```
import numpy as np
import pandas as pd
import seaborn as sns
import matplotlib.pyplot as plt
from sklearn.impute import SimpleImputer
from sklearn.preprocessing import LabelEncoder
import scipy.stats as stats
import warnings
warnings.filterwarnings('ignore')

def diagnostic_plots(df, variable):
  plt.figure(figsize=(15,6))
  # гистограмма
  plt.subplot(1, 2, 1)
  df[variable].hist(bins=30)
  ## Q-Q plot
  plt.subplot(1, 2, 2)
  stats.probplot(df[variable], dist="norm", plot=plt)
  plt.show()
```

Заполнение пустых значений

```
!wget
https://raw.githubusercontent.com/thisismetis/datasets/main/heroes_inf
ormation.csv
data = pd.read_csv('heroes_information.csv', sep=",")
data.head()
```

```
--2023-05-02 10:37:09--
https://raw.githubusercontent.com/thisismetis/datasets/main/heroes_inf
ormation.csv
Resolving raw.githubusercontent.com (raw.githubusercontent.com)...
185.199.110.133, 185.199.111.133, 185.199.109.133, ...
Connecting to raw.githubusercontent.com (raw.githubusercontent.com)|
185.199.110.133|:443... connected.
HTTP request sent, awaiting response... 200 OK
Length: 49195 (48K) [text/plain]
Saving to: ‘heroes_information.csv.2’

 heroes_information.   0%[                    ]       0  --.-KB/s
heroes_information. 100%[===================>]  48.04K  --.-KB/s    in
0.007s

2023-05-02 10:37:09 (6.62 MB/s) - ‘heroes_information.csv.2’ saved
[49195/49195]


   Unnamed: 0         name Gender Eye color               Race Hair
color  \
0           0       A-Bomb   Male    yellow              Human    No
Hair
```

```
1           1   Abe Sapien   Male      blue      Icthyo Sapien    No
Hair
2           2     Abin Sur   Male      blue            Ungaran    No
Hair
3           3  Abomination   Male     green  Human / Radiation    No
Hair
4           4      Abraxas   Male      blue      Cosmic Entity
Black

   Height          Publisher Skin color Alignment  Weight
0   203.0      Marvel Comics          -      good   441.0
1   191.0  Dark Horse Comics       blue      good    65.0
2   185.0          DC Comics        red      good    90.0
3   203.0      Marvel Comics          -       bad   441.0
4   -99.0      Marvel Comics          -       bad   -99.0
```

```
data.isnull().sum()
```

```
Unnamed: 0     0
name           0
Gender         0
Eye color      0
Race           0
Hair color     0
Height         0
Publisher     15
Skin color     0
Alignment      0
Weight         2
dtype: int64
```

```
imputer = SimpleImputer(missing_values=np.nan, strategy="constant",
fill_value = "Unknown")
nullFixedData = pd.DataFrame(data = imputer.fit_transform(data),
columns=data.columns)
nullFixedData.isnull().sum()
```

```
Unnamed: 0    0
name          0
Gender        0
Eye color     0
Race          0
Hair color    0
Height        0
Publisher     0
Skin color    0
Alignment     0
Weight        0
dtype: int64
```

Кодирование категориальных признаков

```
!wget  https://raw.githubusercontent.com/azar-
s91/dataset/master/BankChurners.csv
data = pd.read_csv('BankChurners.csv', sep=",")
data.head()
```

```
--2023-05-02 10:37:09--
https://raw.githubusercontent.com/azar-s91/dataset/master/BankChurners
.csv
Resolving raw.githubusercontent.com (raw.githubusercontent.com)...
185.199.110.133, 185.199.109.133, 185.199.108.133, ...
Connecting to raw.githubusercontent.com (raw.githubusercontent.com)|
185.199.110.133|:443... connected.
HTTP request sent, awaiting response... 200 OK
Length: 1210878 (1.2M) [text/plain]
Saving to: ‘BankChurners.csv.5’

 BankChurners.csv.5    0%[                    ]       0  --.-KB/s
BankChurners.csv.5  100%[===================>]   1.15M  --.-KB/s    in
0.04s

2023-05-02 10:37:09 (30.1 MB/s) - ‘BankChurners.csv.5’ saved
[1210878/1210878]
```

	CLIENTNUM	Attrition_Flag	Customer_Age	Gender	Dependent_count
0	768805383	Existing Customer	45	M	3
1	818770008	Existing Customer	49	F	5
2	713982108	Existing Customer	51	M	3
3	769911858	Existing Customer	40	F	4
4	709106358	Existing Customer	40	M	3

	Education_Level	Marital_Status	Income_Category	Card_Category
0	High School	Married	$60K - $80K	Blue
1	Graduate	Single	Less than $40K	Blue
2	Graduate	Married	$80K - $120K	Blue
3	High School	Unknown	Less than $40K	Blue
4	Uneducated	Married	$60K - $80K	Blue

