```python
import pandas as pd
import numpy as np
from sklearn.model_selection import train_test_split
from sklearn.preprocessing import OneHotEncoder
from sklearn.compose import make_column_transformer
from sklearn.feature_selection import SelectFromModel, SelectKBest,
SelectPercentile, RFE
from sklearn.model_selection import GridSearchCV, StratifiedKFold
from sklearn.ensemble import GradientBoostingClassifier
from sklearn.ensemble import RandomForestClassifier,
RandomForestRegressor
from sklearn.svm import SVC, SVR
from sklearn.metrics import classification_report, confusion_matrix,
ConfusionMatrixDisplay
from sklearn.preprocessing import StandardScaler, MinMaxScaler
from sklearn.pipeline import Pipeline
from sklearn.tree import DecisionTreeClassifier
from sklearn.linear_model import LogisticRegression
from sklearn.metrics import mean_squared_error, mean_absolute_error
from pandas.api.types import is_numeric_dtype
from sklearn.linear_model import Ridge, Lasso
import matplotlib.pyplot as plt

properti = pd.read_csv('/Users/saktiyoga/Downloads/UTS_PMDPM/Dataset
UTS_Gasal 2425.csv')
properti.head(100)
# from google.colab import drive
# drive.mount('/content/drive')
# properti=pd.read_csv('/content/drive/MyDrive/Colab
Notebooks/paris_housing.csv')
# properti.head(100)
```

```
    squaremeters  numberofrooms hasyard haspool  floors  citycode  \
0          75523              3      no     yes      63      9373
1          55712             58      no     yes      19     34457
2          86929            100     yes      no      11     98155
3          51522              3      no      no      61      9047
4          96470             74     yes      no      21     92029
..           ...            ...     ...     ...     ...       ...
95         98868             41      no     yes      67     85917
96         83110             43     yes      no      75     55046
97         71154             67      no     yes      53      8762
98         90841             48     yes      no      15     25300
99         68416             87     yes      no      48     60979

    citypartrange  numprevowners  made isnewbuilt hasstormprotector
basement  \
0               3              8  2005        old               yes
4313
1               6              8  2021        old                no
```

```
2937
2                  3                4  2003        new                 no
6326
3                  8                3  2012        new                yes
632
4                  4                2  2011        new                yes
5414
..               ...              ...   ...        ...                ...
...
95                 7                3  2021        new                yes
2146
96                 7               10  2001        new                 no
4108
97                 2                6  2021        new                yes
8418
98                 6                5  2003        old                 no
3333
99                 8                7  2010        old                 no
1811

    attic  garage hasstorageroom  hasguestroom      price category
0    9005     956             no             7  7559081.5   Luxury
1    8852     135            yes             9  5574642.1   Middle
2    4748     654             no            10  8696869.3   Luxury
3    5792     807            yes             5  5154055.2   Middle
4    1172     716            yes             9  9652258.1   Luxury
..    ...     ...            ...           ...        ...      ...
95   1077     623            yes             3  9892300.1   Luxury
96   5663     380            yes             7  8321631.1   Luxury
97   7187     706             no             8  7122699.1   Luxury
98    149     842             no             9  9086177.3   Luxury
99   6776     424             no             6  6846709.0   Middle

[100 rows x 18 columns]
```

```
properti2 = properti.drop('price', axis=1)
properti2.head(100)
```

```
    squaremeters  numberofrooms hasyard haspool  floors  citycode  \
0          75523              3      no     yes      63      9373
1          55712             58      no     yes      19     34457
2          86929            100     yes      no      11     98155
3          51522              3      no      no      61      9047
4          96470             74     yes      no      21     92029
..           ...            ...     ...     ...     ...       ...
95         98868             41      no     yes      67     85917
96         83110             43     yes      no      75     55046
97         71154             67      no     yes      53      8762
98         90841             48     yes      no      15     25300
99         68416             87     yes      no      48     60979
```

```
    citypartrange  numprevowners  made isnewbuilt hasstormprotector
basement  \
0               3              8  2005        old               yes
4313
1               6              8  2021        old                no
2937
2               3              4  2003        new                no
6326
3               8              3  2012        new               yes
632
4               4              2  2011        new               yes
5414
..            ...            ...   ...        ...               ...
...
95              7              3  2021        new               yes
2146
96              7             10  2001        new                no
4108
97              2              6  2021        new               yes
8418
98              6              5  2003        old                no
3333
99              8              7  2010        old                no
1811

    attic  garage hasstorageroom  hasguestroom category
0    9005     956             no             7   Luxury
1    8852     135            yes             9   Middle
2    4748     654             no            10   Luxury
3    5792     807            yes             5   Middle
4    1172     716            yes             9   Luxury
..    ...     ...            ...           ...      ...
95   1077     623            yes             3   Luxury
96   5663     380            yes             7   Luxury
97   7187     706             no             8   Luxury
98    149     842             no             9   Luxury
99   6776     424             no             6   Middle

[100 rows x 17 columns]
```

```python
print("data null \n", properti2.isnull().sum())
print("data kosong \n", properti2.empty)
print("data nan \n", properti2.isna().sum())
```

```
data null
 squaremeters         0
numberofrooms        0
hasyard              0
haspool              0
```

```
floors                  0
citycode                0
citypartrange           0
numprevowners           0
made                    0
isnewbuilt              0
hasstormprotector       0
basement                0
attic                   0
garage                  0
hasstorageroom          0
hasguestroom            0
category                0
dtype: int64
data kosong
 False
data nan
 squaremeters           0
numberofrooms           0
hasyard                 0
haspool                 0
floors                  0
citycode                0
citypartrange           0
numprevowners           0
made                    0
isnewbuilt              0
hasstormprotector       0
basement                0
attic                   0
garage                  0
hasstorageroom          0
hasguestroom            0
category                0
dtype: int64
```

```
print("Sebelum drop missing value", properti2.shape)
properti2 = properti2.dropna(how="any", inplace=False)
print("Setelah drop missing value", properti2.shape)
```

```
Sebelum drop missing value (10000, 17)
Setelah drop missing value (10000, 17)
```

```
print("Sebelum Pengecekan data duplikat", properti2.shape)
properti3 = properti2.drop_duplicates(keep='last')
print("Setelah Pengecekan data duplikat", properti3.shape)
```

```
Sebelum Pengecekan data duplikat (10000, 17)
Setelah Pengecekan data duplikat (10000, 17)
```

```python
kolom_kategori=['hasyard', 'haspool', 'isnewbuilt',
          'hasstormprotector', 'hasstorageroom']
transform = make_column_transformer(
    (OneHotEncoder(), kolom_kategori),
    remainder = 'passthrough'
)

x=properti3.drop('category',axis=1)
y=properti3.category

x_train, x_test, y_train, y_test = train_test_split(x, y,
test_size=0.20, random_state=84)

print(x_train.shape)
print(x_test.shape)
```

```
(8000, 16)
(2000, 16)
```

```python
x_train_enc = transform.fit_transform(x_train)
x_test_enc = transform.fit_transform(x_test)

df_train_enc = pd.DataFrame (x_train_enc,
columns=transform.get_feature_names_out())
df_test_enc = pd.DataFrame (x_test_enc,
columns=transform.get_feature_names_out())

df_train_enc.head(10)
df_test_enc.head(10)
```

```
   onehotencoder__hasyard_no  onehotencoder__hasyard_yes  \
0                        0.0                         1.0
1                        0.0                         1.0
2                        0.0                         1.0
3                        1.0                         0.0
4                        0.0                         1.0
5                        1.0                         0.0
6                        0.0                         1.0
7                        1.0                         0.0
8                        1.0                         0.0
9                        0.0                         1.0

   onehotencoder__haspool_no  onehotencoder__haspool_yes  \
0                        0.0                         1.0
1                        0.0                         1.0
2                        0.0                         1.0
3                        0.0                         1.0
4                        0.0                         1.0
5                        0.0                         1.0
6                        0.0                         1.0
7                        1.0                         0.0
```

```
8                             1.0                             0.0
9                             0.0                             1.0

   onehotencoder__isnewbuilt_new  onehotencoder__isnewbuilt_old  \
0                            0.0                            1.0
1                            1.0                            0.0
2                            1.0                            0.0
3                            1.0                            0.0
4                            1.0                            0.0
5                            1.0                            0.0
6                            1.0                            0.0
7                            1.0                            0.0
8                            1.0                            0.0
9                            1.0                            0.0

   onehotencoder__hasstormprotector_no
onehotencoder__hasstormprotector_yes  \
0                                  0.0
1.0
1                                  1.0
0.0
2                                  1.0
0.0
3                                  1.0
0.0
4                                  0.0
1.0
5                                  0.0
1.0
6                                  1.0
0.0
7                                  0.0
1.0
8                                  1.0
0.0
9                                  1.0
0.0

   onehotencoder__hasstorageroom_no  onehotencoder__hasstorageroom_yes
...  \
0                               1.0                                0.0
...
1                               1.0                                0.0
...
2                               0.0                                1.0
...
3                               1.0                                0.0
...
4                               1.0                                0.0
...
```

```
5                                0.0                                  1.0
...
6                                0.0                                  1.0
...
7                                1.0                                  0.0
...
8                                0.0                                  1.0
...
9                                0.0                                  1.0
...

   remainder__numberofrooms  remainder__floors  remainder__citycode  \
0                      97.0               45.0              62899.0
1                      76.0               54.0              82737.0
2                      72.0               26.0               7812.0
3                      46.0               51.0              91317.0
4                       4.0               30.0               8424.0
5                      47.0               14.0              50927.0
6                      54.0               15.0              61691.0
7                      42.0               50.0              50833.0
8                      97.0                3.0              68804.0
9                      18.0               26.0              67302.0

   remainder__citypartrange  remainder__numprevowners  remainder__made
\
0                       1.0                       9.0           1990.0

1                       7.0                       3.0           1998.0

2                       6.0                       3.0           1995.0

3                       5.0                       3.0           2020.0

4                       4.0                      10.0           2003.0

5                       9.0                       6.0           1993.0

6                       2.0                       2.0           2002.0

7                       3.0                       8.0           2009.0

8                      10.0                       5.0           1991.0

9                       6.0                       2.0           2005.0


   remainder__basement  remainder__attic  remainder__garage  \
0               4110.0            1675.0              599.0
1               4010.0            8343.0              260.0
2               6972.0            3804.0              828.0
```

```
3                 3337.0            7250.0              337.0
4                 5655.0            1684.0              453.0
5                 4078.0             315.0              767.0
6                 5925.0            9705.0              342.0
7                 9320.0            5752.0              936.0
8                 5804.0            2070.0              846.0
9                 6111.0             771.0              500.0

   remainder__hasguestroom
0                      4.0
1                     10.0
2                      8.0
3                      1.0
4                      8.0
5                     10.0
6                      8.0
7                      3.0
8                      9.0
9                     10.0

[10 rows x 21 columns]

pipe_GBT_kbest = Pipeline([
    ('scaler', StandardScaler()),
    ('feature_selection', SelectKBest()),
    ('classifier', GradientBoostingClassifier(random_state=84))
])

pipe_GBT_percentile = Pipeline([
    ('scaler', StandardScaler()),
    ('feature_selection', SelectPercentile()),
    ('classifier', GradientBoostingClassifier(random_state=84))
])

param_grid_GBT_kbest = {
    'feature_selection__k': [3, 5],
    'classifier__n_estimators': [50, 100],
    'classifier__learning_rate': [0.005, 0.01],
    'classifier__max_depth': [3]
}

param_grid_GBT_percentile = {
    'feature_selection__percentile': [30, 50],
    'classifier__n_estimators': [50, 100],
    'classifier__learning_rate': [0.005, 0.01],
    'classifier__max_depth': [3]
}

gscv_GBT_kbest = GridSearchCV(pipe_GBT_kbest, param_grid_GBT_kbest,
cv=StratifiedKFold(n_splits=5))
```

```
gscv_GBT_kbest.fit(x_train_enc, y_train)
print("GSCV finished")

gscv_GBT_percentile = GridSearchCV(pipe_GBT_percentile,
param_grid_GBT_percentile, cv=StratifiedKFold(n_splits=5))
gscv_GBT_percentile.fit(x_train_enc, y_train)
print("GSCV finished")
```

