hearttrainaf

May 1, 2025

[3]:
```
import pandas as pd
import numpy as np
import seaborn as sns
import matplotlib.pyplot as plt
```

[4]:
```
df=pd.read_csv('heart.csv')
```

[5]:
```
df=df.drop_duplicates()
```

[6]:
```
df.isna().sum()
```

[6]:
```
id            0
age           0
sex           0
dataset       0
cp            0
trestbps     59
chol         30
fbs          90
restecg       2
thalch       55
exang        55
oldpeak      62
slope       309
ca          611
thal        486
num           0
dtype: int64
```

[7]:
```
mean_col=['trestbps','chol','thalch','oldpeak','ca']
median_col=['fbs','restecg','exang','slope','thal']
```

[8]:
```
for col in mean_col:
    if col in df.columns:
        df[col]=df[col].fillna(df[col].mean())

for col in median_col:
    if col in df.columns:
        df[col]=df[col].fillna(df[col].mode()[0])
```

```
C:\Users\AMOL\AppData\Local\Temp\ipykernel_9720\1465429545.py:7: FutureWarning:
Downcasting object dtype arrays on .fillna, .ffill, .bfill is deprecated and
will change in a future version. Call result.infer_objects(copy=False) instead.
To opt-in to the future behavior, set
`pd.set_option('future.no_silent_downcasting', True)`
  df[col]=df[col].fillna(df[col].mode()[0])
```

[9]:

```
df.isna().sum()
```

[9]:

```
id          0
age         0
sex         0
dataset     0
cp          0
trestbps    0
chol        0
fbs         0
restecg     0
thalch      0
exang       0
oldpeak     0
slope       0
ca          0
thal        0
num         0
dtype: int64
```

[10]:

```
df1=df[['age','cp','chol','thalch']]
df2=df[['exang','slope','num']]
```

[11]:

```
merged_df=pd.concat([df1,df2],axis=1)
merged_df
df.head()
```

[11]:

```
   id  age     sex   dataset               cp  trestbps   chol    fbs  \
0   1   63    Male  Cleveland  typical angina     145.0  233.0   True
1   2   67    Male  Cleveland    asymptomatic     160.0  286.0  False
2   3   67    Male  Cleveland    asymptomatic     120.0  229.0  False
3   4   37    Male  Cleveland     non-anginal     130.0  250.0  False
4   5   41  Female  Cleveland  atypical angina    130.0  204.0  False

         restecg  thalch  exang  oldpeak        slope   ca  \
0  lv hypertrophy   150.0  False      2.3  downsloping  0.0
1  lv hypertrophy   108.0   True      1.5         flat  3.0
```

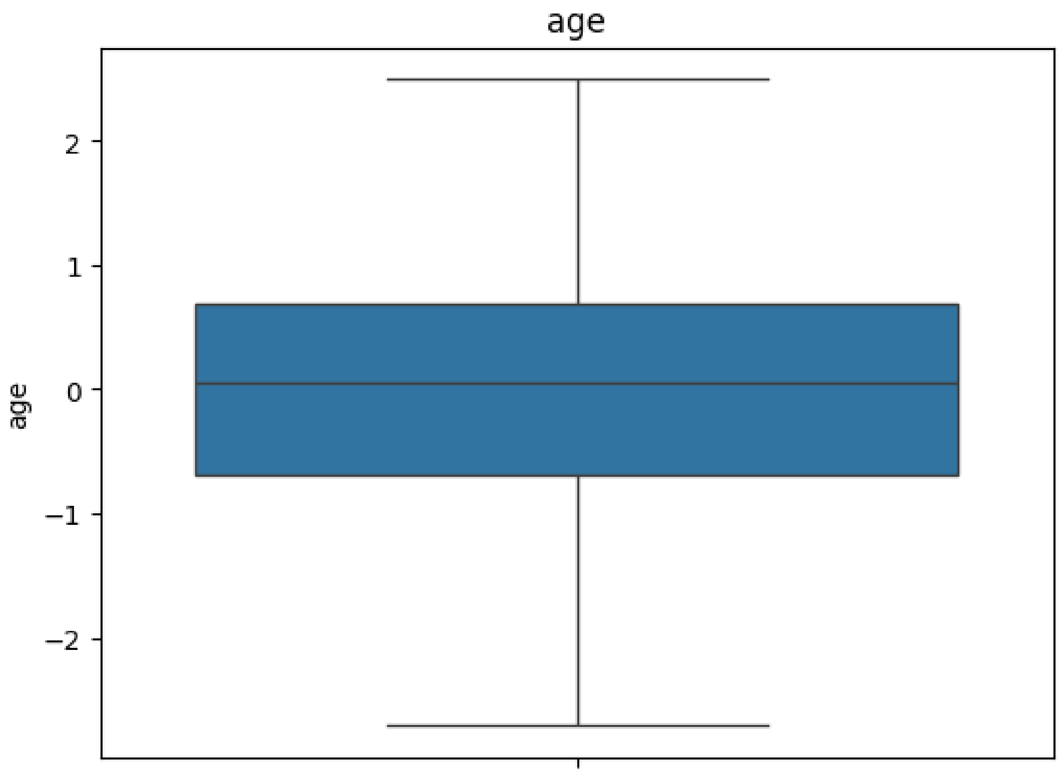
```
2  lv hypertrophy   129.0   True       2.6         flat  2.0
3          normal   187.0  False       3.5  downsloping  0.0
4  lv hypertrophy   172.0  False       1.4    upsloping  0.0

                thal  num
0       fixed defect    0
1             normal    2
2  reversable defect    1
3             normal    0
4             normal    0
```

