 <= 2.00
|   |   |   |   |   |   |   |   |   |   |--- feature_2 <= 0.01
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 14
|   |   |   |   |   |   |   |   |   |   |--- feature_2 >  0.01
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 16
|   |   |   |   |   |   |   |   |   |--- feature_7 >  2.00
|   |   |   |   |   |   |   |   |   |   |--- feature_9 <= 1.26
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 9
|   |   |   |   |   |   |   |   |   |   |--- feature_9 >  1.26
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 4
```

```
|   |   |   |   |   |   |   |   |--- feature_16 >  -0.28
|   |   |   |   |   |   |   |   |   |--- feature_3 <= 4.50
|   |   |   |   |   |   |   |   |   |   |--- feature_9 <= 1.26
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 19
|   |   |   |   |   |   |   |   |   |   |--- feature_9 >  1.26
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 17
|   |   |   |   |   |   |   |   |   |--- feature_3 >  4.50
|   |   |   |   |   |   |   |   |   |   |--- feature_6 <= -0.69
|   |   |   |   |   |   |   |   |   |   |   |--- value: [70.00]
|   |   |   |   |   |   |   |   |   |   |--- feature_6 >  -0.69
|   |   |   |   |   |   |   |   |   |   |   |--- value: [90.00]
|   |   |   |   |   |   |   |--- feature_10 >  1.45
|   |   |   |   |   |   |   |   |--- feature_7 <= 2.00
|   |   |   |   |   |   |   |   |   |--- feature_3 <= 2.50
|   |   |   |   |   |   |   |   |   |   |--- feature_2 <= 0.01
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 12
|   |   |   |   |   |   |   |   |   |   |--- feature_2 >  0.01
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 15
|   |   |   |   |   |   |   |   |   |--- feature_3 >  2.50
|   |   |   |   |   |   |   |   |   |   |--- feature_21 <= 0.15
|   |   |   |   |   |   |   |   |   |   |   |--- value: [90.81]
|   |   |   |   |   |   |   |   |   |   |--- feature_21 >  0.15
|   |   |   |   |   |   |   |   |   |   |   |--- value: [74.76]
|   |   |   |   |   |   |   |   |--- feature_7 >  2.00
|   |   |   |   |   |   |   |   |   |--- feature_17 <= -1.11
|   |   |   |   |   |   |   |   |   |   |--- feature_16 <= -2.45
|   |   |   |   |   |   |   |   |   |   |   |--- value: [60.34]
|   |   |   |   |   |   |   |   |   |   |--- feature_16 >  -2.45
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 8
|   |   |   |   |   |   |   |   |   |--- feature_17 >  -1.11
|   |   |   |   |   |   |   |   |   |   |--- feature_2 <= 0.01
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 10
|   |   |   |   |   |   |   |   |   |   |--- feature_2 >  0.01
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 11
|   |   |   |   |   |--- feature_8 >  1.39
|   |   |   |   |   |   |--- feature_10 <= -0.07
|   |   |   |   |   |   |   |--- feature_9 <= -0.28
|   |   |   |   |   |   |   |   |--- feature_2 <= 0.01
|   |   |   |   |   |   |   |   |   |--- feature_5 <= 1.58
|   |   |   |   |   |   |   |   |   |   |--- feature_12 <= 1.25
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 9
|   |   |   |   |   |   |   |   |   |   |--- feature_12 >  1.25
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 6
|   |   |   |   |   |   |   |   |   |--- feature_5 >  1.58
|   |   |   |   |   |   |   |   |   |   |--- feature_9 <= -0.70
|   |   |   |   |   |   |   |   |   |   |   |--- value: [10.50]
|   |   |   |   |   |   |   |   |   |   |--- feature_9 >  -0.70
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 4
```

```
|   |   |   |   |   |   |   |   |--- feature_2 >  0.01
|   |   |   |   |   |   |   |   |   |--- feature_3 <= 1.50
|   |   |   |   |   |   |   |   |   |   |--- feature_12 <= 1.25
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 11
|   |   |   |   |   |   |   |   |   |   |--- feature_12 >  1.25
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 9
|   |   |   |   |   |   |   |   |   |--- feature_3 >  1.50
|   |   |   |   |   |   |   |   |   |   |--- value: [80.75]
|   |   |   |   |   |   |   |--- feature_9 >  -0.28
|   |   |   |   |   |   |   |   |--- feature_2 <= 0.01
|   |   |   |   |   |   |   |   |   |--- feature_9 <= 0.93
|   |   |   |   |   |   |   |   |   |   |--- feature_2 <= 0.01
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 11
|   |   |   |   |   |   |   |   |   |   |--- feature_2 >  0.01
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 11
|   |   |   |   |   |   |   |   |   |--- feature_9 >  0.93
|   |   |   |   |   |   |   |   |   |   |--- feature_12 <= 1.25
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 10
|   |   |   |   |   |   |   |   |   |   |--- feature_12 >  1.25
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 13
|   |   |   |   |   |   |   |   |--- feature_2 >  0.01
|   |   |   |   |   |   |   |   |   |--- feature_21 <= 0.15
|   |   |   |   |   |   |   |   |   |   |--- feature_16 <= 0.41
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 13
|   |   |   |   |   |   |   |   |   |   |--- feature_16 >  0.41
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 7
|   |   |   |   |   |   |   |   |   |--- feature_21 >  0.15
|   |   |   |   |   |   |   |   |   |   |--- feature_12 <= 1.25
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 9
|   |   |   |   |   |   |   |   |   |   |--- feature_12 >  1.25
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 7
|   |   |   |   |   |   |--- feature_10 >  -0.07
|   |   |   |   |   |   |   |--- feature_9 <= 1.00
|   |   |   |   |   |   |   |   |--- feature_2 <= 0.01
|   |   |   |   |   |   |   |   |   |--- feature_3 <= 1.50
|   |   |   |   |   |   |   |   |   |   |--- feature_9 <= 0.37
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 18
|   |   |   |   |   |   |   |   |   |   |--- feature_9 >  0.37
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 15
|   |   |   |   |   |   |   |   |   |--- feature_3 >  1.50
|   |   |   |   |   |   |   |   |   |   |--- feature_9 <= -0.34
|   |   |   |   |   |   |   |   |   |   |   |--- value: [85.55]
|   |   |   |   |   |   |   |   |   |   |--- feature_9 >  -0.34
|   |   |   |   |   |   |   |   |   |   |   |--- value: [85.60]
|   |   |   |   |   |   |   |   |--- feature_2 >  0.01
|   |   |   |   |   |   |   |   |   |--- feature_3 <= 1.50
|   |   |   |   |   |   |   |   |   |   |--- feature_12 <= 1.25
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 10
```

```
|   |   |   |   |   |   |   |   |   |   |--- feature_12 >  1.25
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 20
|   |   |   |   |   |   |   |   |   |--- feature_3 >  1.50
|   |   |   |   |   |   |   |   |   |   |--- feature_13 <= 0.88
|   |   |   |   |   |   |   |   |   |   |   |--- value: [88.05]
|   |   |   |   |   |   |   |   |   |   |--- feature_13 >  0.88
|   |   |   |   |   |   |   |   |   |   |   |--- value: [87.30]
|   |   |   |   |   |   |   |--- feature_9 >  1.00
|   |   |   |   |   |   |   |   |--- feature_2 <= 0.01
|   |   |   |   |   |   |   |   |   |--- feature_2 <= 0.01
|   |   |   |   |   |   |   |   |   |   |--- feature_17 <= -1.19
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 6
|   |   |   |   |   |   |   |   |   |   |--- feature_17 >  -1.19
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 15
|   |   |   |   |   |   |   |   |   |--- feature_2 >  0.01
|   |   |   |   |   |   |   |   |   |   |--- feature_21 <= 0.15
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 14
|   |   |   |   |   |   |   |   |   |   |--- feature_21 >  0.15
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 11
|   |   |   |   |   |   |   |   |--- feature_2 >  0.01
|   |   |   |   |   |   |   |   |   |--- feature_8 <= 2.30
|   |   |   |   |   |   |   |   |   |   |--- feature_13 <= 0.88
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 12
|   |   |   |   |   |   |   |   |   |   |--- feature_13 >  0.88
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 14
|   |   |   |   |   |   |   |   |   |--- feature_8 >  2.30
|   |   |   |   |   |   |   |   |   |   |--- feature_1 <= 2.50
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 17
|   |   |   |   |   |   |   |   |   |   |--- feature_1 >  2.50
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 5
|   |   |   |   |--- feature_2 >  0.01
|   |   |   |   |   |--- feature_10 <= 1.86
|   |   |   |   |   |   |--- feature_2 <= 0.02
|   |   |   |   |   |   |   |--- feature_9 <= 0.81
|   |   |   |   |   |   |   |   |--- feature_8 <= 0.09
|   |   |   |   |   |   |   |   |   |--- feature_7 <= 2.50
|   |   |   |   |   |   |   |   |   |   |--- feature_3 <= 52.00
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 19
|   |   |   |   |   |   |   |   |   |   |--- feature_3 >  52.00
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 10
|   |   |   |   |   |   |   |   |   |--- feature_7 >  2.50
|   |   |   |   |   |   |   |   |   |   |--- feature_16 <= -1.49
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 10
|   |   |   |   |   |   |   |   |   |   |--- feature_16 >  -1.49
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 12
|   |   |   |   |   |   |   |   |--- feature_8 >  0.09
|   |   |   |   |   |   |   |   |   |--- feature_9 <= -0.35
|   |   |   |   |   |   |   |   |   |   |--- feature_5 <= 1.72
```

```
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 18
|   |   |   |   |   |   |   |   |   |   |--- feature_5 >  1.72
|   |   |   |   |   |   |   |   |   |   |   |--- value: [100.95]
|   |   |   |   |   |   |   |   |   |--- feature_9 >  -0.35
|   |   |   |   |   |   |   |   |   |   |--- feature_9 <= -0.35
|   |   |   |   |   |   |   |   |   |   |   |--- value: [93.25]
|   |   |   |   |   |   |   |   |   |   |--- feature_9 >  -0.35
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 14
|   |   |   |   |   |   |   |--- feature_9 >  0.81
|   |   |   |   |   |   |   |   |--- feature_7 <= 2.00
|   |   |   |   |   |   |   |   |   |--- feature_2 <= 0.01
|   |   |   |   |   |   |   |   |   |   |--- feature_8 <= 1.39
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 14
|   |   |   |   |   |   |   |   |   |   |--- feature_8 >  1.39
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 12
|   |   |   |   |   |   |   |   |   |--- feature_2 >  0.01
|   |   |   |   |   |   |   |   |   |   |--- feature_8 <= 0.09
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 14
|   |   |   |   |   |   |   |   |   |   |--- feature_8 >  0.09
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 17
|   |   |   |   |   |   |   |   |--- feature_7 >  2.00
|   |   |   |   |   |   |   |   |   |--- feature_16 <= -0.89
|   |   |   |   |   |   |   |   |   |   |--- feature_2 <= 0.02
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 5
|   |   |   |   |   |   |   |   |   |   |--- feature_2 >  0.02
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 3
|   |   |   |   |   |   |   |   |   |--- feature_16 >  -0.89
|   |   |   |   |   |   |   |   |   |   |--- feature_14 <= 0.42
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 6
|   |   |   |   |   |   |   |   |   |   |--- feature_14 >  0.42
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 5
|   |   |   |   |   |   |--- feature_2 >  0.02
|   |   |   |   |   |   |   |--- feature_3 <= 52.00
|   |   |   |   |   |   |   |   |--- feature_3 <= 1.50
|   |   |   |   |   |   |   |   |   |--- feature_9 <= -0.25
|   |   |   |   |   |   |   |   |   |   |--- feature_2 <= 0.02
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 19
|   |   |   |   |   |   |   |   |   |   |--- feature_2 >  0.02
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 19
|   |   |   |   |   |   |   |   |   |--- feature_9 >  -0.25
|   |   |   |   |   |   |   |   |   |   |--- feature_7 <= 2.00
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 16
|   |   |   |   |   |   |   |   |   |   |--- feature_7 >  2.00
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 12
|   |   |   |   |   |   |   |   |--- feature_3 >  1.50
|   |   |   |   |   |   |   |   |   |--- feature_3 <= 4.50
|   |   |   |   |   |   |   |   |   |   |--- feature_9 <= 1.02
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 11
```

```
|   |   |   |   |   |   |   |   |   |   |--- feature_9 >  1.02
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 4
|   |   |   |   |   |   |   |   |   |--- feature_3 >  4.50
|   |   |   |   |   |   |   |   |   |   |--- feature_2 <= 0.02
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 5
|   |   |   |   |   |   |   |   |   |   |--- feature_2 >  0.02
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 2
|   |   |   |   |   |   |   |--- feature_3 >  52.00
|   |   |   |   |   |   |   |   |--- feature_2 <= 0.02
|   |   |   |   |   |   |   |   |   |--- feature_6 <= 0.67
|   |   |   |   |   |   |   |   |   |   |--- feature_6 <= 0.19
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 7
|   |   |   |   |   |   |   |   |   |   |--- feature_6 >  0.19
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 3
|   |   |   |   |   |   |   |   |   |--- feature_6 >  0.67
|   |   |   |   |   |   |   |   |   |   |--- feature_2 <= 0.02
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 3
|   |   |   |   |   |   |   |   |   |   |--- feature_2 >  0.02
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 2
|   |   |   |   |   |   |   |   |--- feature_2 >  0.02
|   |   |   |   |   |   |   |   |   |--- feature_6 <= 0.61
|   |   |   |   |   |   |   |   |   |   |--- feature_5 <= -0.63
|   |   |   |   |   |   |   |   |   |   |   |--- value: [57.00]
|   |   |   |   |   |   |   |   |   |   |--- feature_5 >  -0.63
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 4
|   |   |   |   |   |   |   |   |   |--- feature_6 >  0.61
|   |   |   |   |   |   |   |   |   |   |--- value: [64.00]
|   |   |   |   |   |--- feature_10 >  1.86
|   |   |   |   |   |   |--- feature_10 <= 4.75
|   |   |   |   |   |   |   |--- feature_7 <= 2.50
|   |   |   |   |   |   |   |   |--- feature_9 <= 0.23
|   |   |   |   |   |   |   |   |   |--- feature_2 <= 0.02
|   |   |   |   |   |   |   |   |   |   |--- feature_21 <= 0.15
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 19
|   |   |   |   |   |   |   |   |   |   |--- feature_21 >  0.15
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 17
|   |   |   |   |   |   |   |   |   |--- feature_2 >  0.02
|   |   |   |   |   |   |   |   |   |   |--- feature_3 <= 52.00
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 17
|   |   |   |   |   |   |   |   |   |   |--- feature_3 >  52.00
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 10
|   |   |   |   |   |   |   |   |--- feature_9 >  0.23
|   |   |   |   |   |   |   |   |   |--- feature_2 <= 0.02
|   |   |   |   |   |   |   |   |   |   |--- feature_21 <= 0.15
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 18
|   |   |   |   |   |   |   |   |   |   |--- feature_21 >  0.15
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 14
|   |   |   |   |   |   |   |   |   |--- feature_2 >  0.02
```

```
|   |   |   |   |   |   |   |   |   |   |--- feature_2 <= 0.02
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 11
|   |   |   |   |   |   |   |   |   |   |--- feature_2 >  0.02
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 13
|   |   |   |   |   |   |   |--- feature_7 >  2.50
|   |   |   |   |   |   |   |   |--- feature_21 <= 0.15
|   |   |   |   |   |   |   |   |   |--- feature_2 <= 0.02
|   |   |   |   |   |   |   |   |   |   |--- feature_2 <= 0.01
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 10
|   |   |   |   |   |   |   |   |   |   |--- feature_2 >  0.01
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 11
|   |   |   |   |   |   |   |   |   |--- feature_2 >  0.02
|   |   |   |   |   |   |   |   |   |   |--- feature_2 <= 0.02
|   |   |   |   |   |   |   |   |   |   |   |--- value: [99.62]
|   |   |   |   |   |   |   |   |   |   |--- feature_2 >  0.02
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 7
|   |   |   |   |   |   |   |   |--- feature_21 >  0.15
|   |   |   |   |   |   |   |   |   |--- feature_9 <= -1.17
|   |   |   |   |   |   |   |   |   |   |--- feature_17 <= -0.61
|   |   |   |   |   |   |   |   |   |   |   |--- value: [47.41]
|   |   |   |   |   |   |   |   |   |   |--- feature_17 >  -0.61
|   |   |   |   |   |   |   |   |   |   |   |--- value: [11.72]
|   |   |   |   |   |   |   |   |   |--- feature_9 >  -1.17
|   |   |   |   |   |   |   |   |   |   |--- feature_17 <= -1.45
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 10
|   |   |   |   |   |   |   |   |   |   |--- feature_17 >  -1.45
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 11
|   |   |   |   |   |   |--- feature_10 >  4.75
|   |   |   |   |   |   |   |--- feature_2 <= 0.02
|   |   |   |   |   |   |   |   |--- feature_10 <= 5.83
|   |   |   |   |   |   |   |   |   |--- feature_6 <= 0.34
|   |   |   |   |   |   |   |   |   |   |--- feature_2 <= 0.02
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 4
|   |   |   |   |   |   |   |   |   |   |--- feature_2 >  0.02
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 3
|   |   |   |   |   |   |   |   |   |--- feature_6 >  0.34
|   |   |   |   |   |   |   |   |   |   |--- feature_13 <= 0.88
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 4
|   |   |   |   |   |   |   |   |   |   |--- feature_13 >  0.88
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 3
|   |   |   |   |   |   |   |   |--- feature_10 >  5.83
|   |   |   |   |   |   |   |   |   |--- feature_2 <= 0.02
|   |   |   |   |   |   |   |   |   |   |--- feature_10 <= 7.14
|   |   |   |   |   |   |   |   |   |   |   |--- value: [84.25]
|   |   |   |   |   |   |   |   |   |   |--- feature_10 >  7.14
|   |   |   |   |   |   |   |   |   |   |   |--- value: [86.65]
|   |   |   |   |   |   |   |   |   |--- feature_2 >  0.02
|   |   |   |   |   |   |   |   |   |   |--- feature_14 <= -0.92
```

```
|   |   |   |   |   |   |   |   |   |   |   |--- value: [99.83]
|   |   |   |   |   |   |   |   |   |   |--- feature_14 >  -0.92
|   |   |   |   |   |   |   |   |   |   |   |--- value: [116.00]
|   |   |   |   |   |   |   |--- feature_2 >  0.02
|   |   |   |   |   |   |   |   |--- feature_17 <= -1.95
|   |   |   |   |   |   |   |   |   |--- feature_16 <= -0.63
|   |   |   |   |   |   |   |   |   |   |--- value: [163.75]
|   |   |   |   |   |   |   |   |   |--- feature_16 >  -0.63
|   |   |   |   |   |   |   |   |   |   |--- feature_6 <= 0.08
|   |   |   |   |   |   |   |   |   |   |   |--- value: [133.75]
|   |   |   |   |   |   |   |   |   |   |--- feature_6 >  0.08
|   |   |   |   |   |   |   |   |   |   |   |--- value: [122.32]
|   |   |   |   |   |   |   |   |--- feature_17 >  -1.95
|   |   |   |   |   |   |   |   |   |--- feature_2 <= 0.02
|   |   |   |   |   |   |   |   |   |   |--- feature_2 <= 0.02
|   |   |   |   |   |   |   |   |   |   |   |--- value: [93.15]
|   |   |   |   |   |   |   |   |   |   |--- feature_2 >  0.02
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 2
|   |   |   |   |   |   |   |   |   |--- feature_2 >  0.02
|   |   |   |   |   |   |   |   |   |   |--- feature_1 <= 1.50
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 9
|   |   |   |   |   |   |   |   |   |   |--- feature_1 >  1.50
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 7
|   |   |   |--- feature_9 >  1.61
|   |   |   |   |--- feature_9 <= 2.61
|   |   |   |   |   |--- feature_2 <= 0.01
|   |   |   |   |   |   |--- feature_10 <= 1.78
|   |   |   |   |   |   |   |--- feature_9 <= 2.17
|   |   |   |   |   |   |   |   |--- feature_2 <= 0.01
|   |   |   |   |   |   |   |   |   |--- feature_9 <= 1.72
|   |   |   |   |   |   |   |   |   |   |--- feature_2 <= 0.01
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 5
|   |   |   |   |   |   |   |   |   |   |--- feature_2 >  0.01
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 11
|   |   |   |   |   |   |   |   |   |--- feature_9 >  1.72
|   |   |   |   |   |   |   |   |   |   |--- feature_9 <= 1.74
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 2
|   |   |   |   |   |   |   |   |   |   |--- feature_9 >  1.74
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 15
|   |   |   |   |   |   |   |   |--- feature_2 >  0.01
|   |   |   |   |   |   |   |   |   |--- feature_9 <= 1.62
|   |   |   |   |   |   |   |   |   |   |--- feature_9 <= 1.62
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 2
|   |   |   |   |   |   |   |   |   |   |--- feature_9 >  1.62
|   |   |   |   |   |   |   |   |   |   |   |--- value: [127.60]
|   |   |   |   |   |   |   |   |   |--- feature_9 >  1.62
|   |   |   |   |   |   |   |   |   |   |--- feature_8 <= 1.39
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 15
```

```
|   |   |   |   |   |   |   |   |   |   |--- feature_8 >  1.39
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 15
|   |   |   |   |   |   |   |--- feature_9 >  2.17
|   |   |   |   |   |   |   |   |--- feature_17 <= 0.57
|   |   |   |   |   |   |   |   |   |--- feature_2 <= 0.01
|   |   |   |   |   |   |   |   |   |   |--- feature_5 <= -1.30
|   |   |   |   |   |   |   |   |   |   |   |--- value: [59.73]
|   |   |   |   |   |   |   |   |   |   |--- feature_5 >  -1.30
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 2
|   |   |   |   |   |   |   |   |   |--- feature_2 >  0.01
|   |   |   |   |   |   |   |   |   |   |--- feature_2 <= 0.01
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 2
|   |   |   |   |   |   |   |   |   |   |--- feature_2 >  0.01
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 12
|   |   |   |   |   |   |   |   |--- feature_17 >  0.57
|   |   |   |   |   |   |   |   |   |--- feature_2 <= 0.01
|   |   |   |   |   |   |   |   |   |   |--- feature_8 <= -0.76
|   |   |   |   |   |   |   |   |   |   |   |--- value: [70.80]
|   |   |   |   |   |   |   |   |   |   |--- feature_8 >  -0.76
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 8
|   |   |   |   |   |   |   |   |   |--- feature_2 >  0.01
|   |   |   |   |   |   |   |   |   |   |--- feature_15 <= 0.40
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 4
|   |   |   |   |   |   |   |   |   |   |--- feature_15 >  0.40
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 5
|   |   |   |   |   |   |--- feature_10 >  1.78
|   |   |   |   |   |   |   |--- feature_9 <= 2.16
|   |   |   |   |   |   |   |   |--- feature_2 <= 0.01
|   |   |   |   |   |   |   |   |   |--- feature_10 <= 3.88
|   |   |   |   |   |   |   |   |   |   |--- feature_3 <= 1.50
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 18
|   |   |   |   |   |   |   |   |   |   |--- feature_3 >  1.50
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 2
|   |   |   |   |   |   |   |   |   |--- feature_10 >  3.88
|   |   |   |   |   |   |   |   |   |   |--- feature_17 <= 0.15
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 2
|   |   |   |   |   |   |   |   |   |   |--- feature_17 >  0.15
|   |   |   |   |   |   |   |   |   |   |   |--- value: [98.85]
|   |   |   |   |   |   |   |   |--- feature_2 >  0.01
|   |   |   |   |   |   |   |   |   |--- feature_8 <= 1.19
|   |   |   |   |   |   |   |   |   |   |--- feature_17 <= -0.94
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 8
|   |   |   |   |   |   |   |   |   |   |--- feature_17 >  -0.94
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 11
|   |   |   |   |   |   |   |   |   |--- feature_8 >  1.19
|   |   |   |   |   |   |   |   |   |   |--- feature_21 <= 0.15
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 16
|   |   |   |   |   |   |   |   |   |   |--- feature_21 >  0.15
```

```
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 14
|   |   |   |   |   |   |   |--- feature_9 >  2.16
|   |   |   |   |   |   |   |   |--- feature_3 <= 1.50
|   |   |   |   |   |   |   |   |   |--- feature_21 <= 0.15
|   |   |   |   |   |   |   |   |   |   |--- feature_2 <= 0.01
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 10
|   |   |   |   |   |   |   |   |   |   |--- feature_2 >  0.01
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 17
|   |   |   |   |   |   |   |   |   |--- feature_21 >  0.15
|   |   |   |   |   |   |   |   |   |   |--- feature_2 <= 0.01
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 8
|   |   |   |   |   |   |   |   |   |   |--- feature_2 >  0.01
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 13
|   |   |   |   |   |   |   |   |--- feature_3 >  1.50
|   |   |   |   |   |   |   |   |   |--- feature_1 <= 2.50
|   |   |   |   |   |   |   |   |   |   |--- feature_6 <= 0.61
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 5
|   |   |   |   |   |   |   |   |   |   |--- feature_6 >  0.61
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 3
|   |   |   |   |   |   |   |   |   |--- feature_1 >  2.50
|   |   |   |   |   |   |   |   |   |   |--- feature_13 <= 0.88
|   |   |   |   |   |   |   |   |   |   |   |--- value: [99.66]
|   |   |   |   |   |   |   |   |   |   |--- feature_13 >  0.88
|   |   |   |   |   |   |   |   |   |   |   |--- value: [105.25]
|   |   |   |   |   |--- feature_2 >  0.01
|   |   |   |   |   |   |--- feature_9 <= 2.11
|   |   |   |   |   |   |   |--- feature_10 <= 2.19
|   |   |   |   |   |   |   |   |--- feature_2 <= 0.02
|   |   |   |   |   |   |   |   |   |--- feature_3 <= 1.50
|   |   |   |   |   |   |   |   |   |   |--- feature_8 <= 0.09
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 11
|   |   |   |   |   |   |   |   |   |   |--- feature_8 >  0.09
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 16
|   |   |   |   |   |   |   |   |   |--- feature_3 >  1.50
|   |   |   |   |   |   |   |   |   |   |--- feature_15 <= 0.40
|   |   |   |   |   |   |   |   |   |   |   |--- value: [78.19]
|   |   |   |   |   |   |   |   |   |   |--- feature_15 >  0.40
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 2
|   |   |   |   |   |   |   |   |--- feature_2 >  0.02
|   |   |   |   |   |   |   |   |   |--- feature_3 <= 1.50
|   |   |   |   |   |   |   |   |   |   |--- feature_2 <= 0.02
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 15
|   |   |   |   |   |   |   |   |   |   |--- feature_2 >  0.02
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 18
|   |   |   |   |   |   |   |   |   |--- feature_3 >  1.50
|   |   |   |   |   |   |   |   |   |   |--- feature_9 <= 1.76
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 3
|   |   |   |   |   |   |   |   |   |   |--- feature_9 >  1.76
```

```
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 7
|   |   |   |   |   |   |   |--- feature_10 >  2.19
|   |   |   |   |   |   |   |   |--- feature_2 <= 0.02
|   |   |   |   |   |   |   |   |   |--- feature_8 <= -0.11
|   |   |   |   |   |   |   |   |   |   |--- feature_2 <= 0.02
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 10
|   |   |   |   |   |   |   |   |   |   |--- feature_2 >  0.02
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 6
|   |   |   |   |   |   |   |   |   |--- feature_8 >  -0.11
|   |   |   |   |   |   |   |   |   |   |--- feature_2 <= 0.02
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 15
|   |   |   |   |   |   |   |   |   |   |--- feature_2 >  0.02
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 15
|   |   |   |   |   |   |   |   |--- feature_2 >  0.02
|   |   |   |   |   |   |   |   |   |--- feature_10 <= 5.73
|   |   |   |   |   |   |   |   |   |   |--- feature_3 <= 1.50
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 11
|   |   |   |   |   |   |   |   |   |   |--- feature_3 >  1.50
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 4
|   |   |   |   |   |   |   |   |   |--- feature_10 >  5.73
|   |   |   |   |   |   |   |   |   |   |--- feature_2 <= 0.02
|   |   |   |   |   |   |   |   |   |   |   |--- value: [113.65]
|   |   |   |   |   |   |   |   |   |   |--- feature_2 >  0.02
|   |   |   |   |   |   |   |   |   |   |   |--- value: [120.55]
|   |   |   |   |   |   |--- feature_9 >  2.11
|   |   |   |   |   |   |   |--- feature_2 <= 0.02
|   |   |   |   |   |   |   |   |--- feature_3 <= 1.50
|   |   |   |   |   |   |   |   |   |--- feature_10 <= 1.78
|   |   |   |   |   |   |   |   |   |   |--- feature_20 <= 0.14
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 18
|   |   |   |   |   |   |   |   |   |   |--- feature_20 >  0.14
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 11
|   |   |   |   |   |   |   |   |   |--- feature_10 >  1.78
|   |   |   |   |   |   |   |   |   |   |--- feature_2 <= 0.02
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 17
|   |   |   |   |   |   |   |   |   |   |--- feature_2 >  0.02
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 16
|   |   |   |   |   |   |   |   |--- feature_3 >  1.50
|   |   |   |   |   |   |   |   |   |--- feature_3 <= 4.50
|   |   |   |   |   |   |   |   |   |   |--- feature_16 <= 0.67
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 5
|   |   |   |   |   |   |   |   |   |   |--- feature_16 >  0.67
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 2
|   |   |   |   |   |   |   |   |   |--- feature_3 >  4.50
|   |   |   |   |   |   |   |   |   |   |--- value: [123.00]
|   |   |   |   |   |   |   |--- feature_2 >  0.02
|   |   |   |   |   |   |   |   |--- feature_10 <= 1.78
|   |   |   |   |   |   |   |   |   |--- feature_3 <= 1.50
```