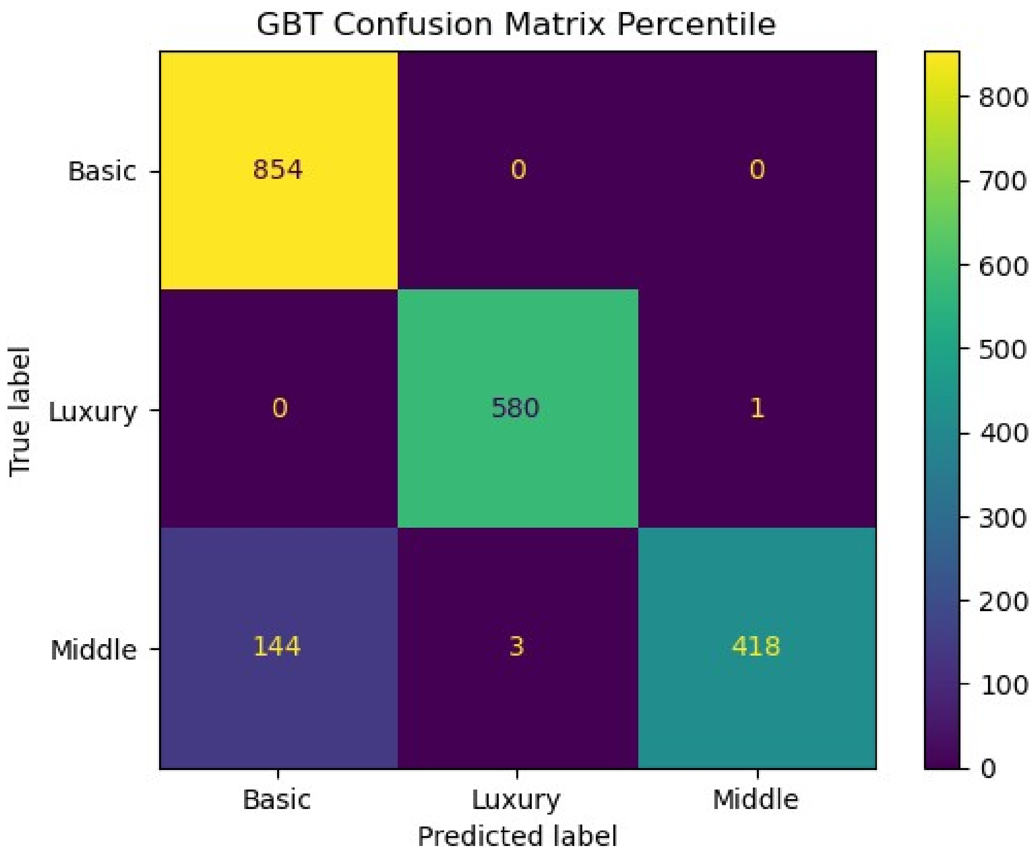
```
GSCV finished
GSCV finished
```

```
mask =
gscv_GBT_kbest.best_estimator_.named_steps['feature_selection'].get_su
pport()

print("Best model:{}".format(gscv_GBT_kbest.best_estimator_))
print("Selected features:{}".format(df_train_enc.columns[mask]))

print("Best CV score: {:.2f}".format(gscv_GBT_kbest.best_score_))
print("Train set score:
{:.2f}".format(gscv_GBT_kbest.score(x_test_enc,y_test)))

GBT_pred = gscv_GBT_kbest.predict(x_test_enc)

import matplotlib.pyplot as plt
cm = confusion_matrix(y_test, GBT_pred,
labels=gscv_GBT_kbest.classes_)
disp = ConfusionMatrixDisplay(confusion_matrix=cm,
display_labels=gscv_GBT_kbest.classes_)
disp.plot()
plt.title("GBT Confusion Matrix KBest")
plt.show()
#tampilkan classification report
print("Classification report GBT KBest: \n",
classification_report(y_test,GBT_pred))

mask =
gscv_GBT_percentile.best_estimator_.named_steps['feature_selection'].g
et_support()

print("Best model:{}".format(gscv_GBT_percentile.best_estimator_))
print("Selected features:{}".format(df_train_enc.columns[mask]))

print("Best CV score: {:.2f}".format(gscv_GBT_percentile.best_score_))
print("Train set score:
{:.2f}".format(gscv_GBT_percentile.score(x_test_enc,y_test)))

GBT_pred = gscv_GBT_percentile.predict(x_test_enc)

import matplotlib.pyplot as plt
cm = confusion_matrix(y_test, GBT_pred,
```

```
labels=gscv_GBT_percentile.classes_)
disp = ConfusionMatrixDisplay(confusion_matrix=cm,
display_labels=gscv_GBT_percentile.classes_)
disp.plot()
plt.title("GBT Confusion Matrix Percentile")
plt.show()
#tampilkan classification report
print("Classification report GBT Percentile: \n",
classification_report(y_test,GBT_pred))
```

```
Best model:Pipeline(steps=[('scaler', StandardScaler()),
                ('feature_selection', SelectKBest(k=3)),
                ('classifier',
                 GradientBoostingClassifier(learning_rate=0.005,
                                            n_estimators=50,
                                            random_state=84))])
Selected features:Index(['onehotencoder__haspool_no',
'onehotencoder__haspool_yes',
       'remainder__squaremeters'],
      dtype='object')
Best CV score: 0.94
Train set score: 0.93
```

```
Classification report GBT KBest:
               precision    recall  f1-score   support

       Basic       0.86      1.00      0.92       854
      Luxury       0.99      1.00      1.00       581
      Middle       1.00      0.74      0.85       565

    accuracy                           0.93      2000
   macro avg       0.95      0.91      0.92      2000
weighted avg       0.94      0.93      0.92      2000

Best model:Pipeline(steps=[('scaler', StandardScaler()),
                ('feature_selection',
SelectPercentile(percentile=30)),
                ('classifier',
                 GradientBoostingClassifier(learning_rate=0.005,
                                            n_estimators=50,
                                            random_state=84))])
Selected features:Index(['onehotencoder__hasyard_no',
'onehotencoder__hasyard_yes',
       'onehotencoder__haspool_no', 'onehotencoder__haspool_yes',
       'onehotencoder__isnewbuilt_new', 'remainder__squaremeters'],
      dtype='object')
Best CV score: 0.94
Train set score: 0.93
```




```
Classification report GBT Percentile:
              precision    recall  f1-score   support

       Basic       0.86      1.00      0.92       854
      Luxury       0.99      1.00      1.00       581
      Middle       1.00      0.74      0.85       565

    accuracy                           0.93      2000
   macro avg       0.95      0.91      0.92      2000
weighted avg       0.94      0.93      0.92      2000


pipe_svm_percentile = Pipeline([
    ('scaler', StandardScaler()),
    ('feature_selection', SelectPercentile()),
    ('classifier', SVC(random_state=84))
])

pipe_svm_kbest = Pipeline([
    ('scaler', MinMaxScaler()),
    ('feature_selection', SelectKBest()),
    ('classifier', SVC(random_state=84))
])
```

```
param_grid_svm_kbest = {
    'feature_selection__k': [2, 3, 5],
    'classifier__C': [0.01, 0.1, 1],
    'classifier__kernel': ['rbf', 'linear']
}

param_grid_svm_percentile = {
    'feature_selection__percentile': [20, 30, 50],
    'classifier__C': [0.01, 0.1, 1],
    'classifier__kernel': ['rbf', 'linear']
}

gscv_SVM_kbest = GridSearchCV(pipe_svm_kbest, param_grid_svm_kbest,
cv=StratifiedKFold(n_splits=5))
gscv_SVM_kbest.fit(x_train_enc, y_train)
print("GSCV finished")

gscv_SVM_percentile = GridSearchCV(pipe_svm_percentile,
param_grid_svm_percentile, cv=StratifiedKFold(n_splits=5))
gscv_SVM_percentile.fit(x_train_enc, y_train)
print("GSCV finished")
```