	Months_on_book	...	Months_Inactive_12_mon	Contacts_Count_12_mon
0	39	...	1	3
1	44	...	1	2

```
2              36  ...                       1                        0

3              34  ...                       4                        1

4              21  ...                       1                        0


   Credit_Limit  Total_Revolving_Bal  Avg_Open_To_Buy
Total_Amt_Chng_Q4_Q1  \
0       12691.0                  777          11914.0
1.335
1        8256.0                  864           7392.0
1.541
2        3418.0                    0           3418.0
2.594
3        3313.0                 2517            796.0
1.405
4        4716.0                    0           4716.0
2.175

   Total_Trans_Amt  Total_Trans_Ct  Total_Ct_Chng_Q4_Q1
Avg_Utilization_Ratio
0             1144              42                1.625
0.061
1             1291              33                3.714
0.105
2             1887              20                2.333
0.000
3             1171              20                2.333
0.760
4              816              28                2.500
0.000

[5 rows x 21 columns]
```

```
labelEnc = LabelEncoder()
for column in data.columns:
  if data[column].dtype not in ['float', 'int']:
    data[[column]] =
pd.DataFrame(labelEnc.fit_transform(data[column].astype(str)),
columns=[column])
data.head(10)
```

```
   CLIENTNUM  Attrition_Flag  Customer_Age  Gender  Dependent_count  \
0  768805383               1            45       1                3
1  818770008               1            49       0                5
2  713982108               1            51       1                3
3  769911858               1            40       0                4
4  709106358               1            40       1                3
```

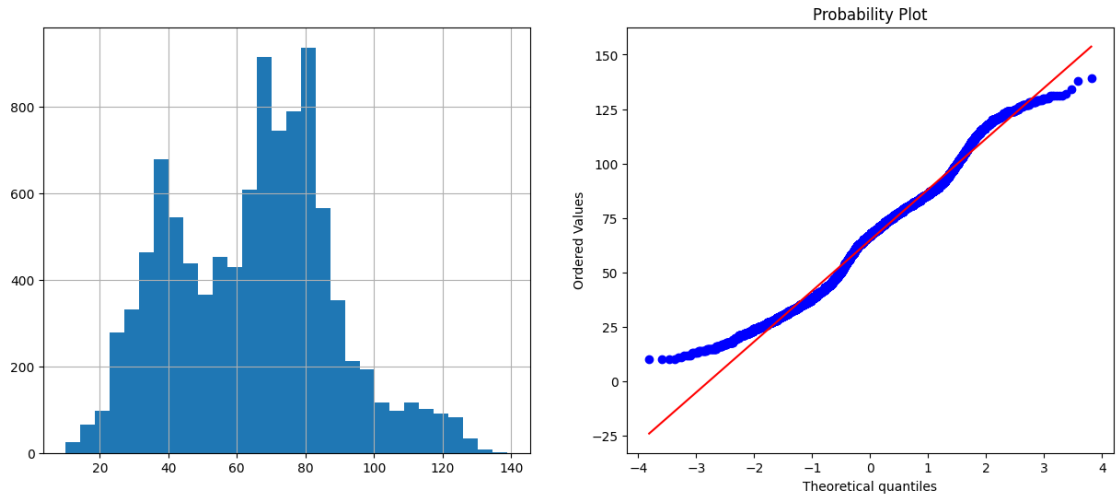
```
5  713061558              1            44       1                 2
6  810347208              1            51       1                 4
7  818906208              1            32       1                 0
8  710930508              1            37       1                 3
9  719661558              1            48       1                 2

   Education_Level  Marital_Status  Income_Category  Card_Category  \
0                3               1                2              0
1                2               2                4              0
2                2               1                3              0
3                3               3                4              0
4                5               1                2              0
5                2               1                1              0
6                6               1                0              1
7                3               3                2              3
8                5               2                2              0
9                2               2                3              0

   Months_on_book  ...  Months_Inactive_12_mon  Contacts_Count_12_mon
\
0              39  ...                       1                      3

1              44  ...                       1                      2

2              36  ...                       1                      0

3              34  ...                       4                      1

4              21  ...                       1                      0

5              36  ...                       1                      2

6              46  ...                       1                      3

7              27  ...                       2                      2

8              36  ...                       2                      0

9              36  ...                       3                      3


   Credit_Limit  Total_Revolving_Bal  Avg_Open_To_Buy
Total_Amt_Chng_Q4_Q1  \
0       12691.0                  777          11914.0
1.335
1        8256.0                  864           7392.0
1.541
2        3418.0                    0           3418.0
2.594
```

```
3        3313.0                 2517            796.0
1.405
4        4716.0                    0           4716.0
2.175
5        4010.0                 1247           2763.0
1.376
6       34516.0                 2264          32252.0
1.975
7       29081.0                 1396          27685.0
2.204
8       22352.0                 2517          19835.0
3.355
9       11656.0                 1677           9979.0
1.524

   Total_Trans_Amt  Total_Trans_Ct  Total_Ct_Chng_Q4_Q1
Avg_Utilization_Ratio
0             1144              42                1.625
0.061
1             1291              33                3.714
0.105
2             1887              20                2.333
0.000
3             1171              20                2.333
0.760
4              816              28                2.500
0.000
5             1088              24                0.846
0.311
6             1330              31                0.722
0.066
7             1538              36                0.714
0.048
8             1350              24                1.182
0.113
9             1441              32                0.882
0.144

[10 rows x 21 columns]
```

Нормализация числовых признаков

```
data.hist(figsize=(20,20))
plt.show()
```


```
diagnostic_plots(data, 'Total_Trans_Ct')
```



```
data['Total_Trans_Ct_sqrt'] = data['Total_Trans_Ct']**(1/2)
diagnostic_plots(data, 'Total_Trans_Ct_sqrt')
```