```
|   |   |   |   |   |   |   |   |   |   |--- feature_9 <= 2.57
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 15
|   |   |   |   |   |   |   |   |   |   |--- feature_9 >  2.57
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 2
|   |   |   |   |   |   |   |   |   |--- feature_3 >  1.50
|   |   |   |   |   |   |   |   |   |   |--- feature_17 <= 0.07
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 5
|   |   |   |   |   |   |   |   |   |   |--- feature_17 >  0.07
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 5
|   |   |   |   |   |   |   |   |--- feature_10 >  1.78
|   |   |   |   |   |   |   |   |   |--- feature_21 <= 0.15
|   |   |   |   |   |   |   |   |   |   |--- feature_10 <= 4.53
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 10
|   |   |   |   |   |   |   |   |   |   |--- feature_10 >  4.53
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 6
|   |   |   |   |   |   |   |   |   |--- feature_21 >  0.15
|   |   |   |   |   |   |   |   |   |   |--- feature_3 <= 2.50
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 7
|   |   |   |   |   |   |   |   |   |   |--- feature_3 >  2.50
|   |   |   |   |   |   |   |   |   |   |   |--- value: [106.98]
|   |   |   |   |--- feature_9 >  2.61
|   |   |   |   |   |--- feature_9 <= 4.10
|   |   |   |   |   |   |--- feature_3 <= 1.50
|   |   |   |   |   |   |   |--- feature_2 <= 0.02
|   |   |   |   |   |   |   |   |--- feature_21 <= 0.15
|   |   |   |   |   |   |   |   |   |--- feature_14 <= 0.42
|   |   |   |   |   |   |   |   |   |   |--- feature_14 <= -0.92
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 11
|   |   |   |   |   |   |   |   |   |   |--- feature_14 >  -0.92
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 17
|   |   |   |   |   |   |   |   |   |--- feature_14 >  0.42
|   |   |   |   |   |   |   |   |   |   |--- feature_13 <= 0.88
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 9
|   |   |   |   |   |   |   |   |   |   |--- feature_13 >  0.88
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 15
|   |   |   |   |   |   |   |   |--- feature_21 >  0.15
|   |   |   |   |   |   |   |   |   |--- feature_2 <= 0.01
|   |   |   |   |   |   |   |   |   |   |--- feature_9 <= 2.92
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 8
|   |   |   |   |   |   |   |   |   |   |--- feature_9 >  2.92
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 7
|   |   |   |   |   |   |   |   |   |--- feature_2 >  0.01
|   |   |   |   |   |   |   |   |   |   |--- feature_0 <= 0.50
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 4
|   |   |   |   |   |   |   |   |   |   |--- feature_0 >  0.50
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 12
|   |   |   |   |   |   |   |--- feature_2 >  0.02
|   |   |   |   |   |   |   |   |--- feature_10 <= 1.78
```

```
|   |   |   |   |   |   |   |   |   |--- feature_21 <= 0.15
|   |   |   |   |   |   |   |   |   |   |--- feature_9 <= 2.97
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 10
|   |   |   |   |   |   |   |   |   |   |--- feature_9 >  2.97
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 10
|   |   |   |   |   |   |   |   |   |--- feature_21 >  0.15
|   |   |   |   |   |   |   |   |   |   |--- feature_2 <= 0.02
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 8
|   |   |   |   |   |   |   |   |   |   |--- feature_2 >  0.02
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 6
|   |   |   |   |   |   |   |   |--- feature_10 >  1.78
|   |   |   |   |   |   |   |   |   |--- feature_21 <= 0.15
|   |   |   |   |   |   |   |   |   |   |--- feature_9 <= 3.09
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 13
|   |   |   |   |   |   |   |   |   |   |--- feature_9 >  3.09
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 11
|   |   |   |   |   |   |   |   |   |--- feature_21 >  0.15
|   |   |   |   |   |   |   |   |   |   |--- feature_2 <= 0.02
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 10
|   |   |   |   |   |   |   |   |   |   |--- feature_2 >  0.02
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 6
|   |   |   |   |   |   |--- feature_3 >  1.50
|   |   |   |   |   |   |   |--- feature_10 <= 4.42
|   |   |   |   |   |   |   |   |--- feature_9 <= 3.19
|   |   |   |   |   |   |   |   |   |--- feature_5 <= 1.66
|   |   |   |   |   |   |   |   |   |   |--- feature_9 <= 2.64
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 3
|   |   |   |   |   |   |   |   |   |   |--- feature_9 >  2.64
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 10
|   |   |   |   |   |   |   |   |   |--- feature_5 >  1.66
|   |   |   |   |   |   |   |   |   |   |--- feature_2 <= 0.02
|   |   |   |   |   |   |   |   |   |   |   |--- value: [70.50]
|   |   |   |   |   |   |   |   |   |   |--- feature_2 >  0.02
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 4
|   |   |   |   |   |   |   |   |--- feature_9 >  3.19
|   |   |   |   |   |   |   |   |   |--- feature_13 <= 0.88
|   |   |   |   |   |   |   |   |   |   |--- feature_6 <= -0.55
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 4
|   |   |   |   |   |   |   |   |   |   |--- feature_6 >  -0.55
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 7
|   |   |   |   |   |   |   |   |   |--- feature_13 >  0.88
|   |   |   |   |   |   |   |   |   |   |--- feature_6 <= 0.82
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 3
|   |   |   |   |   |   |   |   |   |   |--- feature_6 >  0.82
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 3
|   |   |   |   |   |   |   |--- feature_10 >  4.42
|   |   |   |   |   |   |   |   |--- feature_9 <= 3.79
|   |   |   |   |   |   |   |   |   |--- feature_2 <= 0.02
```

```
|   |   |   |   |   |   |   |   |   |   |--- feature_21 <= -0.89
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 2
|   |   |   |   |   |   |   |   |   |   |--- feature_21 >  -0.89
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 5
|   |   |   |   |   |   |   |   |   |--- feature_2 >  0.02
|   |   |   |   |   |   |   |   |   |   |--- feature_16 <= -1.15
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 5
|   |   |   |   |   |   |   |   |   |   |--- feature_16 >  -1.15
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 7
|   |   |   |   |   |   |   |   |--- feature_9 >  3.79
|   |   |   |   |   |   |   |   |   |--- feature_3 <= 4.50
|   |   |   |   |   |   |   |   |   |   |--- feature_16 <= -0.80
|   |   |   |   |   |   |   |   |   |   |   |--- value: [120.19]
|   |   |   |   |   |   |   |   |   |   |--- feature_16 >  -0.80
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 2
|   |   |   |   |   |   |   |   |   |--- feature_3 >  4.50
|   |   |   |   |   |   |   |   |   |   |--- value: [160.05]
|   |   |   |   |   |--- feature_9 >  4.10
|   |   |   |   |   |   |--- feature_10 <= 8.90
|   |   |   |   |   |   |   |--- feature_3 <= 2.50
|   |   |   |   |   |   |   |   |--- feature_16 <= -2.53
|   |   |   |   |   |   |   |   |   |--- value: [204.00]
|   |   |   |   |   |   |   |   |--- feature_16 >  -2.53
|   |   |   |   |   |   |   |   |   |--- feature_6 <= 1.61
|   |   |   |   |   |   |   |   |   |   |--- feature_8 <= 3.34
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 11
|   |   |   |   |   |   |   |   |   |   |--- feature_8 >  3.34
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 4
|   |   |   |   |   |   |   |   |   |--- feature_6 >  1.61
|   |   |   |   |   |   |   |   |   |   |--- feature_15 <= 0.40
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 3
|   |   |   |   |   |   |   |   |   |   |--- feature_15 >  0.40
|   |   |   |   |   |   |   |   |   |   |   |--- value: [102.85]
|   |   |   |   |   |   |   |--- feature_3 >  2.50
|   |   |   |   |   |   |   |   |--- feature_2 <= 0.02
|   |   |   |   |   |   |   |   |   |--- feature_5 <= -1.32
|   |   |   |   |   |   |   |   |   |   |--- value: [151.25]
|   |   |   |   |   |   |   |   |   |--- feature_5 >  -1.32
|   |   |   |   |   |   |   |   |   |   |--- feature_2 <= 0.01
|   |   |   |   |   |   |   |   |   |   |   |--- value: [84.42]
|   |   |   |   |   |   |   |   |   |   |--- feature_2 >  0.01
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 4
|   |   |   |   |   |   |   |   |--- feature_2 >  0.02
|   |   |   |   |   |   |   |   |   |--- feature_3 <= 4.00
|   |   |   |   |   |   |   |   |   |   |--- feature_21 <= 0.66
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 6
|   |   |   |   |   |   |   |   |   |   |--- feature_21 >  0.66
|   |   |   |   |   |   |   |   |   |   |   |--- value: [117.70]
```

```
|   |   |   |   |   |   |   |   |   |--- feature_3 >  4.00
|   |   |   |   |   |   |   |   |   |   |--- feature_6 <= -0.57
|   |   |   |   |   |   |   |   |   |   |   |--- value: [175.94]
|   |   |   |   |   |   |   |   |   |   |--- feature_6 >  -0.57
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 2
|   |   |   |   |   |   |--- feature_10 >  8.90
|   |   |   |   |   |   |   |--- feature_17 <= 0.40
|   |   |   |   |   |   |   |   |--- feature_6 <= 0.91
|   |   |   |   |   |   |   |   |   |--- value: [214.05]
|   |   |   |   |   |   |   |   |--- feature_6 >  0.91
|   |   |   |   |   |   |   |   |   |--- value: [224.58]
|   |   |   |   |   |   |   |--- feature_17 >  0.40
|   |   |   |   |   |   |   |   |--- value: [144.78]
|   |--- feature_2 >  0.03
|   |   |--- feature_11 <= -0.50
|   |   |   |--- feature_2 <= 0.09
|   |   |   |   |--- feature_2 <= 0.05
|   |   |   |   |   |--- feature_3 <= 3.00
|   |   |   |   |   |   |--- feature_2 <= 0.04
|   |   |   |   |   |   |   |--- feature_8 <= 0.93
|   |   |   |   |   |   |   |   |--- feature_2 <= 0.03
|   |   |   |   |   |   |   |   |   |--- feature_17 <= 1.24
|   |   |   |   |   |   |   |   |   |   |--- feature_9 <= -1.05
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 2
|   |   |   |   |   |   |   |   |   |   |--- feature_9 >  -1.05
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 3
|   |   |   |   |   |   |   |   |   |--- feature_17 >  1.24
|   |   |   |   |   |   |   |   |   |   |--- value: [-68.85]
|   |   |   |   |   |   |   |   |--- feature_2 >  0.03
|   |   |   |   |   |   |   |   |   |--- feature_3 <= 1.50
|   |   |   |   |   |   |   |   |   |   |--- feature_2 <= 0.03
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 3
|   |   |   |   |   |   |   |   |   |   |--- feature_2 >  0.03
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 5
|   |   |   |   |   |   |   |   |   |--- feature_3 >  1.50
|   |   |   |   |   |   |   |   |   |   |--- feature_17 <= -1.70
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 2
|   |   |   |   |   |   |   |   |   |   |--- feature_17 >  -1.70
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 7
|   |   |   |   |   |   |   |--- feature_8 >  0.93
|   |   |   |   |   |   |   |   |--- feature_17 <= -0.27
|   |   |   |   |   |   |   |   |   |--- value: [-76.35]
|   |   |   |   |   |   |   |   |--- feature_17 >  -0.27
|   |   |   |   |   |   |   |   |   |--- feature_9 <= -0.36
|   |   |   |   |   |   |   |   |   |   |--- feature_8 <= 2.23
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 8
|   |   |   |   |   |   |   |   |   |   |--- feature_8 >  2.23
|   |   |   |   |   |   |   |   |   |   |   |--- value: [-91.70]
```

```
|   |   |   |   |   |   |   |   |   |--- feature_9 >  -0.36
|   |   |   |   |   |   |   |   |   |   |--- value: [-79.00]
|   |   |   |   |   |   |--- feature_2 >  0.04
|   |   |   |   |   |   |   |--- feature_14 <= 0.42
|   |   |   |   |   |   |   |   |--- feature_3 <= 1.50
|   |   |   |   |   |   |   |   |   |--- feature_8 <= -0.76
|   |   |   |   |   |   |   |   |   |   |--- value: [-90.25]
|   |   |   |   |   |   |   |   |   |--- feature_8 >  -0.76
|   |   |   |   |   |   |   |   |   |   |--- value: [-90.55]
|   |   |   |   |   |   |   |   |--- feature_3 >  1.50
|   |   |   |   |   |   |   |   |   |--- feature_8 <= 0.28
|   |   |   |   |   |   |   |   |   |   |--- value: [-82.30]
|   |   |   |   |   |   |   |   |   |--- feature_8 >  0.28
|   |   |   |   |   |   |   |   |   |   |--- feature_1 <= 3.00
|   |   |   |   |   |   |   |   |   |   |   |--- value: [-84.80]
|   |   |   |   |   |   |   |   |   |   |--- feature_1 >  3.00
|   |   |   |   |   |   |   |   |   |   |   |--- value: [-87.30]
|   |   |   |   |   |   |   |--- feature_14 >  0.42
|   |   |   |   |   |   |   |   |--- feature_5 <= 0.12
|   |   |   |   |   |   |   |   |   |--- feature_2 <= 0.04
|   |   |   |   |   |   |   |   |   |   |--- value: [-99.05]
|   |   |   |   |   |   |   |   |   |--- feature_2 >  0.04
|   |   |   |   |   |   |   |   |   |   |--- feature_9 <= -0.51
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 2
|   |   |   |   |   |   |   |   |   |   |--- feature_9 >  -0.51
|   |   |   |   |   |   |   |   |   |   |   |--- value: [-97.80]
|   |   |   |   |   |   |   |   |--- feature_5 >  0.12
|   |   |   |   |   |   |   |   |   |--- value: [-92.35]
|   |   |   |   |   |--- feature_3 >  3.00
|   |   |   |   |   |   |--- feature_8 <= 1.19
|   |   |   |   |   |   |   |--- feature_6 <= 1.03
|   |   |   |   |   |   |   |   |--- feature_6 <= 0.12
|   |   |   |   |   |   |   |   |   |--- value: [-99.75]
|   |   |   |   |   |   |   |   |--- feature_6 >  0.12
|   |   |   |   |   |   |   |   |   |--- value: [-91.25]
|   |   |   |   |   |   |   |--- feature_6 >  1.03
|   |   |   |   |   |   |   |   |--- feature_17 <= -0.86
|   |   |   |   |   |   |   |   |   |--- value: [-112.30]
|   |   |   |   |   |   |   |   |--- feature_17 >  -0.86
|   |   |   |   |   |   |   |   |   |--- value: [-103.50]
|   |   |   |   |   |   |--- feature_8 >  1.19
|   |   |   |   |   |   |   |--- value: [-129.30]
|   |   |   |   |--- feature_2 >  0.05
|   |   |   |   |   |--- feature_2 <= 0.06
|   |   |   |   |   |   |--- feature_1 <= 1.50
|   |   |   |   |   |   |   |--- feature_5 <= -1.07
|   |   |   |   |   |   |   |   |--- feature_17 <= 0.57
|   |   |   |   |   |   |   |   |   |--- value: [-108.45]
```

```
|   |   |   |   |   |   |   |   |--- feature_17 >  0.57
|   |   |   |   |   |   |   |   |   |--- value: [-109.75]
|   |   |   |   |   |   |   |--- feature_5 >  -1.07
|   |   |   |   |   |   |   |   |--- feature_6 <= 0.32
|   |   |   |   |   |   |   |   |   |--- feature_16 <= 0.93
|   |   |   |   |   |   |   |   |   |   |--- feature_17 <= -0.35
|   |   |   |   |   |   |   |   |   |   |   |--- value: [-103.80]
|   |   |   |   |   |   |   |   |   |   |--- feature_17 >  -0.35
|   |   |   |   |   |   |   |   |   |   |   |--- value: [-103.15]
|   |   |   |   |   |   |   |   |   |--- feature_16 >  0.93
|   |   |   |   |   |   |   |   |   |   |--- value: [-106.05]
|   |   |   |   |   |   |   |   |--- feature_6 >  0.32
|   |   |   |   |   |   |   |   |   |--- value: [-100.60]
|   |   |   |   |   |   |--- feature_1 >  1.50
|   |   |   |   |   |   |   |--- feature_12 <= 1.25
|   |   |   |   |   |   |   |   |--- value: [-116.70]
|   |   |   |   |   |   |   |--- feature_12 >  1.25
|   |   |   |   |   |   |   |   |--- value: [-111.85]
|   |   |   |   |   |--- feature_2 >  0.06
|   |   |   |   |   |   |--- feature_5 <= 0.94
|   |   |   |   |   |   |   |--- value: [-124.20]
|   |   |   |   |   |   |--- feature_5 >  0.94
|   |   |   |   |   |   |   |--- value: [-139.55]
|   |   |   |--- feature_2 >  0.09
|   |   |   |   |--- feature_21 <= 1.18
|   |   |   |   |   |--- feature_15 <= 0.40
|   |   |   |   |   |   |--- value: [-273.25]
|   |   |   |   |   |--- feature_15 >  0.40
|   |   |   |   |   |   |--- value: [-305.30]
|   |   |   |   |--- feature_21 >  1.18
|   |   |   |   |   |--- value: [-576.75]
|   |   |--- feature_11 >  -0.50
|   |   |   |--- feature_2 <= 0.07
|   |   |   |   |--- feature_3 <= 2.50
|   |   |   |   |   |--- feature_9 <= 2.16
|   |   |   |   |   |   |--- feature_2 <= 0.04
|   |   |   |   |   |   |   |--- feature_9 <= 0.46
|   |   |   |   |   |   |   |   |--- feature_10 <= 2.43
|   |   |   |   |   |   |   |   |   |--- feature_2 <= 0.03
|   |   |   |   |   |   |   |   |   |   |--- feature_8 <= 1.39
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 13
|   |   |   |   |   |   |   |   |   |   |--- feature_8 >  1.39
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 8
|   |   |   |   |   |   |   |   |   |--- feature_2 >  0.03
|   |   |   |   |   |   |   |   |   |   |--- feature_2 <= 0.04
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 21
|   |   |   |   |   |   |   |   |   |   |--- feature_2 >  0.04
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 10
```

```
|   |   |   |   |   |   |   |   |--- feature_10 >  2.43
|   |   |   |   |   |   |   |   |   |--- feature_8 <= 1.39
|   |   |   |   |   |   |   |   |   |   |--- feature_10 <= 5.30
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 21
|   |   |   |   |   |   |   |   |   |   |--- feature_10 >  5.30
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 10
|   |   |   |   |   |   |   |   |   |--- feature_8 >  1.39
|   |   |   |   |   |   |   |   |   |   |--- feature_10 <= 5.04
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 19
|   |   |   |   |   |   |   |   |   |   |--- feature_10 >  5.04
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 5
|   |   |   |   |   |   |   |--- feature_9 >  0.46
|   |   |   |   |   |   |   |   |--- feature_10 <= 2.36
|   |   |   |   |   |   |   |   |   |--- feature_7 <= 2.00
|   |   |   |   |   |   |   |   |   |   |--- feature_2 <= 0.03
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 15
|   |   |   |   |   |   |   |   |   |   |--- feature_2 >  0.03
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 19
|   |   |   |   |   |   |   |   |   |--- feature_7 >  2.00
|   |   |   |   |   |   |   |   |   |   |--- feature_8 <= -0.30
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 9
|   |   |   |   |   |   |   |   |   |   |--- feature_8 >  -0.30
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 3
|   |   |   |   |   |   |   |   |--- feature_10 >  2.36
|   |   |   |   |   |   |   |   |   |--- feature_8 <= 1.39
|   |   |   |   |   |   |   |   |   |   |--- feature_7 <= 2.00
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 20
|   |   |   |   |   |   |   |   |   |   |--- feature_7 >  2.00
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 17
|   |   |   |   |   |   |   |   |   |--- feature_8 >  1.39
|   |   |   |   |   |   |   |   |   |   |--- feature_9 <= 1.48
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 16
|   |   |   |   |   |   |   |   |   |   |--- feature_9 >  1.48
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 19
|   |   |   |   |   |   |--- feature_2 >  0.04
|   |   |   |   |   |   |   |--- feature_3 <= 1.50
|   |   |   |   |   |   |   |   |--- feature_2 <= 0.05
|   |   |   |   |   |   |   |   |   |--- feature_16 <= -2.36
|   |   |   |   |   |   |   |   |   |   |--- feature_9 <= -1.01
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 2
|   |   |   |   |   |   |   |   |   |   |--- feature_9 >  -1.01
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 4
|   |   |   |   |   |   |   |   |   |--- feature_16 >  -2.36
|   |   |   |   |   |   |   |   |   |   |--- feature_9 <= 1.05
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 12
|   |   |   |   |   |   |   |   |   |   |--- feature_9 >  1.05
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 6
|   |   |   |   |   |   |   |   |--- feature_2 >  0.05
```

```
|   |   |   |   |   |   |   |   |   |--- feature_10 <= 6.95
|   |   |   |   |   |   |   |   |   |   |--- feature_2 <= 0.06
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 16
|   |   |   |   |   |   |   |   |   |   |--- feature_2 >  0.06
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 10
|   |   |   |   |   |   |   |   |   |--- feature_10 >  6.95
|   |   |   |   |   |   |   |   |   |   |--- feature_5 <= 0.06
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 3
|   |   |   |   |   |   |   |   |   |   |--- feature_5 >  0.06
|   |   |   |   |   |   |   |   |   |   |   |--- value: [155.45]
|   |   |   |   |   |   |   |--- feature_3 >  1.50
|   |   |   |   |   |   |   |   |--- feature_9 <= 0.71
|   |   |   |   |   |   |   |   |   |--- feature_10 <= 1.13
|   |   |   |   |   |   |   |   |   |   |--- feature_7 <= 0.50
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 3
|   |   |   |   |   |   |   |   |   |   |--- feature_7 >  0.50
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 4
|   |   |   |   |   |   |   |   |   |--- feature_10 >  1.13
|   |   |   |   |   |   |   |   |   |   |--- feature_9 <= -0.23
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 7
|   |   |   |   |   |   |   |   |   |   |--- feature_9 >  -0.23
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 6
|   |   |   |   |   |   |   |   |--- feature_9 >  0.71
|   |   |   |   |   |   |   |   |   |--- feature_8 <= 1.39
|   |   |   |   |   |   |   |   |   |   |--- feature_10 <= 1.13
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 4
|   |   |   |   |   |   |   |   |   |   |--- feature_10 >  1.13
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 8
|   |   |   |   |   |   |   |   |   |--- feature_8 >  1.39
|   |   |   |   |   |   |   |   |   |   |--- feature_9 <= 1.71
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 6
|   |   |   |   |   |   |   |   |   |   |--- feature_9 >  1.71
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 3
|   |   |   |   |   |--- feature_9 >  2.16
|   |   |   |   |   |   |--- feature_9 <= 3.30
|   |   |   |   |   |   |   |--- feature_10 <= 1.95
|   |   |   |   |   |   |   |   |--- feature_2 <= 0.04
|   |   |   |   |   |   |   |   |   |--- feature_9 <= 2.72
|   |   |   |   |   |   |   |   |   |   |--- feature_2 <= 0.03
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 13
|   |   |   |   |   |   |   |   |   |   |--- feature_2 >  0.03
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 16
|   |   |   |   |   |   |   |   |   |--- feature_9 >  2.72
|   |   |   |   |   |   |   |   |   |   |--- feature_2 <= 0.03
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 15
|   |   |   |   |   |   |   |   |   |   |--- feature_2 >  0.03
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 16
|   |   |   |   |   |   |   |   |--- feature_2 >  0.04
```

```
|   |   |   |   |   |   |   |   |   |--- feature_12 <= 1.25
|   |   |   |   |   |   |   |   |   |   |--- feature_5 <= 0.19
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 6
|   |   |   |   |   |   |   |   |   |   |--- feature_5 >  0.19
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 5
|   |   |   |   |   |   |   |   |   |--- feature_12 >  1.25
|   |   |   |   |   |   |   |   |   |   |--- feature_17 <= 0.32
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 5
|   |   |   |   |   |   |   |   |   |   |--- feature_17 >  0.32
|   |   |   |   |   |   |   |   |   |   |   |--- value: [96.90]
|   |   |   |   |   |   |   |--- feature_10 >  1.95
|   |   |   |   |   |   |   |   |--- feature_8 <= 1.39
|   |   |   |   |   |   |   |   |   |--- feature_2 <= 0.06
|   |   |   |   |   |   |   |   |   |   |--- feature_10 <= 6.35
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 25
|   |   |   |   |   |   |   |   |   |   |--- feature_10 >  6.35
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 7
|   |   |   |   |   |   |   |   |   |--- feature_2 >  0.06
|   |   |   |   |   |   |   |   |   |   |--- feature_5 <= 1.11
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 2
|   |   |   |   |   |   |   |   |   |   |--- feature_5 >  1.11
|   |   |   |   |   |   |   |   |   |   |   |--- value: [98.41]
|   |   |   |   |   |   |   |   |--- feature_8 >  1.39
|   |   |   |   |   |   |   |   |   |--- feature_2 <= 0.05
|   |   |   |   |   |   |   |   |   |   |--- feature_21 <= 0.15
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 24
|   |   |   |   |   |   |   |   |   |   |--- feature_21 >  0.15
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 7
|   |   |   |   |   |   |   |   |   |--- feature_2 >  0.05
|   |   |   |   |   |   |   |   |   |   |--- feature_1 <= 1.50
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 3
|   |   |   |   |   |   |   |   |   |   |--- feature_1 >  1.50
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 2
|   |   |   |   |   |   |--- feature_9 >  3.30
|   |   |   |   |   |   |   |--- feature_2 <= 0.05
|   |   |   |   |   |   |   |   |--- feature_9 <= 6.23
|   |   |   |   |   |   |   |   |   |--- feature_3 <= 1.50
|   |   |   |   |   |   |   |   |   |   |--- feature_2 <= 0.04
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 12
|   |   |   |   |   |   |   |   |   |   |--- feature_2 >  0.04
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 13
|   |   |   |   |   |   |   |   |   |--- feature_3 >  1.50
|   |   |   |   |   |   |   |   |   |   |--- feature_8 <= 1.39
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 20
|   |   |   |   |   |   |   |   |   |   |--- feature_8 >  1.39
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 15
|   |   |   |   |   |   |   |   |--- feature_9 >  6.23
|   |   |   |   |   |   |   |   |   |--- feature_9 <= 15.73
```

```
|   |   |   |   |   |   |   |   |   |   |--- feature_14 <= 0.42
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 3
|   |   |   |   |   |   |   |   |   |   |--- feature_14 >  0.42
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 2
|   |   |   |   |   |   |   |   |   |--- feature_9 >  15.73
|   |   |   |   |   |   |   |   |   |   |--- feature_6 <= 0.37
|   |   |   |   |   |   |   |   |   |   |   |--- value: [172.30]
|   |   |   |   |   |   |   |   |   |   |--- feature_6 >  0.37
|   |   |   |   |   |   |   |   |   |   |   |--- value: [185.75]
|   |   |   |   |   |   |   |--- feature_2 >  0.05
|   |   |   |   |   |   |   |   |--- feature_3 <= 1.50
|   |   |   |   |   |   |   |   |   |--- feature_9 <= 3.93
|   |   |   |   |   |   |   |   |   |   |--- feature_2 <= 0.06
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 9
|   |   |   |   |   |   |   |   |   |   |--- feature_2 >  0.06
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 3
|   |   |   |   |   |   |   |   |   |--- feature_9 >  3.93
|   |   |   |   |   |   |   |   |   |   |--- feature_9 <= 4.63
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 9
|   |   |   |   |   |   |   |   |   |   |--- feature_9 >  4.63
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 8
|   |   |   |   |   |   |   |   |--- feature_3 >  1.50
|   |   |   |   |   |   |   |   |   |--- feature_10 <= 6.95
|   |   |   |   |   |   |   |   |   |   |--- feature_9 <= 4.09
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 6
|   |   |   |   |   |   |   |   |   |   |--- feature_9 >  4.09
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 5
|   |   |   |   |   |   |   |   |   |--- feature_10 >  6.95
|   |   |   |   |   |   |   |   |   |   |--- value: [119.40]
|   |   |   |   |--- feature_3 >  2.50
|   |   |   |   |   |--- feature_3 <= 52.00
|   |   |   |   |   |   |--- feature_9 <= 4.89
|   |   |   |   |   |   |   |--- feature_2 <= 0.05
|   |   |   |   |   |   |   |   |--- feature_9 <= 3.46
|   |   |   |   |   |   |   |   |   |--- feature_10 <= 3.67
|   |   |   |   |   |   |   |   |   |   |--- feature_2 <= 0.04
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 15
|   |   |   |   |   |   |   |   |   |   |--- feature_2 >  0.04
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 10
|   |   |   |   |   |   |   |   |   |--- feature_10 >  3.67
|   |   |   |   |   |   |   |   |   |   |--- feature_2 <= 0.04
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 18
|   |   |   |   |   |   |   |   |   |   |--- feature_2 >  0.04
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 7
|   |   |   |   |   |   |   |   |--- feature_9 >  3.46
|   |   |   |   |   |   |   |   |   |--- feature_9 <= 4.48
|   |   |   |   |   |   |   |   |   |   |--- feature_2 <= 0.03
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 11
```