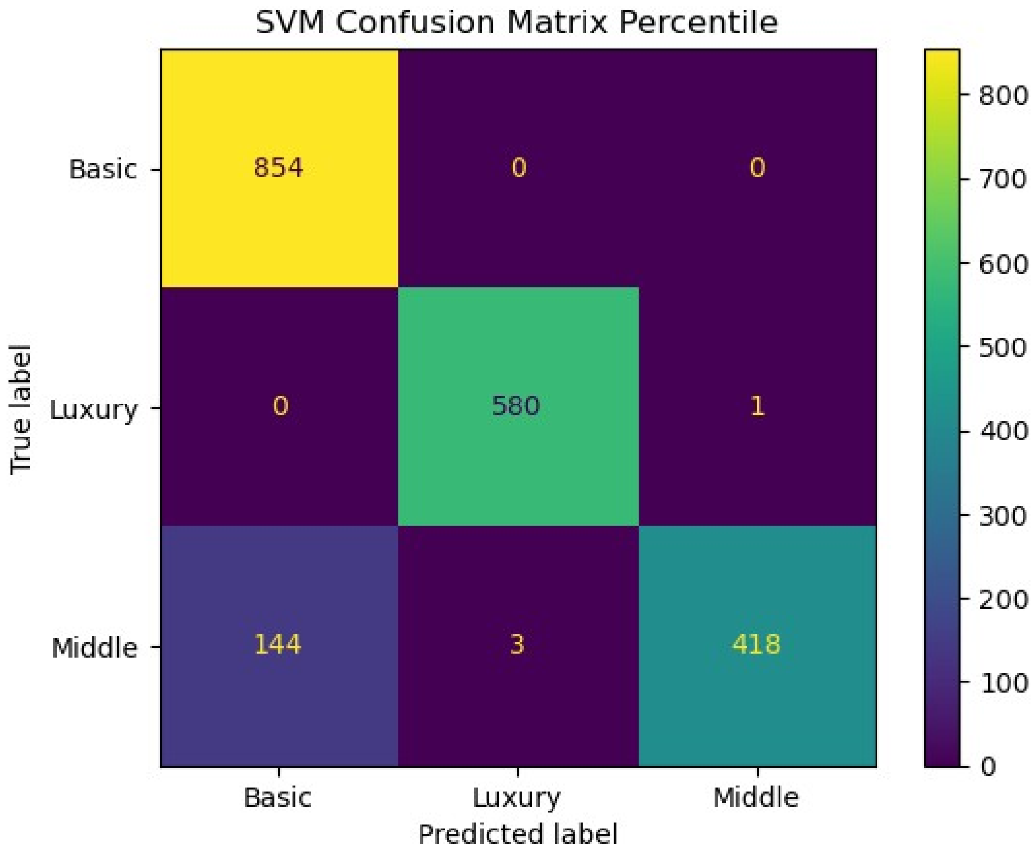
```
GSCV finished
GSCV finished
```

```
mask =
gscv_SVM_kbest.best_estimator_.named_steps['feature_selection'].get_su
pport()

print("Best model:{}".format(gscv_SVM_kbest.best_estimator_))
print("Selected features:{}".format(df_train_enc.columns[mask]))

print("Best CV score: {:.2f}".format(gscv_SVM_kbest.best_score_))
print("Train set score:
{:.2f}".format(gscv_SVM_kbest.score(x_test_enc,y_test)))

SVM_pred = gscv_SVM_kbest.predict(x_test_enc)

import matplotlib.pyplot as plt
cm = confusion_matrix(y_test, SVM_pred,
labels=gscv_GBT_kbest.classes_)
disp = ConfusionMatrixDisplay(confusion_matrix=cm,
display_labels=gscv_SVM_kbest.classes_)
disp.plot()
plt.title("SVM Confusion Matrix KBest")
plt.show()
#tampilkan classification report
print("Classification report SVM KBest: \n",
classification_report(y_test,SVM_pred))
```

```python
mask =
gscv_SVM_percentile.best_estimator_.named_steps['feature_selection'].g
et_support()

print("Best model:{}".format(gscv_SVM_percentile.best_estimator_))
print("Selected features:{}".format(df_train_enc.columns[mask]))

print("Best CV score: {:.2f}".format(gscv_SVM_percentile.best_score_))
print("Train set score:
{:.2f}".format(gscv_SVM_percentile.score(x_test_enc,y_test)))

SVM_pred = gscv_SVM_percentile.predict(x_test_enc)

import matplotlib.pyplot as plt
cm = confusion_matrix(y_test, GBT_pred,
labels=gscv_SVM_percentile.classes_)
disp = ConfusionMatrixDisplay(confusion_matrix=cm,
display_labels=gscv_SVM_percentile.classes_)
disp.plot()
plt.title("SVM Confusion Matrix Percentile")
plt.show()
#tampilkan classification report
print("Classification report SVM Percentile: \n",
classification_report(y_test,SVM_pred))
```

```
Best model:Pipeline(steps=[('scaler', MinMaxScaler()),
                ('feature_selection', SelectKBest(k=2)),
                ('classifier', SVC(C=1, random_state=84))])
Selected features:Index(['onehotencoder__haspool_yes',
'remainder__squaremeters'], dtype='object')
Best CV score: 0.93
Train set score: 0.92
```


```
Classification report SVM KBest:
              precision    recall  f1-score   support

       Basic       0.86      0.97      0.91       854
      Luxury       1.00      1.00      1.00       581
      Middle       0.95      0.75      0.84       565

    accuracy                           0.92      2000
   macro avg       0.93      0.91      0.92      2000
weighted avg       0.92      0.92      0.92      2000

Best model:Pipeline(steps=[('scaler', StandardScaler()),
                ('feature_selection',
SelectPercentile(percentile=30)),
                ('classifier', SVC(C=1, random_state=84))])
Selected features:Index(['onehotencoder__hasyard_no',
'onehotencoder__hasyard_yes',
       'onehotencoder__haspool_no', 'onehotencoder__haspool_yes',
       'onehotencoder__isnewbuilt_new', 'remainder__squaremeters'],
      dtype='object')
Best CV score: 0.99
Train set score: 0.98
```




```
Classification report SVM Percentile:
              precision    recall  f1-score   support

       Basic       0.99      0.99      0.99       854
      Luxury       0.99      0.99      0.99       581
      Middle       0.97      0.98      0.97       565

    accuracy                           0.98      2000
   macro avg       0.98      0.98      0.98      2000
weighted avg       0.99      0.98      0.99      2000


import pickle
best_model = gscv_SVM_percentile.best_estimator_

with open('BestModel_CLF_gscv_SVM_percentile_matplotlib.pkl', 'wb') as
f:
    pickle.dump(best_model, f)
print("Model Terbaik berhasil disimpan ke
'BestModel_CLF_gscv_SVM_percentile_matplotlib.pkl.pkl'")

Model Terbaik berhasil disimpan ke
'BestModel_CLF_gscv_SVM_percentile_matplotlib.pkl.pkl'
```

```python
import pandas as pd
import numpy as np
from sklearn.model_selection import train_test_split
from sklearn.preprocessing import OneHotEncoder
from sklearn.compose import make_column_transformer
from sklearn.feature_selection import SelectFromModel, SelectKBest,
SelectPercentile, RFE
from sklearn.model_selection import GridSearchCV, StratifiedKFold
from sklearn.ensemble import GradientBoostingClassifier
from sklearn.ensemble import RandomForestClassifier,
RandomForestRegressor
from sklearn.svm import SVC, SVR
from sklearn.metrics import classification_report, confusion_matrix,
ConfusionMatrixDisplay
from sklearn.preprocessing import StandardScaler, MinMaxScaler
from sklearn.pipeline import Pipeline
from sklearn.tree import DecisionTreeClassifier
from sklearn.linear_model import LogisticRegression
from sklearn.metrics import mean_squared_error, mean_absolute_error
from pandas.api.types import is_numeric_dtype
from sklearn.linear_model import Ridge, Lasso
import matplotlib.pyplot as plt

properti = pd.read_csv('Dataset_UTS_Gasal_2425.csv')
properti.head(100)
```

```
    squaremeters  numberofrooms hasyard haspool  floors  citycode  \
0          75523              3      no     yes      63      9373
1          55712             58      no     yes      19     34457
2          86929            100     yes      no      11     98155
3          51522              3      no      no      61      9047
4          96470             74     yes      no      21     92029
..           ...            ...     ...     ...     ...       ...
95         98868             41      no     yes      67     85917
96         83110             43     yes      no      75     55046
97         71154             67      no     yes      53      8762
98         90841             48     yes      no      15     25300
99         68416             87     yes      no      48     60979

    citypartrange  numprevowners  made isnewbuilt hasstormprotector
basement  \
0               3              8  2005        old               yes
4313
1               6              8  2021        old                no
2937
2               3              4  2003        new                no
6326
3               8              3  2012        new               yes
632
4               4              2  2011        new               yes
```

```
5414
..             ...            ...   ...        ...              ...
...
95               7              3  2021        new              yes
2146
96               7             10  2001        new               no
4108
97               2              6  2021        new              yes
8418
98               6              5  2003        old               no
3333
99               8              7  2010        old               no
1811

    attic  garage hasstorageroom  hasguestroom      price category
0    9005     956             no             7  7559081.5   Luxury
1    8852     135            yes             9  5574642.1   Middle
2    4748     654             no            10  8696869.3   Luxury
3    5792     807            yes             5  5154055.2   Middle
4    1172     716            yes             9  9652258.1   Luxury
..    ...     ...            ...           ...        ...      ...
95   1077     623            yes             3  9892300.1   Luxury
96   5663     380            yes             7  8321631.1   Luxury
97   7187     706             no             8  7122699.1   Luxury
98    149     842             no             9  9086177.3   Luxury
99   6776     424             no             6  6846709.0   Middle

[100 rows x 18 columns]
```

```
properti2 = properti.drop('price', axis=1)
properti2.head(100)
```

```
    squaremeters  numberofrooms hasyard haspool  floors  citycode  \
0          75523              3      no     yes      63      9373
1          55712             58      no     yes      19     34457
2          86929            100     yes      no      11     98155
3          51522              3      no      no      61      9047
4          96470             74     yes      no      21     92029
..           ...            ...     ...     ...     ...       ...
95         98868             41      no     yes      67     85917
96         83110             43     yes      no      75     55046
97         71154             67      no     yes      53      8762
98         90841             48     yes      no      15     25300
99         68416             87     yes      no      48     60979

    citypartrange  numprevowners  made isnewbuilt hasstormprotector
basement  \
0               3              8  2005        old               yes
4313
1               6              8  2021        old                no
```

```
2937
2                 3                 4  2003         new                  no
6326
3                 8                 3  2012         new                 yes
632
4                 4                 2  2011         new                 yes
5414
..              ...               ...   ...         ...                 ...
...
95                7                 3  2021         new                 yes
2146
96                7                10  2001         new                  no
4108
97                2                 6  2021         new                 yes
8418
98                6                 5  2003         old                  no
3333
99                8                 7  2010         old                  no
1811

    attic  garage hasstorageroom  hasguestroom category
0    9005     956             no             7   Luxury
1    8852     135            yes             9   Middle
2    4748     654             no            10   Luxury
3    5792     807            yes             5   Middle
4    1172     716            yes             9   Luxury
..    ...     ...            ...           ...      ...
95   1077     623            yes             3   Luxury
96   5663     380            yes             7   Luxury
97   7187     706             no             8   Luxury
98    149     842             no             9   Luxury
99   6776     424             no             6   Middle

[100 rows x 17 columns]
```

```
print("data null \n", properti2.isnull().sum())
print("data kosong \n", properti2.empty)
print("data nan \n", properti2.isna().sum())
```

```
data null
 squaremeters        0
numberofrooms       0
hasyard             0
haspool             0
floors              0
citycode            0
citypartrange       0
numprevowners       0
made                0
isnewbuilt          0
```

```
hasstormprotector    0
basement             0
attic                0
garage               0
hasstorageroom       0
hasguestroom         0
category             0
dtype: int64
data kosong
 False
data nan
 squaremeters         0
numberofrooms        0
hasyard              0
haspool              0
floors               0
citycode             0
citypartrange        0
numprevowners        0
made                 0
isnewbuilt           0
hasstormprotector    0
basement             0
attic                0
garage               0
hasstorageroom       0
hasguestroom         0
category             0
dtype: int64
```

```
print("Sebelum drop missing value", properti2.shape)
properti2 = properti2.dropna(how="any", inplace=False)
print("Setelah drop missing value", properti2.shape)
```

```
Sebelum drop missing value (10000, 17)
Setelah drop missing value (10000, 17)
```

```
print("Sebelum Pengecekan data duplikat", properti2.shape)
properti3 = properti2.drop_duplicates(keep='last')
print("Setelah Pengecekan data duplikat", properti3.shape)
```

```
Sebelum Pengecekan data duplikat (10000, 17)
Setelah Pengecekan data duplikat (10000, 17)
```

```
kolom_kategori=['hasyard', 'haspool', 'isnewbuilt',
          'hasstormprotector', 'hasstorageroom']
transform = make_column_transformer(
    (OneHotEncoder(), kolom_kategori),
    remainder = 'passthrough'
)
```

```
x=properti3.drop('category',axis=1)
y=properti3.category

x_train, x_test, y_train, y_test = train_test_split(x, y,
test_size=0.20, random_state=84)

print(x_train.shape)
print(x_test.shape)
```

```
(8000, 16)
(2000, 16)
```

```
x_train_enc = transform.fit_transform(x_train)
x_test_enc = transform.fit_transform(x_test)

df_train_enc = pd.DataFrame (x_train_enc,
columns=transform.get_feature_names_out())
df_test_enc = pd.DataFrame (x_test_enc,
columns=transform.get_feature_names_out())

df_train_enc.head(10)
df_test_enc.head(10)
```

```
   onehotencoder__hasyard_no  onehotencoder__hasyard_yes  \
0                        0.0                         1.0
1                        0.0                         1.0
2                        0.0                         1.0
3                        1.0                         0.0
4                        0.0                         1.0
5                        1.0                         0.0
6                        0.0                         1.0
7                        1.0                         0.0
8                        1.0                         0.0
9                        0.0                         1.0

   onehotencoder__haspool_no  onehotencoder__haspool_yes  \
0                        0.0                         1.0
1                        0.0                         1.0
2                        0.0                         1.0
3                        0.0                         1.0
4                        0.0                         1.0
5                        0.0                         1.0
6                        0.0                         1.0
7                        1.0                         0.0
8                        1.0                         0.0
9                        0.0                         1.0

   onehotencoder__isnewbuilt_new  onehotencoder__isnewbuilt_old  \
0                            0.0                            1.0
1                            1.0                            0.0
2                            1.0                            0.0
```

```
3                             1.0                               0.0
4                             1.0                               0.0
5                             1.0                               0.0
6                             1.0                               0.0
7                             1.0                               0.0
8                             1.0                               0.0
9                             1.0                               0.0

   onehotencoder__hasstormprotector_no
onehotencoder__hasstormprotector_yes  \
0                                   0.0
1.0
1                                   1.0
0.0
2                                   1.0
0.0
3                                   1.0
0.0
4                                   0.0
1.0
5                                   0.0
1.0
6                                   1.0
0.0
7                                   0.0
1.0
8                                   1.0
0.0
9                                   1.0
0.0

   onehotencoder__hasstorageroom_no  onehotencoder__hasstorageroom_yes
...  \
0                                1.0                                0.0
...
1                                1.0                                0.0
...
2                                0.0                                1.0
...
3                                1.0                                0.0
...
4                                1.0                                0.0
...
5                                0.0                                1.0
...
6                                0.0                                1.0
...
7                                1.0                                0.0
...
```

```
8                                    0.0                                1.0
...
9                                    0.0                                1.0
...

   remainder__numberofrooms  remainder__floors  remainder__citycode  \
0                      97.0               45.0              62899.0
1                      76.0               54.0              82737.0
2                      72.0               26.0               7812.0
3                      46.0               51.0              91317.0
4                       4.0               30.0               8424.0
5                      47.0               14.0              50927.0
6                      54.0               15.0              61691.0
7                      42.0               50.0              50833.0
8                      97.0                3.0              68804.0
9                      18.0               26.0              67302.0

   remainder__citypartrange  remainder__numprevowners  remainder__made
\
0                       1.0                       9.0           1990.0

1                       7.0                       3.0           1998.0

2                       6.0                       3.0           1995.0

3                       5.0                       3.0           2020.0

4                       4.0                      10.0           2003.0

5                       9.0                       6.0           1993.0

6                       2.0                       2.0           2002.0

7                       3.0                       8.0           2009.0

8                      10.0                       5.0           1991.0

9                       6.0                       2.0           2005.0


   remainder__basement  remainder__attic  remainder__garage  \
0               4110.0            1675.0              599.0
1               4010.0            8343.0              260.0
2               6972.0            3804.0              828.0
3               3337.0            7250.0              337.0
4               5655.0            1684.0              453.0
5               4078.0             315.0              767.0
6               5925.0            9705.0              342.0
7               9320.0            5752.0              936.0
8               5804.0            2070.0              846.0
```

```
9                6111.0            771.0             500.0

   remainder__hasguestroom
0                       4.0
1                      10.0
2                       8.0
3                       1.0
4                       8.0
5                      10.0
6                       8.0
7                       3.0
8                       9.0
9                      10.0

[10 rows x 21 columns]
```

```
#import Library yang dibutuhkan
from sklearn.preprocessing import MinMaxScaler, StandardScaler
from sklearn.feature_selection import SelectKBest, SelectPercentile
from sklearn.ensemble import RandomForestClassifier
from sklearn.pipeline import Pipeline
from sklearn.model_selection import GridSearchCV, StratifiedKFold
import numpy as np

#buat rancangan pipeline mulai dari data scaling hingga classifier
pipe_RF = [
    ('data scaling', StandardScaler()),
    ('feature select', SelectKBest()),
    ('clf', RandomForestClassifier(random_state=84,
class_weight='balanced'))
]

#buat parameter grid untuk step feature selection dan classifier
params_grid_RF = [
    {
        'data scaling': [StandardScaler()],
        'feature select__k': np.arange(2, 6),
        'clf__max_depth': np.arange(4, 6),  # Ubah dari 4-5 menjadi 4-
6
        'clf__n_estimators': [50, 100]  # Ubah dari 100, 150 menjadi
50, 100
    },

    {
        'data scaling': [MinMaxScaler()],
        'feature select__k': np.arange(2, 6),
        'clf__max_depth': np.arange(4, 6),  # Ubah dari 4-5 menjadi 4-
6
        'clf__n_estimators': [50, 100]  # Ubah dari 100, 150 menjadi
50, 100
```