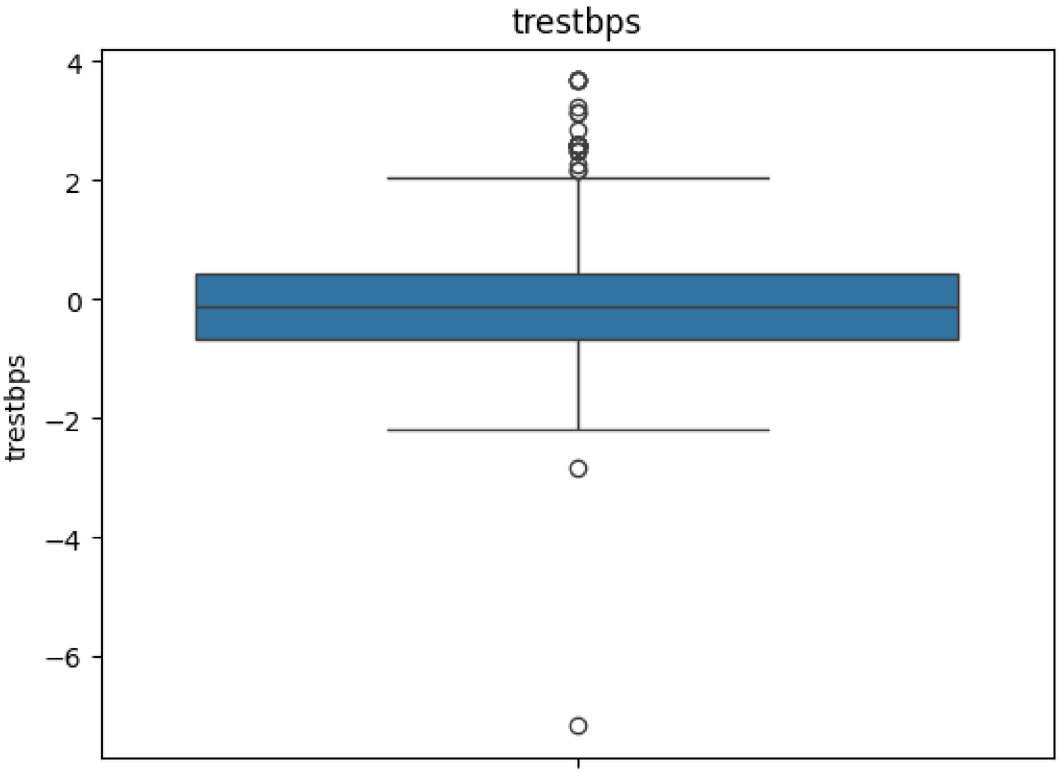
[12]:

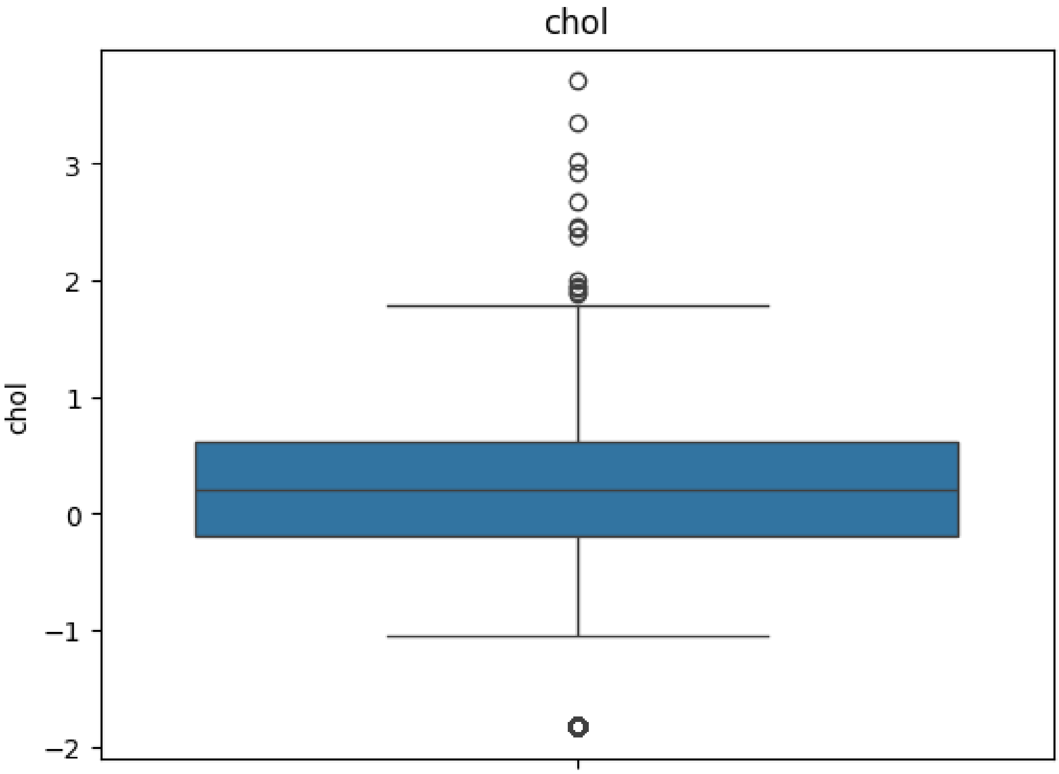
```python
from sklearn.preprocessing import StandardScaler,LabelEncoder
label_encoder=LabelEncoder()
scaler=StandardScaler()
cat_col=['sex','dataset','cp','restecg','slope','thal']
num_cols=['age','trestbps','chol','thalch','oldpeak','ca']
```