```
|   |   |   |   |   |   |   |   |   |   |--- feature_2 >  0.03
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 14
|   |   |   |   |   |   |   |   |   |--- feature_9 >  4.48
|   |   |   |   |   |   |   |   |   |   |--- feature_5 <= -0.27
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 6
|   |   |   |   |   |   |   |   |   |   |--- feature_5 >  -0.27
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 10
|   |   |   |   |   |   |   |--- feature_2 >  0.05
|   |   |   |   |   |   |   |   |--- feature_7 <= 1.50
|   |   |   |   |   |   |   |   |   |--- feature_2 <= 0.05
|   |   |   |   |   |   |   |   |   |   |--- value: [287.26]
|   |   |   |   |   |   |   |   |   |--- feature_2 >  0.05
|   |   |   |   |   |   |   |   |   |   |--- feature_2 <= 0.06
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 10
|   |   |   |   |   |   |   |   |   |   |--- feature_2 >  0.06
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 8
|   |   |   |   |   |   |   |   |--- feature_7 >  1.50
|   |   |   |   |   |   |   |   |   |--- feature_6 <= 0.59
|   |   |   |   |   |   |   |   |   |   |--- value: [40.00]
|   |   |   |   |   |   |   |   |   |--- feature_6 >  0.59
|   |   |   |   |   |   |   |   |   |   |--- value: [41.00]
|   |   |   |   |   |   |--- feature_9 >  4.89
|   |   |   |   |   |   |   |--- feature_2 <= 0.04
|   |   |   |   |   |   |   |   |--- feature_9 <= 6.03
|   |   |   |   |   |   |   |   |   |--- feature_3 <= 3.50
|   |   |   |   |   |   |   |   |   |   |--- feature_2 <= 0.04
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 12
|   |   |   |   |   |   |   |   |   |   |--- feature_2 >  0.04
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 3
|   |   |   |   |   |   |   |   |   |--- feature_3 >  3.50
|   |   |   |   |   |   |   |   |   |   |--- feature_17 <= 0.23
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 4
|   |   |   |   |   |   |   |   |   |   |--- feature_17 >  0.23
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 4
|   |   |   |   |   |   |   |   |--- feature_9 >  6.03
|   |   |   |   |   |   |   |   |   |--- feature_3 <= 3.50
|   |   |   |   |   |   |   |   |   |   |--- feature_2 <= 0.03
|   |   |   |   |   |   |   |   |   |   |   |--- value: [191.15]
|   |   |   |   |   |   |   |   |   |   |--- feature_2 >  0.03
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 4
|   |   |   |   |   |   |   |   |   |--- feature_3 >  3.50
|   |   |   |   |   |   |   |   |   |   |--- feature_2 <= 0.04
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 3
|   |   |   |   |   |   |   |   |   |   |--- feature_2 >  0.04
|   |   |   |   |   |   |   |   |   |   |   |--- value: [180.05]
|   |   |   |   |   |   |   |--- feature_2 >  0.04
|   |   |   |   |   |   |   |   |--- feature_6 <= 1.55
|   |   |   |   |   |   |   |   |   |--- feature_9 <= 5.82
```

```
|   |   |   |   |   |   |   |   |   |   |--- feature_2 <= 0.05
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 5
|   |   |   |   |   |   |   |   |   |   |--- feature_2 >  0.05
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 6
|   |   |   |   |   |   |   |   |   |--- feature_9 >  5.82
|   |   |   |   |   |   |   |   |   |   |--- feature_2 <= 0.06
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 9
|   |   |   |   |   |   |   |   |   |   |--- feature_2 >  0.06
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 4
|   |   |   |   |   |   |   |   |--- feature_6 >  1.55
|   |   |   |   |   |   |   |   |   |--- feature_10 <= 7.07
|   |   |   |   |   |   |   |   |   |   |--- value: [284.65]
|   |   |   |   |   |   |   |   |   |--- feature_10 >  7.07
|   |   |   |   |   |   |   |   |   |   |--- value: [334.30]
|   |   |   |   |   |--- feature_3 >  52.00
|   |   |   |   |   |   |--- feature_10 <= 1.78
|   |   |   |   |   |   |   |--- feature_2 <= 0.03
|   |   |   |   |   |   |   |   |--- feature_5 <= 0.90
|   |   |   |   |   |   |   |   |   |--- feature_9 <= -0.56
|   |   |   |   |   |   |   |   |   |   |--- feature_2 <= 0.03
|   |   |   |   |   |   |   |   |   |   |   |--- value: [52.00]
|   |   |   |   |   |   |   |   |   |   |--- feature_2 >  0.03
|   |   |   |   |   |   |   |   |   |   |   |--- value: [50.00]
|   |   |   |   |   |   |   |   |   |--- feature_9 >  -0.56
|   |   |   |   |   |   |   |   |   |   |--- feature_10 <= 0.37
|   |   |   |   |   |   |   |   |   |   |   |--- value: [54.00]
|   |   |   |   |   |   |   |   |   |   |--- feature_10 >  0.37
|   |   |   |   |   |   |   |   |   |   |   |--- value: [55.00]
|   |   |   |   |   |   |   |   |--- feature_5 >  0.90
|   |   |   |   |   |   |   |   |   |--- feature_9 <= -0.54
|   |   |   |   |   |   |   |   |   |   |--- feature_20 <= -0.36
|   |   |   |   |   |   |   |   |   |   |   |--- value: [54.00]
|   |   |   |   |   |   |   |   |   |   |--- feature_20 >  -0.36
|   |   |   |   |   |   |   |   |   |   |   |--- value: [47.00]
|   |   |   |   |   |   |   |   |   |--- feature_9 >  -0.54
|   |   |   |   |   |   |   |   |   |   |--- feature_16 <= -0.45
|   |   |   |   |   |   |   |   |   |   |   |--- value: [38.00]
|   |   |   |   |   |   |   |   |   |   |--- feature_16 >  -0.45
|   |   |   |   |   |   |   |   |   |   |   |--- value: [25.70]
|   |   |   |   |   |   |   |--- feature_2 >  0.03
|   |   |   |   |   |   |   |   |--- feature_20 <= 0.14
|   |   |   |   |   |   |   |   |   |--- feature_20 <= -0.87
|   |   |   |   |   |   |   |   |   |   |--- feature_17 <= -0.19
|   |   |   |   |   |   |   |   |   |   |   |--- value: [51.45]
|   |   |   |   |   |   |   |   |   |   |--- feature_17 >  -0.19
|   |   |   |   |   |   |   |   |   |   |   |--- value: [52.45]
|   |   |   |   |   |   |   |   |   |--- feature_20 >  -0.87
|   |   |   |   |   |   |   |   |   |   |--- value: [45.00]
```

```
|   |   |   |   |   |   |   |   |--- feature_20 >  0.14
|   |   |   |   |   |   |   |   |   |--- feature_9 <= -1.02
|   |   |   |   |   |   |   |   |   |   |--- feature_5 <= -1.22
|   |   |   |   |   |   |   |   |   |   |   |--- value: [51.00]
|   |   |   |   |   |   |   |   |   |   |--- feature_5 >  -1.22
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 3
|   |   |   |   |   |   |   |   |   |--- feature_9 >  -1.02
|   |   |   |   |   |   |   |   |   |   |--- feature_6 <= -0.01
|   |   |   |   |   |   |   |   |   |   |   |--- value: [65.45]
|   |   |   |   |   |   |   |   |   |   |--- feature_6 >  -0.01
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 2
|   |   |   |   |   |   |--- feature_10 >  1.78
|   |   |   |   |   |   |   |--- feature_10 <= 10.34
|   |   |   |   |   |   |   |   |--- feature_2 <= 0.04
|   |   |   |   |   |   |   |   |   |--- feature_17 <= -0.27
|   |   |   |   |   |   |   |   |   |   |--- feature_2 <= 0.03
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 5
|   |   |   |   |   |   |   |   |   |   |--- feature_2 >  0.03
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 5
|   |   |   |   |   |   |   |   |   |--- feature_17 >  -0.27
|   |   |   |   |   |   |   |   |   |   |--- feature_9 <= -1.13
|   |   |   |   |   |   |   |   |   |   |   |--- value: [47.25]
|   |   |   |   |   |   |   |   |   |   |--- feature_9 >  -1.13
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 4
|   |   |   |   |   |   |   |   |--- feature_2 >  0.04
|   |   |   |   |   |   |   |   |   |--- feature_2 <= 0.05
|   |   |   |   |   |   |   |   |   |   |--- feature_16 <= 0.50
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 9
|   |   |   |   |   |   |   |   |   |   |--- feature_16 >  0.50
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 3
|   |   |   |   |   |   |   |   |   |--- feature_2 >  0.05
|   |   |   |   |   |   |   |   |   |   |--- feature_20 <= 1.16
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 2
|   |   |   |   |   |   |   |   |   |   |--- feature_20 >  1.16
|   |   |   |   |   |   |   |   |   |   |   |--- value: [75.25]
|   |   |   |   |   |   |   |--- feature_10 >  10.34
|   |   |   |   |   |   |   |   |--- value: [98.26]
|   |   |   |--- feature_2 >  0.07
|   |   |   |   |--- feature_2 <= 0.09
|   |   |   |   |   |--- feature_3 <= 2.50
|   |   |   |   |   |   |--- feature_3 <= 1.50
|   |   |   |   |   |   |   |--- feature_9 <= 3.47
|   |   |   |   |   |   |   |   |--- feature_2 <= 0.08
|   |   |   |   |   |   |   |   |   |--- feature_7 <= 2.00
|   |   |   |   |   |   |   |   |   |   |--- feature_17 <= -1.78
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 3
|   |   |   |   |   |   |   |   |   |   |--- feature_17 >  -1.78
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 7
```

```
|   |   |   |   |   |   |   |   |   |--- feature_7 >  2.00
|   |   |   |   |   |   |   |   |   |   |--- feature_2 <= 0.07
|   |   |   |   |   |   |   |   |   |   |   |--- value: [103.92]
|   |   |   |   |   |   |   |   |   |   |--- feature_2 >  0.07
|   |   |   |   |   |   |   |   |   |   |   |--- value: [114.75]
|   |   |   |   |   |   |   |   |--- feature_2 >  0.08
|   |   |   |   |   |   |   |   |   |--- feature_8 <= 2.04
|   |   |   |   |   |   |   |   |   |   |--- feature_9 <= 2.41
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 2
|   |   |   |   |   |   |   |   |   |   |--- feature_9 >  2.41
|   |   |   |   |   |   |   |   |   |   |   |--- value: [180.00]
|   |   |   |   |   |   |   |   |   |--- feature_8 >  2.04
|   |   |   |   |   |   |   |   |   |   |--- value: [196.60]
|   |   |   |   |   |   |   |--- feature_9 >  3.47
|   |   |   |   |   |   |   |   |--- feature_12 <= 1.25
|   |   |   |   |   |   |   |   |   |--- feature_6 <= 0.19
|   |   |   |   |   |   |   |   |   |   |--- feature_2 <= 0.09
|   |   |   |   |   |   |   |   |   |   |   |--- value: [194.75]
|   |   |   |   |   |   |   |   |   |   |--- feature_2 >  0.09
|   |   |   |   |   |   |   |   |   |   |   |--- value: [193.74]
|   |   |   |   |   |   |   |   |   |--- feature_6 >  0.19
|   |   |   |   |   |   |   |   |   |   |--- value: [197.70]
|   |   |   |   |   |   |   |   |--- feature_12 >  1.25
|   |   |   |   |   |   |   |   |   |--- feature_17 <= 0.15
|   |   |   |   |   |   |   |   |   |   |--- value: [175.80]
|   |   |   |   |   |   |   |   |   |--- feature_17 >  0.15
|   |   |   |   |   |   |   |   |   |   |--- value: [156.05]
|   |   |   |   |   |   |--- feature_3 >  1.50
|   |   |   |   |   |   |   |--- feature_10 <= 8.05
|   |   |   |   |   |   |   |   |--- feature_0 <= 0.50
|   |   |   |   |   |   |   |   |   |--- value: [74.00]
|   |   |   |   |   |   |   |   |--- feature_0 >  0.50
|   |   |   |   |   |   |   |   |   |--- feature_7 <= 0.50
|   |   |   |   |   |   |   |   |   |   |--- value: [80.55]
|   |   |   |   |   |   |   |   |   |--- feature_7 >  0.50
|   |   |   |   |   |   |   |   |   |   |--- value: [82.30]
|   |   |   |   |   |   |   |--- feature_10 >  8.05
|   |   |   |   |   |   |   |   |--- value: [120.30]
|   |   |   |   |   |--- feature_3 >  2.50
|   |   |   |   |   |   |--- feature_9 <= 7.82
|   |   |   |   |   |   |   |--- feature_2 <= 0.09
|   |   |   |   |   |   |   |   |--- feature_9 <= -1.17
|   |   |   |   |   |   |   |   |   |--- feature_5 <= 0.15
|   |   |   |   |   |   |   |   |   |   |--- feature_10 <= 8.77
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 2
|   |   |   |   |   |   |   |   |   |   |--- feature_10 >  8.77
|   |   |   |   |   |   |   |   |   |   |   |--- value: [208.39]
|   |   |   |   |   |   |   |   |   |--- feature_5 >  0.15
```

```
|   |   |   |   |   |   |   |   |   |   |--- feature_6 <= -0.09
|   |   |   |   |   |   |   |   |   |   |   |--- value: [143.05]
|   |   |   |   |   |   |   |   |   |   |--- feature_6 >  -0.09
|   |   |   |   |   |   |   |   |   |   |   |--- value: [146.05]
|   |   |   |   |   |   |   |   |--- feature_9 >  -1.17
|   |   |   |   |   |   |   |   |   |--- feature_17 <= -0.10
|   |   |   |   |   |   |   |   |   |   |--- feature_2 <= 0.08
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 8
|   |   |   |   |   |   |   |   |   |   |--- feature_2 >  0.08
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 5
|   |   |   |   |   |   |   |   |   |--- feature_17 >  -0.10
|   |   |   |   |   |   |   |   |   |   |--- feature_10 <= 5.81
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 8
|   |   |   |   |   |   |   |   |   |   |--- feature_10 >  5.81
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 9
|   |   |   |   |   |   |   |--- feature_2 >  0.09
|   |   |   |   |   |   |   |   |--- feature_5 <= -0.02
|   |   |   |   |   |   |   |   |   |--- feature_3 <= 4.50
|   |   |   |   |   |   |   |   |   |   |--- feature_8 <= -0.11
|   |   |   |   |   |   |   |   |   |   |   |--- value: [273.25]
|   |   |   |   |   |   |   |   |   |   |--- feature_8 >  -0.11
|   |   |   |   |   |   |   |   |   |   |   |--- value: [274.25]
|   |   |   |   |   |   |   |   |   |--- feature_3 >  4.50
|   |   |   |   |   |   |   |   |   |   |--- value: [313.00]
|   |   |   |   |   |   |   |   |--- feature_5 >  -0.02
|   |   |   |   |   |   |   |   |   |--- feature_12 <= 1.25
|   |   |   |   |   |   |   |   |   |   |--- feature_13 <= 0.88
|   |   |   |   |   |   |   |   |   |   |   |--- value: [236.00]
|   |   |   |   |   |   |   |   |   |   |--- feature_13 >  0.88
|   |   |   |   |   |   |   |   |   |   |   |--- value: [258.95]
|   |   |   |   |   |   |   |   |   |--- feature_12 >  1.25
|   |   |   |   |   |   |   |   |   |   |--- value: [211.10]
|   |   |   |   |   |   |--- feature_9 >  7.82
|   |   |   |   |   |   |   |--- feature_17 <= -2.03
|   |   |   |   |   |   |   |   |--- value: [334.62]
|   |   |   |   |   |   |   |--- feature_17 >  -2.03
|   |   |   |   |   |   |   |   |--- feature_9 <= 8.73
|   |   |   |   |   |   |   |   |   |--- feature_6 <= -0.57
|   |   |   |   |   |   |   |   |   |   |--- feature_14 <= -0.92
|   |   |   |   |   |   |   |   |   |   |   |--- value: [256.08]
|   |   |   |   |   |   |   |   |   |   |--- feature_14 >  -0.92
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 2
|   |   |   |   |   |   |   |   |   |--- feature_6 >  -0.57
|   |   |   |   |   |   |   |   |   |   |--- feature_15 <= -0.27
|   |   |   |   |   |   |   |   |   |   |   |--- value: [243.43]
|   |   |   |   |   |   |   |   |   |   |--- feature_15 >  -0.27
|   |   |   |   |   |   |   |   |   |   |   |--- value: [243.07]
|   |   |   |   |   |   |   |   |--- feature_9 >  8.73
```

```
|   |   |   |   |   |   |   |   |   |--- feature_5 <= 1.38
|   |   |   |   |   |   |   |   |   |   |--- feature_10 <= 1.13
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 3
|   |   |   |   |   |   |   |   |   |   |--- feature_10 >  1.13
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 3
|   |   |   |   |   |   |   |   |   |--- feature_5 >  1.38
|   |   |   |   |   |   |   |   |   |   |--- value: [245.88]
|   |   |   |   |--- feature_2 >  0.09
|   |   |   |   |   |--- feature_2 <= 12.40
|   |   |   |   |   |   |--- feature_2 <= 0.14
|   |   |   |   |   |   |   |--- feature_9 <= 9.82
|   |   |   |   |   |   |   |   |--- feature_9 <= -1.21
|   |   |   |   |   |   |   |   |   |--- value: [407.05]
|   |   |   |   |   |   |   |   |--- feature_9 >  -1.21
|   |   |   |   |   |   |   |   |   |--- feature_8 <= 2.69
|   |   |   |   |   |   |   |   |   |   |--- feature_6 <= 0.85
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 8
|   |   |   |   |   |   |   |   |   |   |--- feature_6 >  0.85
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 4
|   |   |   |   |   |   |   |   |   |--- feature_8 >  2.69
|   |   |   |   |   |   |   |   |   |   |--- value: [373.95]
|   |   |   |   |   |   |   |--- feature_9 >  9.82
|   |   |   |   |   |   |   |   |--- feature_2 <= 0.11
|   |   |   |   |   |   |   |   |   |--- feature_17 <= 0.40
|   |   |   |   |   |   |   |   |   |   |--- feature_6 <= -0.43
|   |   |   |   |   |   |   |   |   |   |   |--- value: [358.27]
|   |   |   |   |   |   |   |   |   |   |--- feature_6 >  -0.43
|   |   |   |   |   |   |   |   |   |   |   |--- value: [351.31]
|   |   |   |   |   |   |   |   |   |--- feature_17 >  0.40
|   |   |   |   |   |   |   |   |   |   |--- feature_13 <= 0.88
|   |   |   |   |   |   |   |   |   |   |   |--- value: [332.76]
|   |   |   |   |   |   |   |   |   |   |--- feature_13 >  0.88
|   |   |   |   |   |   |   |   |   |   |   |--- value: [340.98]
|   |   |   |   |   |   |   |   |--- feature_2 >  0.11
|   |   |   |   |   |   |   |   |   |--- feature_10 <= 4.53
|   |   |   |   |   |   |   |   |   |   |--- value: [307.62]
|   |   |   |   |   |   |   |   |   |--- feature_10 >  4.53
|   |   |   |   |   |   |   |   |   |   |--- feature_13 <= 0.88
|   |   |   |   |   |   |   |   |   |   |   |--- value: [320.10]
|   |   |   |   |   |   |   |   |   |   |--- feature_13 >  0.88
|   |   |   |   |   |   |   |   |   |   |   |--- value: [322.57]
|   |   |   |   |   |   |--- feature_2 >  0.14
|   |   |   |   |   |   |   |--- feature_2 <= 0.17
|   |   |   |   |   |   |   |   |--- feature_17 <= 1.24
|   |   |   |   |   |   |   |   |   |--- feature_10 <= 2.90
|   |   |   |   |   |   |   |   |   |   |--- feature_19 <= 5.62
|   |   |   |   |   |   |   |   |   |   |   |--- value: [461.95]
|   |   |   |   |   |   |   |   |   |   |--- feature_19 >  5.62
```

```
|   |   |   |   |   |   |   |   |   |   |   |--- value: [461.00]
|   |   |   |   |   |   |   |   |   |--- feature_10 >  2.90
|   |   |   |   |   |   |   |   |   |   |--- feature_17 <= 0.99
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 3
|   |   |   |   |   |   |   |   |   |   |--- feature_17 >  0.99
|   |   |   |   |   |   |   |   |   |   |   |--- value: [396.31]
|   |   |   |   |   |   |   |   |--- feature_17 >  1.24
|   |   |   |   |   |   |   |   |   |--- value: [288.60]
|   |   |   |   |   |   |   |--- feature_2 >  0.17
|   |   |   |   |   |   |   |   |--- feature_8 <= -0.11
|   |   |   |   |   |   |   |   |   |--- feature_14 <= 0.42
|   |   |   |   |   |   |   |   |   |   |--- feature_8 <= -0.76
|   |   |   |   |   |   |   |   |   |   |   |--- value: [470.30]
|   |   |   |   |   |   |   |   |   |   |--- feature_8 >  -0.76
|   |   |   |   |   |   |   |   |   |   |   |--- value: [456.90]
|   |   |   |   |   |   |   |   |   |--- feature_14 >  0.42
|   |   |   |   |   |   |   |   |   |   |--- value: [491.15]
|   |   |   |   |   |   |   |   |--- feature_8 >  -0.11
|   |   |   |   |   |   |   |   |   |--- feature_10 <= 1.13
|   |   |   |   |   |   |   |   |   |   |--- feature_21 <= 0.15
|   |   |   |   |   |   |   |   |   |   |   |--- truncated branch of depth 2
|   |   |   |   |   |   |   |   |   |   |--- feature_21 >  0.15
|   |   |   |   |   |   |   |   |   |   |   |--- value: [587.25]
|   |   |   |   |   |   |   |   |   |--- feature_10 >  1.13
|   |   |   |   |   |   |   |   |   |   |--- value: [494.00]
|   |   |   |   |   |--- feature_2 >  12.40
|   |   |   |   |   |   |--- feature_5 <= -0.17
|   |   |   |   |   |   |   |--- feature_5 <= -0.68
|   |   |   |   |   |   |   |   |--- value: [18.00]
|   |   |   |   |   |   |   |--- feature_5 >  -0.68
|   |   |   |   |   |   |   |   |--- value: [9.60]
|   |   |   |   |   |   |--- feature_5 >  -0.17
|   |   |   |   |   |   |   |--- feature_9 <= 0.36
|   |   |   |   |   |   |   |   |--- value: [27.92]
|   |   |   |   |   |   |   |--- feature_9 >  0.36
|   |   |   |   |   |   |   |   |--- value: [42.56]
```

12.3 Bagging and Boosting

Bagging: * `sklearn.ensemble.BaggingRegressor` * `sklearn.ensemble.RandomForestRegressor`

Boosting: * `sklearn.ensemble.GradientBoostingRegressor` * `sklearn.ensemble.AdaBoostRegressor`

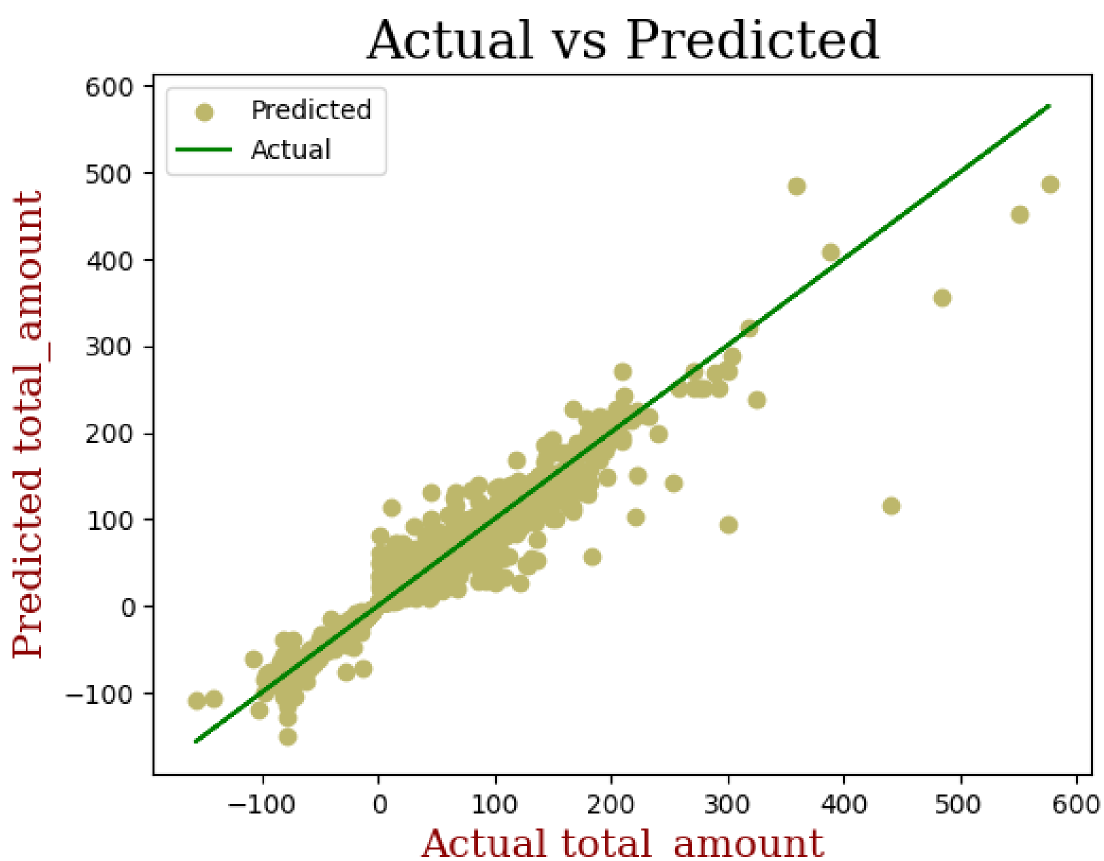
12.3.1 BaggingRegressor()

[130]:
```
b1_reg = BaggingRegressor()
b1_reg.fit(X_train, y_train)
b1_reg_predict = b1_reg.predict(X_val)
print(b1_reg_predict)
b1_reg_score = r2_score(y_val,b1_reg_predict)
print("R2_Score (BaggingRegressor) :",b1_reg_score)
```

```
[36.143 24.758 98.585 … 11.259 17.898 33.04 ]
R2_Score (BaggingRegressor) : 0.953593491869053
```

- **Plotting Actual vs Predicted**

[131]:
```
act_vs_predict(y_val,b1_reg_predict)
```



Tunning Hyperparameters & Training as well as evaluating on the same.

[132]:
```
'''
tuned_parameters = [{"n_estimators": [50,100,200],
                     "max_features":[1,2,6,8,10,12,14],
```

```
              "max_samples": [0.5,0.1],
            "bootstrap": [True, False],
         "bootstrap_features": [True, False]}
]

Bag_model_GS = GridSearchCV(BaggingRegressor(), param_grid=tuned_parameters)
Bag_model_GS.fit(X_train,y_train)

print("The best parameter value is:", Bag_model_GS.best_params_)
'''
```

[132]:

```
'\ntuned_parameters = [{"n_estimators": [50,100,200],\n
"max_features":[1,2,6,8,10,12,14],\n              "max_samples": [0.5,0.1],\n
"bootstrap": [True, False],\n         "bootstrap_features": [True,
False]}\n]\n\nBag_model_GS = GridSearchCV(BaggingRegressor(),
param_grid=tuned_parameters)\nBag_model_GS.fit(X_train,y_train)\n\nprint("The
best parameter value is:", Bag_model_GS.best_params_)\n'
```

- **Result**
  - The best parameter value is: {'bootstrap': False, 'bootstrap_features': False, 'max_features': 14, 'max_samples': 0.5, 'n_estimators': 200}

[133]:

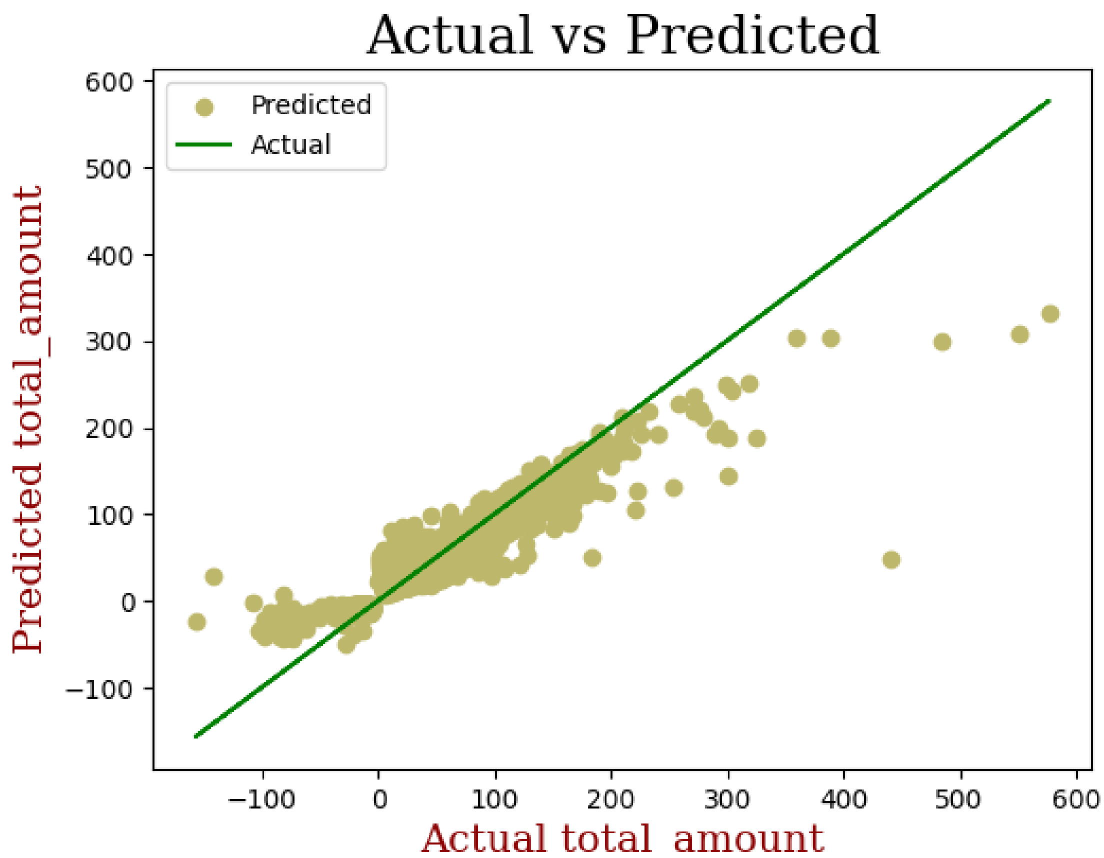
```
b2_reg = BaggingRegressor(bootstrap = False, bootstrap_features = False, ␣
 ↪max_features = 14, max_samples = 0.5,  n_estimators = 200)
b2_reg.fit(X_train, y_train)
b2_reg_predict = b2_reg.predict(X_val)
print(b2_reg_predict)
b2_reg_score = r2_score(y_val,b2_reg_predict)
print("R2_Score (BaggingRegressor_GridSearchCV):",b2_reg_score)
```

```
[32.25645333 23.41767869 96.9075985  … 13.89428657 20.41377645
 31.2600289 ]
R2_Score (BaggingRegressor_GridSearchCV): 0.9240647115132927
```

- **Plotting Actual vs Predicted**

[134]:

```
act_vs_predict(y_val,b2_reg_predict)
```



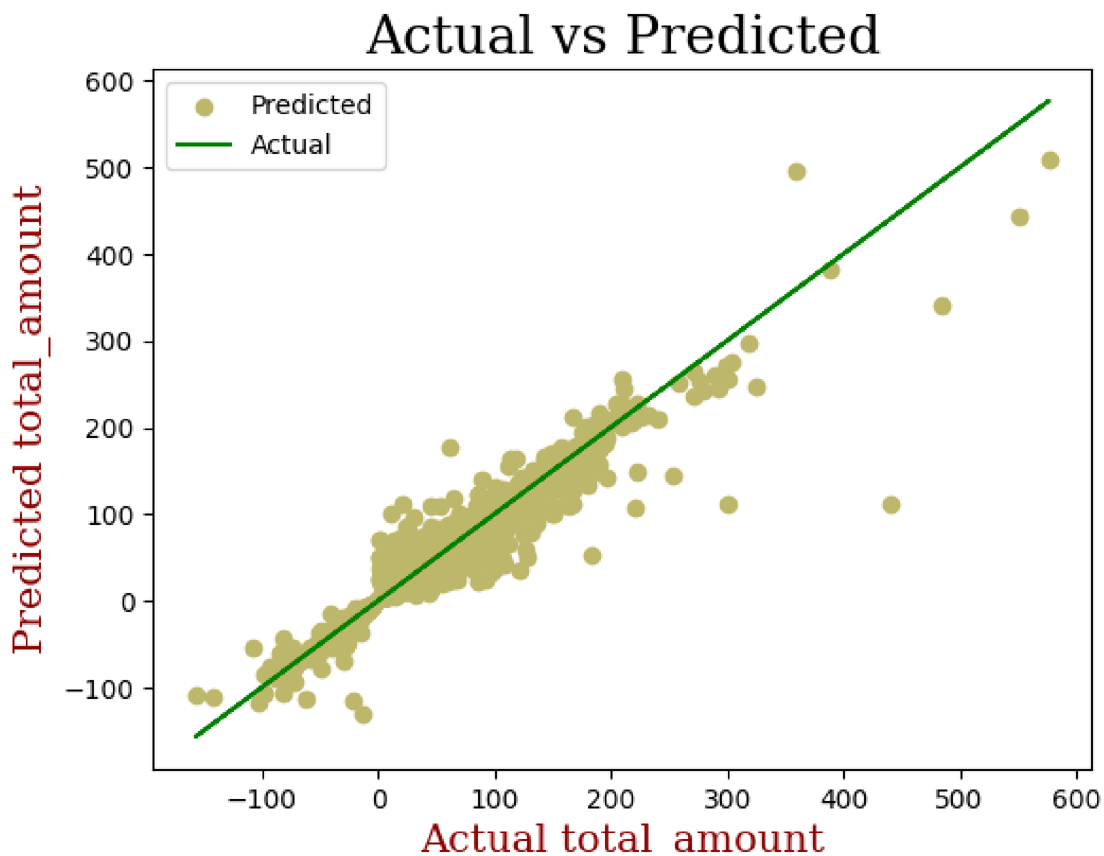
12.3.2 RandomForestRegressor()

[135]:
```
rf_reg = RandomForestRegressor()
rf_reg.fit(X_train, y_train)
rf_reg_predict = rf_reg.predict(X_val)
print(rf_reg_predict)
rf_score = r2_score(y_val,rf_reg_predict)
print("R2_Score (RandomForestRegressor) :",rf_score)
```

```
[38.7645 24.0149 98.5336 … 11.368  18.7129 34.1035]
R2_Score (RandomForestRegressor) : 0.9558003724642914
```

- **Plotting Actual vs Predicted**

[136]:
```
act_vs_predict(y_val,rf_reg_predict)
```



Tunning Hyperparameters & Training as well as evaluating on the same.

[137]:
```
'''
tuned_parameters = [{"n_estimators": [10,20,30,100],
             "max_features" : ["sqrt", "log2"],
             "min_samples_split" : [2,4,8,12,14],
             "bootstrap": [True, False]}
]

RF_model_GS = GridSearchCV(RandomForestRegressor(), param_grid=tuned_parameters)
RF_model_GS.fit(X_train,y_train)

print ("The best parameter value is:",RF_model_GS.best_params_)
'''
```

[137]:
```
'\ntuned_parameters = [{"n_estimators": [10,20,30,100],\n
"max_features" : ["sqrt", "log2"],\n             "min_samples_split" :
[2,4,8,12,14],\n             "bootstrap": [True, False]}\n]\n\nRF_model_GS =
GridSearchCV(RandomForestRegressor(),
param_grid=tuned_parameters)\nRF_model_GS.fit(X_train,y_train)\n\nprint ("The
```

best parameter value is:",RF_model_GS.best_params_)\n'

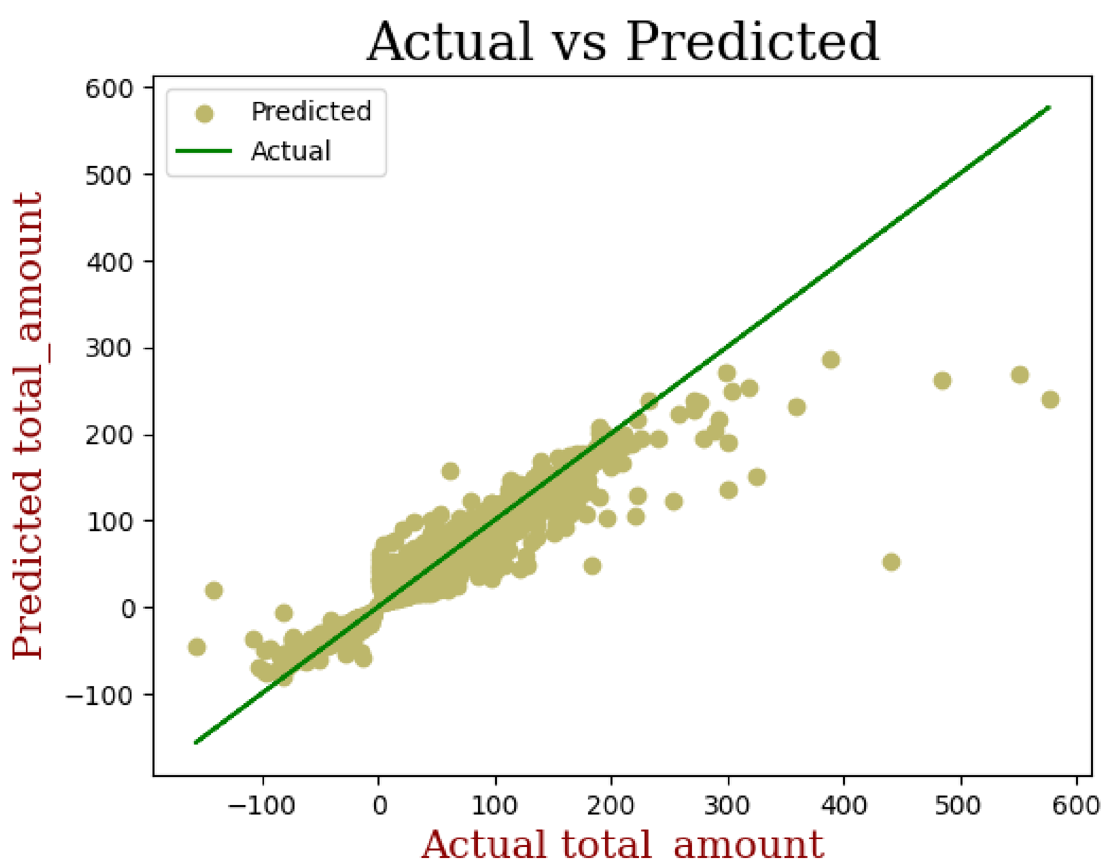
- **Result**
  - The best parameter value is: {'bootstrap': False, 'max_features': 'log2', 'min_samples_split': 12, 'n_estimators': 100}

[138]:
```
rf_reg_gs = RandomForestRegressor(bootstrap= False,  max_features = "log2",␣
 ↪min_samples_split = 12, n_estimators = 100)
rf_reg_gs.fit(X_train, y_train)
rf_reg_gs_predict = rf_reg_gs.predict(X_val)
print(rf_reg_gs_predict)
rf_gs_score = r2_score(y_val,rf_reg_gs_predict)
print("R2_Score (RandomForestRegressor_GridSearchCV) :",rf_gs_score)
```

```
[35.85258519 25.19617547 98.40027754 … 11.99899801 19.54522356
 33.56592826]
R2_Score (RandomForestRegressor_GridSearchCV) : 0.9399512008533738
```

- **Plotting Actual vs Predicted**

[139]:
```
act_vs_predict(y_val,rf_reg_gs_predict)
```



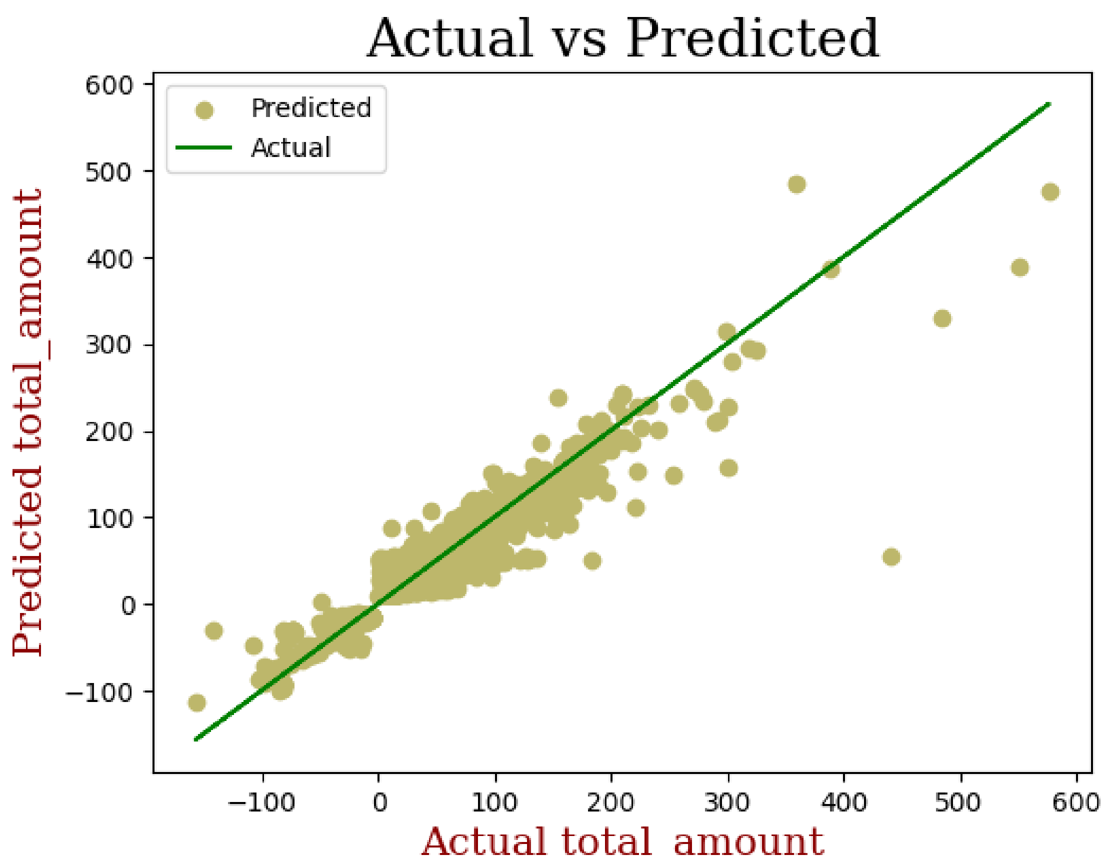
12.3.3 GradientBoostingRegressor()

[140]:
```
gbr_reg = GradientBoostingRegressor()
gbr_reg.fit(X_train, y_train)
gbr_reg_predict = gbr_reg.predict(X_val)
print(gbr_reg_predict)
gbr_score = r2_score(y_val,gbr_reg_predict)
print("R2_Score (GradientBoostingRegressor) :",gbr_score)
```

```
[34.58479065 25.34970183 99.8001712  … 12.13507249 19.51708466
 32.66469827]
R2_Score (GradientBoostingRegressor) : 0.9450252139819497
```

- **Plotting Actual vs Predicted**

[141]:
```
act_vs_predict(y_val,gbr_reg_predict)
```



Tunning Hyperparameters & Training as well as evaluating on the same.

[142]:
```
'''
tuned_parameters = [{'max_depth': [80, 100],
    'max_features': [2, 3],
    'min_samples_leaf': [3, 4],
    'min_samples_split': [8, 10],
    'n_estimators': [100, 200, 500]}
]

gb_model_gs = GridSearchCV(GradientBoostingRegressor(), param_grid =␣
 ↪tuned_parameters)
gb_model_gs.fit(X_train,y_train)

print ("The best parameter value is:",gb_model_gs.best_params_)
'''
```

[142]:
```
'\ntuned_parameters = [{\'max_depth\': [80, 100],\n    \'max_features\': [2,
3],\n    \'min_samples_leaf\': [3, 4],\n    \'min_samples_split\': [8, 10],\n
\'n_estimators\': [100, 200, 500]}\n]\n\ngb_model_gs =
GridSearchCV(GradientBoostingRegressor(), param_grid =
tuned_parameters)\ngb_model_gs.fit(X_train,y_train)\n\nprint ("The best
parameter value is:",gb_model_gs.best_params_)\n'
```

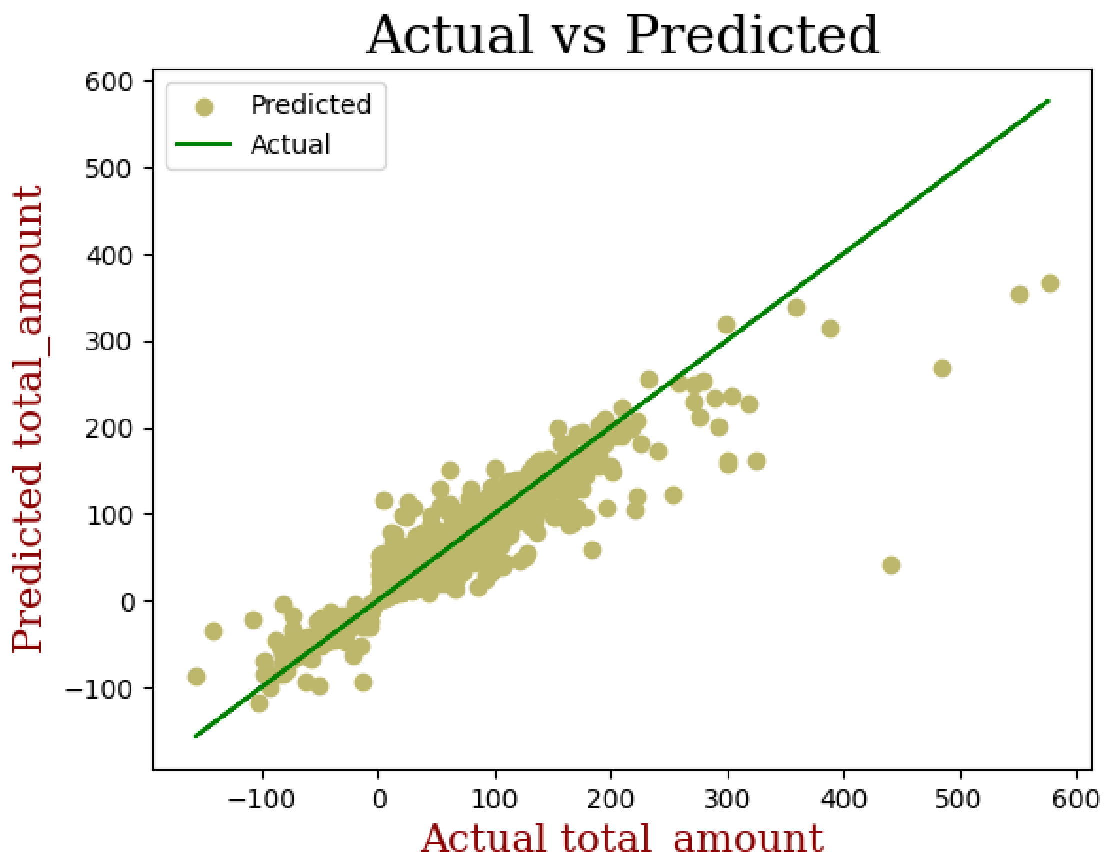
- **Result**
  - `The best parameter value is: {'max_depth': 80, 'max_features': 3, 'min_samples_leaf': 3, 'min_samples_split': 8, 'n_estimators': 500}`

[143]:
```
gbr_gs_reg = GradientBoostingRegressor(max_depth=80, max_features=3,␣
 ↪min_samples_leaf=3,
                                       min_samples_split=8, n_estimators=500)
gbr_gs_reg.fit(X_train, y_train)
gbr_gs_reg_predict = gbr_gs_reg.predict(X_val)
print(gbr_gs_reg_predict)
gbr_gs_score = r2_score(y_val,gbr_gs_reg_predict)
print("R2_Score (GradientBoostingRegressor) :",gbr_gs_score)
```

```
[35.56314981 23.93400861 98.7719081  … 12.18134527 19.84103645
 34.5502852 ]
R2_Score (GradientBoostingRegressor) : 0.9414157182291742
```

- **Plotting Actual vs Predicted**

[144]:
```
act_vs_predict(y_val,gbr_gs_reg_predict)
```



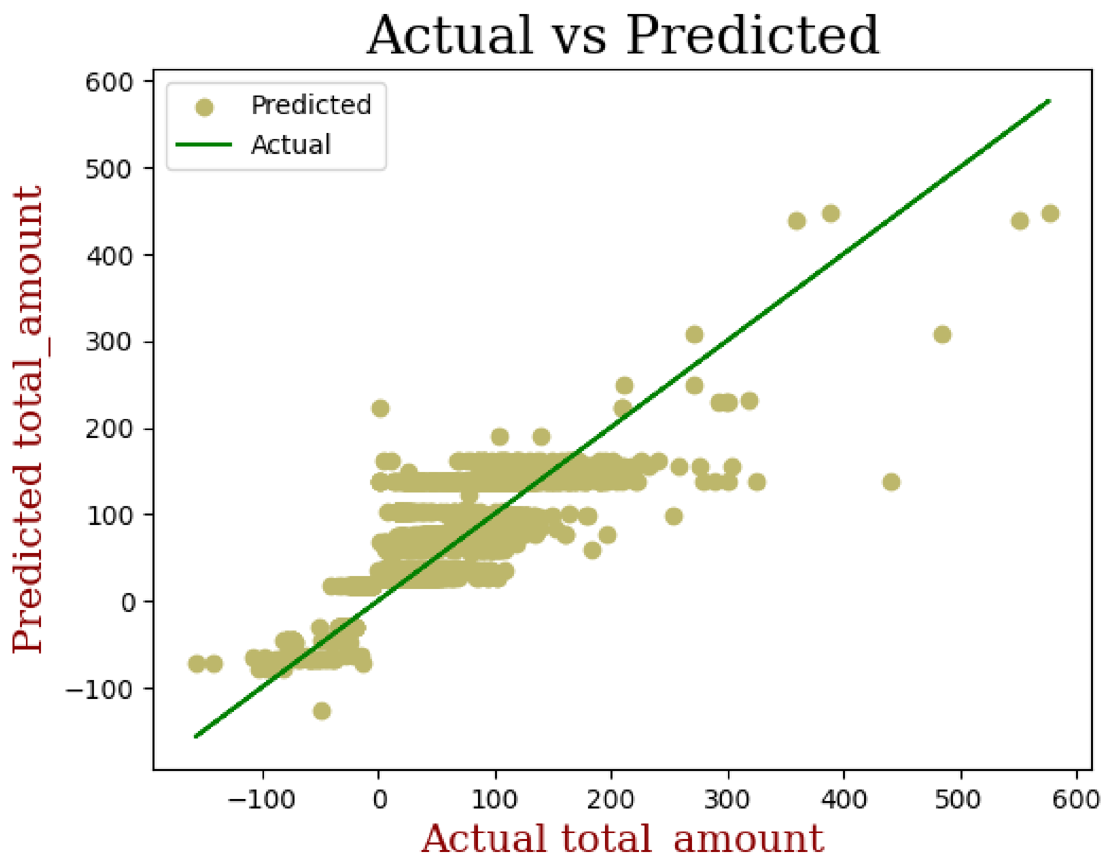
12.3.4 AdaBoostRegressor()

[145]:
```
abr_reg = AdaBoostRegressor()
abr_reg.fit(X_train, y_train)
abr_reg_predict = abr_reg.predict(X_val)
print(abr_reg_predict)
abr_score = r2_score(y_val,abr_reg_predict)
print("R2_Score (AdaBoostRegressor) :",abr_score)
```

```
[33.01612259 27.81546549 95.34801327 … 25.72434292 25.72434292
 33.01612259]
R2_Score (AdaBoostRegressor) : 0.7029315901227482
```

- **Plotting Actual vs Predicted**

[146]:
```
act_vs_predict(y_val,abr_reg_predict)
```



Tunning Hyperparameters & Training as well as evaluating on the same.

[147]:
```
'''
tuned_parameters = [{'n_estimators': [50, 100],
 'learning_rate' : [0.01, 0.05, 0.1, 0.5],
 'loss' : ['linear', 'square', 'exponential']}
]

ab_model_gs = GridSearchCV(AdaBoostRegressor(), param_grid=tuned_parameters)
ab_model_gs.fit(X_train,y_train)

print ("The best parameter value is:",ab_model_gs.best_params_)
'''
```

[147]:
```
'\ntuned_parameters = [{\'n_estimators\': [50, 100],\n \'learning_rate\' :
[0.01, 0.05, 0.1, 0.5],\n \'loss\' : [\'linear\', \'square\',
\'exponential\']}\n]\n\nab_model_gs = GridSearchCV(AdaBoostRegressor(),
param_grid=tuned_parameters)\nab_model_gs.fit(X_train,y_train)\n\nprint ("The
best parameter value is:",ab_model_gs.best_params_)\n'
```

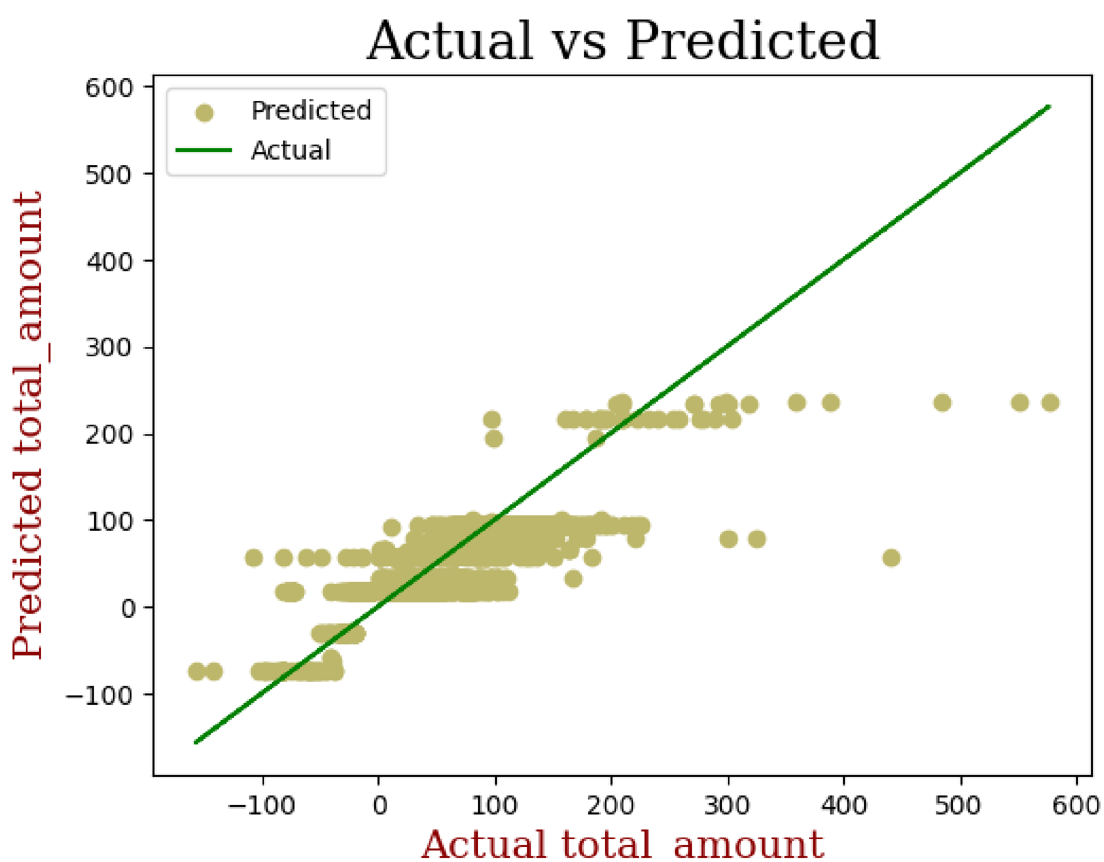
- **Result**
  - The best parameter value is: {'learning_rate': 0.01, 'loss': 'exponential', 'n_estimators': 50}

[148]:
```
abr_gs_reg = AdaBoostRegressor(learning_rate=0.01, loss='exponential',␣
 ↪n_estimators=50)
abr_gs_reg.fit(X_train, y_train)
abr_gs_reg_predict = abr_gs_reg.predict(X_val)
print(abr_gs_reg_predict)
abr_gs_score = r2_score(y_val,abr_gs_reg_predict)
print("R2_Score (AdaBoostRegressor) :",abr_gs_score)
```

```
[33.21667992 32.94129353 94.66289302 … 18.15600922 18.15600922
 32.94129353]
R2_Score (AdaBoostRegressor) : 0.8126664426526186
```

- **Plotting Actual vs Predicted**

[149]:
```
act_vs_predict(y_val,abr_gs_reg_predict)
```



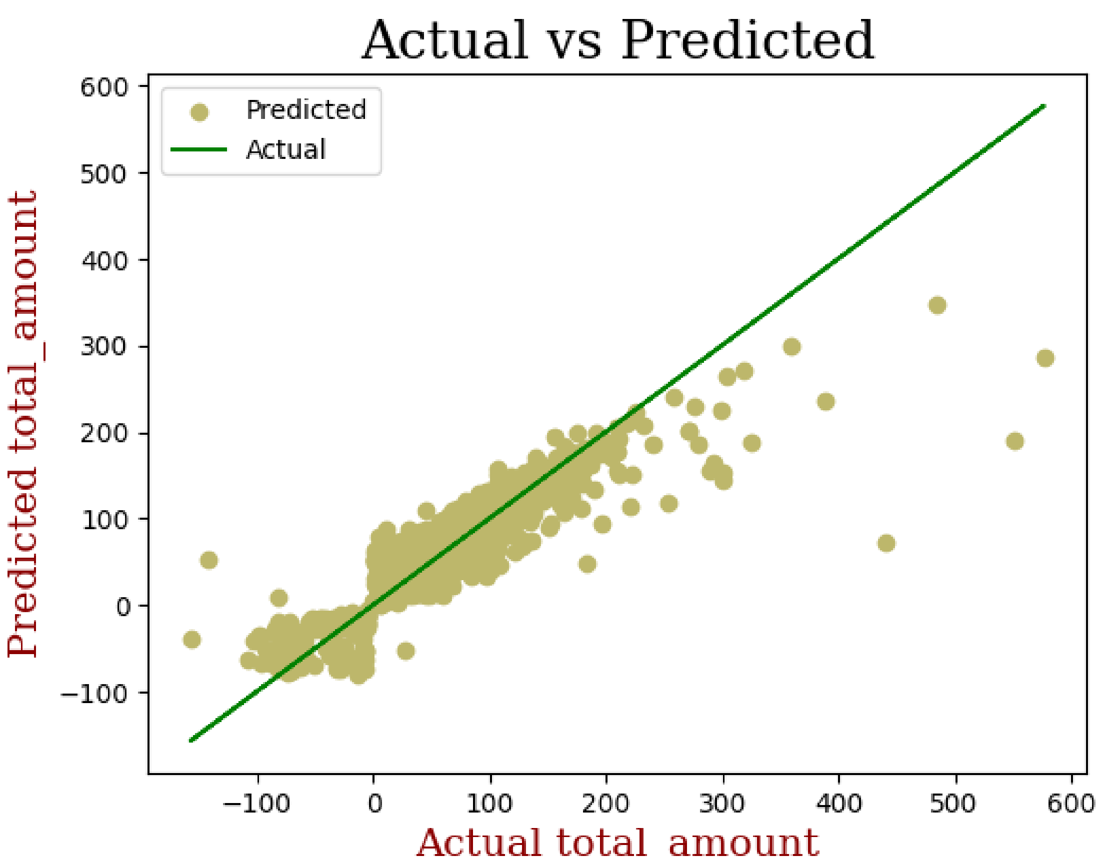
12.4 MLP (Multi-Layer Perceptron) Regressor

[150]:
```
mlp_reg = MLPRegressor()
mlp_reg.fit(X_train, y_train)
mlp_reg_predict = mlp_reg.predict(X_val)
print(mlp_reg_predict)
mlp_score = r2_score(y_val,mlp_reg_predict)
print("R2_Score (MLPRegressor) :",mlp_score)
```