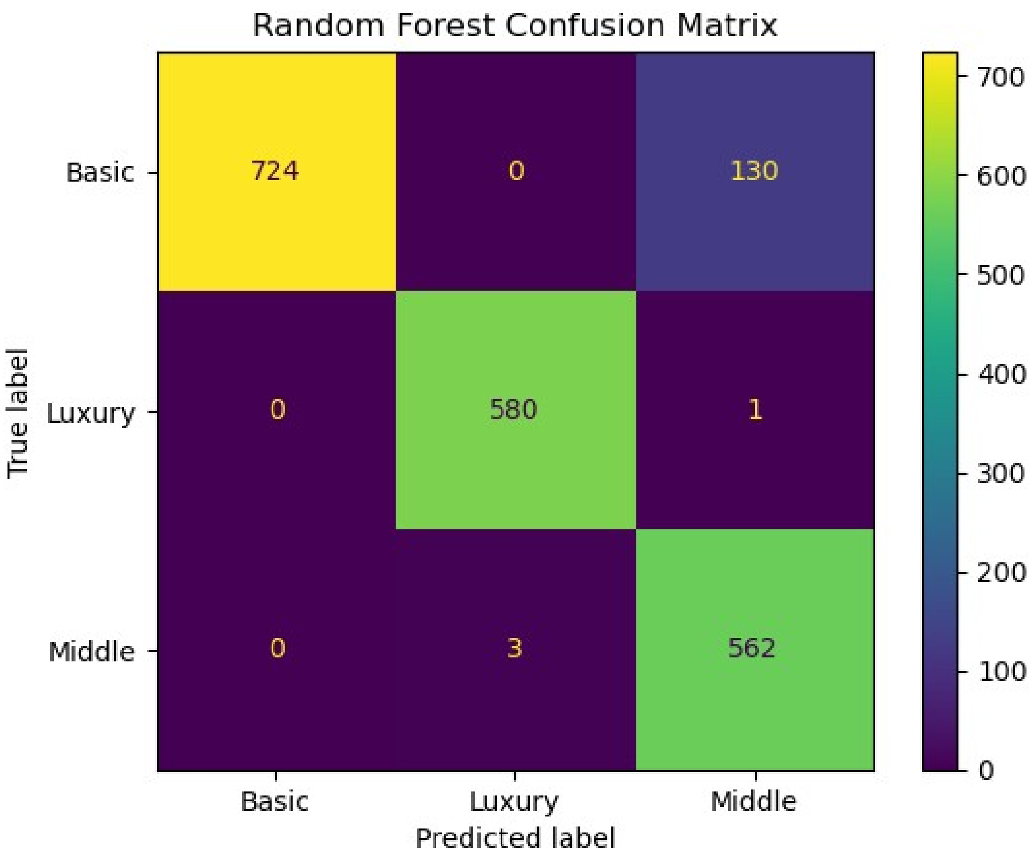
```
    },
]

#muat tancangan pipeline ke dalam objek pipeline
estimator_RF = Pipeline(pipe_RF)

#muat pipeline dan parameter grid ke dalam objek GSCV dengan
Stratified 5-fold CV
SKF = StratifiedKFold(n_splits=5, shuffle=True, random_state=84)  #
RANDOM STATE MENGGUNAKAN 2 atau 1 DIGIT
GSCV_RF = GridSearchCV(estimator_RF, params_grid_RF, cv=SKF)

#jalankan objek GSCV untuk melatih model dengan train set menggunakan
fungsi fit
GSCV_RF.fit(x_train_enc, y_train)
print("GSCV training finished")
```

```
GSCV training finished
```

```
#tampilkan skor cross-validation
print("CV Score: {}".format(GSCV_RF.best_score_))
#tampilkan skor model terbaik GSCV pada test set
print("Test Score:
{}".format(GSCV_RF.best_estimator_.score(x_test_enc, y_test)))
#tampilkan best model dan best features
print("Best model:", GSCV_RF.best_estimator_)

mask = GSCV_RF.best_estimator_.named_steps['feature
select'].get_support()
print("Best features:", df_train_enc.columns[mask])

#buat prediksi dari test set
RF_pred = GSCV_RF.predict(x_test_enc)

import matplotlib.pyplot as plt
#buat confusion matrix
cm = confusion_matrix(y_test, RF_pred, labels=GSCV_RF.classes_)
#buat confusion matrix display
disp = ConfusionMatrixDisplay(confusion_matrix=cm,
display_labels=GSCV_RF.classes_)
disp.plot()

plt. title("Random Forest Confusion Matrix")
plt.show()
#tampilkan Classification report
print("Classification report RF: \n", classification_report(y_test,
RF_pred))
```

```
CV Score: 0.937875
Test Score: 0.933
Best model: Pipeline(steps=[('data scaling', StandardScaler()),
```

```
                ('feature select', SelectKBest(k=4)),
                ('clf',
                 RandomForestClassifier(class_weight='balanced',
max_depth=4,
                                        n_estimators=50,
random_state=84))])
Best features: Index(['onehotencoder__hasyard_yes',
'onehotencoder__haspool_no',
       'onehotencoder__haspool_yes', 'remainder__squaremeters'],
      dtype='object')
```




```
Classification report RF:
              precision    recall  f1-score   support

       Basic       1.00      0.85      0.92       854
      Luxury       0.99      1.00      1.00       581
      Middle       0.81      0.99      0.89       565

    accuracy                           0.93      2000
   macro avg       0.94      0.95      0.94      2000
weighted avg       0.95      0.93      0.93      2000
```

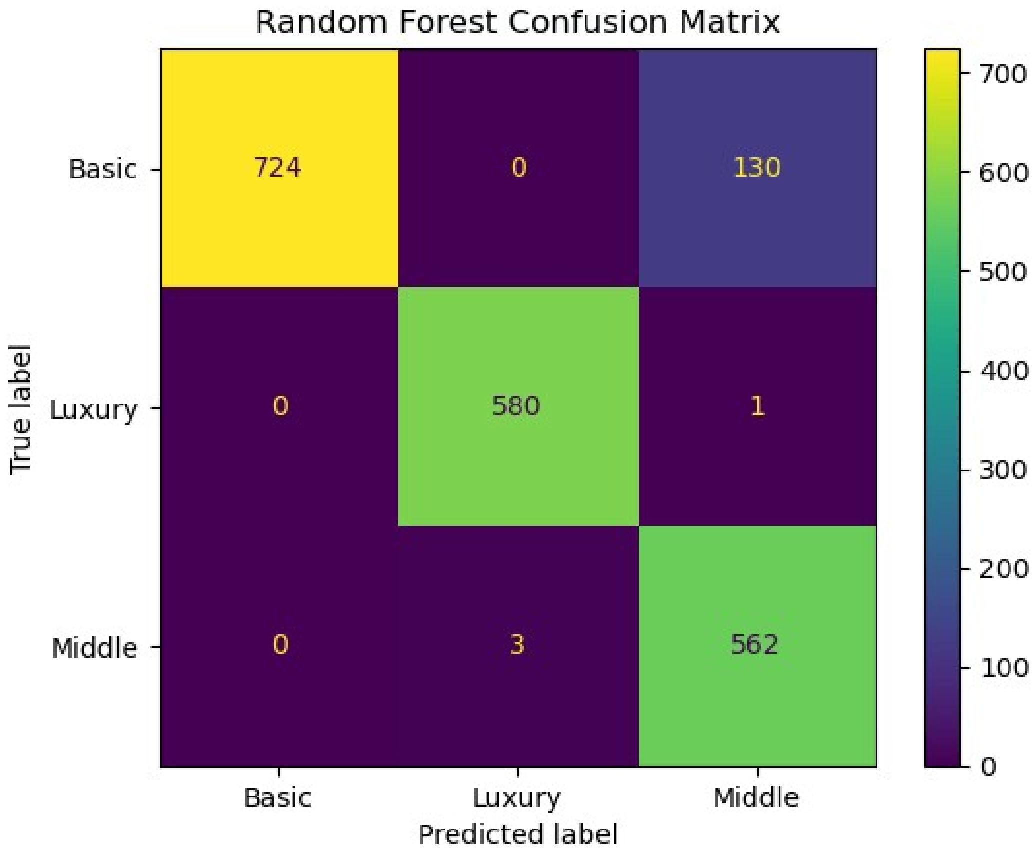
```python
#import Library yang dibutuhkan
from sklearn.preprocessing import MinMaxScaler, StandardScaler
from sklearn.feature_selection import SelectPercentile
from sklearn.ensemble import RandomForestClassifier
from sklearn.pipeline import Pipeline
from sklearn.model_selection import GridSearchCV, StratifiedKFold
import numpy as np

# Buat rancangan pipeline mulai dari data scaling hingga classifier
pipe_RF_percentil = [('data_scaling', StandardScaler()),
                     ('feature_select', SelectPercentile()),
                     ('clf', RandomForestClassifier(random_state=84,
class_weight='balanced'))]

# Buat parameter grid untuk step feature selection dan classifier
params_grid_RF_percentil = [{
                    'data_scaling': [StandardScaler()],
                    'feature_select': [SelectPercentile()],
                    'feature_select__percentile': np.arange(30, 51),
                    'clf__max_depth': np.arange(4, 6),
                    'clf__n_estimators': [50, 100, 150, 200]
                    },
                {
                'data_scaling': [MinMaxScaler()],
                'feature_select': [SelectPercentile()],
                'feature_select__percentile': np.arange(30, 51),
                'clf__max_depth': np.arange(4, 6),
                'clf__n_estimators': [50, 100, 150, 200]
                }]

# Definisikan StratifiedKFold
SKF = StratifiedKFold(n_splits=5, shuffle=True, random_state=84)

# Muat tancangan pipeline ke dalam objek pipeline
estimator_RF = Pipeline(pipe_RF_percentil)

# Muat pipeline dan parameter grid ke dalam objek GSCV dengan
Stratified 5-fold CV
GSCV_RF = GridSearchCV(estimator_RF, params_grid_RF_percentil, cv=SKF)

# Jalankan objek GSCV untuk melatih model dengan train set menggunakan
fungsi fit
GSCV_RF.fit(x_train_enc, y_train)
print("GSCV training finished")
```

```
GSCV training finished
```

```python
#tampilkan skor cross-validation
print("CV Score: {}".format(GSCV_RF.best_score_))
#tampilkan skor model terbaik GSCV pada test set
```

```
print("Test Score:
{}".format(GSCV_RF.best_estimator_.score(x_test_enc, y_test)))
#tampilkan best model dan best features
print("Best model:", GSCV_RF.best_estimator_)

mask = GSCV_RF.best_estimator_.named_steps['feature
select'].get_support()
print("Best features:", df_train_enc.columns[mask])

#buat prediksi dari test set
RF_pred = GSCV_RF.predict(x_test_enc)

import matplotlib.pyplot as plt
#buat confusion matrix
cm = confusion_matrix(y_test, RF_pred, labels=GSCV_RF.classes_)
#buat confusion matrix display
disp = ConfusionMatrixDisplay(confusion_matrix=cm,
display_labels=GSCV_RF.classes_)
disp.plot()

plt. title("Random Forest Confusion Matrix")
plt.show()
#tampilkan Classification report
print("Classification report RF: \n", classification_report(y_test,
RF_pred))
```

```
CV Score: 0.937875
Test Score: 0.933
Best model: Pipeline(steps=[('data scaling', StandardScaler()),
                ('feature select', SelectKBest(k=4)),
                ('clf',
                 RandomForestClassifier(class_weight='balanced',
max_depth=4,
                                        n_estimators=50,
random_state=84))])
Best features: Index(['onehotencoder__hasyard_yes',
'onehotencoder__haspool_no',
       'onehotencoder__haspool_yes', 'remainder__squaremeters'],
      dtype='object')
```




```
Classification report RF:
               precision    recall  f1-score   support

       Basic       1.00      0.85      0.92       854
      Luxury       0.99      1.00      1.00       581
      Middle       0.81      0.99      0.89       565

    accuracy                           0.93      2000
   macro avg       0.94      0.95      0.94      2000
weighted avg       0.95      0.93      0.93      2000


#import Library yang dibutuhkan
from sklearn.preprocessing import MinMaxScaler, StandardScaler
from sklearn.feature_selection import SelectPercentile
from sklearn.linear_model import LogisticRegression
from sklearn.pipeline import Pipeline
from sklearn.model_selection import GridSearchCV, StratifiedKFold
import numpy as np

# Buat rancangan pipeline mulai dari data scaling hingga classifier
pipe_LR_percentil = [('data_scaling', StandardScaler()),
                     ('feature_select', SelectPercentile()),
```

```
                     ('clf', LogisticRegression(random_state=84,
class_weight='balanced', solver='liblinear'))]

# Buat parameter grid untuk step feature selection dan classifier
params_grid_LR_percentil = [{
                    'data_scaling': [StandardScaler()],
                    'feature_select': [SelectPercentile()],
                    'feature_select__percentile': np.arange(30, 51),
                    'clf__C': [0.01, 0.1, 1, 10],
                    'clf__penalty': ['l1', 'l2']
                    },
                {
                'data_scaling': [MinMaxScaler()],
                'feature_select': [SelectPercentile()],
                'feature_select__percentile': np.arange(30, 51),
                'clf__C': [0.01, 0.1, 1, 10],
                'clf__penalty': ['l1', 'l2']
                }]

# Definisikan StratifiedKFold
SKF = StratifiedKFold(n_splits=5, shuffle=True, random_state=84)

# Muat tancangan pipeline ke dalam objek pipeline
estimator_LR = Pipeline(pipe_LR_percentil)

# Muat pipeline dan parameter grid ke dalam objek GSCV dengan
Stratified 5-fold CV
GSCV_LR = GridSearchCV(estimator_LR, params_grid_LR_percentil, cv=SKF)

# Jalankan objek GSCV untuk melatih model dengan train set menggunakan
fungsi fit
GSCV_LR.fit(x_train_enc, y_train)
print("GSCV training finished")
```

```
c:\Users\capsl\anaconda3\Lib\site-packages\sklearn\svm\_base.py:1237:
ConvergenceWarning: Liblinear failed to converge, increase the number
of iterations.
  warnings.warn(
c:\Users\capsl\anaconda3\Lib\site-packages\sklearn\svm\_base.py:1237:
ConvergenceWarning: Liblinear failed to converge, increase the number
of iterations.
  warnings.warn(
c:\Users\capsl\anaconda3\Lib\site-packages\sklearn\svm\_base.py:1237:
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of iterations.
  warnings.warn(
```

```
c:\Users\capsl\anaconda3\Lib\site-packages\sklearn\svm\_base.py:1237:
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  warnings.warn(
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  warnings.warn(
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  warnings.warn(
c:\Users\capsl\anaconda3\Lib\site-packages\sklearn\svm\_base.py:1237:
ConvergenceWarning: Liblinear failed to converge, increase the number
of iterations.
  warnings.warn(
c:\Users\capsl\anaconda3\Lib\site-packages\sklearn\svm\_base.py:1237:
```

```
ConvergenceWarning: Liblinear failed to converge, increase the number
of iterations.
  warnings.warn(
c:\Users\capsl\anaconda3\Lib\site-packages\sklearn\svm\_base.py:1237:
ConvergenceWarning: Liblinear failed to converge, increase the number
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GSCV training finished

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# tampilkan skor cross-validation
print("CV Score: {}".format(GSCV_LR.best_score_))

# tampilkan skor model terbaik GSCV pada test set
print("Test Score:
{}".format(GSCV_LR.best_estimator_.score(x_test_enc, y_test)))

# tampilkan best model dan best features
print("Best model:", GSCV_LR.best_estimator_)

# Mendapatkan fitur terbaik berdasarkan seleksi fitur
mask =
GSCV_LR.best_estimator_.named_steps['feature_select'].get_support()
print("Best features:", df_train_enc.columns[mask])

# buat prediksi dari test set
LR_pred = GSCV_LR.predict(x_test_enc)

import matplotlib.pyplot as plt
from sklearn.metrics import confusion_matrix, ConfusionMatrixDisplay,
classification_report

# buat confusion matrix
cm = confusion_matrix(y_test, LR_pred, labels=GSCV_LR.classes_)

# buat confusion matrix display
disp = ConfusionMatrixDisplay(confusion_matrix=cm,
display_labels=GSCV_LR.classes_)
disp.plot()

plt.title("Logistic Regression Confusion Matrix")
plt.show()

# tampilkan Classification report
```
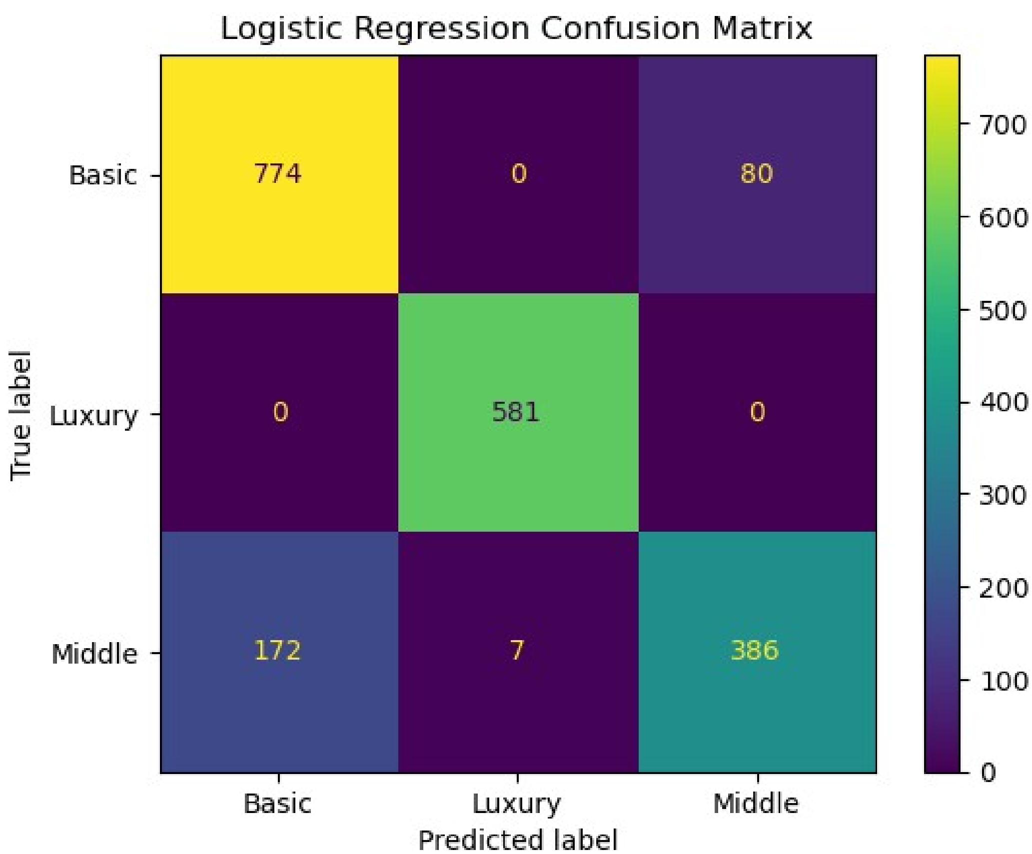

```
print("Classification report LR: \n", classification_report(y_test,
LR_pred))
```

```
CV Score: 0.88025
Test Score: 0.8705
Best model: Pipeline(steps=[('data_scaling', StandardScaler()),
                ('feature_select', SelectPercentile(percentile=41)),
                ('clf',
                 LogisticRegression(C=10, class_weight='balanced',
penalty='l1',
                                    random_state=84,
solver='liblinear'))])
Best features: Index(['onehotencoder__hasyard_no',
'onehotencoder__hasyard_yes',
       'onehotencoder__haspool_no', 'onehotencoder__haspool_yes',
       'onehotencoder__isnewbuilt_new',
'onehotencoder__isnewbuilt_old',
       'remainder__squaremeters', 'remainder__numberofrooms',
       'remainder__basement'],
      dtype='object')
```



```
Classification report LR:
              precision    recall  f1-score   support

       Basic       0.82      0.91      0.86       854
      Luxury       0.99      1.00      0.99       581
      Middle       0.83      0.68      0.75       565

    accuracy                           0.87      2000
   macro avg       0.88      0.86      0.87      2000
weighted avg       0.87      0.87      0.87      2000
```

```python
#import Library yang dibutuhkan
from sklearn.preprocessing import MinMaxScaler, StandardScaler
from sklearn.feature_selection import SelectKBest
from sklearn.linear_model import LogisticRegression
from sklearn.pipeline import Pipeline
from sklearn.model_selection import GridSearchCV, StratifiedKFold
import numpy as np

# buat rancangan pipeline mulai dari data scaling hingga classifier
pipe_LR = [
    ('data scaling', StandardScaler()),
    ('feature select', SelectKBest()),
    ('clf', LogisticRegression(random_state=84,
class_weight='balanced', solver='liblinear'))  # Menentukan solver
]

# buat parameter grid untuk step feature selection dan classifier
params_grid_LR = [
    {
        'data scaling': [StandardScaler()],
        'feature select__k': np.arange(2, 6),
        'clf__C': [0.01, 0.1, 1, 10],  # Regularization strength
        'clf__penalty': ['l1', 'l2']   # Jenis penalty
    },
    {
        'data scaling': [MinMaxScaler()],
        'feature select__k': np.arange(2, 6),
        'clf__C': [0.01, 0.1, 1, 10],
        'clf__penalty': ['l1', 'l2']
    },
]

# muat tancangan pipeline ke dalam objek pipeline
estimator_LR = Pipeline(pipe_LR)

# muat pipeline dan parameter grid ke dalam objek GSCV dengan
Stratified 5-fold CV
SKF = StratifiedKFold(n_splits=5, shuffle=True, random_state=84)
```

```python
GSCV_LR = GridSearchCV(estimator_LR, params_grid_LR, cv=SKF)

# jalankan objek GSCV untuk melatih model dengan train set menggunakan
fungsi fit
GSCV_LR.fit(x_train_enc, y_train)
print("GSCV training finished")
```