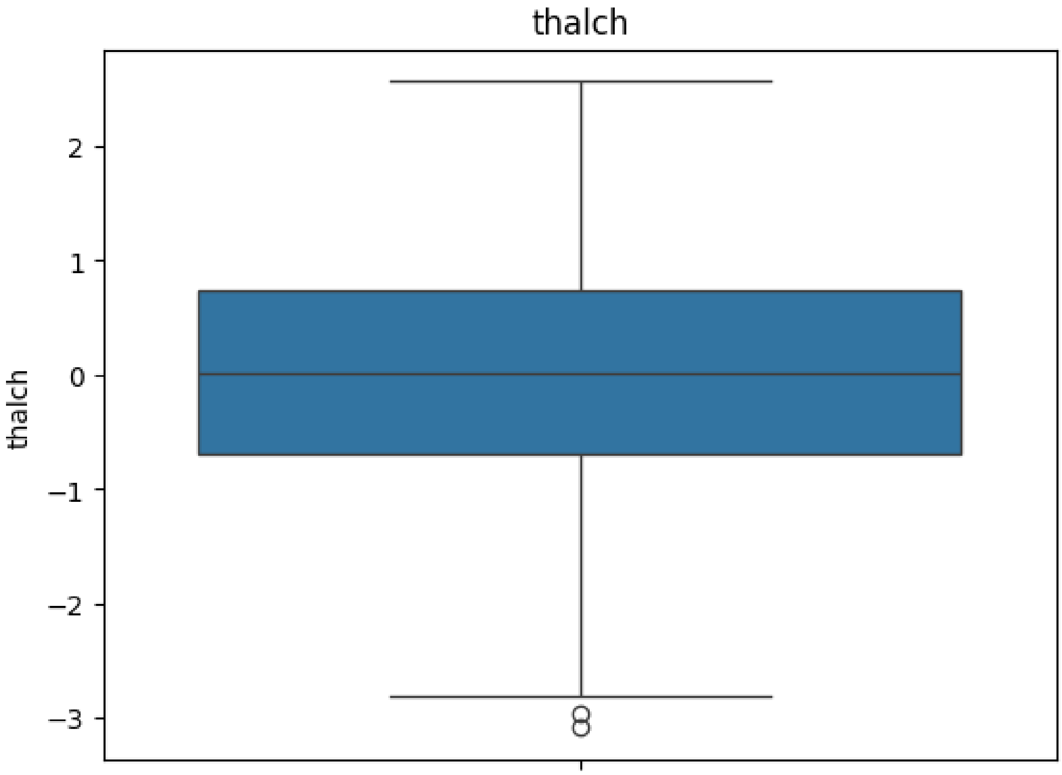
[13]:

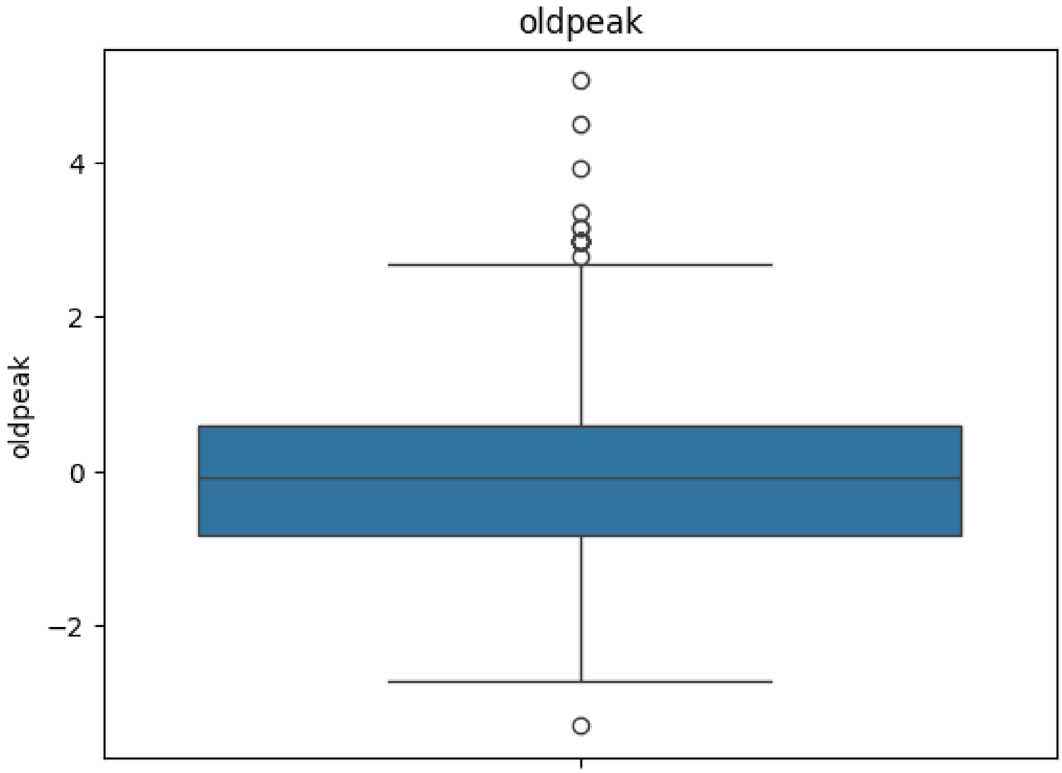
```python
for col in cat_col:
    df[col]=label_encoder.fit_transform(df[col].astype(str))
df[num_cols]=scaler.fit_transform(df[num_cols])

for col in num_cols:
    sns.boxplot(df[col])
    plt.title(col)
    plt.show()
```