```
[36.73100112 25.93075791 96.41489588 … 13.08092546 20.53488195
 34.84404628]
R2_Score (MLPRegressor) : 0.9238723323787169
```

- **Plotting Actual vs Predicted**

[151]:
```
act_vs_predict(y_val,mlp_reg_predict)
```



13 Comparison of R2 Scores (In case of different ML Models)

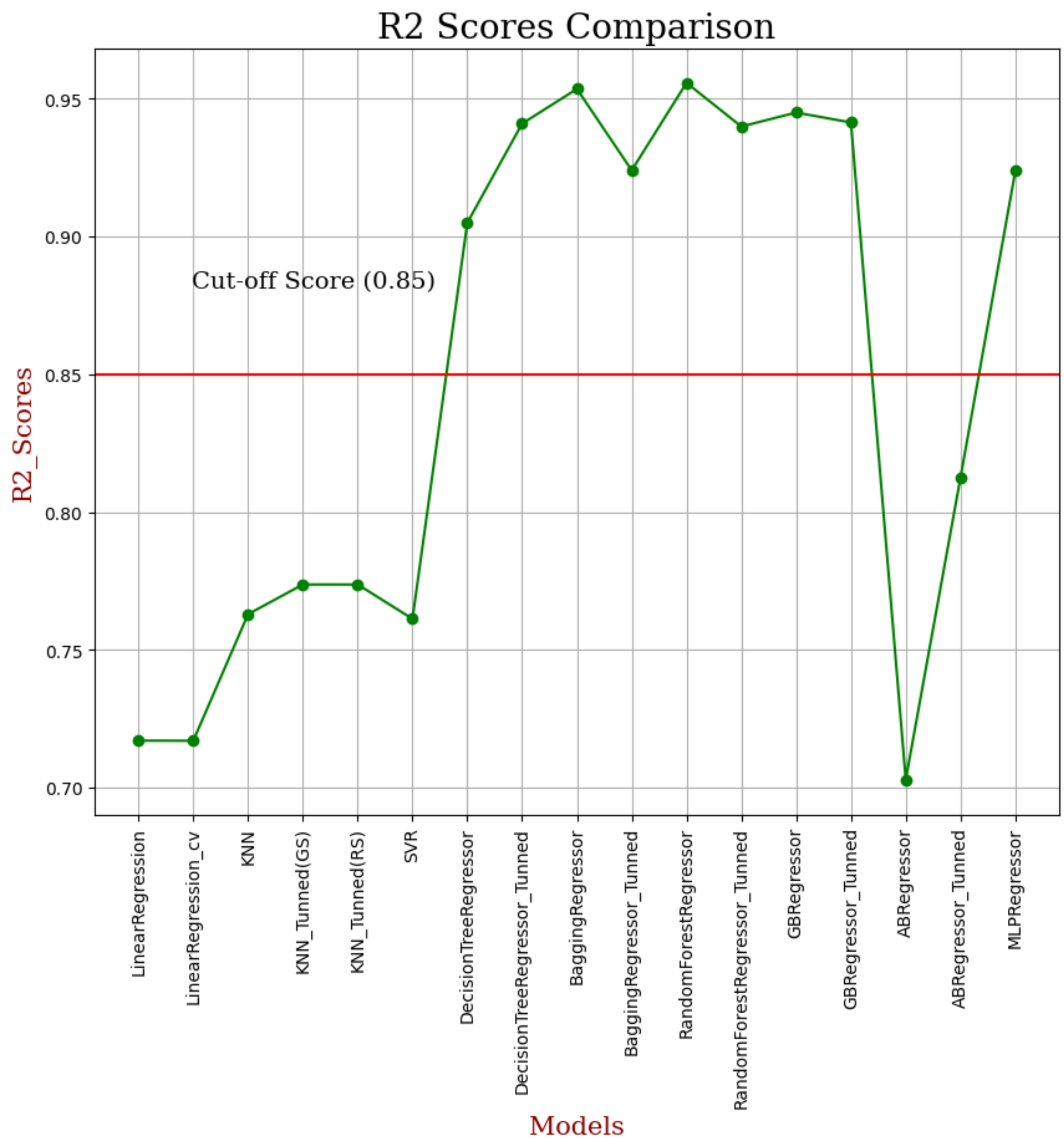
[152]:

```
#Array having Name of Models
models = np.array(["LinearRegression", "LinearRegression_cv", "KNN",␣
↪"KNN_Tunned(GS)", "KNN_Tunned(RS)",
                   "SVR",␣
↪"DecisionTreeRegressor","DecisionTreeRegressor_Tunned", "BaggingRegressor",
                   "BaggingRegressor_Tunned", "RandomForestRegressor",␣
↪"RandomForestRegressor_Tunned",
                  ␣
↪"GBRegressor","GBRegressor_Tunned","ABRegressor","ABRegressor_Tunned",␣
↪"MLPRegressor"])

# Array having all R2 Scores
r2_scores = np.array([lr_score, lr_cv_score, knn_score, knn_gs_score,␣
↪knn_rs_score, svr_score, dt_score,
                      dt_gs_score, b1_reg_score, b2_reg_score, rf_score,␣
↪rf_gs_score,gbr_score,gbr_gs_score,
                     abr_score,abr_gs_score,mlp_score])

# Plotting
plt.figure( figsize = (10,8) )
ax=plt.subplot(111)
plt.plot(models, r2_scores, 'o-g')
plt.axhline(y = 0.85, color = 'r', linestyle = '-')
ax.text(0.1, 0.68, "Cut-off Score (0.85)",
        verticalalignment='bottom', horizontalalignment='left',
        transform=ax.transAxes,
        color='black', fontsize=14,family='serif')
font1 = {'family':'serif','color':'black','size':20}
font2 = {'family':'serif','color':'darkred','size':15}
plt.title("R2 Scores Comparison", fontdict=font1)
plt.xlabel("Models", fontdict=font2)
plt.ylabel("R2_Scores", fontdict=font2)
plt.grid()
plt.xticks(rotation = 90)

# Showing plot
plt.show()
```



13.0.1 Observations

- Models `LinearRegression`, `LinearRegression_cv`, `KNN`, `KNN_Tunned(GS)`, `KNN_Tunned(RS)`, `SVR`, `ABRegressor`, `ABregressor_Tunned` **are not passing the cut-off score** after training on train data and validation on validation data.
- Models `DecisionTreeRegressor`, `DecisionTreeRegressor_Tunned`, `BaggingRegressor`, `BaggingRegressor_Tunned`, `RandomForestRegressor`, `RandomForestRegressor_Tunned`, `GBRegressor`, `GBRegressor_Tunned`, `MLPRegressor` **are passing the cut-off score** after training on train data and validation on validation data.
- `RandomForestRegressor` having default hyperparameters is giving the highest *R2 Score*.

- `AdaBoostRegressor` having default hyperparameters is giving the lowest *R2 Score*.

14 Applying same data preprocessing on `test.csv`

14.0.1 1. Overview

[153]:
```
#shape
test_data.shape
```

[153]:
```
(50000, 16)
```

[154]:
```
#info
test_data.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 50000 entries, 0 to 49999
Data columns (total 16 columns):
 #   Column                 Non-Null Count  Dtype
---  ------                 --------------  -----
 0   VendorID               50000 non-null  int64
 1   tpep_pickup_datetime   50000 non-null  object
 2   tpep_dropoff_datetime  50000 non-null  object
 3   passenger_count        48221 non-null  float64
 4   trip_distance          50000 non-null  float64
 5   RatecodeID             48221 non-null  float64
 6   store_and_fwd_flag     48221 non-null  object
 7   PULocationID           50000 non-null  int64
 8   DOLocationID           50000 non-null  int64
 9   payment_type           50000 non-null  object
 10  extra                  50000 non-null  float64
 11  tip_amount             50000 non-null  float64
 12  tolls_amount           50000 non-null  float64
 13  improvement_surcharge  50000 non-null  float64
 14  congestion_surcharge   48221 non-null  float64
 15  Airport_fee            48221 non-null  float64
dtypes: float64(9), int64(3), object(4)
memory usage: 6.1+ MB
```

[155]:
```
# Numerical attribute statistics
test_data.describe()
```

[155]:
```
           VendorID  passenger_count  trip_distance    RatecodeID  \
count  50000.000000     48221.000000   50000.000000  48221.000000
mean       0.730280         1.358309       3.999013      1.567014
std        0.444584         0.879948      78.958759      6.875115
min        0.000000         0.000000       0.000000      1.000000
25%        0.000000         1.000000       1.090000      1.000000
```

```
50%         1.000000          1.000000        1.850000        1.000000
75%         1.000000          1.000000        3.600000        1.000000
max         2.000000          8.000000    17624.430000       99.000000

       PULocationID  DOLocationID         extra    tip_amount  tolls_amount  \
count  50000.000000  50000.000000  50000.000000  50000.000000  50000.000000
mean     132.208160    132.559300      1.918050      6.107765      0.615867
std       76.483766     76.410602      1.938568      4.408572      2.289421
min        1.000000      1.000000     -7.500000      0.000409    -23.000000
25%       66.000000     67.000000      0.000000      3.464018      0.000000
50%      132.000000    133.000000      1.000000      5.271687      0.000000
75%      199.000000    199.000000      2.500000      7.504048      0.000000
max      264.000000    264.000000     11.750000     96.551343     47.750000

       improvement_surcharge  congestion_surcharge   Airport_fee
count           50000.000000          48221.000000  48221.000000
mean                0.981354              2.255345      0.152133
std                 0.190203              0.803190      0.502866
min                -1.000000             -2.500000     -1.750000
25%                 1.000000              2.500000      0.000000
50%                 1.000000              2.500000      0.000000
75%                 1.000000              2.500000      0.000000
max                 1.000000              2.500000      1.750000
```

[156]:
```
# Categorical attribute statistics
test_data.describe(include='object')
```

[156]:
```
       tpep_pickup_datetime tpep_dropoff_datetime store_and_fwd_flag  \
count                 50000                 50000              48221
unique                43216                 43205                  2
top     2023-06-29 20:59:17   2023-06-29 22:46:33                  N
freq                      6                     5              47881

       payment_type
count         50000
unique            5
top     Credit Card
freq          38672
```

Observation

- There are 50000 rows (Observations) and 16 columns (variables).
- There are 9 columns having type `float64`, 3 columns having type `int64` and 4 columns having type `object`.
- Statistics for numerical attributes can be seen above.
- `store_and_fwd_flag` has two unique values. (most_frequent = 'N') i.e 'N' (No) & 'Y' (Yes)
- `payment_type` has 5 unique values. (most_frequent = 'Credit Card')

14.0.2 2. Columns/Attributes

1. VendorID

[157]:
```
print("Unique values :", pd.unique(test_data['VendorID']))
print("No. of distinct values :", len(pd.unique(test_data['VendorID'])))
print("No. of missing values :",test_data['VendorID'].isnull().sum(),␣
↪"[","Percentage(%) :", (test_data['VendorID'].isnull().sum())*(100/
↪50000),"]")
```

```
Unique values : [1 0 2]
No. of distinct values : 3
No. of missing values : 0 [ Percentage(%) : 0.0 ]
```

Observations

- There are 3 distinct values.
- It doesn't contain any null value.
- Most frequent `VendorID` value is 1.

2. tpep_pickup_datetime

[158]:
```
test_data['tpep_pickup_datetime'] = pd.
↪to_datetime(test_data['tpep_pickup_datetime'])
```

[159]:
```
print("Maximum Value :",test_data['tpep_pickup_datetime'].max())
print("Minimum Value :",test_data['tpep_pickup_datetime'].min())
print("No. of missing values :",test_data['tpep_pickup_datetime'].isnull().
↪sum(), "[","Percentage(%) :", (test_data['tpep_pickup_datetime'].isnull().
↪sum())*(100/50000),"]")
```

```
Maximum Value : 2023-07-01 00:55:16
Minimum Value : 2023-06-28 15:31:06
No. of missing values : 0 [ Percentage(%) : 0.0 ]
```

Observations

- There are no missing values.
- `Maximum Value : 2023-07-01 00:55:16`
- `Minimum Value : 2023-06-28 15:31:06`

3. tpep_dropoff_datetime

[160]:
```
test_data['tpep_dropoff_datetime'] = pd.
↪to_datetime(test_data['tpep_dropoff_datetime'])
```

[161]:
```
print("Maximum Value :",test_data['tpep_dropoff_datetime'].max())
print("Minimum Value :",test_data['tpep_dropoff_datetime'].min())
print("No. of missing values :",test_data['tpep_dropoff_datetime'].isnull().
↪sum(), "[","Percentage(%) :", (test_data['tpep_dropoff_datetime'].isnull().
↪sum())*(100/50000),"]")
```

```
Maximum Value : 2023-07-03 16:31:27
Minimum Value : 2023-06-28 15:41:05
No. of missing values : 0 [ Percentage(%) : 0.0 ]
```

Observations

- There are no missing values.
- `Maximum Value : 2023-07-03 16:31:27`
- `Minimum Value : 2023-06-28 15:41:05`

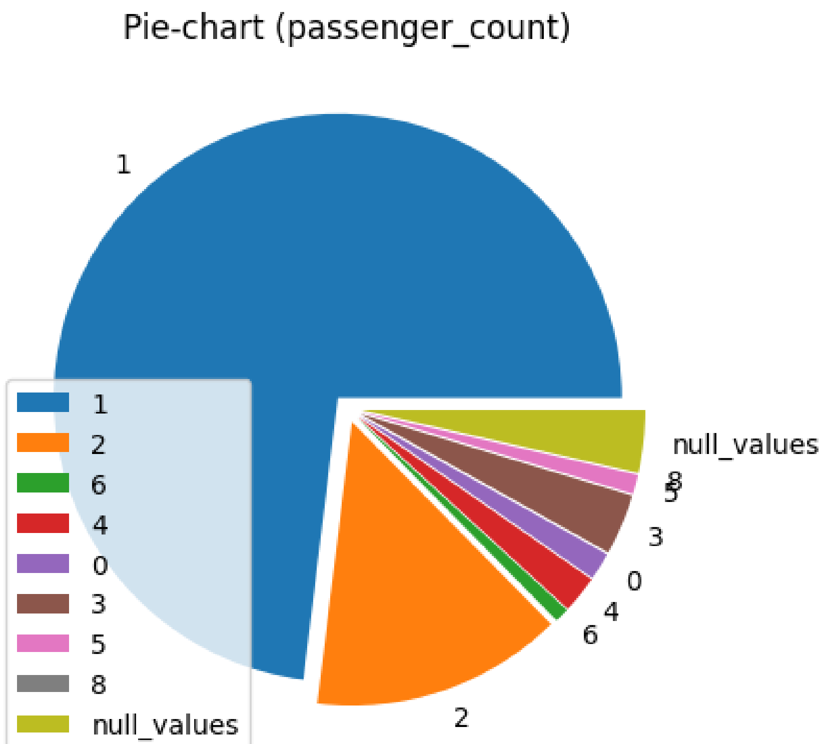
4. passenger_count

[162]:
```python
print("Unique values :", pd.unique(test_data['passenger_count']))
print("Values count :", test_data['passenger_count'].value_counts())
print("No. of distinct values :", len(pd.unique(test_data['passenger_count'])))
print("No. of missing values :",test_data['passenger_count'].isnull().sum(),␣
 ↪"[","Percentage(%) :", (test_data['passenger_count'].isnull().sum())*(100/
 ↪50000),"]")
print("No. of 0 values :
 ↪",len(test_data[test_data['passenger_count']==0]),"[","Percentage(%) :",␣
 ↪len(test_data[test_data['passenger_count']==0])*(100/50000),"]")
print("No. of -ve values :
 ↪",len(test_data[test_data['passenger_count']<0]),"[","Percentage(%) :",␣
 ↪len(test_data[test_data['passenger_count']<0])*(100/50000),"]")
print("Maximum Value :",test_data['passenger_count'].max())
print("Minimum Value :",test_data['passenger_count'].min())
```

```
Unique values : [ 1.  2. nan  6.  4.  0.  3.  5.  8.]
Values count : passenger_count
1.0    36532
2.0     7155
3.0     1731
4.0     1062
0.0      781
5.0      546
6.0      413
8.0        1
Name: count, dtype: int64
No. of distinct values : 9
No. of missing values : 1779 [ Percentage(%) : 3.5580000000000003 ]
No. of 0 values : 781 [ Percentage(%) : 1.562 ]
No. of -ve values : 0 [ Percentage(%) : 0.0 ]
Maximum Value : 8.0
Minimum Value : 0.0
```

[163]:
```python
Unique_values = [ 1,  2,  6,  4, 0,  3,  5,  8]
value_count = []
for i in Unique_values:
```

```
    value_count.append(test_data['passenger_count'].value_counts()[i])
Unique_values.append('null_values')
value_count.append(test_data['passenger_count'].isnull().sum())
#print(value_count)
plt.pie(value_count,labels=Unique_values,explode=[0.05,0.05,0.05,0.05,0.05,0.
 ↪05,0.05,0.05,0.05])
plt.title('Pie-chart (passenger_count)')
plt.legend(Unique_values)
plt.show()
```



Observations

- `passenger_count` contains 1779 missing values which is approx 3.6% of total number of values.
- `passenger_count` contains 781 zero values which is approx 1.6% of total number of values.
- There are no negative values.
- There are 9 distinct values (including null values).
- Most Frequent value is 1.
- `Maximum Value : 8.0`
- `Minimum Value : 0.0`

5. trip_distance

[164]:
```
print("Unique values :", pd.unique(test_data['trip_distance']))
print("No. of missing values :",test_data['trip_distance'].isnull().sum(),␣
 ↪"[","Percentage(%) :", (test_data['trip_distance'].isnull().sum())*(100/
 ↪50000),"]")
print("No. of 0 values :
 ↪",len(test_data[test_data['trip_distance']==0]),"[","Percentage(%) :",␣
 ↪len(test_data[test_data['trip_distance']==0])*(100/50000),"]")
print("No. of -ve values :
 ↪",len(test_data[test_data['trip_distance']<0]),"[","Percentage(%) :",␣
 ↪len(test_data[test_data['trip_distance']<0])*(100/50000),"]")
print("Maximum Value :",test_data['trip_distance'].max())
print("Minimum Value :",test_data['trip_distance'].min())
print("Value Counts (> 200) :",len(test_data[test_data['trip_distance']>200]))
```

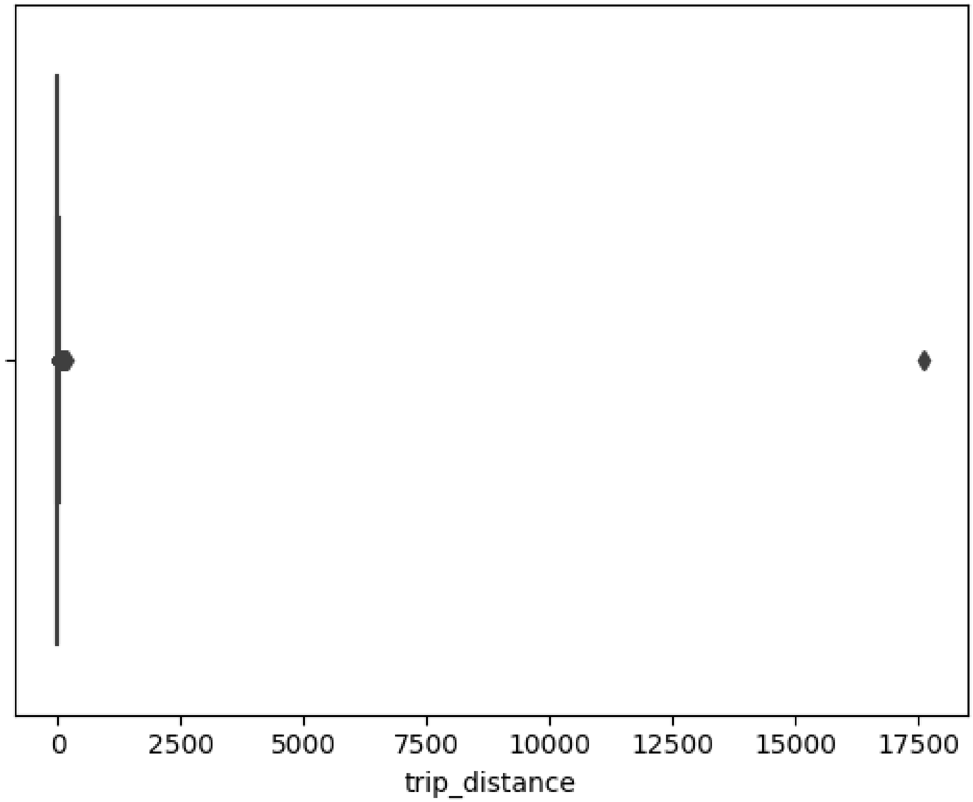
```
Unique values : [ 4.95  2.1   0.95 … 20.9  30.7  29.09]
No. of missing values : 0 [ Percentage(%) : 0.0 ]
No. of 0 values : 742 [ Percentage(%) : 1.484 ]
No. of -ve values : 0 [ Percentage(%) : 0.0 ]
Maximum Value : 17624.43
Minimum Value : 0.0
Value Counts (> 200) : 1
```

Observations

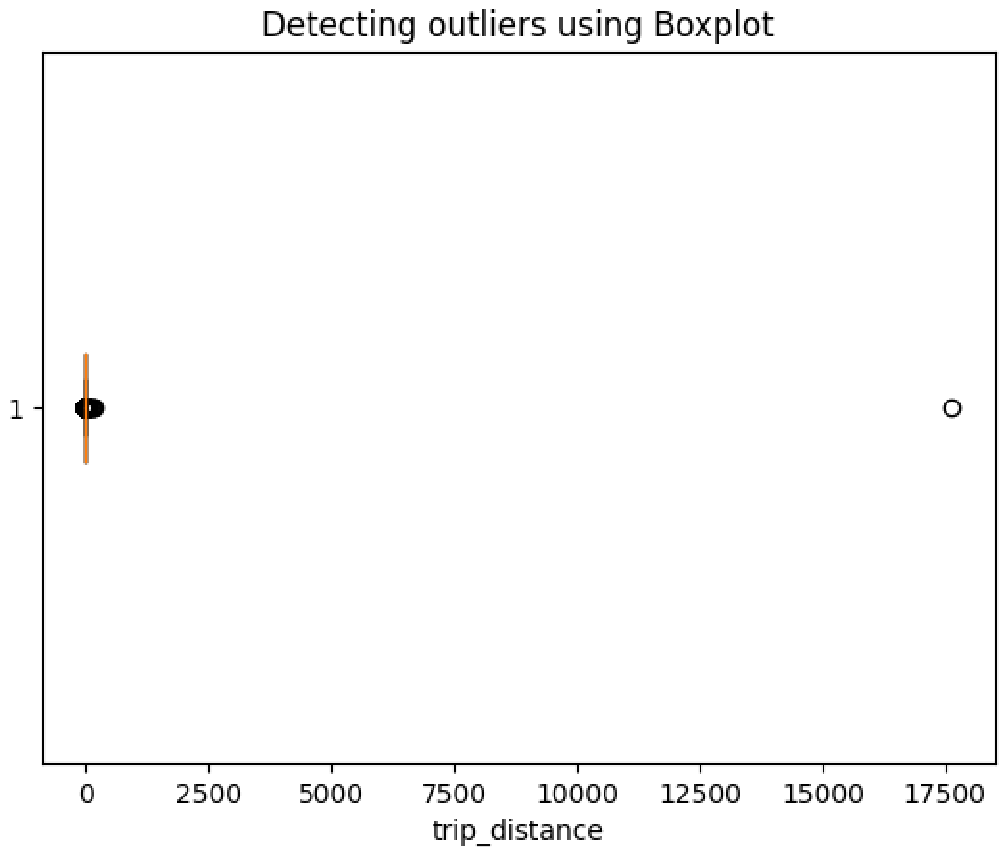
- There are no missing values.
- `trip_distance` contains 742 zero values which is approx 1.5% of total number of values.
- There are no negative values.
- `Maximum Value : 17624.43`
- `Minimum Value : 0.0`

[165]:
```
sns.boxplot(x='trip_distance', data=test_data)
#plt.boxplot(train_data['trip_distance'],vert=0,patch_artist = True)
#plt.xlabel("trip_distance")
#plt.title('Box_plot (trip_distance)')
#plt.show()
```

[165]: <Axes: xlabel='trip_distance'>



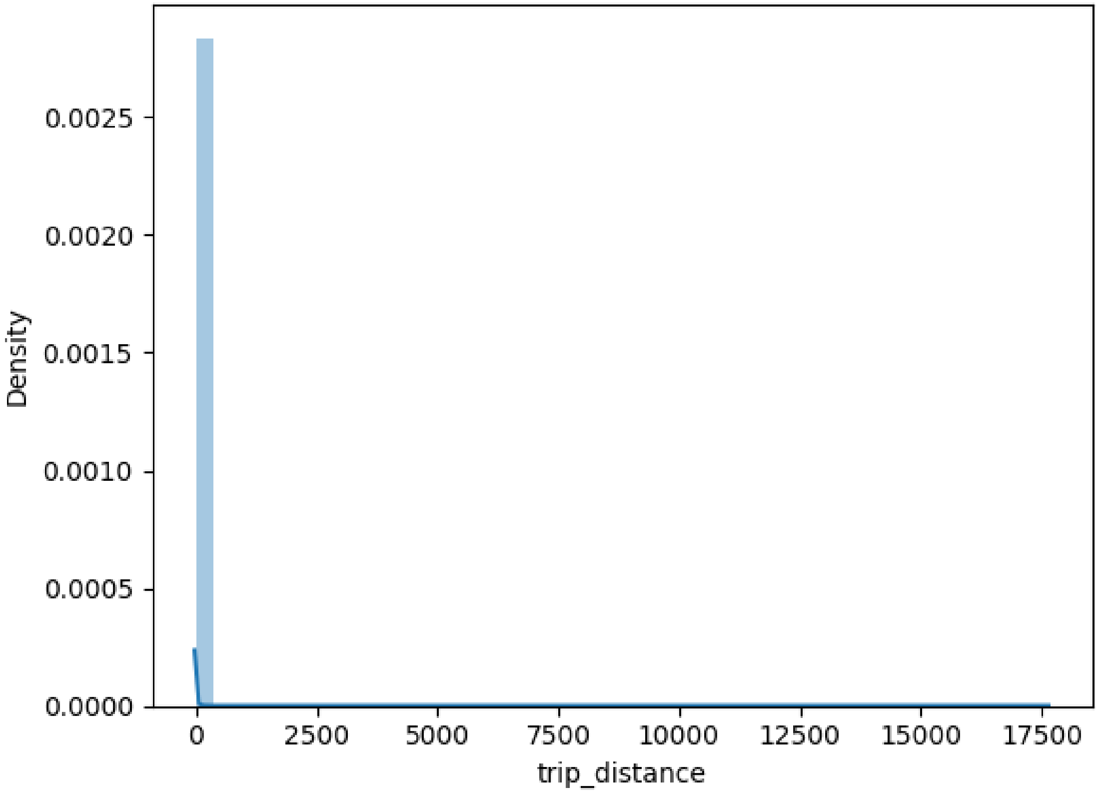
[166]:
```
plt.boxplot(test_data['trip_distance'], vert=False)
plt.title("Detecting outliers using Boxplot")
plt.xlabel('trip_distance')
plt.show()
```



[167]:
```
sns.distplot(test_data['trip_distance'])
```

```
/tmp/ipykernel_20/2474477597.py:1: 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(test_data['trip_distance'])
```

[167]: <Axes: xlabel='trip_distance', ylabel='Density'>



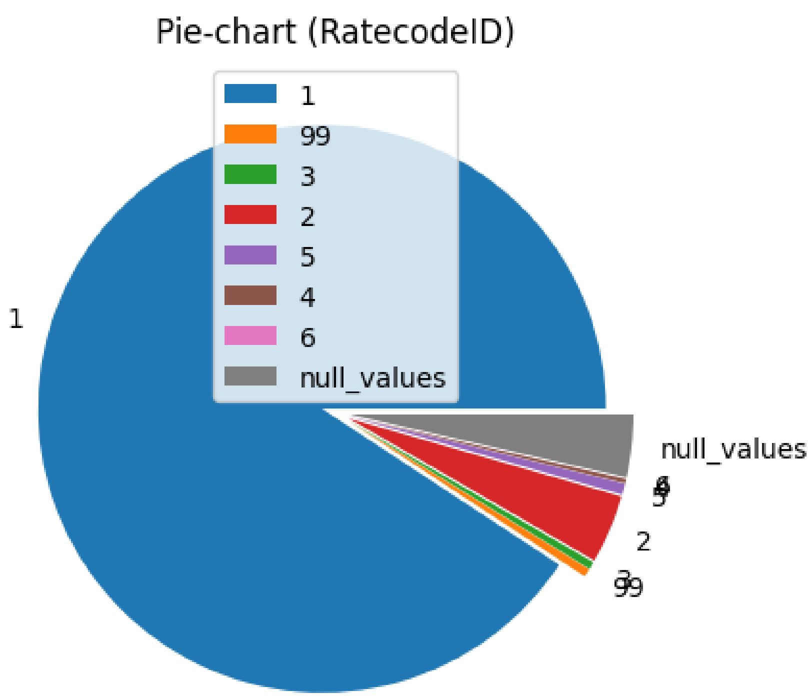
6. RatecodeID

[168]:
```
print("Unique values :", pd.unique(test_data['RatecodeID']))
print("No. of distinct values :", len(pd.unique(test_data['RatecodeID'])))
print("No. of missing values :",test_data['RatecodeID'].isnull().sum(),␣
↪"[","Percentage(%) :", (test_data['RatecodeID'].isnull().sum())*(100/
↪50000),"]")
print("No. of 0 values :
↪",len(test_data[test_data['RatecodeID']==0]),"[","Percentage(%) :",␣
↪len(test_data[test_data['RatecodeID']==0])*(100/50000),"]")
print("No. of -ve values :
↪",len(test_data[test_data['RatecodeID']<0]),"[","Percentage(%) :",␣
↪len(test_data[test_data['RatecodeID']<0])*(100/50000),"]")
print("Maximum Value :",test_data['RatecodeID'].max())
print("Minimum Value :",test_data['RatecodeID'].min())
print("Value Counts (=99) :",len(test_data[test_data['RatecodeID']==99]))
```

```
Unique values : [ 1.  4.  5.  2. nan  3. 99.  6.]
No. of distinct values : 8
No. of missing values : 1779 [ Percentage(%) : 3.5580000000000003 ]
No. of 0 values : 0 [ Percentage(%) : 0.0 ]
No. of -ve values : 0 [ Percentage(%) : 0.0 ]
```