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GSCV training finished

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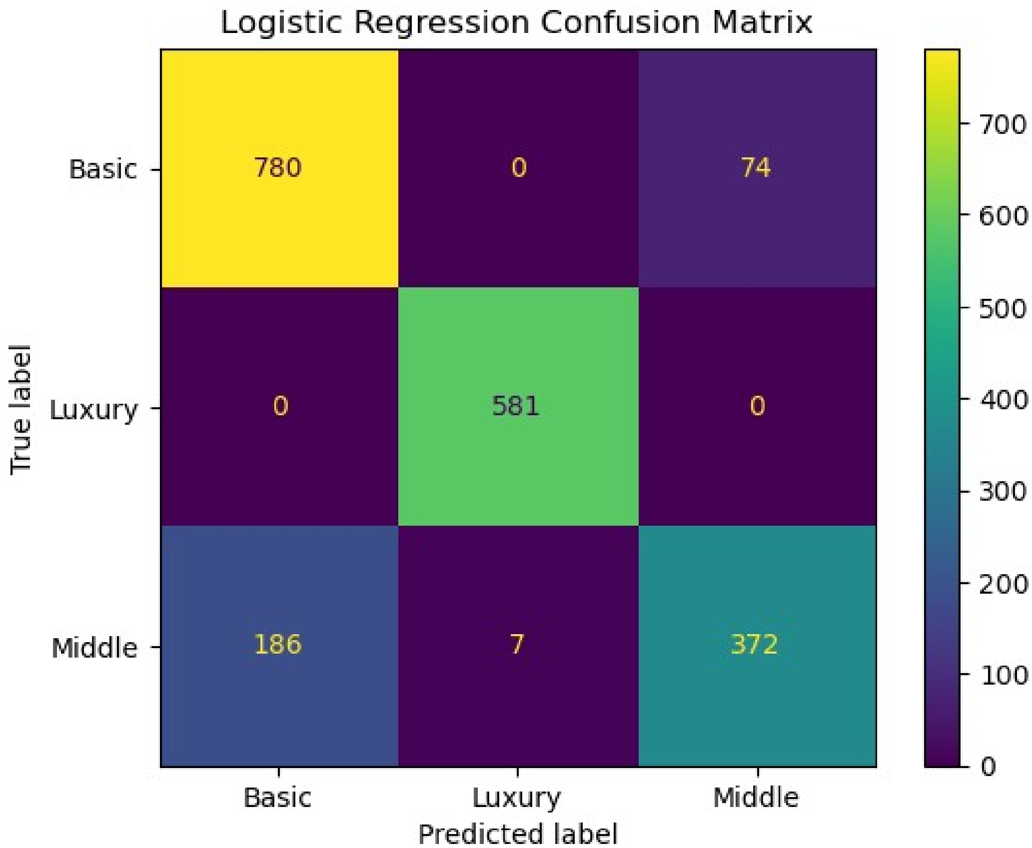
```

```python
# tampilkan skor cross-validation
print("CV Score: {}".format(GSCV_LR.best_score_))

# tampilkan skor model terbaik GSCV pada test set
print("Test Score:
{}".format(GSCV_LR.best_estimator_.score(x_test_enc, y_test)))

# tampilkan best model dan best features
print("Best model:", GSCV_LR.best_estimator_)

# Mendapatkan fitur terbaik berdasarkan seleksi fitur
mask = GSCV_LR.best_estimator_.named_steps['feature
```

```
select'].get_support()
print("Best features:", df_train_enc.columns[mask])

# buat prediksi dari test set
LR_pred = GSCV_LR.predict(x_test_enc)

import matplotlib.pyplot as plt
from sklearn.metrics import confusion_matrix, ConfusionMatrixDisplay,
classification_report

# buat confusion matrix
cm = confusion_matrix(y_test, LR_pred, labels=GSCV_LR.classes_)

# buat confusion matrix display
disp = ConfusionMatrixDisplay(confusion_matrix=cm,
display_labels=GSCV_LR.classes_)
disp.plot()

plt.title("Logistic Regression Confusion Matrix")
plt.show()

# tampilkan Classification report
print("Classification report LR: \n", classification_report(y_test,
LR_pred))
```

```
CV Score: 0.882
Test Score: 0.8665
Best model: Pipeline(steps=[('data scaling', StandardScaler()),
                ('feature select', SelectKBest(k=5)),
                ('clf',
                 LogisticRegression(C=10, class_weight='balanced',
penalty='l1',
                                    random_state=84,
solver='liblinear'))])
Best features: Index(['onehotencoder__hasyard_no',
'onehotencoder__hasyard_yes',
       'onehotencoder__haspool_no', 'onehotencoder__haspool_yes',
       'remainder__squaremeters'],
      dtype='object')
```




```
Classification report LR:
              precision    recall  f1-score   support

       Basic       0.81      0.91      0.86       854
      Luxury       0.99      1.00      0.99       581
      Middle       0.83      0.66      0.74       565

    accuracy                           0.87      2000
   macro avg       0.88      0.86      0.86      2000
weighted avg       0.87      0.87      0.86      2000
```

```
import pandas as pd
import numpy as np
from sklearn.model_selection import train_test_split
from sklearn.preprocessing import OneHotEncoder
from sklearn.compose import make_column_transformer
from sklearn.feature_selection import SelectFromModel, SelectKBest,
SelectPercentile, RFE
from sklearn.model_selection import GridSearchCV, StratifiedKFold
from sklearn.ensemble import GradientBoostingClassifier
from sklearn.ensemble import RandomForestClassifier,
RandomForestRegressor
from sklearn.svm import SVC, SVR
from sklearn.metrics import classification_report, confusion_matrix,
ConfusionMatrixDisplay
from sklearn.preprocessing import StandardScaler, MinMaxScaler
from sklearn.pipeline import Pipeline
from sklearn.tree import DecisionTreeClassifier
from sklearn.linear_model import LogisticRegression
from sklearn.metrics import mean_squared_error, mean_absolute_error
from pandas.api.types import is_numeric_dtype
from sklearn.linear_model import Ridge, Lasso
import matplotlib.pyplot as plt

properti_price =
pd.read_csv('/Users/saktiyoga/Downloads/UTS_PMDPM/Dataset UTS_Gasal
2425.csv')
properti_price.head(100)
```

```
    squaremeters  numberofrooms hasyard haspool  floors  citycode  \
0          75523              3      no     yes      63      9373
1          55712             58      no     yes      19     34457
2          86929            100     yes      no      11     98155
3          51522              3      no      no      61      9047
4          96470             74     yes      no      21     92029
..           ...            ...     ...     ...     ...       ...
95         98868             41      no     yes      67     85917
96         83110             43     yes      no      75     55046
97         71154             67      no     yes      53      8762
98         90841             48     yes      no      15     25300
99         68416             87     yes      no      48     60979

    citypartrange  numprevowners  made isnewbuilt hasstormprotector
basement  \
0               3              8  2005        old               yes
4313
1               6              8  2021        old                no
2937
2               3              4  2003        new                no
6326
3               8              3  2012        new               yes
```