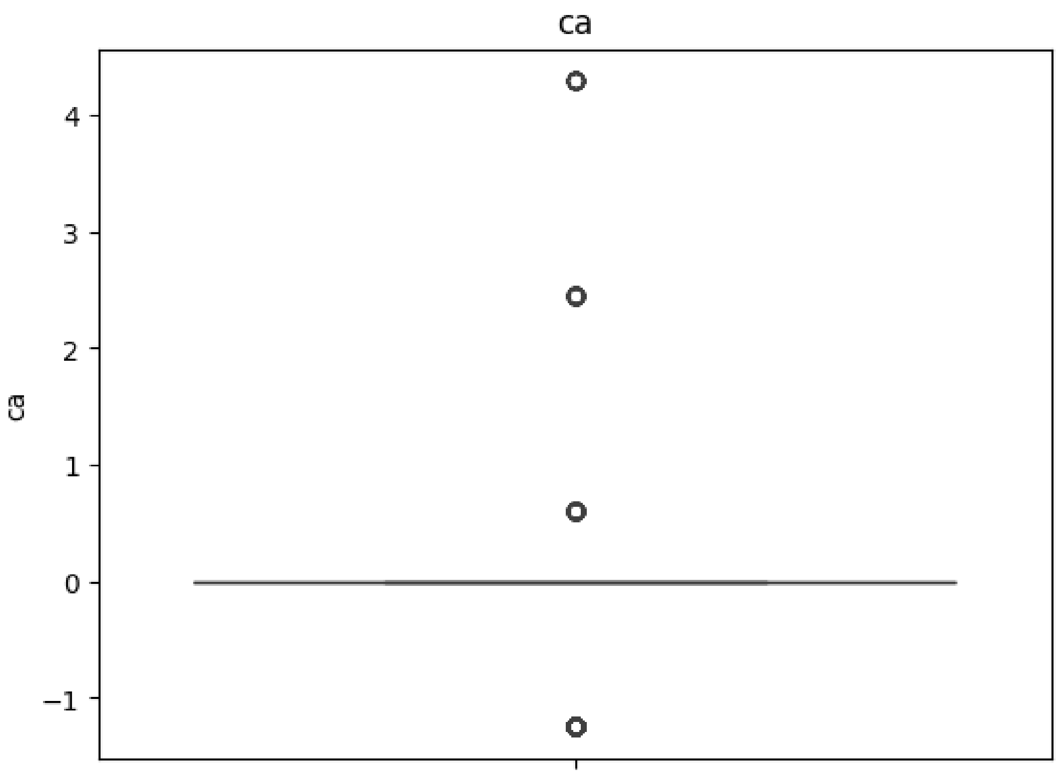

age
2
1
0
−1
−2
age


trestbps
4
2
0
−2
−4
−6
trestbps


chol
chol
3
2
1
0
−1
−2

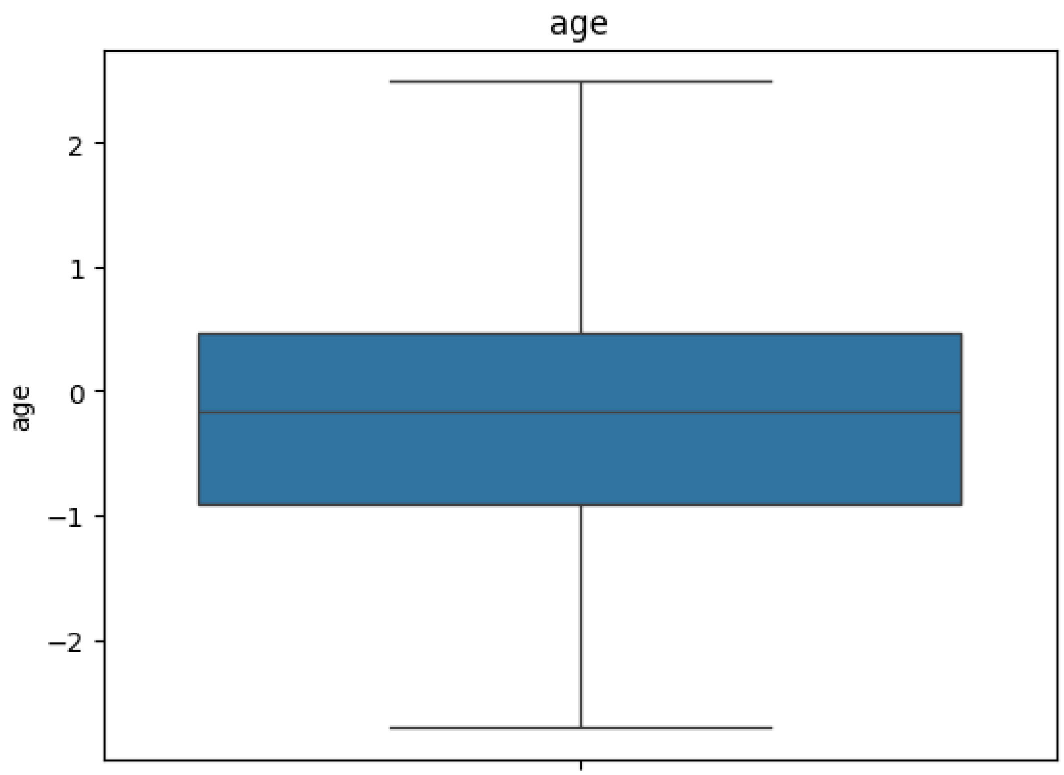

thalch
thalch