```
Maximum Value : 99.0
Minimum Value : 1.0
Value Counts (=99) : 238
```

[169]:
```
Unique_values = [1, 99,  3, 2, 5, 4, 6]
value_count = []
for i in Unique_values:
    value_count.append(test_data['RatecodeID'].value_counts()[i])
Unique_values.append('null_values')
value_count.append(test_data['RatecodeID'].isnull().sum())
#print(value_count)
plt.pie(value_count,labels=Unique_values,explode=[0.05,0.05,0.05,0.05,0.05,0.
 ↪05,0.05,0.05])
plt.title('Pie-chart (RatecodeID)')
plt.legend(Unique_values)
plt.show()
```



Observations

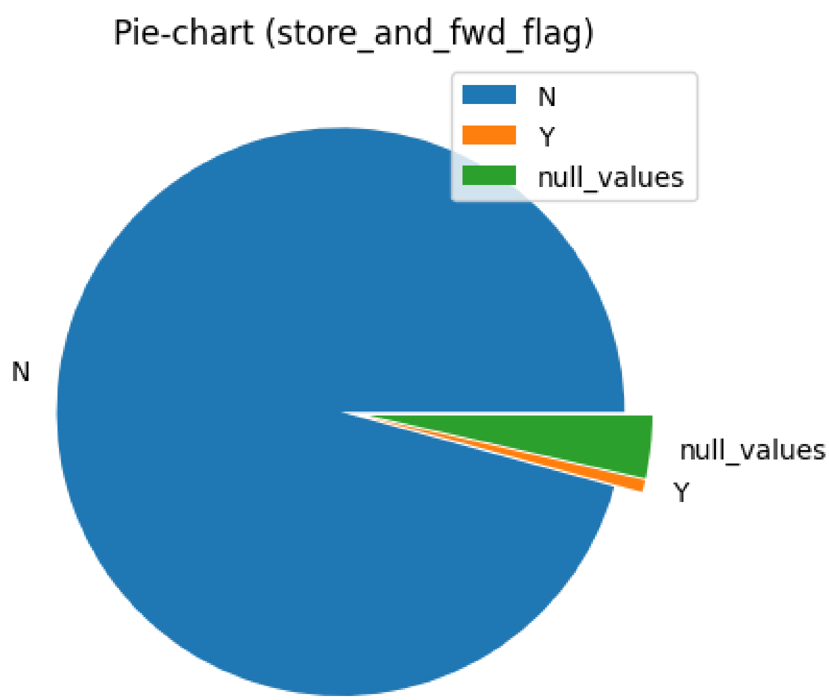
- `RatecodeID` contains 1779 missing values which is approx 3.6% of total number of values.
- There are no negative and zero values.
- There are 8 distinct values (including null values).
- Most Frequent value is 1.

7. store_and_fwd_flag

[170]:
```
print("Unique values :", pd.unique(test_data['store_and_fwd_flag']))
print("No. of distinct values :", len(pd.
↪unique(test_data['store_and_fwd_flag'])))
print("No. of missing values :",test_data['store_and_fwd_flag'].isnull().sum(),␣
↪"[","Percentage(%) :", (test_data['store_and_fwd_flag'].isnull().sum())*(100/
↪50000),"]")
```

```
Unique values : ['N' nan 'Y']
No. of distinct values : 3
No. of missing values : 1779 [ Percentage(%) : 3.5580000000000003 ]
```

[171]:
```
Unique_values = ['N','Y']
value_count = []
for i in Unique_values:
    value_count.append(test_data['store_and_fwd_flag'].value_counts()[i])
Unique_values.append('null_values')
value_count.append(test_data['store_and_fwd_flag'].isnull().sum())
#print(value_count)
plt.pie(value_count,labels=Unique_values,explode=[0.05,0.05,0.05])
plt.title('Pie-chart (store_and_fwd_flag)')
plt.legend(Unique_values)
plt.show()
```



Observations

- `store_and_fwd_flag` contains 1789 missing values which is approx 3.6% of total number of values.
- There are 3 distinct values (including null values).
- Most Frequent value is `'N'`.

8. PULocationID

[172]:
```
print("Unique values :", pd.unique(test_data['PULocationID']))
print("No. of missing values :",test_data['PULocationID'].isnull().sum(),␣
 ↪"[","Percentage(%) :", (test_data['PULocationID'].isnull().sum())*(100/
 ↪50000),"]")
print("No. of 0 values :
 ↪",len(test_data[test_data['PULocationID']==0]),"[","Percentage(%) :",␣
 ↪len(test_data[test_data['PULocationID']==0])*(100/50000),"]")
print("No. of -ve values :
 ↪",len(test_data[test_data['PULocationID']<0]),"[","Percentage(%) :",␣
 ↪len(test_data[test_data['PULocationID']<0])*(100/50000),"]")
print("Maximum Value :",test_data['PULocationID'].max())
print("Minimum Value :",test_data['PULocationID'].min())
```

```
Unique values : [ 20   9  92  19 131 194 163 146  45 254 170  81  31  17 171 224
220  11
 197 221 249 199 104  64  54 144  84 212  56 192 158   2 244 105 246 253
 156  16 125  27  24 258 123 106  77 102 241  12  98  91 160 263 256  49
 211 174 201  44  28 166  95 132  21  69 172 200 130  99  23  52 190  22
 196 195 115 150 162 181  74 202  83 136 234 121  47 103  38 245 185 193
 127 117 231 209 262 145  15 110   7 157 178 155 251  55 148  13 112 176
   1 137  33  43 159 153 239 179 250  59 205 124  94 134 238  88 173  75
 198 232  35 242  65 116  93 189 204  66 113 164  96 222 149 257   6 228
  78  61 259  48 139 207  76  85 138  25   8  29  79  63 161  32  68 180
 111  89 188  80 147 240 218  39 252   5 216 118  70 248 186 237  58  51
 167 210  57 203 243 227  34  60 214 225  40 235 129  30 177 233  82 219
 126 107 187 114 140 217 168 109  53   3 223 165 247  41   4 260  46 122
 182 135 141 183 100  71 143 264 169  37 151 215 206  42  14  26 128  87
  50  72 120 175  90  36 133 261 152  62 191 229 108 208 142 154  10 119
 213 255 236  97  73  18  67 101  86 230 184 226]
No. of missing values : 0 [ Percentage(%) : 0.0 ]
No. of 0 values : 0 [ Percentage(%) : 0.0 ]
No. of -ve values : 0 [ Percentage(%) : 0.0 ]
Maximum Value : 264
Minimum Value : 1
```

Observations

- `PULocationID` doesn't contain any missing, zero or -ve values.

- Maximum Value : 264
- Minimum Value : 1

9. DOLocationID

[173]:
```
print("Unique values :", pd.unique(test_data['DOLocationID']))
print("No. of missing values :",test_data['DOLocationID'].isnull().sum(),␣
↪"[","Percentage(%) :", (test_data['DOLocationID'].isnull().sum())*(100/
↪50000),"]")
print("No. of 0 values :
↪",len(test_data[test_data['DOLocationID']==0]),"[","Percentage(%) :",␣
↪len(test_data[test_data['DOLocationID']==0])*(100/50000),"]")
print("No. of -ve values :
↪",len(test_data[test_data['DOLocationID']<0]),"[","Percentage(%) :",␣
↪len(test_data[test_data['DOLocationID']<0])*(100/50000),"]")
print("Maximum Value :",test_data['DOLocationID'].max())
print("Minimum Value :",test_data['DOLocationID'].min())
```

```
Unique values : [  3  81  90 102 229 154  26 192 232 238  73  68 100 124 173 136
99 213
 144 184 159 237  58  82  67 217  40  89  44   9 153 106 113 203 196 254
 125 163  33  50 181  35  78 210 155 171 187 182  84 105 162  56 219 200
 221 151 123  16 176 199   4 201 209  31 257 119 103 249  91 126 207  52
  42  74 240  18 179  36  86  88 129  93 134 253  45  51  10 145  60 185
 261 239 189   5  22 263  54 180 178 235 174  46  17 143  25 216 168 170
 260 204 109 227 256 205 101 262  14 167  37 198  87 117   8 231   1 172
 223  23  69  24 108  20 234 252 112 128  63 246 157 226 236 138 259 183
  12 211 247 242 114 158 193  55 150 139 160  11 195  57 148  34  64  97
  95 190 191 135  27 215 165  77  70 111 188 212 132  83  28 149 197  66
  76  65  43 245 228 142 222 146 116 243  75  85 225 186 175  21 137 214
 224  79 107   7 248  39  29  13  38   6 127  94  59 147 166 220 230 233
 255 133  96 120 104  19 131  15 244 140  30 118 122 218  47  71 251 258
  49  41  98  48 177 250  53 202 208 130 194  62  61 264 161  72  32 152
 169 121 241 156 164  80  92   2 110 141 206 115]
No. of missing values : 0 [ Percentage(%) : 0.0 ]
No. of 0 values : 0 [ Percentage(%) : 0.0 ]
No. of -ve values : 0 [ Percentage(%) : 0.0 ]
Maximum Value : 264
Minimum Value : 1
```

Observations

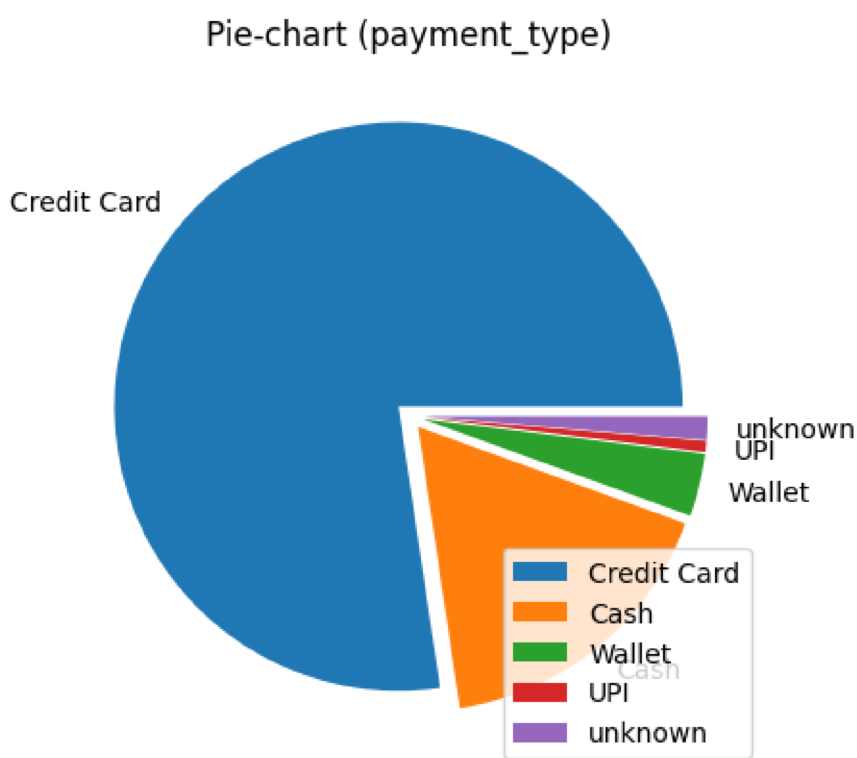
- `DULocationID` doesn't contain any missing, zero or -ve values.
- Maximum Value : 264
- Minimum Value : 1

10. payment_type

[174]:
```
print("Unique values :", pd.unique(test_data['payment_type']))
print("Values Count :", test_data['payment_type'].value_counts())
print("No. of distinct values :", len(pd.unique(test_data['payment_type'])))
print("No. of missing values :",test_data['payment_type'].isnull().sum(),␣
↪"[","Percentage(%) :", (test_data['payment_type'].isnull().sum())*(100/
↪50000),"]")
```

```
Unique values : ['Credit Card' 'Cash' 'UPI' 'unknown' 'Wallet']
Values Count : payment_type
Credit Card    38672
Cash            8571
Wallet          1779
unknown          665
UPI              313
Name: count, dtype: int64
No. of distinct values : 5
No. of missing values : 0 [ Percentage(%) : 0.0 ]
```

[175]:
```
Unique_values = ['Credit Card', 'Cash', 'Wallet', 'UPI', 'unknown']
value_count = []
for i in Unique_values:
    value_count.append(test_data['payment_type'].value_counts()[i])
plt.pie(value_count,labels=Unique_values,explode=[0.05,0.05,0.05,0.05,0.05])
plt.title('Pie-chart (payment_type)')
plt.legend(Unique_values)
plt.show()
```



Observations

- There are no missing values.
- There are 5 distinct values which are `'Credit Card'`, `'Cash'`, `'Wallet'`, `'UPI'`, `'unknown'`
- Most frequent is `Credit Card`.
- There are some `unknown` values.

11. extra

[176]:
```
print("Unique values :", pd.unique(test_data['extra']))
print("No. of missing values :",test_data['extra'].isnull().sum(),␣
 ↪"[","Percentage(%) :", (test_data['extra'].isnull().sum())*(100/50000),"]")
print("No. of 0 values :
 ↪",len(test_data[test_data['extra']==0]),"[","Percentage(%) :",␣
 ↪len(test_data[test_data['extra']==0])*(100/50000),"]")
print("No. of -ve values :
 ↪",len(test_data[test_data['extra']<0]),"[","Percentage(%) :",␣
 ↪len(test_data[test_data['extra']<0])*(100/50000),"]")
print("Maximum Value :",test_data['extra'].max())
print("Minimum Value :",test_data['extra'].min())
print("Mean Value :",test_data['extra'].mean())
```

```
Unique values : [ 1.    2.5   3.5   0.    5.    7.5   6.75  4.25  6.    7.75 10.
-1.
 -2.5   1.75  9.25  2.75 -5.   11.75 10.25  8.5  -6.    0.03 -7.5   5.25
  3.2 ]
No. of missing values : 0 [ Percentage(%) : 0.0 ]
No. of 0 values : 14819 [ Percentage(%) : 29.638 ]
No. of -ve values : 289 [ Percentage(%) : 0.578 ]
Maximum Value : 11.75
Minimum Value : -7.5
Mean Value : 1.9180496
```

Observations

- `extra` contains no missing values.
- `extra` contains 14819 zero values which is approx 29.6% of total number of value.
- `extra` contains 289 -ve values which is approx 0.6% of total number of value.
- `Maximum Value : 11.75`
- `Minimum Value : -7.5`
- `Mean Value : 1.9321434857142856`

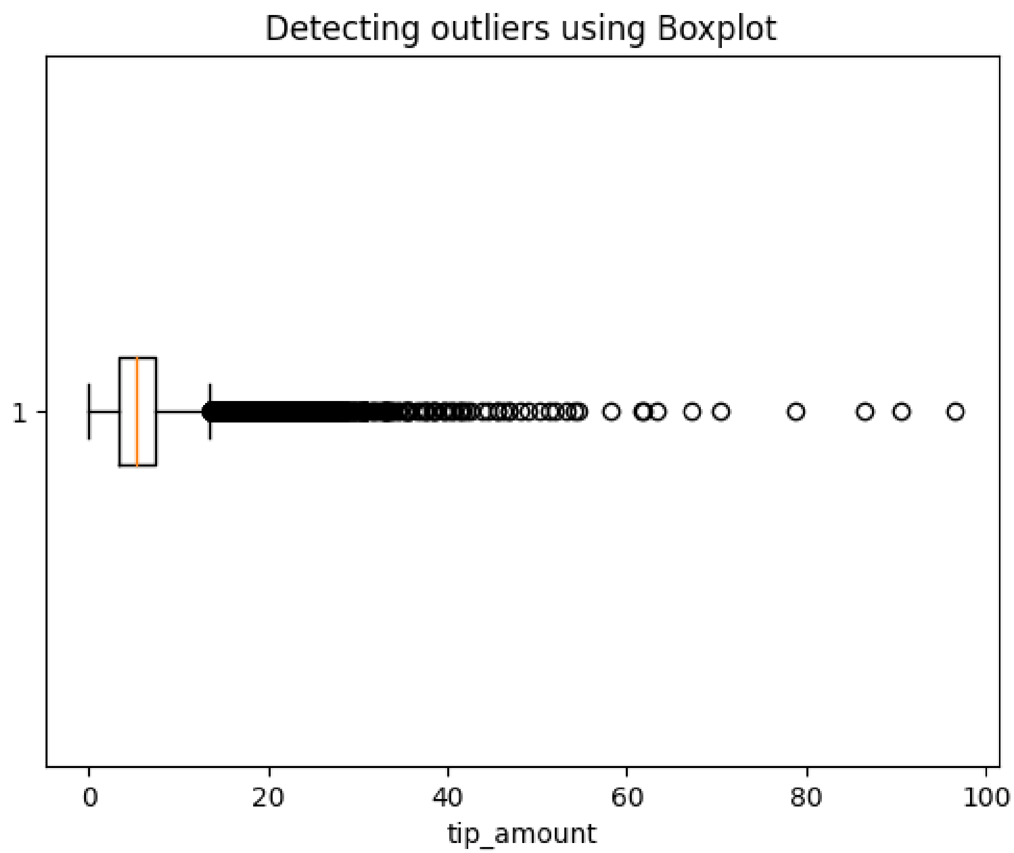
12. tip_amount

[177]:
```
print("Unique values :", pd.unique(test_data['tip_amount']))
print("No. of missing values :",test_data['tip_amount'].isnull().sum(),␣
↪"[","Percentage(%) :", (test_data['tip_amount'].isnull().sum())*(100/
↪50000),"]")
print("No. of 0 values :
↪",len(test_data[test_data['tip_amount']==0]),"[","Percentage(%) :",␣
↪len(test_data[test_data['tip_amount']==0])*(100/50000),"]")
print("No. of -ve values :
↪",len(test_data[test_data['tip_amount']<0]),"[","Percentage(%) :",␣
↪len(test_data[test_data['tip_amount']<0])*(100/50000),"]")
print("Maximum Value :",test_data['tip_amount'].max())
print("Minimum Value :",test_data['tip_amount'].min())
print("Mean Value :",test_data['tip_amount'].mean())
```

```
Unique values : [6.06761177 6.19126924 3.98387237 … 5.63659038 7.29314367
1.96659215]
No. of missing values : 0 [ Percentage(%) : 0.0 ]
No. of 0 values : 0 [ Percentage(%) : 0.0 ]
No. of -ve values : 0 [ Percentage(%) : 0.0 ]
Maximum Value : 96.55134327894214
Minimum Value : 0.0004089398699957
Mean Value : 6.107764502747721
```

[178]:
```
plt.boxplot(test_data['tip_amount'], vert=False)
plt.title("Detecting outliers using Boxplot")
plt.xlabel('tip_amount')
```

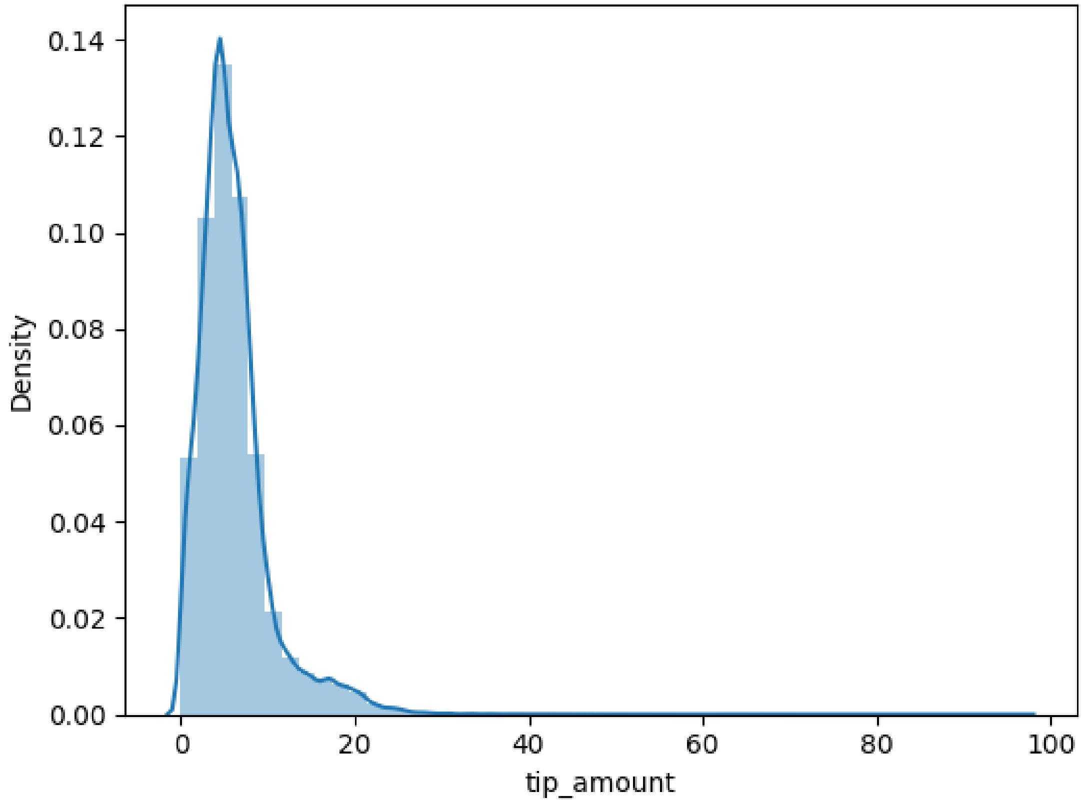
```
plt.show()
```



[179]:
```
sns.distplot(test_data['tip_amount'])
```

```
/tmp/ipykernel_20/1311658211.py:1: 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(test_data['tip_amount'])
```

[179]:
```
<Axes: xlabel='tip_amount', ylabel='Density'>
```



Observations

- `tip_amount` doesn't contains any missing,zero or -ve values.
- `Maximum Value : 96.55134327894214`
- `Minimum Value : 0.0004089398699957`
- `Mean Value : 6.107764502747721`

13. tolls_amount

[180]:
```
print("Unique values :", pd.unique(test_data['tolls_amount']))
print("No. of missing values :",test_data['tolls_amount'].isnull().sum(),␣
↪"[","Percentage(%) :", (test_data['tolls_amount'].isnull().sum())*(100/
↪50000),"]")
print("No. of 0 values :
↪",len(test_data[test_data['tolls_amount']==0]),"[","Percentage(%) :",␣
↪len(test_data[test_data['tolls_amount']==0])*(100/50000),"]")
print("No. of -ve values :
↪",len(test_data[test_data['tolls_amount']<0]),"[","Percentage(%) :",␣
↪len(test_data[test_data['tolls_amount']<0])*(100/50000),"]")
print("Maximum Value :",test_data['tolls_amount'].max())
print("Minimum Value :",test_data['tolls_amount'].min())
```

```
print("Mean Value :",test_data['tolls_amount'].mean())
```

```
Unique values : [  0.     6.55  21.3   14.75   9.    12.75  10.     6.    19.75
13.1
  19.3   18.75  21.    24.48  -6.55  20.75  14.55   8.55  20.25  13.75
   2.     3.     2.45  22.75  21.05  21.75  24.   -23.    29.     9.05
  24.3   27.3   22.     8.3   11.55  21.65  21.25  24.75  18.5   17.85
  25.5   12.     8.36  22.65  13.3   29.5   15.75  20.     9.55  17.75
  18.25  24.5  -15.75   6.45   5.    33.56  30.     7.    23.    17.25
  18.95  39.05  27.75  16.75  13.    11.75  29.3   26.3   34.05 -12.75
  39.3  -14.75  21.1   22.5   18.    26.75  19.    10.55  41.     7.74
  20.5   11.    25.3   27.8    8.    26.    19.95  34.    41.75  19.25
  21.45  41.3   25.25  18.3   12.55  14.65  -3.    19.65  15.2   20.55
  -8.5   47.75   1.    26.55  18.4   10.87  17.    23.25]
No. of missing values : 0 [ Percentage(%) : 0.0 ]
No. of 0 values : 45749 [ Percentage(%) : 91.498 ]
No. of -ve values : 42 [ Percentage(%) : 0.084 ]
Maximum Value : 47.75
Minimum Value : -23.0
Mean Value : 0.6158674
```

Observations

- `tolls_amount` contains no missing values.
- `tolls_amount` contains 45749 zero values which is approx 91.5% of total number of value.
- `tolls_amount` contains 42 -ve values which is approx 0.1% of total number of value.
- `Maximum Value : 47.75`
- `Minimum Value : -23.0`
- `Mean Value : 0.6158674`

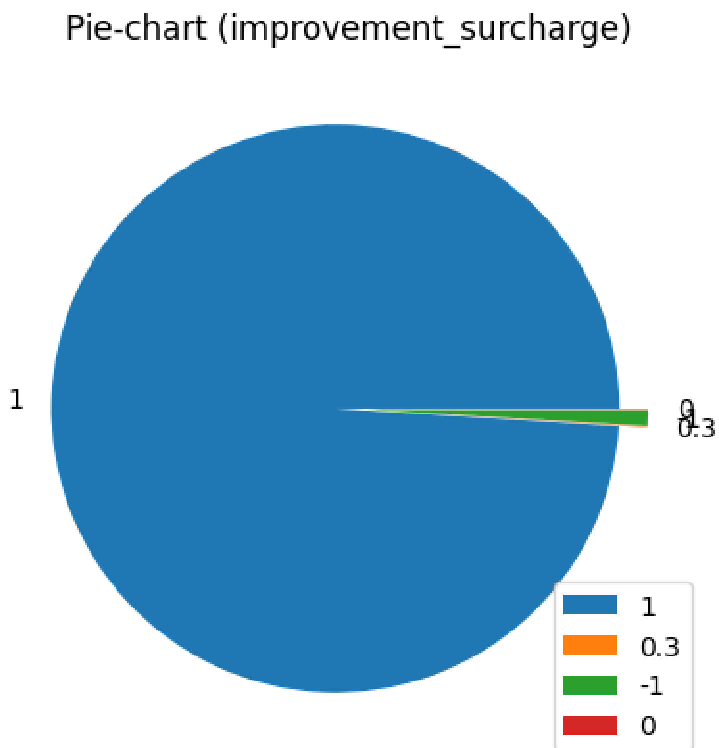
14. improvement_surcharge

[181]:
```
print("Unique values :", pd.unique(test_data['improvement_surcharge']))
print("No. of distinct values :", len(pd.
 ↪unique(test_data['improvement_surcharge'])))
print("No. of missing values :",test_data['improvement_surcharge'].isnull().
 ↪sum(), "[","Percentage(%) :", (test_data['improvement_surcharge'].isnull().
 ↪sum())*(100/50000),"]")
```

```
Unique values : [ 1.  -1.   0.3  0. ]
No. of distinct values : 4
No. of missing values : 0 [ Percentage(%) : 0.0 ]
```

[182]:
```
Unique_values = [1, 0.3, -1, 0]
value_count = []
for i in Unique_values:
    value_count.append(test_data['improvement_surcharge'].value_counts()[i])
plt.pie(value_count,labels=Unique_values,explode=[0.05,0.05,0.05,0.05])
```

```
plt.title('Pie-chart (improvement_surcharge)')
plt.legend(Unique_values)
plt.show()
```



Observations

- There are no missing values.
- There are 4 distinct values.
- Most Frequent is 1.

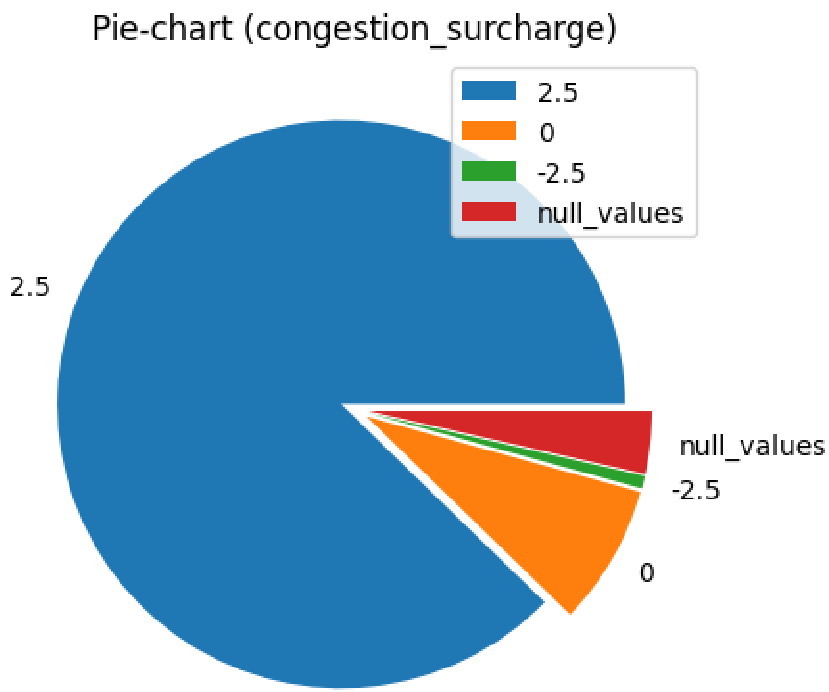
15. congestion_surcharge

[183]:
```
print("Unique values :", pd.unique(test_data['congestion_surcharge']))
print("No. of distinct values :", len(pd.
 ↪unique(test_data['congestion_surcharge'])))
print("No. of missing values :",test_data['congestion_surcharge'].isnull().
 ↪sum(), "[","Percentage(%) :", (test_data['congestion_surcharge'].isnull().
 ↪sum())*(100/50000),"]")
print("Mean Value :",test_data['congestion_surcharge'].mean())
```

```
Unique values : [ 2.5  0.   nan -2.5]
No. of distinct values : 4
```

```
No. of missing values : 1779 [ Percentage(%) : 3.5580000000000003 ]
Mean Value : 2.2553451815599015
```

[184]:
```
Unique_values = [2.5,  0, -2.5]
value_count = []
for i in Unique_values:
    value_count.append(test_data['congestion_surcharge'].value_counts()[i])
Unique_values.append('null_values')
value_count.append(test_data['congestion_surcharge'].isnull().sum())
#print(value_count)
plt.pie(value_count,labels=Unique_values,explode=[0.05,0.05,0.05,0.05])
plt.title('Pie-chart (congestion_surcharge)')
plt.legend(Unique_values)
plt.show()
```



Observations

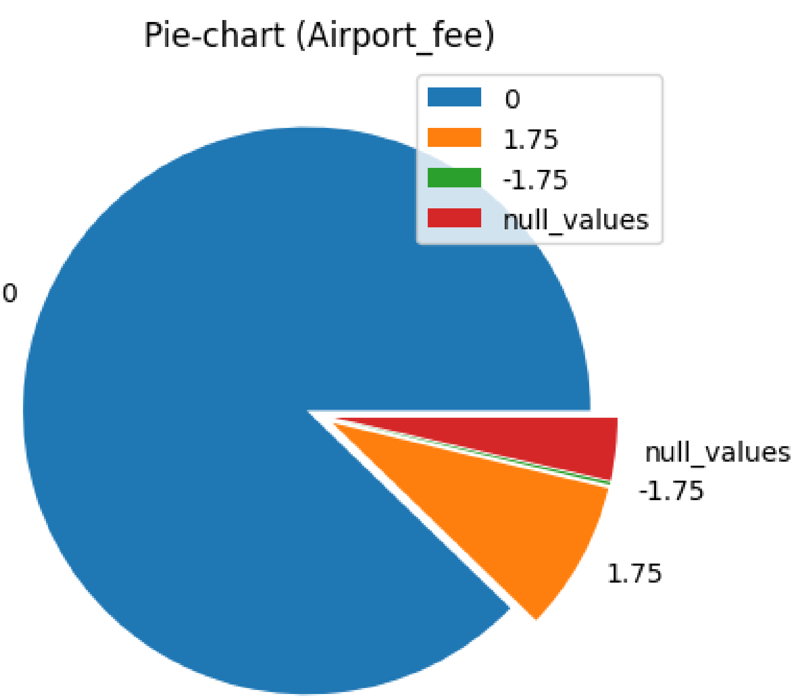
- There are 4 distinct values (including null values as type).
- `congestion_surcharge` contains 1779 missing values which is approx 01% of total number of values.
- Most Frequent is 2.5
- `Mean Value : 2.2553451815599015`

16. Airport_fee

[185]:
```
print("Unique values :", pd.unique(test_data['Airport_fee']))
print("No. of distinct values :", len(pd.unique(test_data['Airport_fee'])))
print("No. of missing values :",test_data['Airport_fee'].isnull().sum(),␣
↪"[","Percentage(%) :", (test_data['Airport_fee'].isnull().sum())*(100/
↪50000),"]")
print("Mean Value :",test_data['Airport_fee'].mean())
```