```
632
4                4              2  2011        new               yes
5414
..             ...            ...   ...        ...               ...
...
95               7              3  2021        new               yes
2146
96               7             10  2001        new                no
4108
97               2              6  2021        new               yes
8418
98               6              5  2003        old                no
3333
99               8              7  2010        old                no
1811

    attic  garage hasstorageroom  hasguestroom      price category
0    9005     956             no             7  7559081.5   Luxury
1    8852     135            yes             9  5574642.1   Middle
2    4748     654             no            10  8696869.3   Luxury
3    5792     807            yes             5  5154055.2   Middle
4    1172     716            yes             9  9652258.1   Luxury
..    ...     ...            ...           ...        ...      ...
95   1077     623            yes             3  9892300.1   Luxury
96   5663     380            yes             7  8321631.1   Luxury
97   7187     706             no             8  7122699.1   Luxury
98    149     842             no             9  9086177.3   Luxury
99   6776     424             no             6  6846709.0   Middle

[100 rows x 18 columns]
```

```python
properti_price2 = properti_price.drop('category', axis=1)
properti_price2.head(100)
```

```
    squaremeters  numberofrooms hasyard haspool  floors  citycode  \
0          75523              3      no     yes      63      9373
1          55712             58      no     yes      19     34457
2          86929            100     yes      no      11     98155
3          51522              3      no      no      61      9047
4          96470             74     yes      no      21     92029
..           ...            ...     ...     ...     ...       ...
95         98868             41      no     yes      67     85917
96         83110             43     yes      no      75     55046
97         71154             67      no     yes      53      8762
98         90841             48     yes      no      15     25300
99         68416             87     yes      no      48     60979

    citypartrange  numprevowners  made isnewbuilt hasstormprotector
basement  \
0               3              8  2005        old               yes
```

```
4313
1               6              8  2021        old                  no
2937
2               3              4  2003        new                  no
6326
3               8              3  2012        new                 yes
632
4               4              2  2011        new                 yes
5414
..            ...            ...   ...        ...                 ...
...
95              7              3  2021        new                 yes
2146
96              7             10  2001        new                  no
4108
97              2              6  2021        new                 yes
8418
98              6              5  2003        old                  no
3333
99              8              7  2010        old                  no
1811

    attic  garage hasstorageroom  hasguestroom      price
0    9005     956             no             7  7559081.5
1    8852     135            yes             9  5574642.1
2    4748     654             no            10  8696869.3
3    5792     807            yes             5  5154055.2
4    1172     716            yes             9  9652258.1
..    ...     ...            ...           ...        ...
95   1077     623            yes             3  9892300.1
96   5663     380            yes             7  8321631.1
97   7187     706             no             8  7122699.1
98    149     842             no             9  9086177.3
99   6776     424             no             6  6846709.0

[100 rows x 17 columns]
```

```
properti_price2.info
```

```
<bound method DataFrame.info of       squaremeters  numberofrooms
hasyard haspool  floors  citycode  \
0            75523              3      no     yes      63      9373
1            55712             58      no     yes      19     34457
2            86929            100     yes      no      11     98155
3            51522              3      no      no      61      9047
4            96470             74     yes      no      21     92029
...            ...            ...     ...     ...     ...       ...
9995           341             83      no      no       8      1960
9996         21514              5      no     yes      11     91373
9997          1726             89      no     yes       5     73133
```

```
9998        44403            29    yes     yes      12     34606
9999         1440            84     no      no      49     18412

      citypartrange  numprevowners  made isnewbuilt hasstormprotector  \
0                 3              8  2005        old               yes   
1                 6              8  2021        old                no   
2                 3              4  2003        new                no   
3                 8              3  2012        new               yes   
4                 4              2  2011        new               yes   
...             ...            ...   ...        ...               ...   
9995              4              4  1993        new               yes   
9996              1              1  1999        old                no   
9997              7              6  2009        old               yes   
9998              9              4  1990        old               yes   
9999              6             10  1994        new                no   

      basement  attic  garage hasstorageroom  hasguestroom      price  
0         4313   9005     956             no             7  7559081.5  
1         2937   8852     135            yes             9  5574642.1  
2         6326   4748     654             no            10  8696869.3  
3          632   5792     807            yes             5  5154055.2  
4         5414   1172     716            yes             9  9652258.1  
...        ...    ...     ...            ...           ...        ...  
9995      2366   4016     229            yes             5    35371.3  
9996      2584   5266     787             no             3  2153602.9  
9997      9311   1698     218             no             4   176425.9  
9998      9061   1742     230             no             0  4448474.0  
9999      8485   2024     278            yes             6   146708.4  
```

```
[10000 rows x 17 columns]>

properti_price2.describe()

       squaremeters  numberofrooms        floors      citycode
citypartrange  \
count   10000.00000   10000.000000  10000.000000  10000.000000
10000.000000
mean    49870.13120      50.358400     50.276300  50225.486100
5.510100
std     28774.37535      28.816696     28.889171  29006.675799
2.872024
min        89.00000       1.000000      1.000000      3.000000
1.000000
25%     25098.50000      25.000000     25.000000  24693.750000
3.000000
50%     50105.50000      50.000000     50.000000  50693.000000
5.000000
75%     74609.75000      75.000000     76.000000  75683.250000
8.000000
max     99999.00000     100.000000    100.000000  99953.000000
10.000000

       numprevowners          made      basement         attic
garage  \
count   10000.000000  10000.00000  10000.000000  10000.00000
10000.00000
mean        5.521700   2005.48850   5033.103900   5028.01060
553.12120
std         2.856667      9.30809   2876.729545   2894.33221
262.05017
min         1.000000   1990.00000      0.000000      1.00000
100.00000
25%         3.000000   1997.00000   2559.750000   2512.00000
327.75000
50%         5.000000   2005.50000   5092.500000   5045.00000
554.00000
75%         8.000000   2014.00000   7511.250000   7540.50000
777.25000
max        10.000000   2021.00000  10000.000000  10000.00000
1000.00000

       hasguestroom         price
count   10000.00000  1.000000e+04
mean        4.99460  4.993448e+06
std         3.17641  2.877424e+06
min         0.00000  1.031350e+04
25%         2.00000  2.516402e+06
50%         5.00000  5.016180e+06
```

```
75%          8.00000  7.469092e+06
max         10.00000  1.000677e+07
```

```python
print(properti_price2['price'].value_counts())
```

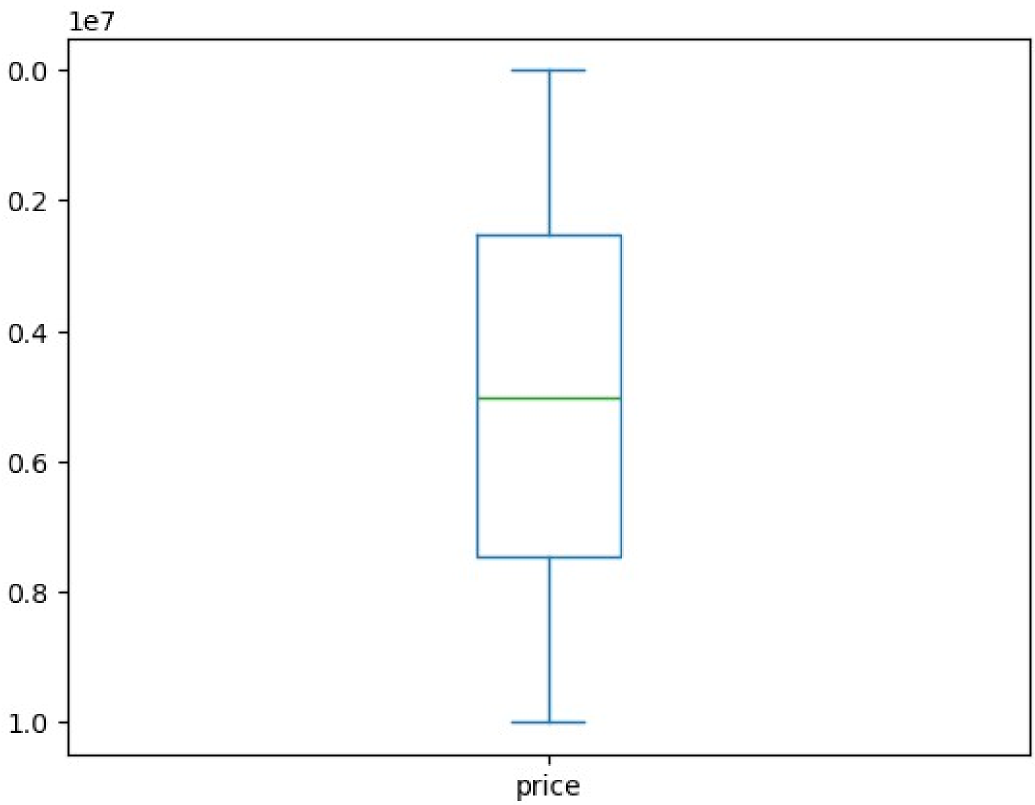
```
price
7559081.5    1
2600292.1    1
3804577.4    1
3658559.7    1
2316639.4    1
            ..
5555606.6    1
5501007.5    1
9986201.2    1
9104801.8    1
146708.4     1
Name: count, Length: 10000, dtype: int64
```

```python
print("data null \n", properti_price2.isnull().sum())
print("data kosong \n", properti_price2.empty)
print("data nan \n", properti_price2.isna().sum())
```

```
data null
 squaremeters          0
numberofrooms         0
hasyard               0
haspool               0
floors                0
citycode              0
citypartrange         0
numprevowners         0
made                  0
isnewbuilt            0
hasstormprotector     0
basement              0
attic                 0
garage                0
hasstorageroom        0
hasguestroom          0
price                 0
dtype: int64
data kosong
 False
data nan
 squaremeters          0
numberofrooms         0
hasyard               0
haspool               0
floors                0
```

```
citycode             0
citypartrange        0
numprevowners        0
made                 0
isnewbuilt           0
hasstormprotector    0
basement             0
attic                0
garage               0
hasstorageroom       0
hasguestroom         0
price                0
dtype: int64
```

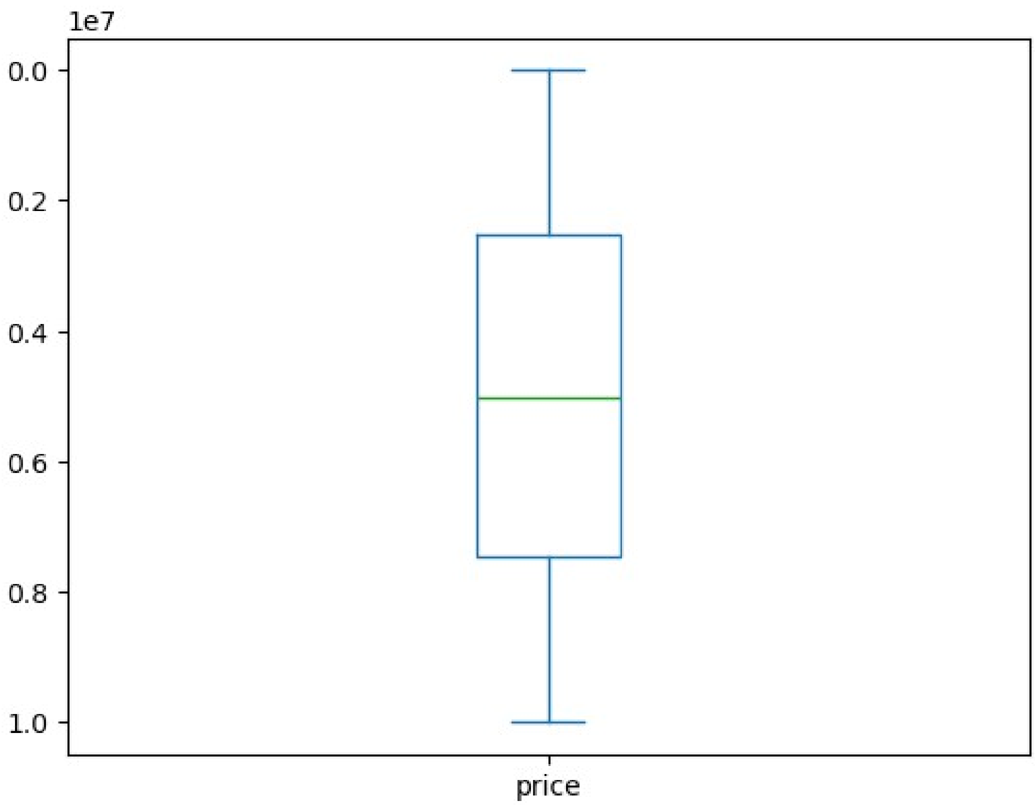
```
properti_price2.price.plot(kind='box')
plt.gca().invert_yaxis()
plt.show()
```




```
def remove_outlier(df_in):
  for col_name in list(df_in):
    if is_numeric_dtype(df_in[col_name]):
      q1 = df_in[col_name].quantile(0.25)
      q3 = df_in[col_name].quantile(0.75)
```

```
      iqr = q3-q1
      batas_atas = q3+(iqr*1.5)
      batas_bawah = q1-(iqr*1.5)

      df_out = df_in.loc[(df_in[col_name]>=batas_bawah) &
(df_in[col_name]<=batas_atas)]

  return df_out

properti_price_clean = remove_outlier(properti_price2)
print("Jumlah baris DataFrame sebelum di
outlier",properti_price2.shape[0])
print("Jumlah baris DataFrame sesudah di
outlier",properti_price_clean.shape[0])
properti_price_clean.price.plot(kind='box', vert=True)

plt.gca().invert_yaxis()
plt.show()
```

```
Jumlah baris DataFrame sebelum di outlier 10000
Jumlah baris DataFrame sesudah di outlier 10000
```