2
1
0
−1
−2
−3

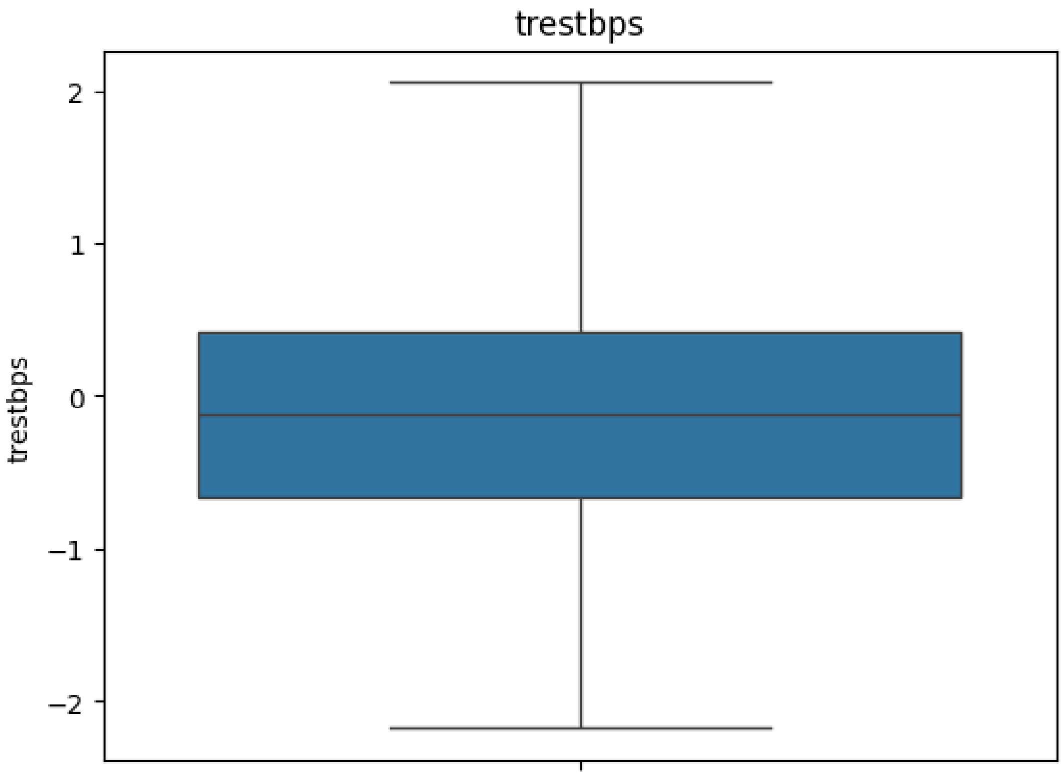

oldpeak
oldpeak
4
2
0
−2

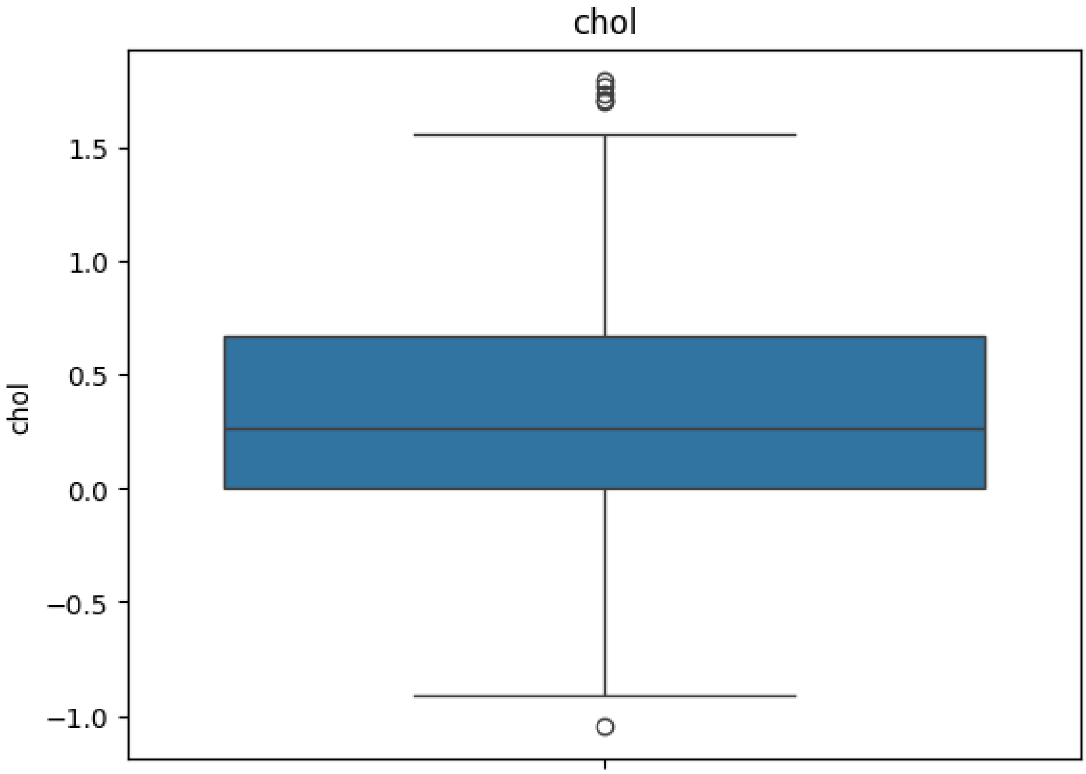


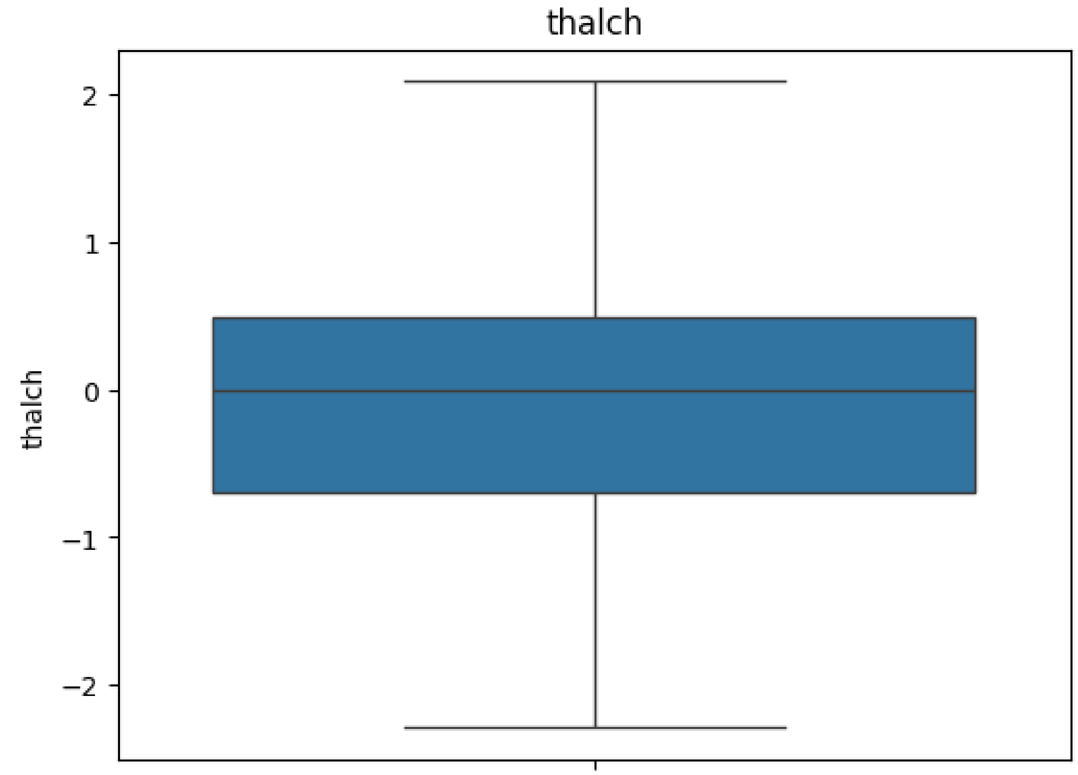
[14]:

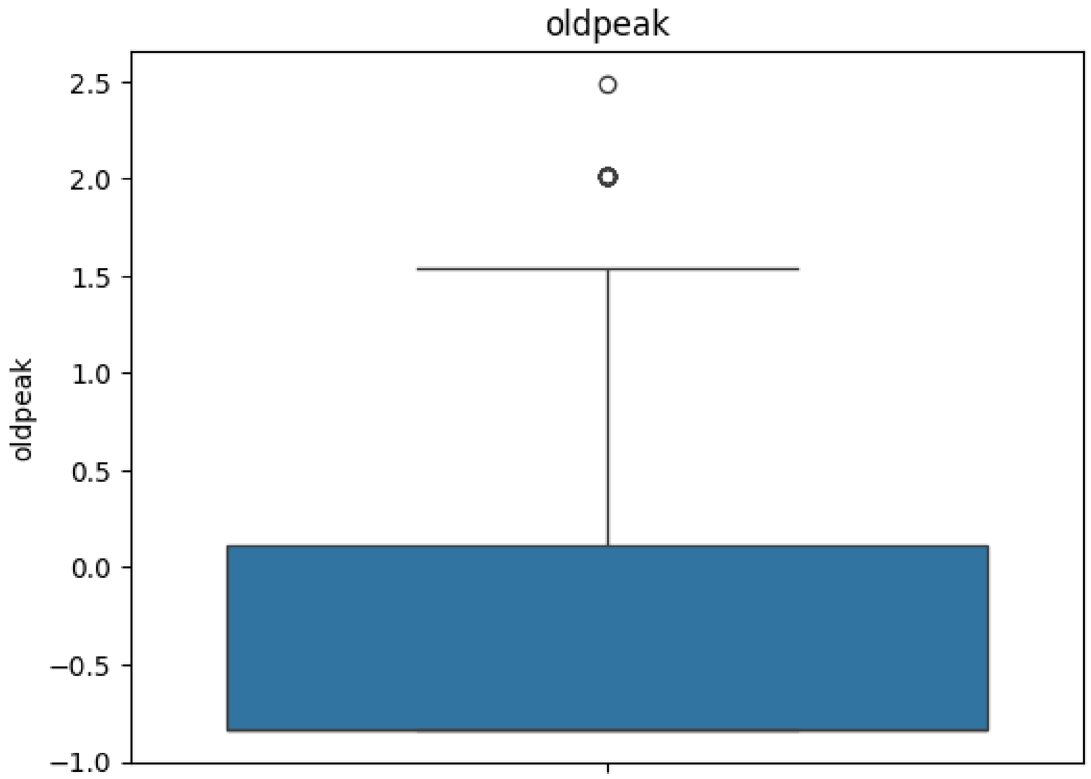
```
def remove_outliers(df, col):
    Q1=df[col].quantile(0.25)
    Q3=df[col].quantile(0.75)
    IQR=Q3-Q1
    lower= Q1 - 1.5 * IQR
    upper= Q3 + 1.5 * IQR
    return df[(df[col]>=lower) & (df[col]<=upper) ]

for col in num_cols:
    df=remove_outliers(df, col)


for col in num_cols:
    sns.boxplot(df[col])
    plt.title(col)
    plt.show()
```