```
Unique values : [ 0.    1.75   nan -1.75]
No. of distinct values : 4
No. of missing values : 1779 [ Percentage(%) : 3.5580000000000003 ]
Mean Value : 0.15213288816075984
```

[186]:
```
Unique_values = [0, 1.75, -1.75]
value_count = []
for i in Unique_values:
    value_count.append(test_data['Airport_fee'].value_counts()[i])
Unique_values.append('null_values')
value_count.append(test_data['Airport_fee'].isnull().sum())
#print(value_count)
plt.pie(value_count,labels=Unique_values,explode=[0.05,0.05,0.05,0.05])
plt.title('Pie-chart (Airport_fee)')
plt.legend(Unique_values)
plt.show()
```



Observations

- There are 4 distinct values (including null values as type).
- `Airport_fee` contains 6077 missing values which is approx 01% of total number of values.
- Most Frequent is 1.
- `Mean Value : 0.15213288816075984`

14.1 Overall Observations

- **There are 5 attributes having missing values. (`passenger_count`,`RatecodeID`,`store_and_fwd_flag`, `congestion_surcharge`, `Airport_fee`)**
- **Two attributes (`store_and_fwd_flag`, `payment_type`) are of Categorical type**. It can be encoded using `Label Encoder`. We will not use `Ordinal Encoder` because labels are not having some order.
- `payment_type` has some `unknown` values.
- `passenger_count` & `trip_distance` has some 0 values.

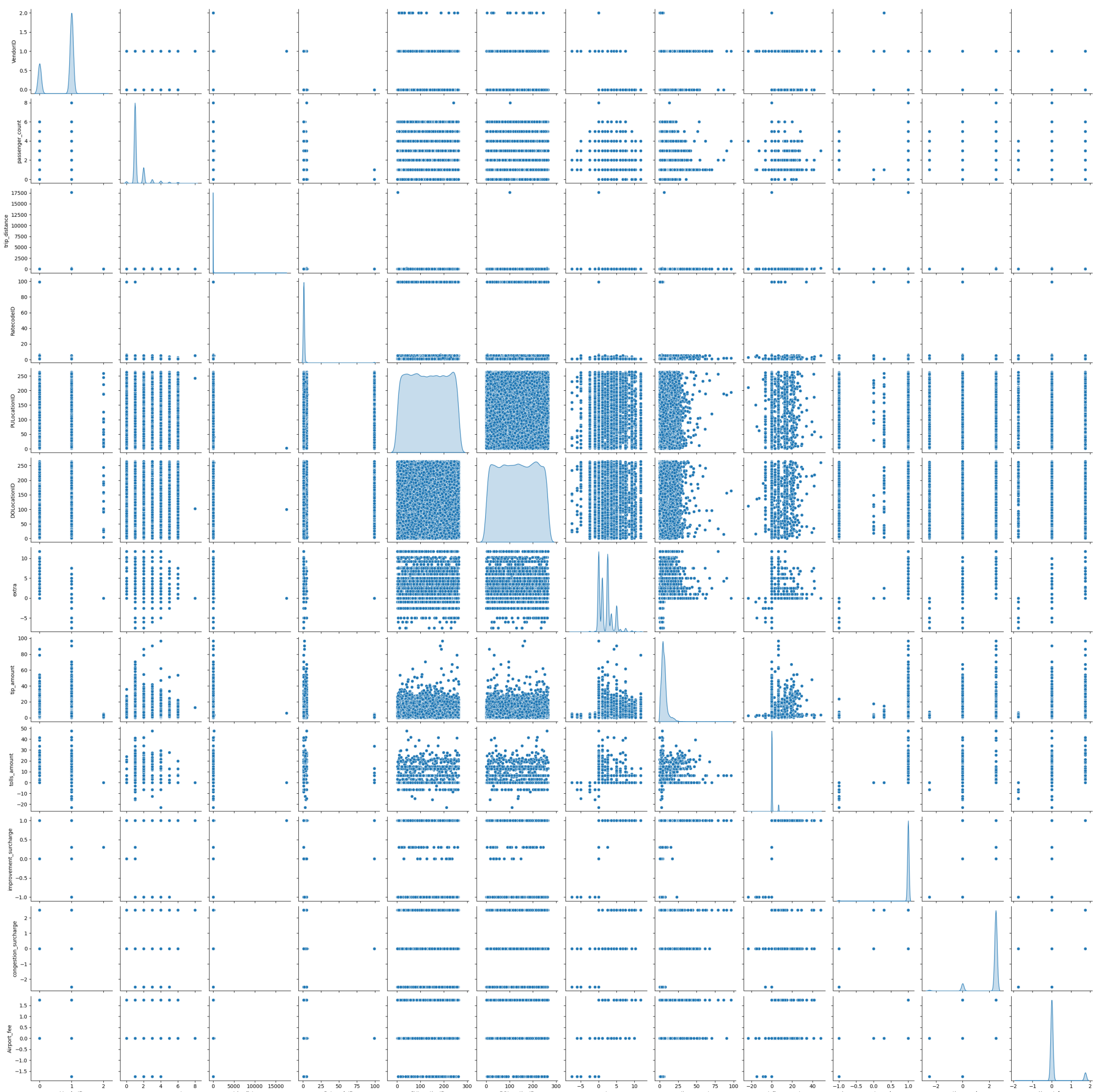
14.2 Bivariate Analysis

- Using `pairplot`

[187]:
```python
sns.pairplot(test_data, diag_kind='kde')
```

```
/opt/conda/lib/python3.10/site-packages/seaborn/axisgrid.py:118: UserWarning:
The figure layout has changed to tight
  self._figure.tight_layout(*args, **kwargs)
```

[187]:
```
<seaborn.axisgrid.PairGrid at 0x7d702fec5fc0>
```



14.3 Test data preprocessing

14.3.1 Handling Outliers

[188]:
```
'''
# trip_distance
trip_percentile25 = test_data['trip_distance'].quantile(0.25)
trip_percentile75 = test_data['trip_distance'].quantile(0.75)
trip_iqr = trip_percentile75 - trip_percentile25

print("25th Percentile (Trip distance) :", trip_percentile25)
print("75th Percentile (Trip distance) :", trip_percentile75)
print("IQR (Trip distance) :", trip_iqr)
```

```
trip_upper_limit = trip_percentile75 + (trip_iqr*1.5)
trip_lower_limit = trip_percentile25 - (trip_iqr*1.5)

print("Upper Limit (Trip distance) :", trip_upper_limit)
print("Lower Limit (Trip distance) :", trip_lower_limit)

test_data['trip_distance']=np.where(
test_data['trip_distance']>trip_upper_limit, trip_upper_limit,np.where(
test_data['trip_distance']<trip_lower_limit,trip_lower_limit,␣
↪test_data['trip_distance']))

print("---------------------------------------------------")

# tip_amount
tip_percentile25 = test_data['tip_amount'].quantile(0.25)
tip_percentile75 = test_data['tip_amount'].quantile(0.75)
tip_iqr = tip_percentile75 - tip_percentile25

print("25th Percentile (Tip Amount) :", tip_percentile25)
print("75th Percentile (Tip Amount) :", tip_percentile75)
print("IQR (Tip Amount) :", tip_iqr)

tip_upper_limit = tip_percentile75 + (tip_iqr*1.5)
tip_lower_limit = tip_percentile25 - (tip_iqr*1.5)

print("Upper Limit (Tip amount) :", tip_upper_limit)
print("Lower Limit (Tip amount) :", tip_lower_limit)

test_data['tip_amount']=np.where(
test_data['tip_amount']>tip_upper_limit, tip_upper_limit,np.where(
test_data['tip_amount']<tip_lower_limit,tip_lower_limit,␣
↪test_data['tip_amount']))
'''
```

[188]:
```
'\n# trip_distance\ntrip_percentile25 =
test_data[\'trip_distance\'].quantile(0.25)\ntrip_percentile75 =
test_data[\'trip_distance\'].quantile(0.75)\ntrip_iqr = trip_percentile75 -
trip_percentile25\n\nprint("25th Percentile (Trip distance) :",
trip_percentile25)\nprint("75th Percentile (Trip distance) :",
trip_percentile75)\nprint("IQR (Trip distance) :", trip_iqr)\n\ntrip_upper_limit
= trip_percentile75 + (trip_iqr*1.5)\ntrip_lower_limit = trip_percentile25 -
(trip_iqr*1.5)\n\nprint("Upper Limit (Trip distance) :",
trip_upper_limit)\nprint("Lower Limit (Trip distance) :", trip_lower_limit)\n\nt
est_data[\'trip_distance\']=np.where(\ntest_data[\'trip_distance\']>trip_upper_l
imit, trip_upper_limit,np.where(\ntest_data[\'trip_distance\']<trip_lower_limit,
trip_lower_limit, test_data[\'trip_distance\']))\n\nprint("--------------------
```

```
------------------------------")\n\n# tip_amount\ntip_percentile25 =
test_data[\'tip_amount\'].quantile(0.25)\ntip_percentile75 =
test_data[\'tip_amount\'].quantile(0.75)\ntip_iqr = tip_percentile75 -
tip_percentile25\n\nprint("25th Percentile (Tip Amount) :",
tip_percentile25)\nprint("75th Percentile (Tip Amount) :",
tip_percentile75)\nprint("IQR (Tip Amount) :", tip_iqr)\n\ntip_upper_limit =
tip_percentile75 + (tip_iqr*1.5)\ntip_lower_limit = tip_percentile25 -
(tip_iqr*1.5)\n\nprint("Upper Limit (Tip amount) :",
tip_upper_limit)\nprint("Lower Limit (Tip amount) :", tip_lower_limit)\n\ntest_d
ata[\'tip_amount\']=np.where(\ntest_data[\'tip_amount\']>tip_upper_limit, tip_up
per_limit,np.where(\ntest_data[\'tip_amount\']<tip_lower_limit,tip_lower_limit,
test_data[\'tip_amount\']))\n'
```

[189]:
```
#sns.boxplot(test_data['trip_distance'])
```

[190]:
```
#sns.boxplot(test_data['tip_amount'])
```

[191]:
```
test_data['trip_distance'].mask(test_data['trip_distance'] == 0.0, 1.0,␣
 ↪inplace=True)
test_data['extra'] = test_data['extra'].abs()
#test_data['improvement_surcharge'] = test_data['improvement_surcharge'].abs()
#test_data['tolls_amount'] = test_data['tolls_amount'].abs()
#toll_mean = test_data['tolls_amount'][test_data['tolls_amount']>0].mean()
test_data['tolls_amount'].mask(test_data['tolls_amount'] <0.0, 0.0,␣
 ↪inplace=True)
#tip_5th_per = np.percentile(test_data['tip_amount'], 5)
#tip_95th_per = np.percentile(test_data['tip_amount'], 95)
#test_data['tip_amount'].mask(test_data['tip_amount']<tip_5th_per, tip_5th_per,␣
 ↪inplace=True)
#test_data['tip_amount'].mask(test_data['tip_amount']>tip_95th_per,␣
 ↪tip_95th_per, inplace=True)
#test_data['trip_distance'].
 ↪mask(test_data['trip_distance']>test_data['trip_distance'].median(),␣
 ↪test_data['trip_distance'].median(), inplace=True)
test_data['Airport_fee'].mask(test_data['Airport_fee'] == -1.75, 1.75,␣
 ↪inplace=True)
test_data['congestion_surcharge'].mask(test_data['congestion_surcharge'] == -2.
 ↪5, 2.5, inplace=True)
test_data['passenger_count'].mask(test_data['passenger_count'] == 0, 1,␣
 ↪inplace=True)
#test_data['congestion_surcharge'].mask(test_data['congestion_surcharge'] < 0.
 ↪0, 0.0, inplace=True)
#test_data['improvement_surcharge'].mask(test_data['improvement_surcharge'] <␣
 ↪-1, 1, inplace=True)
#test_data['trip_distance'].mask(test_data['trip_distance']>15000,␣
 ↪train_data['trip_distance'].mean(), inplace=True)
```

```
#test_data['passenger_count'].mask(test_data['passenger_count'] == 8, 1,␣
↪inplace=True)
```

Extract and creating new features from the datetime features

[192]:
```
#test_data['pickup_day'] = test_data['tpep_pickup_datetime'].dt.day_name()
#test_data['dropoff_day'] = test_data['tpep_dropoff_datetime'].dt.day_name()
test_data['pickup_day_no'] = test_data['tpep_pickup_datetime'].dt.weekday
test_data['dropoff_day_no'] = test_data['tpep_dropoff_datetime'].dt.weekday
test_data['pickup_hour'] = test_data['tpep_pickup_datetime'].dt.hour
test_data['dropoff_hour'] = test_data['tpep_dropoff_datetime'].dt.hour
test_data['pickup_month'] = test_data['tpep_pickup_datetime'].dt.month
test_data['dropoff_month'] = test_data['tpep_dropoff_datetime'].dt.month
```

[193]:
```
test_data['pickup_timeofday'] = test_data['pickup_hour'].apply(time_of_day)
test_data['dropoff_timeofday'] = test_data['dropoff_hour'].apply(time_of_day)
```

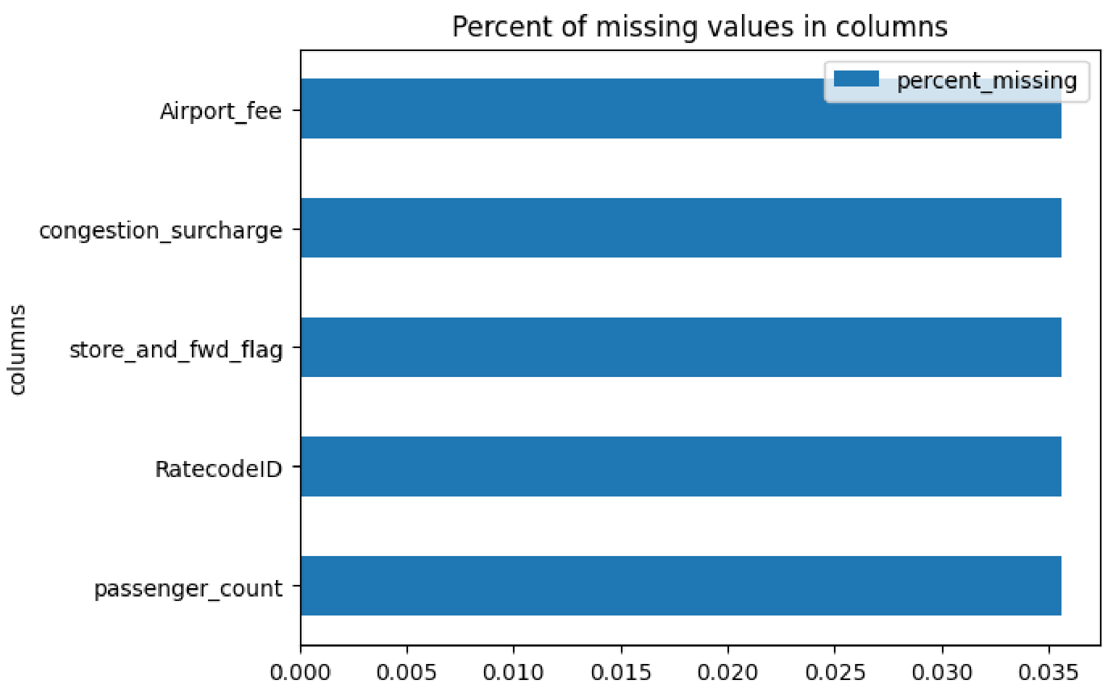
[194]:
```
test_data.head()
```

[194]:
```
   VendorID tpep_pickup_datetime tpep_dropoff_datetime  passenger_count  \
0         1  2023-06-29 00:21:20   2023-06-29 00:25:20              1.0
1         1  2023-06-30 17:44:43   2023-06-30 17:53:13              1.0
2         1  2023-06-29 18:17:04   2023-06-29 19:23:48              1.0
3         0  2023-06-30 21:33:53   2023-06-30 21:46:20              1.0
4         1  2023-06-29 14:53:54   2023-06-29 15:22:17              1.0

   trip_distance  RatecodeID store_and_fwd_flag  PULocationID  DOLocationID  \
0           4.95         1.0                  N            20             3
1           2.10         1.0                  N             9            81
2           0.95         1.0                  N            92            90
3           0.80         1.0                  N            19           102
4           4.01         1.0                  N           131           229

  payment_type  …  congestion_surcharge  Airport_fee  pickup_day_no  \
0  Credit Card  …                   2.5          0.0              3
1  Credit Card  …                   2.5          0.0              4
2         Cash  …                   2.5          0.0              3
3  Credit Card  …                   2.5          0.0              4
4         Cash  …                   0.0          0.0              3

   dropoff_day_no  pickup_hour  dropoff_hour  pickup_month  dropoff_month  \
0               3            0             0             6              6
1               4           17            17             6              6
2               3           18            19             6              6
3               4           21            21             6              6
4               3           14            15             6              6
```

```
   pickup_timeofday  dropoff_timeofday
0        Late night         Late night
1           Evening            Evening
2           Evening            Evening
3           Evening            Evening
4         Afternoon          Afternoon

[5 rows x 24 columns]
```

14.3.2 Handling Missing Values

[195]:
```python
# Plotting Missing value percentage for test data
plot_missing_values(test_data)
```



[196]:
```python
imp = SimpleImputer(missing_values=np.nan, strategy='most_frequent')
imp.fit(test_data)
test_data = pd.DataFrame(imp.transform(test_data), columns = test_data.columns)
train_data.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 174997 entries, 0 to 174996
Data columns (total 23 columns):
 #   Column                 Non-Null Count   Dtype
---  ------                 --------------   -----
 0   VendorID               174997 non-null  float64
```

```
 1   passenger_count        174997 non-null  float64
 2   trip_distance          174997 non-null  float64
 3   RatecodeID             174997 non-null  float64
 4   store_and_fwd_flag     174997 non-null  int64
 5   PULocationID           174997 non-null  float64
 6   DOLocationID           174997 non-null  float64
 7   payment_type           174997 non-null  int64
 8   extra                  174997 non-null  float64
 9   tip_amount             174997 non-null  float64
 10  tolls_amount           174997 non-null  float64
 11  improvement_surcharge  174997 non-null  float64
 12  total_amount           174997 non-null  float64
 13  congestion_surcharge   174997 non-null  float64
 14  Airport_fee            174997 non-null  float64
 15  pickup_day_no          174997 non-null  float64
 16  dropoff_day_no         174997 non-null  float64
 17  pickup_hour            174997 non-null  float64
 18  dropoff_hour           174997 non-null  float64
 19  pickup_month           174997 non-null  float64
 20  dropoff_month          174997 non-null  float64
 21  pickup_timeofday       174997 non-null  float64
 22  dropoff_timeofday      174997 non-null  float64
dtypes: float64(21), int64(2)
memory usage: 30.7 MB
```

14.3.3 Handling Payment type `unknown` values

- Replacing it by `Cash`

[197]:
```
test_data['payment_type'].mask(test_data['payment_type'] == 'unknown', "Cash",␣
↪inplace=True)
```

[198]:
```
test_data['payment_type'].value_counts()
```

[198]:
```
payment_type
Credit Card    38672
Cash            9236
Wallet          1779
UPI              313
Name: count, dtype: int64
```

14.3.4 Encoding Categorical Variable

[199]:
```
test_data = MultiColumnLabelEncoder(columns =␣
↪['store_and_fwd_flag','payment_type','pickup_timeofday','dropoff_timeofday']).
↪fit_transform(test_data)
```

14.3.5 Dropping `tpep_pickup_datetime` & `tpep_dropoff_datetime` columns

[200]:
```
test_data = test_data.drop(['tpep_pickup_datetime', 'tpep_dropoff_datetime'],␣
 ↪axis=1)
```

14.4 Coverting columns having type 'object' to 'float64' for further smooth processing.

[201]:
```
test_data[['VendorID','passenger_count','trip_distance','RatecodeID','PULocationID','DOLocatic
 ↪=␣
 ↪test_data[['VendorID','passenger_count','trip_distance','RatecodeID','PULocationID','DOLocat
 ↪astype('float64')
```

14.5 Visualization of test data

[202]:
```
test_data.hist(bins=50,figsize=(15,15), color='green')
# displaying histogram
plt.show()
```

14.6 Scaling

- Using same `StandardScaler()` as in case of train data.

[203]:
```
test_data[['PULocationID','DOLocationID','trip_distance','extra','tip_amount','tolls_amount','
↪= pd.DataFrame(scaler.
↪transform(test_data[['PULocationID','DOLocationID','trip_distance','extra','tip_amount','to
↪columns =␣
↪['PULocationID','DOLocationID','trip_distance','extra','tip_amount','tolls_amount','pickup_
test_data.head()
```

[203]:
```
   VendorID  passenger_count  trip_distance  RatecodeID  store_and_fwd_flag  \
0       1.0              1.0      -0.000534         1.0                   0
1       1.0              1.0      -0.007750         1.0                   0
```

```
2       1.0              1.0      -0.010661         1.0                   0
3       0.0              1.0      -0.011041         1.0                   0
4       1.0              1.0      -0.002914         1.0                   0

   PULocationID  DOLocationID  payment_type     extra  tip_amount  …  \
0     -1.480153     -1.702277             1 -0.499245   -0.012957  …
1     -1.624608     -0.678553             1  0.281471    0.013863  …
2     -0.534634     -0.560431             0  0.281471   -0.464906  …
3     -1.493286     -0.402935             1  0.801949    0.154426  …
4     -0.022477      1.263897             0 -1.019723   -1.010377  …

   congestion_surcharge  Airport_fee  pickup_day_no  dropoff_day_no  \
0                   2.5          0.0      -0.253021       -0.269033
1                   2.5          0.0       1.088124        1.065018
2                   2.5          0.0      -0.253021       -0.269033
3                   2.5          0.0       1.088124        1.065018
4                   0.0          0.0      -0.253021       -0.269033

   pickup_hour  dropoff_hour  pickup_month  dropoff_month  pickup_timeofday  \
0    -2.618962     -2.537794     -0.065343      -0.088271          0.650232
1     0.326177      0.318702     -0.065343      -0.088271         -0.363187
2     0.499420      0.654760     -0.065343      -0.088271         -0.363187
3     1.019150      0.990819     -0.065343      -0.088271         -0.363187
4    -0.193554     -0.017356     -0.065343      -0.088271         -1.376605

   dropoff_timeofday
0           0.660823
1          -0.369946
2          -0.369946
3          -0.369946
4          -1.400716

[5 rows x 22 columns]
```

[204]:

```
test_data.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 50000 entries, 0 to 49999
Data columns (total 22 columns):
 #   Column                 Non-Null Count  Dtype
---  ------                 --------------  -----
 0   VendorID               50000 non-null  float64
 1   passenger_count        50000 non-null  float64
 2   trip_distance          50000 non-null  float64
 3   RatecodeID             50000 non-null  float64
 4   store_and_fwd_flag     50000 non-null  int64
 5   PULocationID           50000 non-null  float64
```

```
 6   DOLocationID           50000 non-null  float64
 7   payment_type           50000 non-null  int64
 8   extra                  50000 non-null  float64
 9   tip_amount             50000 non-null  float64
 10  tolls_amount           50000 non-null  float64
 11  improvement_surcharge  50000 non-null  float64
 12  congestion_surcharge   50000 non-null  float64
 13  Airport_fee            50000 non-null  float64
 14  pickup_day_no          50000 non-null  float64
 15  dropoff_day_no         50000 non-null  float64
 16  pickup_hour            50000 non-null  float64
 17  dropoff_hour           50000 non-null  float64
 18  pickup_month           50000 non-null  float64
 19  dropoff_month          50000 non-null  float64
 20  pickup_timeofday       50000 non-null  float64
 21  dropoff_timeofday      50000 non-null  float64
dtypes: float64(20), int64(2)
memory usage: 8.4 MB
```

[205]:

```
test_data.head()
```

[205]:

```
   VendorID  passenger_count  trip_distance  RatecodeID  store_and_fwd_flag  \
0       1.0              1.0      -0.000534         1.0                   0
1       1.0              1.0      -0.007750         1.0                   0
2       1.0              1.0      -0.010661         1.0                   0
3       0.0              1.0      -0.011041         1.0                   0
4       1.0              1.0      -0.002914         1.0                   0

   PULocationID  DOLocationID  payment_type     extra  tip_amount  …  \
0     -1.480153     -1.702277             1 -0.499245   -0.012957  …
1     -1.624608     -0.678553             1  0.281471    0.013863  …
2     -0.534634     -0.560431             0  0.281471   -0.464906  …
3     -1.493286     -0.402935             1  0.801949    0.154426  …
4     -0.022477      1.263897             0 -1.019723   -1.010377  …

   congestion_surcharge  Airport_fee  pickup_day_no  dropoff_day_no  \
0                   2.5          0.0      -0.253021       -0.269033
1                   2.5          0.0       1.088124        1.065018
2                   2.5          0.0      -0.253021       -0.269033
3                   2.5          0.0       1.088124        1.065018
4                   0.0          0.0      -0.253021       -0.269033

   pickup_hour  dropoff_hour  pickup_month  dropoff_month  pickup_timeofday  \
0    -2.618962     -2.537794     -0.065343      -0.088271          0.650232
1     0.326177      0.318702     -0.065343      -0.088271         -0.363187
2     0.499420      0.654760     -0.065343      -0.088271         -0.363187
3     1.019150      0.990819     -0.065343      -0.088271         -0.363187
```

```
4    -0.193554     -0.017356     -0.065343      -0.088271          -1.376605

   dropoff_timeofday
0           0.660823
1          -0.369946
2          -0.369946
3          -0.369946
4          -1.400716

[5 rows x 22 columns]
```

[206]:
```
#test_data = test_data.
↪drop(['pickup_timeofday','VendorID','pickup_day_no','dropoff_day_no','Airport_fee','store_a
↪axis=1)
```

15 Considering Correlation result

- From the above plotted `heatmap`, we can observe that 14 features are in good (+ve) correlation with target variable.
- And, The columns are : `['VendorID', 'passenger_count', 'trip_distance', 'RatecodeID', 'PULocationID', 'payment_type', 'extra', 'tip_amount', 'tolls_amount', 'improvemet_surcharge', 'Airport_fee', 'dropoff_day_no', 'pickup_month', 'dropoff_month' ]`

15.0.1 Training and validating `Random Forest Regressor` on the above selected 14 features only.

[207]:
```
corr_cols = ['VendorID', 'passenger_count', 'trip_distance', 'RatecodeID',␣
↪'PULocationID',
             'payment_type', 'extra', 'tip_amount', 'tolls_amount',␣
↪'improvement_surcharge',
             'Airport_fee', 'dropoff_day_no', 'pickup_month', 'dropoff_month']

rf_reg_corr = RandomForestRegressor()
rf_reg_corr.fit(X_train[corr_cols], y_train)
rf_reg_corr_predict = rf_reg_corr.predict(X_val[corr_cols])
print("Predicted data :", rf_reg_corr_predict)
rf_corr_score = r2_score(y_val, rf_reg_corr_predict)
print("R2 Score (RF with selected columns only) :", rf_corr_score)
```

```
Predicted data : [38.5247 23.6207 98.3574 … 11.4402 19.1987 32.9071]
R2 Score (RF with selected columns only) : 0.9520890858363609
```

16 Recursive feature elimination to select desired number of features.

Using `Random Forest Regressor` as estimator

[208]:
```
'''
from sklearn.feature_selection import RFE

RF_Models = []
RF_r2_Scores = []

for i in range(5, 0, -1):
    rfe = RFE(estimator = RandomForestRegressor(), n_features_to_select=i)
    rfe.fit(X_train, y_train)
    sel_cols = []
    for j, col in zip(range(X_train.shape[1]), X_train.columns):
        if (rfe.ranking_[j] == 1):
            sel_cols.append(col)
    print("Total number of features :",i)
    RF_Models.append("RF_RFE_with_"+str(i)+"_"+"Cols")
    print("Selected Columns are :",sel_cols)
    rf_rfe = RandomForestRegressor()
    rf_rfe.fit(X_train[sel_cols], y_train)
    rf_rfe_predict = rf_rfe.predict(X_val[sel_cols])
    print("Predicted values :",rf_rfe_predict)
    rf_rfe_score = r2_score(y_val,rf_rfe_predict)
    RF_r2_Scores.append(rf_rfe_score)
    print("R2_Score (RandomForestRegressor_RFE) :",rf_rfe_score)
    print()

print("RF_Models :", RF_Models)
print("RF_r2_Scores :", RF_r2_Scores)
'''
```

[208]:
```
'\nfrom sklearn.feature_selection import RFE\n\nRF_Models = []\nRF_r2_Scores =
[]\n\nfor i in range(5, 0, -1):\n    rfe = RFE(estimator =
RandomForestRegressor(), n_features_to_select=i)\n    rfe.fit(X_train,
y_train)\n    sel_cols = []\n    for j, col in zip(range(X_train.shape[1]),
X_train.columns):\n        if (rfe.ranking_[j] == 1):\n
sel_cols.append(col) \n    print("Total number of features :",i) \n
RF_Models.append("RF_RFE_with_"+str(i)+"_"+"Cols")\n    print("Selected Columns
are :",sel_cols)\n    rf_rfe = RandomForestRegressor()\n
rf_rfe.fit(X_train[sel_cols], y_train)\n    rf_rfe_predict =
rf_rfe.predict(X_val[sel_cols])\n    print("Predicted values
:",rf_rfe_predict)\n    rf_rfe_score = r2_score(y_val,rf_rfe_predict)\n
RF_r2_Scores.append(rf_rfe_score)\n    print("R2_Score
(RandomForestRegressor_RFE) :",rf_rfe_score)\n    print()\n
```