```python
print("data null \n", properti_price_clean.isnull().sum())
print("data kosong \n", properti_price_clean.empty)
print("data nan \n", properti_price_clean.isna().sum())
```

```
data null
 squaremeters         0
numberofrooms        0
hasyard              0
haspool              0
floors               0
citycode             0
citypartrange        0
numprevowners        0
made                 0
isnewbuilt           0
hasstormprotector    0
basement             0
attic                0
garage               0
hasstorageroom       0
hasguestroom         0
price                0
dtype: int64
data kosong
 False
data nan
 squaremeters         0
numberofrooms        0
hasyard              0
haspool              0
floors               0
citycode             0
citypartrange        0
numprevowners        0
made                 0
isnewbuilt           0
hasstormprotector    0
basement             0
attic                0
garage               0
hasstorageroom       0
hasguestroom         0
price                0
dtype: int64
```

```python
X_regress=properti_price_clean.drop('price',axis=1)
y_regress=properti_price_clean.price

X_train_price, X_test_price, y_train_price, y_test_price =
```

```
train_test_split(X_regress, y_regress, test_size=0.20,
random_state=84)

X_regress=properti_price_clean.drop('price',axis=1)
y_regress=properti_price_clean.price

X_train_ins, X_test_ins, y_train_ins, y_test_ins =
train_test_split(X_regress, y_regress, test_size=0.20,
random_state=84)
cat_cols =
X_train_ins.select_dtypes(include=['object']).columns.tolist()
print("Kolom kategorik:",cat_cols)

transformer = make_column_transformer(
    (OneHotEncoder(), cat_cols),
    remainder = 'passthrough'
)

X_train_enc = transformer.fit_transform(X_train_ins)
X_test_enc = transformer.transform(X_test_ins)

df_train_enc = pd.DataFrame (X_train_enc,
columns=transformer.get_feature_names_out())
df_test_enc = pd.DataFrame (X_test_enc,
columns=transformer.get_feature_names_out())

df_train_enc.head(10)
df_test_enc.head(10)
```

```
Kolom kategorik: ['hasyard', 'haspool', 'isnewbuilt',
'hasstormprotector', 'hasstorageroom']

   onehotencoder__hasyard_no  onehotencoder__hasyard_yes  \
0                        0.0                         1.0
1                        0.0                         1.0
2                        0.0                         1.0
3                        1.0                         0.0
4                        0.0                         1.0
5                        1.0                         0.0
6                        0.0                         1.0
7                        1.0                         0.0
8                        1.0                         0.0
9                        0.0                         1.0

   onehotencoder__haspool_no  onehotencoder__haspool_yes  \
0                        0.0                         1.0
1                        0.0                         1.0
2                        0.0                         1.0
3                        0.0                         1.0
4                        0.0                         1.0
5                        0.0                         1.0
```

```
6                         0.0                           1.0
7                         1.0                           0.0
8                         1.0                           0.0
9                         0.0                           1.0

   onehotencoder__isnewbuilt_new  onehotencoder__isnewbuilt_old  \
0                            0.0                            1.0
1                            1.0                            0.0
2                            1.0                            0.0
3                            1.0                            0.0
4                            1.0                            0.0
5                            1.0                            0.0
6                            1.0                            0.0
7                            1.0                            0.0
8                            1.0                            0.0
9                            1.0                            0.0

   onehotencoder__hasstormprotector_no
onehotencoder__hasstormprotector_yes  \
0                                  0.0
1.0
1                                  1.0
0.0
2                                  1.0
0.0
3                                  1.0
0.0
4                                  0.0
1.0
5                                  0.0
1.0
6                                  1.0
0.0
7                                  0.0
1.0
8                                  1.0
0.0
9                                  1.0
0.0

   onehotencoder__hasstorageroom_no  onehotencoder__hasstorageroom_yes
...  \
0                               1.0                                0.0
...
1                               1.0                                0.0
...
2                               0.0                                1.0
...
3                               1.0                                0.0
...
```

```
4                                1.0                                  0.0
...
5                                0.0                                  1.0
...
6                                0.0                                  1.0
...
7                                1.0                                  0.0
...
8                                0.0                                  1.0
...
9                                0.0                                  1.0
...

   remainder__numberofrooms  remainder__floors  remainder__citycode  \
0                      97.0               45.0              62899.0
1                      76.0               54.0              82737.0
2                      72.0               26.0               7812.0
3                      46.0               51.0              91317.0
4                       4.0               30.0               8424.0
5                      47.0               14.0              50927.0
6                      54.0               15.0              61691.0
7                      42.0               50.0              50833.0
8                      97.0                3.0              68804.0
9                      18.0               26.0              67302.0

   remainder__citypartrange  remainder__numprevowners  remainder__made
\
0                       1.0                       9.0           1990.0

1                       7.0                       3.0           1998.0

2                       6.0                       3.0           1995.0

3                       5.0                       3.0           2020.0

4                       4.0                      10.0           2003.0

5                       9.0                       6.0           1993.0

6                       2.0                       2.0           2002.0

7                       3.0                       8.0           2009.0

8                      10.0                       5.0           1991.0

9                       6.0                       2.0           2005.0


   remainder__basement  remainder__attic  remainder__garage  \
0               4110.0            1675.0              599.0
```

```
1                4010.0            8343.0              260.0
2                6972.0            3804.0              828.0
3                3337.0            7250.0              337.0
4                5655.0            1684.0              453.0
5                4078.0             315.0              767.0
6                5925.0            9705.0              342.0
7                9320.0            5752.0              936.0
8                5804.0            2070.0              846.0
9                6111.0             771.0              500.0

   remainder__hasguestroom
0                      4.0
1                     10.0
2                      8.0
3                      1.0
4                      8.0
5                     10.0
6                      8.0
7                      3.0
8                      9.0
9                     10.0

[10 rows x 21 columns]
```

```
from sklearn.linear_model import Lasso
from sklearn.model_selection import GridSearchCV
from sklearn.pipeline import Pipeline
from sklearn.preprocessing import StandardScaler
from sklearn.feature_selection import SelectKBest, f_regression
from sklearn.metrics import mean_absolute_error, mean_squared_error

pipe_Lasso_KBest = Pipeline(steps=[
            ('scale', StandardScaler()),
            ('feature_selection',
SelectKBest(score_func=f_regression)),
            ('reg', Lasso(max_iter=1000)) #max_iter digunakan untuk
menen
            ])

param_grid_Lasso_KBest = {
    'reg__alpha': [0.01,0.1,1,10,100],
    'feature_selection__k': np.arange(1,20)
}

GSCV_Lasso = GridSearchCV(pipe_Lasso_KBest, param_grid_Lasso_KBest,
cv=5, scoring='neg_mean_squared_error')

GSCV_Lasso.fit(X_train_enc, y_train_price)
print("Best model:{}".format(GSCV_Lasso.best_estimator_))
print("Lasso best parameters: {}".format(GSCV_Lasso.best_params_))
```

```
print("Koefisien/bobot:
{}".format(GSCV_Lasso.best_estimator_.named_steps['reg'].coef_))
print("Intercept/bias:
{}".format(GSCV_Lasso.best_estimator_.named_steps['reg'].intercept_))

Lasso_predict = GSCV_Lasso.predict(X_test_enc)

mse_Lasso = mean_squared_error(y_test_price, Lasso_predict)
mae_Lasso = mean_absolute_error(y_test_price, Lasso_predict)

print("Lasso Mean Squared Error (MSE): {}".format(mse_Lasso))
print("Lasso Mean Absolute Error (MAE): {}".format(mae_Lasso))
print("Lasso Root Mean Squared Error: {}".format(np.sqrt(mse_Lasso)))

Best model:Pipeline(steps=[('scale', StandardScaler()),
                ('feature_selection',
                 SelectKBest(k=19,
                             score_func=<function f_regression at
0x12e0b7380>)),
                ('reg', Lasso(alpha=10))])
Lasso best parameters: {'feature_selection__k': 19, 'reg__alpha': 10}
Koefisien/bobot:[-1.48625529e+03  7.33416528e-12 -1.50225115e+03
1.53522706e-12
  7.27030018e+01 -1.23691279e-13 -6.74320323e+01  0.00000000e+00
 -3.53814701e+00  1.93569576e-10  2.88436146e+06  0.00000000e+00
  1.58134765e+03  1.38057483e+02 -3.70828982e+00 -8.77399024e+00
 -1.03200436e+00  2.18869143e+01 -0.00000000e+00]
Intercept/bias:5008877.6749249995
Lasso Mean Squared Error (MSE): 3535757.3574986807
Lasso Mean Absolute Error (MAE): 1462.234583543154
Lasso Root Mean Squared Error: 1880.3609646816967

# df_results['Lasso KBest Prediction']=Lasso_predict
df_results = pd.DataFrame(y_test_price)
df_results['Lasso KBest Prediction']=Lasso_predict

df_results['Selisih Price Lasso KBest'] = df_results['Lasso KBest
Prediction'] - df_results['price']
df_results.head()

          price  Lasso KBest Prediction  Selisih Price Lasso KBest
2457  6033313.0            6.035400e+06                2087.414519
4865  5290006.8            5.285274e+06               -4733.001285
5288  9235289.5            9.234512e+06                -777.323262
1063  7616002.0            7.616129e+06                 126.814548
5197  9390420.3            9.391625e+06                1204.251593

df_results.describe()
```

```
                 price  Lasso KBest Prediction  Selisih Price Lasso KBest
count  2.000000e+03            2.000000e+03                2000.000000
mean   4.931727e+06            4.931789e+06                  61.835861
std    2.848679e+06            2.848584e+06                1879.813963
min    2.381840e+04            2.881419e+04               -6905.546378
25%    2.494605e+06            2.493396e+06               -1087.464237
50%    5.014176e+06            5.014615e+06                  39.206169
75%    7.338401e+06            7.338065e+06                1234.037636
max    9.994474e+06            9.994805e+06                6211.922919
```

```
from sklearn.linear_model import Lasso
from sklearn.model_selection import GridSearchCV
from sklearn.pipeline import Pipeline
from sklearn.preprocessing import StandardScaler
from sklearn.feature_selection import SelectPercentile, f_regression
from sklearn.metrics import mean_absolute_error, mean_squared_error

pipe_Lasso_percentile = Pipeline(steps=[
    ('scale', StandardScaler()),
    ('feature_selection', SelectPercentile(score_func=f_regression)),
# Menggunakan SelectPercentile
    ('reg', Lasso(max_iter=1000))
])

param_grid_Lasso_percentile = {
    'reg__alpha': [0.01, 0.1, 1, 10, 100],
    'feature_selection__percentile': np.arange(10, 100, 10)  #
Menggunakan persentase fitur terbaik
}

GSCV_Lasso = GridSearchCV(pipe_Lasso_percentile,
param_grid_Lasso_percentile, cv=5, scoring='neg_mean_squared_error')

# Fit ke data latih
GSCV_Lasso.fit(X_train_enc, y_train_price)

# Hasil dari GridSearch
print("Best model:{}".format(GSCV_Lasso.best_estimator_))
print("Lasso best parameters: {}".format(GSCV_Lasso.best_params_))

# Koefisien dan intercept dari model terbaik
print("Koefisien/bobot:
{}".format(GSCV_Lasso.best_estimator_.named_steps['reg'].coef_))
print("Intercept/bias:
{}".format(GSCV_Lasso.best_estimator_.named_steps['reg'].intercept_))

# Prediksi terhadap data uji
Lasso_predict = GSCV_Lasso.predict(X_test_enc)

# Menghitung error
```

```
mse_Lasso = mean_squared_error(y_test_price, Lasso_predict)
mae_Lasso = mean_absolute_error(y_test_price, Lasso_predict)

print("Lasso Mean Squared Error (MSE): {}".format(mse_Lasso))
print("Lasso Mean Absolute Error (MAE): {}".format(mae_Lasso))
print("Lasso Root Mean Squared Error: {}".format(np.sqrt(mse_Lasso)))
```

```
Best model:Pipeline(steps=[('scale', StandardScaler()),
                ('feature_selection',
                 SelectPercentile(percentile=90,
                                  score_func=<function f_regression at 
0x12e0b7380>)),
                ('reg', Lasso(alpha=10))])
Lasso best parameters: {'feature_selection__percentile': 90, 
'reg__alpha': 10}
Koefisien/bobot:[ 1.48625529e+03 -1.50225115e+03  1.32422429e-12  
7.27030018e+01
 -2.91038305e-14 -6.74320323e+01  0.00000000e+00 -3.53814701e+00
  1.93609594e-10  2.88436146e+06  0.00000000e+00  1.58134765e+03
  1.38057483e+02 -3.70828982e+00 -8.77399024e+00 -1.03200436e+00
  2.18869143e+01 -0.00000000e+00]
Intercept/bias:5008877.6749249995
Lasso Mean Squared Error (MSE): 3535757.3574986784
Lasso Mean Absolute Error (MAE): 1462.2345835431515
Lasso Root Mean Squared Error: 1880.360964681696
```

```
df_results['Lasso Percentile Prediction']=Lasso_predict
df_results = pd.DataFrame(y_test_price)
df_results['Lasso Percentile Prediction']=Lasso_predict

df_results['Selisih Price Lasso Percentile'] = df_results['Lasso 
Percentile Prediction'] - df_results['price']
df_results.head()
```