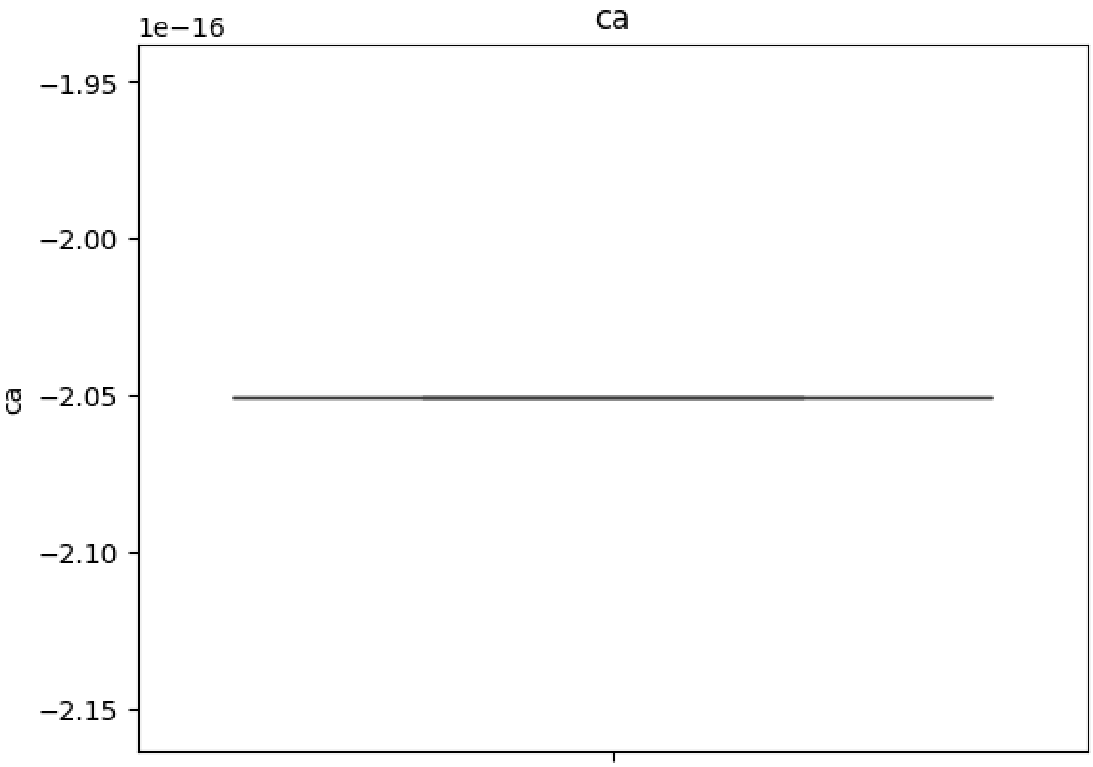

age
age
2
1
0
−1
−2


trestbps
trestbps
2
1
0
−1
−2


chol
chol
1.5
1.0
0.5
0.0
−0.5
−1.0


thalch
thalch
2
1
0
−1
−2


oldpeak
oldpeak
2.5
2.0
1.5
1.0
0.5
0.0
−0.5
−1.0



[15]:
```
df.head()
```

[15]:
```
      id       age  sex  dataset  cp  trestbps      chol    fbs  restecg  \
166  167 -0.160397    1        0   2  0.318305  0.219192  False        1
192  193 -1.115855    1        0   0 -0.007183  0.439581   True        0
287  288  0.476575    1        0   1 -0.386918  0.191643  False        1
302  303 -1.646666    1        0   2  0.318305 -0.221586  False        1
303  304 -2.708286    1        0   1 -0.115679 -0.616449  False        0

       thalch  exang   oldpeak  slope            ca  thal  num
166  1.251922  False -0.834397      2 -2.050756e-16     1    0
192  0.217089   True -0.739448      1 -2.050756e-16     2    1
287  0.256891  False -0.454603      1 -2.050756e-16     2    0
302  1.411127  False -0.834397      2 -2.050756e-16     1    0
303  1.888743  False -0.834397      1 -2.050756e-16     1    0
```

[16]:
```
from sklearn.linear_model import LogisticRegression
from sklearn.model_selection import train_test_split

y=df['num']
```

```
X=df.drop(['id','num'],axis=1)

X_train,X_test,y_train,y_test=train_test_split(X,y,test_size=0.
 ↪2,random_state=42)

from sklearn.metrics import accuracy_score,classification_report

model=LogisticRegression()
model.fit(X_train,y_train)
y_pred=model.predict(X_test)
```

```
C:\Users\AMOL\AppData\Local\Programs\Python\Python313\Lib\site-
packages\sklearn\linear_model\_logistic.py:465: ConvergenceWarning: lbfgs failed
to converge (status=1):
STOP: TOTAL NO. OF ITERATIONS REACHED LIMIT.

Increase the number of iterations (max_iter) or scale the data as shown in:
    https://scikit-learn.org/stable/modules/preprocessing.html
Please also refer to the documentation for alternative solver options:
    https://scikit-learn.org/stable/modules/linear_model.html#logistic-
regression
  n_iter_i = _check_optimize_result(
```

```
[17]: print(f'Accuracy:',accuracy_score(y_test,y_pred))
      print(f'Classification Report:',classification_report(y_test,y_pred))
```

```
Accuracy: 0.75
Classification Report:               precision    recall  f1-score   support

           0       0.87      0.92      0.90        51
           1       0.60      0.60      0.60        20
           2       1.00      0.50      0.67         6
           3       0.14      0.20      0.17         5
           4       0.00      0.00      0.00         2

    accuracy                           0.75        84
   macro avg       0.52      0.44      0.47        84
weighted avg       0.75      0.75      0.74        84


C:\Users\AMOL\AppData\Local\Programs\Python\Python313\Lib\site-
packages\sklearn\metrics\_classification.py:1565: UndefinedMetricWarning:
Precision is ill-defined and being set to 0.0 in labels with no predicted
samples. Use `zero_division` parameter to control this behavior.
  _warn_prf(average, modifier, f"{metric.capitalize()} is", len(result))
C:\Users\AMOL\AppData\Local\Programs\Python\Python313\Lib\site-
packages\sklearn\metrics\_classification.py:1565: UndefinedMetricWarning:
Precision is ill-defined and being set to 0.0 in labels with no predicted
```

```
samples. Use `zero_division` parameter to control this behavior.
  _warn_prf(average, modifier, f"{metric.capitalize()} is", len(result))
C:\Users\AMOL\AppData\Local\Programs\Python\Python313\Lib\site-
packages\sklearn\metrics\_classification.py:1565: UndefinedMetricWarning:
Precision is ill-defined and being set to 0.0 in labels with no predicted
samples. Use `zero_division` parameter to control this behavior.
  _warn_prf(average, modifier, f"{metric.capitalize()} is", len(result))
```

[ ]:

```
new_data = [[-0.2, 1, 0, 2, 0.25, 0.3, 1, 1, 1.2, 0, 0.0, 2, 1, 2]]
```