```
\nprint("RF_Models :", RF_Models)\nprint("RF_r2_Scores :", RF_r2_Scores)\n'
```

- **Result**

Total number of features : 22 Selected Columns are : ['VendorID', 'passenger_count', 'trip_distance', 'RatecodeID', 'store_and_fwd_flag', 'PULocationID', 'DOLocationID', 'payment_type', 'extra', 'tip_amount', 'tolls_amount', 'improvement_surcharge', 'congestion_surcharge', 'Airport_fee', 'pickup_day_no', 'dropoff_day_no', 'pickup_hour', 'dropoff_hour', 'pickup_month', 'dropoff_month', 'pickup_timeofday', 'dropoff_timeofday'] Predicted values : [37.9388 24.183 98.4436 … 11.3555 18.4766 33.7393] R2_Score (RandomForestRegressor_RFE) : 0.9561782455655767

Total number of features : 21 Selected Columns are : ['VendorID', 'passenger_count', 'trip_distance', 'RatecodeID', 'store_and_fwd_flag', 'PULocationID', 'DOLocationID', 'payment_type', 'extra', 'tip_amount', 'tolls_amount', 'improvement_surcharge', 'congestion_surcharge', 'Airport_fee', 'pickup_day_no', 'dropoff_day_no', 'pickup_hour', 'dropoff_hour', 'dropoff_month', 'pickup_timeofday', 'dropoff_timeofday'] Predicted values : [37.2333 24.3653 98.4507 … 11.2484 18.1649 34.0305] R2_Score (RandomForestRegressor_RFE) : 0.955722003641043

Total number of features : 20 Selected Columns are : ['VendorID', 'passenger_count', 'trip_distance', 'RatecodeID', 'store_and_fwd_flag', 'PULocationID', 'DOLocationID', 'payment_type', 'extra', 'tip_amount', 'tolls_amount', 'improvement_surcharge', 'congestion_surcharge', 'Airport_fee', 'pickup_day_no', 'dropoff_day_no', 'pickup_hour', 'dropoff_hour', 'pickup_timeofday', 'dropoff_timeofday'] Predicted values : [37.6167 23.7405 98.446 … 11.2182 18.2508 34.3305] R2_Score (RandomForestRegressor_RFE) : 0.9565792143132187

Total number of features : 19 Selected Columns are : ['VendorID', 'passenger_count', 'trip_distance', 'RatecodeID', 'PULocationID', 'DOLocationID', 'payment_type', 'extra', 'tip_amount', 'tolls_amount', 'improvement_surcharge', 'congestion_surcharge', 'Airport_fee', 'pickup_day_no', 'dropoff_day_no', 'pickup_hour', 'dropoff_hour', 'pickup_timeofday', 'dropoff_timeofday'] Predicted values : [37.8249 24.3703 98.4933 … 11.1526 18.6497 34.065] R2_Score (RandomForestRegressor_RFE) : 0.9563181256783445

Total number of features : 18 Selected Columns are : ['VendorID', 'passenger_count', 'trip_distance', 'RatecodeID', 'PULocationID', 'DOLocationID', 'payment_type', 'extra', 'tip_amount', 'tolls_amount', 'improvement_surcharge', 'congestion_surcharge', 'pickup_day_no', 'dropoff_day_no', 'pickup_hour', 'dropoff_hour', 'pickup_timeofday', 'dropoff_timeofday'] Predicted values : [37.4727 24.511 98.3318 … 11.4249 17.9913 33.4051] R2_Score (RandomForestRegressor_RFE) : 0.9558156255813913

Total number of features : 17 Selected Columns are : ['VendorID', 'passenger_count', 'trip_distance', 'RatecodeID', 'PULocationID', 'DOLocationID', 'payment_type', 'extra', 'tip_amount', 'tolls_amount', 'improvement_surcharge', 'congestion_surcharge', 'dropoff_day_no', 'pickup_hour', 'dropoff_hour', 'pickup_timeofday', 'dropoff_timeofday'] Predicted values : [38.2259 24.6048 98.2249 … 11.4452 18.2079 33.8505] R2_Score (RandomForestRegressor_RFE) : 0.9558068344929752

Total number of features : 16 Selected Columns are : ['passenger_count', 'trip_distance', 'RatecodeID', 'PULocationID', 'DOLocationID', 'payment_type', 'extra', 'tip_amount', 'tolls_amount', 'improvement_surcharge', 'congestion_surcharge', 'pickup_day_no', ‘pickup_hour’, ‘dropoff_hour’, ‘pickup_timeofday’, ‘dropoff_timeofday’] Predicted values : [38.8892 24.2139 98.2225 ... 11.4013 18.8612 33.5367] R2_Score (RandomForestRegressor_RFE) : 0.9558825814985351

Total number of features : 15 Selected Columns are : [‘passenger_count’, ‘trip_distance’, ‘RatecodeID’, ‘PULocationID’, ‘DOLocationID’, ‘payment_type’, ‘extra’, ‘tip_amount’, ‘tolls_amount’, ‘improvement_surcharge’, ‘congestion_surcharge’, ‘pickup_day_no’, ‘pickup_hour’, ‘dropoff_hour’, ‘dropoff_timeofday’] Predicted values : [37.9604 24.2382 98.358 ... 11.2485 18.7239 33.9868] R2_Score (RandomForestRegressor_RFE) : 0.9566194990925527

Total number of features : 14 Selected Columns are : [‘passenger_count’, ‘trip_distance’, ‘RatecodeID’, ‘PULocationID’, ‘DOLocationID’, ‘payment_type’, ‘extra’, ‘tip_amount’, ‘tolls_amount’, ‘improvement_surcharge’, ‘congestion_surcharge’, ‘pickup_hour’, ‘dropoff_hour’, ‘dropoff_timeofday’] Predicted values : [37.3888 23.6099 98.4146 ... 11.3792 18.3575 33.3994] R2_Score (RandomForestRegressor_RFE) : 0.954943989095263

Total number of features : 13 Selected Columns are : [‘passenger_count’, ‘trip_distance’, ‘RatecodeID’, ‘PULocationID’, ‘DOLocationID’, ‘payment_type’, ‘extra’, ‘tip_amount’, ‘tolls_amount’, ‘improvement_surcharge’, ‘pickup_hour’, ‘dropoff_hour’, ‘dropoff_timeofday’] Predicted values : [38.0277 24.3484 97.9969 ... 11.4347 17.3264 33.7031] R2_Score (RandomForestRegressor_RFE) : 0.9534367345017617

Total number of features : 12 Selected Columns are : [‘trip_distance’, ‘RatecodeID’, ‘PULocationID’, ‘DOLocationID’, ‘payment_type’, ‘extra’, ‘tip_amount’, ‘tolls_amount’, ‘improvement_surcharge’, ‘pickup_hour’, ‘dropoff_hour’, ‘dropoff_timeofday’] Predicted values : [38.3127 24.2579 98.264 ... 11.4075 17.327 33.3825] R2_Score (RandomForestRegressor_RFE) : 0.9523303576455688

Total number of features : 11 Selected Columns are : [‘trip_distance’, ‘RatecodeID’, ‘PULocationID’, ‘DOLocationID’, ‘payment_type’, ‘extra’, ‘tip_amount’, ‘tolls_amount’, ‘improvement_surcharge’, ‘pickup_hour’, ‘dropoff_hour’] Predicted values : [36.8941 23.8492 98.4767 ... 11.2561 18.0295 33.5922] R2_Score (RandomForestRegressor_RFE) : 0.9531813787266661

Total number of features : 10 Selected Columns are : [‘trip_distance’, ‘RatecodeID’, ‘PULocationID’, ‘DOLocationID’, ‘extra’, ‘tip_amount’, ‘tolls_amount’, ‘improvement_surcharge’, ‘pickup_hour’, ‘dropoff_hour’] Predicted values : [36.9642 23.8092 98.2655 ... 11.2049 17.6306 33.915] R2_Score (RandomForestRegressor_RFE) : 0.9514042995436127

Total number of features : 9 Selected Columns are : [‘trip_distance’, ‘RatecodeID’, ‘PULocationID’, ‘DOLocationID’, ‘tip_amount’, ‘tolls_amount’, ‘improvement_surcharge’, ‘pickup_hour’, ‘dropoff_hour’] Predicted values : [37.5386 23.8314 98.3854 ... 11.3616 19.1439 34.4214] R2_Score (RandomForestRegressor_RFE) : 0.9496425468171789

Total number of features : 8 Selected Columns are : [‘trip_distance’, ‘RatecodeID’, ‘PULocationID’, ‘DOLocationID’, ‘tip_amount’, ‘tolls_amount’, ‘improvement_surcharge’, ‘dropoff_hour’] Predicted values : [36.6395 24.6118 98.2832 ... 11.2789 18.971 33.7174] R2_Score (RandomForestRegressor_RFE) : 0.9488814727329483

Total number of features : 7 Selected Columns are : [‘trip_distance’, ‘RatecodeID’, ‘PULocationID’, ‘DOLocationID’, ‘tip_amount’, ‘tolls_amount’, ‘improvement_surcharge’] Predicted values : [38.9321 23.8824 98.7915 ... 12.3128 19.3548 36.9436] R2_Score (RandomForestRegressor_RFE) : 0.9429121641107724

Total number of features : 6 Selected Columns are : ['trip_distance', 'RatecodeID', 'PULocationID', 'DOLocationID', 'tip_amount', 'improvement_surcharge'] Predicted values : [39.0041 23.723 97.6006 … 12.5613 19.4786 36.8866] R2_Score (RandomForestRegressor_RFE) : 0.9375039915951607

Total number of features : 5 Selected Columns are : ['trip_distance', 'RatecodeID', 'DOLocationID', 'tip_amount', 'improvement_surcharge'] Predicted values : [38.0591 25.7882 96.9694 … 12.0177 19.4338 38.2195] R2_Score (RandomForestRegressor_RFE) : 0.9380819204870838

Total number of features : 4 Selected Columns are : ['trip_distance', 'RatecodeID', 'tip_amount', 'improvement_surcharge'] Predicted values : [39.6915 28.282 96.7877 … 13.9734 21.3379 34.3977] R2_Score (RandomForestRegressor_RFE) : 0.9258540569625787

Total number of features : 3 Selected Columns are : ['trip_distance', 'tip_amount', 'improvement_surcharge'] Predicted values : [39.4993 28.8858 97.6198 … 13.911 21.7446 34.5785] R2_Score (RandomForestRegressor_RFE) : 0.8922145364663899

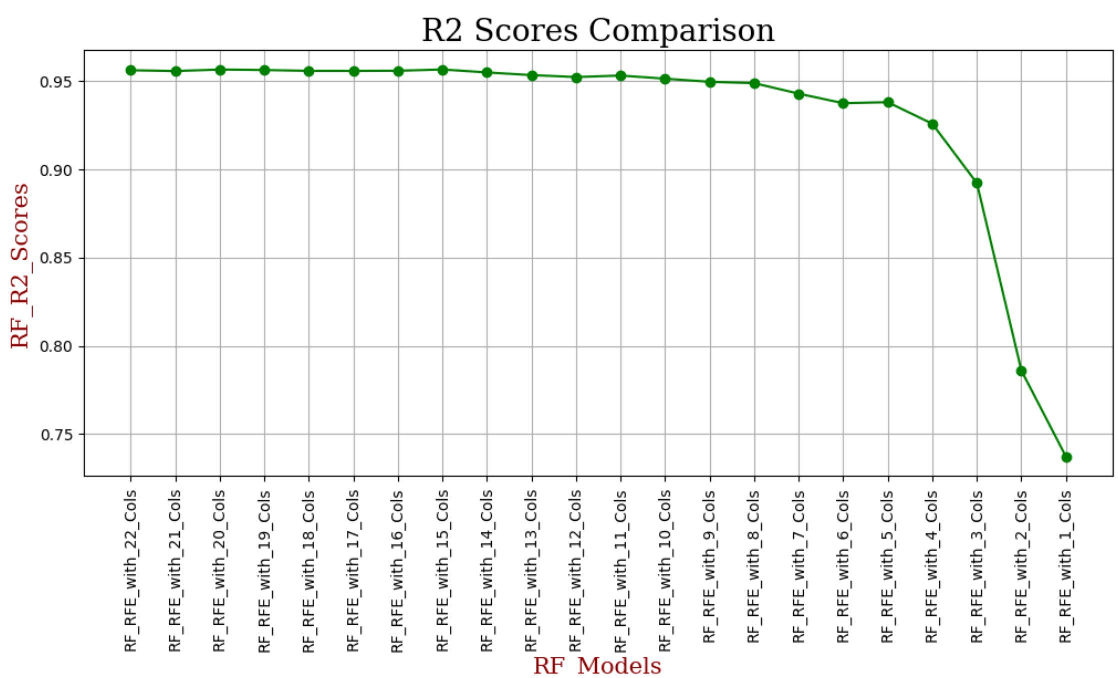
Total number of features : 2 Selected Columns are : ['trip_distance', 'tip_amount'] Predicted values : [40.3389 27.6715 97.3886 … 13.5038 21.6585 34.5027] R2_Score (RandomForestRegressor_RFE) : 0.7859565422966392

Total number of features : 1 Selected Columns are : ['trip_distance'] Predicted values : [39.39124297 26.1609182 96.54879884 … 12.84366089 18.17438061 32.51282336] R2_Score (RandomForestRegressor_RFE) : 0.7372180184215582

RF_Models : ['RF_RFE_with_22_Cols', 'RF_RFE_with_21_Cols', 'RF_RFE_with_20_Cols', 'RF_RFE_with_19_Cols', 'RF_RFE_with_18_Cols', 'RF_RFE_with_17_Cols', 'RF_RFE_with_16_Cols', 'RF_RFE_with_15_Cols', 'RF_RFE_with_14_Cols', 'RF_RFE_with_13_Cols', 'RF_RFE_with_12_Cols', 'RF_RFE_with_11_Cols', 'RF_RFE_with_10_Cols', 'RF_RFE_with_9_Cols', 'RF_RFE_with_8_Cols', 'RF_RFE_with_7_Cols', 'RF_RFE_with_6_Cols', 'RF_RFE_with_5_Cols', 'RF_RFE_with_4_Cols', 'RF_RFE_with_3_Cols', 'RF_RFE_with_2_Cols', 'RF_RFE_with_1_Cols'] RF_r2_Scores : [0.9561782455655767, 0.955722003641043, 0.9565792143132187, 0.9563181256783445, 0.9558156255813913, 0.9558068344929752,0.9558825814985351, 0.9566194990925527, 0.954943989095263, 0.9534367345017617, 0.9523303576455688, 0.9531813787266661, 0.9514042995436127, 0.9496425468171789, 0.9488814727329483, 0.9429121641107724, 0.9375039915951607, 0.9380819204870838, 0.9258540569625787, 0.8922145364663899, 0.7859565422966392, 0.7372180184215582]

[209]:
```
RF_Models = ['RF_RFE_with_22_Cols', 'RF_RFE_with_21_Cols',␣
↪'RF_RFE_with_20_Cols', 'RF_RFE_with_19_Cols',
             'RF_RFE_with_18_Cols', 'RF_RFE_with_17_Cols',␣
↪'RF_RFE_with_16_Cols', 'RF_RFE_with_15_Cols',
             'RF_RFE_with_14_Cols', 'RF_RFE_with_13_Cols',␣
↪'RF_RFE_with_12_Cols', 'RF_RFE_with_11_Cols',
             'RF_RFE_with_10_Cols', 'RF_RFE_with_9_Cols', 'RF_RFE_with_8_Cols',␣
↪'RF_RFE_with_7_Cols',
             'RF_RFE_with_6_Cols', 'RF_RFE_with_5_Cols', 'RF_RFE_with_4_Cols',␣
↪'RF_RFE_with_3_Cols',
```

```
                'RF_RFE_with_2_Cols', 'RF_RFE_with_1_Cols']
RF_r2_Scores = [0.9561782455655767, 0.955722003641043, 0.9565792143132187, 0.
 ↪9563181256783445,
                0.9558156255813913, 0.9558068344929752,0.9558825814985351, 0.
 ↪9566194990925527,
                0.954943989095263, 0.9534367345017617, 0.9523303576455688, 0.
 ↪9531813787266661,
                0.9514042995436127, 0.9496425468171789, 0.9488814727329483, 0.
 ↪9429121641107724,
                0.9375039915951607, 0.9380819204870838, 0.9258540569625787, 0.
 ↪8922145364663899,
                0.7859565422966392, 0.7372180184215582]

# Plotting
plt.figure( figsize = (12,5) )
plt.plot(RF_Models, RF_r2_Scores, 'o-g')
font1 = {'family':'serif','color':'black','size':20}
font2 = {'family':'serif','color':'darkred','size':15}
plt.title("R2 Scores Comparison", fontdict=font1)
plt.xlabel("RF_Models", fontdict=font2)
plt.ylabel("RF_R2_Scores", fontdict=font2)
plt.grid()
plt.xticks(rotation = 90)

# Showing plot
plt.show()
```



Note : From the above line plot, we can observe that we are getting the largest R2 scores in case of 20 columns and the columns are following: - ['VendorID', 'passenger_count', 'trip_distance', 'RatecodeID', 'store_and_fwd_flag', 'PULocationID', 'DOLocationID', 'payment_type', 'extra', 'tip_amount', 'tolls_amount', 'improvement_surcharge', 'congestion_surcharge', 'Airport_fee', 'pickup_day_no', 'dropoff_day_no', 'pickup_hour', 'dropoff_hour', 'pickup_timeofday', 'dropoff_timeofday']

16.0.1 Training and validating Random Forest Regressor on the above selected 20 features only.

[210]:
```
rf_cols = ['VendorID', 'passenger_count', 'trip_distance', 'RatecodeID',␣
↪'store_and_fwd_flag', 'PULocationID',
            'DOLocationID', 'payment_type', 'extra', 'tip_amount',␣
↪'tolls_amount', 'improvement_surcharge',
            'congestion_surcharge', 'Airport_fee', 'pickup_day_no',␣
↪'dropoff_day_no', 'pickup_hour',
            'dropoff_hour', 'pickup_timeofday', 'dropoff_timeofday']

rf_reg_rfe = RandomForestRegressor(n_estimators = 2000, n_jobs=-1)
rf_reg_rfe.fit(X_train[rf_cols], y_train)
rf_reg_rfe_predict = rf_reg_rfe.predict(X_val[rf_cols])
print("Predicted data :", rf_reg_rfe_predict)
rf_rfe_score = r2_score(y_val, rf_reg_rfe_predict)
print("R2 Score (RF with selected columns only) :", rf_rfe_score)
```

```
Predicted data : [37.82236  24.437365 98.46074  … 11.286405 18.531895
33.955945]
R2 Score (RF with selected columns only) : 0.9562054562063217
```

[211]:
```
'''
tuned_parameters = [{"n_estimators": [50,100, 150, 200, 250, 500],
            "max_features" : ["sqrt", "log2", None, 20],
            "max_samples" : [0.5, 0.6, 0.75, 1.0],
            "max_depth" : [2,6,8,10,12,16,20, None],
            "min_samples_split" : [2,4,8,12,14],
            "bootstrap": [True, False]}
]

RFE_model_RS = RandomizedSearchCV(RandomForestRegressor(),␣
↪param_distributions=tuned_parameters, n_jobs=-1, cv=5, verbose = 2)
RFE_model_RS.fit(X_train[rf_cols],y_train)

print ("The best parameter value is:",RFE_model_RS.best_params_)
'''
```

[211]: '\ntuned_parameters = [{"n_estimators": [50,100, 150, 200, 250, 500],\n "max_features" : ["sqrt", "log2", None, 20],\n "max_samples" : [0.5, 0.6, 0.75, 1.0],\n "max_depth" : [2,6,8,10,12,16,20, None],\n "min_samples_split" : [2,4,8,12,14],\n "bootstrap": [True, False]}\n]\n\nRFE_model_RS = RandomizedSearchCV(RandomForestRegressor(), param_distributions=tuned_parameters, n_jobs=-1, cv=5, verbose = 2)\nRFE_model_RS.fit(X_train[rf_cols],y_train)\n\nprint ("The best parameter value is:",RFE_model_RS.best_params_)\n'

- Result Fitting 5 folds for each of 10 candidates, totalling 50 fits [CV] END bootstrap=True, max_depth=None, max_features=sqrt, max_samples=1.0, min_samples_split=14, n_estimators=500; total time= 2.2min [CV] END bootstrap=True, max_depth=20, max_features=log2, max_samples=1.0, min_samples_split=8, n_estimators=100; total time= 22.1s [CV] END bootstrap=True, max_depth=20, max_features=log2, max_samples=1.0, min_samples_split=8, n_estimators=100; total time= 22.8s [CV] END bootstrap=True, max_depth=12, max_features=sqrt, max_samples=1.0, min_samples_split=14, n_estimators=150; total time= 22.1s [CV] END bootstrap=True, max_depth=2, max_features=log2, max_samples=1.0, min_samples_split=14, n_estimators=500; total time= 14.0s [CV] END bootstrap=True, max_depth=2, max_features=log2, max_samples=1.0, min_samples_split=14, n_estimators=500; total time= 14.1s [CV] END bootstrap=True, max_depth=None, max_features=sqrt, max_samples=1.0, min_samples_split=8, n_estimators=100; total time= 27.7s [CV] END bootstrap=True, max_depth=None, max_features=sqrt, max_samples=1.0, min_samples_split=8, n_estimators=100; total time= 27.1s [CV] END bootstrap=True, max_depth=None, max_features=None, max_samples=0.5, min_samples_split=12, n_estimators=500; total time= 5.2min

[CV] END bootstrap=True, max_depth=None, max_features=sqrt, max_samples=0.75, min_samples_split=12, n_estimators=150; total time= 31.8s [CV] END bootstrap=True, max_depth=None, max_features=sqrt, max_samples=1.0, min_samples_split=14, n_estimators=500; total time= 2.2min [CV] END bootstrap=True, max_depth=20, max_features=log2, max_samples=1.0, min_samples_split=8, n_estimators=100; total time= 22.3s [CV] END bootstrap=True, max_depth=20, max_features=log2, max_samples=1.0, min_samples_split=8, n_estimators=100; total time= 22.2s [CV] END bootstrap=True, max_depth=12, max_features=sqrt, max_samples=1.0, min_samples_split=14, n_estimators=150; total time= 21.8s [CV] END bootstrap=True, max_depth=12, max_features=sqrt, max_samples=1.0, min_samples_split=14, n_estimators=150; total time= 21.9s [CV] END bootstrap=True, max_depth=2, max_features=log2, max_samples=1.0, min_samples_split=14, n_estimators=500; total time= 14.0s [CV] END bootstrap=True, max_depth=None, max_features=sqrt, max_samples=1.0, min_samples_split=8, n_estimators=100; total time= 26.8s [CV] END bootstrap=True, max_depth=None, max_features=None, max_samples=0.5, min_samples_split=12, n_estimators=500; total time= 5.2min [CV] END bootstrap=True, max_depth=None, max_features=sqrt, max_samples=0.75, min_samples_split=12, n_estimators=150; total time= 32.3s [CV] END bootstrap=True, max_depth=None, max_features=sqrt, max_samples=0.75, min_samples_split=12, n_estimators=150; total time= 31.0s [CV] END bootstrap=True, max_depth=None, max_features=sqrt, max_samples=1.0, min_samples_split=14, n_estimators=500; total time= 2.2min [CV] END bootstrap=True, max_depth=20, max_features=log2, max_samples=1.0, min_samples_split=8, n_estimators=100; total time= 22.4s [CV] END bootstrap=False, max_depth=2, max_features=20, max_samples=1.0, min_samples_split=2, n_estimators=50; total time= 0.0s [CV] END bootstrap=False, max_depth=2, max_features=20, max_samples=1.0, min_samples_split=2, n_estimators=50; total time= 0.0s [CV] END bootstrap=False, max_depth=2, max_features=20, max_samples=1.0, min_samples_split=2, n_estimators=50; total time= 0.0s [CV] END bootstrap=False, max_depth=2, max_features=20, max_samples=1.0, min_samples_split=2, n_estimators=50; total time= 0.0s [CV] END bootstrap=False, max_depth=2, max_features=20, max_samples=1.0, min_samples_split=2, n_estimators=50; total time= 0.0s [CV] END bootstrap=True, max_depth=12, max_features=sqrt, max_samples=1.0, min_samples_split=14, n_estimators=150; total time= 22.6s [CV] END bootstrap=True, max_depth=12, max_features=sqrt, max_samples=1.0, min_samples_split=14, n_estimators=150; total time= 22.2s [CV] END bootstrap=True, max_depth=2, max_features=log2, max_samples=1.0, min_samples_split=14, n_estimators=500; total time= 14.3s [CV] END bootstrap=True, max_depth=2, max_features=log2, max_samples=1.0, min_samples_split=14, n_estimators=500; total time= 14.5s [CV] END bootstrap=True, max_depth=None, max_features=sqrt, max_samples=1.0, min_samples_split=8, n_estimators=100; total time= 26.6s [CV] END bootstrap=True, max_depth=None, max_features=sqrt, max_samples=1.0, min_samples_split=8, n_estimators=100; total time= 26.8s [CV] END bootstrap=True, max_depth=None, max_features=None, max_samples=0.5, min_samples_split=12, n_estimators=500; total time= 5.2min [CV] END bootstrap=True, max_depth=None, max_features=sqrt, max_samples=0.75, min_samples_split=12, n_estimators=150; total time= 32.7s [CV] END bootstrap=True, max_depth=None, max_features=sqrt, max_samples=0.75, min_samples_split=12, n_estimators=150; total time= 28.1s [CV] END bootstrap=True, max_depth=None, max_features=sqrt, max_samples=1.0, min_samples_split=14, n_estimators=500; total time= 2.2min [CV] END bootstrap=True, max_depth=None, max_features=sqrt, max_samples=1.0, min_samples_split=14, n_estimators=500; total time= 2.1min [CV] END bootstrap=False, max_depth=10, max_features=None, max_samples=1.0, min_samples_split=14, n_estimators=50; total time= 0.0s [CV] END bootstrap=False, max_depth=10, max_features=None, max_samples=1.0, min_samples_split=14, n_estimators=50; total time= 0.0s [CV] END bootstrap=False, max_depth=10, max_features=None, max_samples=1.0, min_samples_split=14, n_estimators=50; total time= 0.0s [CV] END bootstrap=False, max_depth=10, max_features=None, max_samples=1.0, min_samples_split=14, n_estimators=50; total time= 0.0s [CV] END bootstrap=False, max_depth=10, max_features=None, max_samples=1.0, min_samples_split=14, n_estimators=50; total time= 0.0s [CV] END bootstrap=False, max_depth=2, max_features=sqrt, max_samples=1.0, min_samples_split=8, n_estimators=100; total time= 0.0s [CV] END bootstrap=False, max_depth=2, max_features=sqrt, max_samples=1.0, min_samples_split=8, n_estimators=100; total time= 0.0s [CV] END bootstrap=False, max_depth=2, max_features=sqrt, max_samples=1.0, min_samples_split=8, n_estimators=100; total time= 0.0s [CV] END bootstrap=False, max_depth=2, max_features=sqrt, max_samples=1.0, min_samples_split=8, n_estimators=100; total time= 0.0s [CV] END bootstrap=False, max_depth=2, max_features=sqrt, max_samples=1.0, min_samples_split=8, n_estimators=100; total time= 0.0s [CV] END bootstrap=True, max_depth=None, max_features=None, max_samples=0.5, min_samples_split=12, n_estimators=500; total time= 5.2min [CV] END bootstrap=True, max_depth=None, max_features=None, max_samples=0.5, min_samples_split=12, n_estimators=500; total time= 4.2min The best parameter value is: {'n_estimators': 500, 'min_samples_split': 12, 'max_samples': 0.5, 'max_features': None, 'max_depth': None, 'bootstrap': True}

[212]:
```
rf_reg_rfe1 = RandomForestRegressor(n_jobs=-1,n_estimators = 500,␣
 ↪min_samples_split = 12, max_samples=0.5, max_features = None, max_depth =␣
 ↪None, bootstrap = True)
rf_reg_rfe1.fit(X_train[rf_cols], y_train)
rf_reg_rfe1_predict = rf_reg_rfe1.predict(X_val[rf_cols])
print("Predicted data :", rf_reg_rfe1_predict)
rf_rfe1_score = r2_score(y_val, rf_reg_rfe1_predict)
print("R2 Score (RF with selected columns only) :", rf_rfe1_score)
```

```
Predicted data : [37.8324891  24.67483711 98.4699324  … 11.37899214
18.48546443
 33.9356232 ]
R2 Score (RF with selected columns only) : 0.9570416333280967
```

17 Final Observation

- **Case 1 :**Among all Models, `Random Forest Regressor` is giving the best score.
- **Case 2 :**Training `Random Forest Regressor` using only positively correlated features also giving the good score.
-

17.1 Case 3 :After performing `RFE` using `Random Forest Regressor`, the subset of 20 features is giving good score.

`Applying all the above cases on test data and observing the result below.`

18 Final Submission (After Comparing model using `R2` Scores and applying the best model on `test.csv` data)

[213]:
```
#best_model_predict = rf_reg.predict(test_data)
#best_model_predict = rf_reg_corr.predict(test_data[corr_cols])
best_model_predict = rf_reg_rfe.predict(test_data[rf_cols])     # Giving the␣
 ↪best score to the test data.
#best_model_predict = rf_reg_rfe1.predict(test_data[rf_cols])
best_model_predict
```

[213]:
```
array([35.955   , 25.066395, 15.92205 , …, 21.6817   , 35.880645,
       17.62315 ])
```

[214]:
```
res_len = len(best_model_predict)
id = np.array([ i for i in range(1,res_len+1)])
result = pd.DataFrame({"ID" : id, "total_amount" : best_model_predict})
result.to_csv("submission.csv", index=False)
```

19 Conclusion

- `RandomForestRegressor()` having default hyperparameters with 20 selected columns after RFE is giving the best score.