```
          price  Lasso Percentile Prediction  Selisih Price Lasso 
Percentile
2457  6033313.0                 6.035400e+06                      
2087.414519
4865  5290006.8                 5.285274e+06                     -
4733.001285
5288  9235289.5                 9.234512e+06                      -
777.323262
1063  7616002.0                 7.616129e+06                      
126.814548
5197  9390420.3                 9.391625e+06                      
1204.251593
```

```
df_results.describe()
```

```
              price  Lasso Percentile Prediction  \
count  2.000000e+03                 2.000000e+03
```

```
mean   4.931727e+06                4.931789e+06
std    2.848679e+06                2.848584e+06
min    2.381840e+04                2.881419e+04
25%    2.494605e+06                2.493396e+06
50%    5.014176e+06                5.014615e+06
75%    7.338401e+06                7.338065e+06
max    9.994474e+06                9.994805e+06

       Selisih Price Lasso Percentile
count                     2000.000000
mean                        61.835861
std                       1879.813963
min                      -6905.546378
25%                      -1087.464237
50%                         39.206169
75%                       1234.037636
max                       6211.922919
```

```
from sklearn.ensemble import RandomForestRegressor
from sklearn.pipeline import Pipeline
from sklearn.preprocessing import StandardScaler
from sklearn.feature_selection import SelectPercentile, f_regression
from sklearn.model_selection import GridSearchCV
from sklearn.metrics import mean_absolute_error, mean_squared_error
import numpy as np

# Pipeline for Random Forest Regressor
pipe_RF = Pipeline(steps=[
    ('scale', StandardScaler()),
    ('feature_selection', SelectPercentile(score_func=f_regression)),
# Pilih top percentile fitur
    ('reg', RandomForestRegressor(random_state=84))  # Random Forest
Regressor
])

# Parameter grid untuk GridSearchCV
param_grid_RF = {
    'reg__n_estimators': [100, 200],          # Jumlah pohon lebih
sedikit
    'reg__max_depth': [2,3],         # Variasi kedalaman terbatas
    'feature_selection__percentile': np.arange(10, 50)  # Langkah 10
untuk persentil
}

# GridSearchCV to find the best parameters
GSCV_RF = GridSearchCV(pipe_RF, param_grid_RF, cv=5,
scoring='neg_mean_squared_error')

# Fit to the training data
GSCV_RF.fit(X_train_enc, y_train_price)
```

```
# Best model and parameters
print("Best model:{}".format(GSCV_RF.best_estimator_))
print("Random Forest best parameters:
{}".format(GSCV_RF.best_params_))

# Make predictions on the test set
RF_predict = GSCV_RF.predict(X_test_enc)

# Calculate metrics
mse_RF = mean_squared_error(y_test_price, RF_predict)
mae_RF = mean_absolute_error(y_test_price, RF_predict)

print("Random Forest Mean Squared Error (MSE): {}".format(mse_RF))
print("Random Forest Mean Absolute Error (MAE): {}".format(mae_RF))
print("Random Forest Root Mean Squared Error:
{}".format(np.sqrt(mse_RF)))
```

```
Best model:Pipeline(steps=[('scale', StandardScaler()),
                ('feature_selection',
                 SelectPercentile(percentile=41,
                                  score_func=<function f_regression at
0x12e0b7380>)),
                ('reg', RandomForestRegressor(max_depth=3,
random_state=84))])
Random Forest best parameters: {'feature_selection__percentile': 41,
'reg__max_depth': 3, 'reg__n_estimators': 100}
Random Forest Mean Squared Error (MSE): 111333999223.2568
Random Forest Mean Absolute Error (MAE): 289241.46874328353
Random Forest Root Mean Squared Error: 333667.4980025127
```

```
df_results['Random Forest Percentile Prediction']=RF_predict
df_results = pd.DataFrame(y_test_price)
df_results['Random Forest Percentile Prediction']=RF_predict

df_results['Selisih Price RF Percentile'] = df_results['Random Forest
Percentile Prediction'] - df_results['price']
df_results.head()
```

```
          price  Random Forest Percentile Prediction  \
2457  6033313.0                         5.610185e+06
4865  5290006.8                         5.610185e+06
5288  9235289.5                         9.373249e+06
1063  7616002.0                         8.145797e+06
5197  9390420.3                         9.373249e+06

      Selisih Price RF Percentile
2457                -423128.277191
4865                 320177.922809
5288                 137959.866135
```

1063	529794.777347
5197	-17170.933865

```
from sklearn.ensemble import RandomForestRegressor
from sklearn.pipeline import Pipeline
from sklearn.preprocessing import StandardScaler
from sklearn.feature_selection import SelectKBest, f_regression
from sklearn.model_selection import GridSearchCV
from sklearn.metrics import mean_absolute_error, mean_squared_error
import numpy as np

# Pipeline for Random Forest Regressor
pipe_RF_Kbest = Pipeline(steps=[
    ('scale', StandardScaler()),
    ('feature_selection', SelectKBest(score_func=f_regression)),  # 
Pilih top percentile fitur
    ('reg', RandomForestRegressor(random_state=84))  # Random Forest 
Regressor
])

# Parameter grid untuk GridSearchCV
param_grid_RF_Kbest = {
    'reg__n_estimators': [100, 200],          # Jumlah pohon lebih 
sedikit
    'reg__max_depth': [2,3],         # Variasi kedalaman terbatas
    'feature_selection__k': np.arange(10, 50)  # Langkah 10 untuk 
persentil
}

# GridSearchCV to find the best parameters
GSCV_RF = GridSearchCV(pipe_RF_Kbest, param_grid_RF_Kbest, cv=5, 
scoring='neg_mean_squared_error')

# Fit to the training data
GSCV_RF.fit(X_train_enc, y_train_price)

# Best model and parameters
print("Best model:{}".format(GSCV_RF.best_estimator_))
print("Random Forest best parameters: 
{}".format(GSCV_RF.best_params_))

# Make predictions on the test set
RF_predict = GSCV_RF.predict(X_test_enc)

# Calculate metrics
mse_RF = mean_squared_error(y_test_price, RF_predict)
mae_RF = mean_absolute_error(y_test_price, RF_predict)

print("Random Forest Mean Squared Error (MSE): {}".format(mse_RF))
print("Random Forest Mean Absolute Error (MAE): {}".format(mae_RF))
```

```python
print("Random Forest Root Mean Squared Error:
{}".format(np.sqrt(mse_RF)))
```

```
/opt/anaconda3/lib/python3.12/site-packages/sklearn/
feature_selection/_univariate_selection.py:776: UserWarning: k=22 is
greater than n_features=21. All the features will be returned.
  warnings.warn(
/opt/anaconda3/lib/python3.12/site-packages/sklearn/feature_selection/
_univariate_selection.py:776: UserWarning: k=22 is greater than
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```
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```

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```

```
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/opt/anaconda3/lib/python3.12/site-packages/sklearn/feature_selection/
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  warnings.warn(
/opt/anaconda3/lib/python3.12/site-packages/sklearn/feature_selection/
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n_features=21. All the features will be returned.
  warnings.warn(
/opt/anaconda3/lib/python3.12/site-packages/sklearn/feature_selection/
_univariate_selection.py:776: UserWarning: k=25 is greater than
n_features=21. All the features will be returned.
```

```
  warnings.warn(
/opt/anaconda3/lib/python3.12/site-packages/sklearn/feature_selection/
_univariate_selection.py:776: UserWarning: k=25 is greater than
n_features=21. All the features will be returned.
  warnings.warn(
/opt/anaconda3/lib/python3.12/site-packages/sklearn/feature_selection/
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  warnings.warn(
/opt/anaconda3/lib/python3.12/site-packages/sklearn/feature_selection/
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/opt/anaconda3/lib/python3.12/site-packages/sklearn/feature_selection/
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/opt/anaconda3/lib/python3.12/site-packages/sklearn/feature_selection/
_univariate_selection.py:776: UserWarning: k=25 is greater than
n_features=21. All the features will be returned.
  warnings.warn(
/opt/anaconda3/lib/python3.12/site-packages/sklearn/feature_selection/
_univariate_selection.py:776: UserWarning: k=25 is greater than
n_features=21. All the features will be returned.
  warnings.warn(
/opt/anaconda3/lib/python3.12/site-packages/sklearn/feature_selection/
_univariate_selection.py:776: UserWarning: k=25 is greater than
n_features=21. All the features will be returned.
  warnings.warn(
```

```
/opt/anaconda3/lib/python3.12/site-packages/sklearn/feature_selection/
_univariate_selection.py:776: UserWarning: k=25 is greater than
n_features=21. All the features will be returned.
  warnings.warn(
/opt/anaconda3/lib/python3.12/site-packages/sklearn/feature_selection/
_univariate_selection.py:776: UserWarning: k=25 is greater than
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  warnings.warn(
/opt/anaconda3/lib/python3.12/site-packages/sklearn/feature_selection/
_univariate_selection.py:776: UserWarning: k=25 is greater than
n_features=21. All the features will be returned.
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/opt/anaconda3/lib/python3.12/site-packages/sklearn/feature_selection/
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/opt/anaconda3/lib/python3.12/site-packages/sklearn/feature_selection/
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/opt/anaconda3/lib/python3.12/site-packages/sklearn/feature_selection/
_univariate_selection.py:776: UserWarning: k=25 is greater than
n_features=21. All the features will be returned.
  warnings.warn(
/opt/anaconda3/lib/python3.12/site-packages/sklearn/feature_selection/
_univariate_selection.py:776: UserWarning: k=25 is greater than
n_features=21. All the features will be returned.
  warnings.warn(
/opt/anaconda3/lib/python3.12/site-packages/sklearn/feature_selection/
_univariate_selection.py:776: UserWarning: k=26 is greater than
n_features=21. All the features will be returned.
  warnings.warn(
/opt/anaconda3/lib/python3.12/site-packages/sklearn/feature_selection/
_univariate_selection.py:776: UserWarning: k=26 is greater than
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  warnings.warn(
/opt/anaconda3/lib/python3.12/site-packages/sklearn/feature_selection/
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/opt/anaconda3/lib/python3.12/site-packages/sklearn/feature_selection/
_univariate_selection.py:776: UserWarning: k=49 is greater than
n_features=21. All the features will be returned.
```

```
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/opt/anaconda3/lib/python3.12/site-packages/sklearn/feature_selection/
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  warnings.warn(
/opt/anaconda3/lib/python3.12/site-packages/sklearn/feature_selection/
_univariate_selection.py:776: UserWarning: k=49 is greater than
n_features=21. All the features will be returned.
  warnings.warn(

Best model:Pipeline(steps=[('scale', StandardScaler()),
                ('feature_selection',
                 SelectKBest(k=15,
                             score_func=<function f_regression at
0x12e0b7380>)),
                ('reg', RandomForestRegressor(max_depth=3,
random_state=84))])
Random Forest best parameters: {'feature_selection__k': 15,
'reg__max_depth': 3, 'reg__n_estimators': 100}
Random Forest Mean Squared Error (MSE): 111333999223.2568
Random Forest Mean Absolute Error (MAE): 289241.46874328353
Random Forest Root Mean Squared Error: 333667.4980025127

df_results['Random Forest KBest Prediction']=RF_predict
df_results = pd.DataFrame(y_test_price)
df_results['Random Forest KBest Prediction']=RF_predict
```
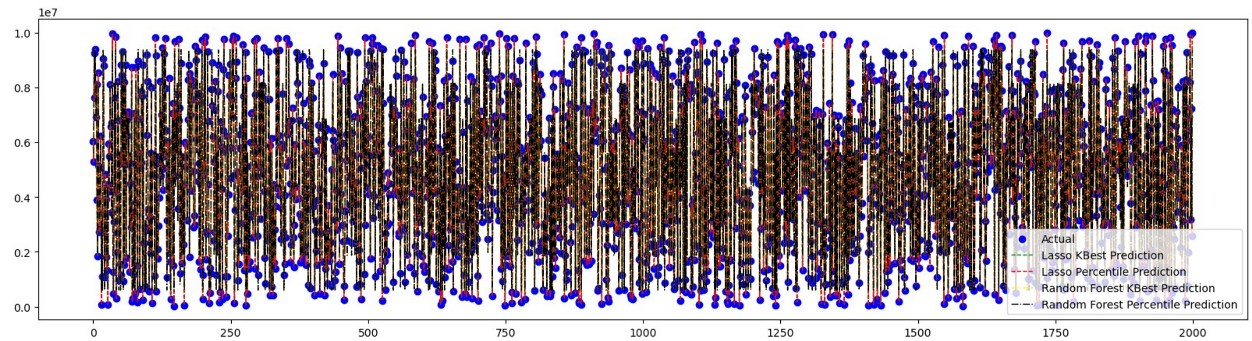

```
df_results['Selisih Price RF KBest'] = df_results['Random Forest KBest
Prediction'] - df_results['price']
df_results.head()
```

```
          price  Random Forest KBest Prediction  Selisih Price RF
KBest
2457  6033313.0                    5.610185e+06          -
423128.277191
4865  5290006.8                    5.610185e+06
320177.922809
5288  9235289.5                    9.373249e+06
137959.866135
1063  7616002.0                    8.145797e+06
529794.777347
5197  9390420.3                    9.373249e+06           -
17170.933865
```

```
import pandas as pd
import matplotlib.pyplot as plt

# Misalkan Ridge_predict dan SVR_predict sudah didefinisikan
sebelumnya
# Ridge_predict = model_ridge.predict(X_test)
# SVR_predict = model_svr.predict(X_test)

# Mengonversi y_test_price menjadi DataFrame
df_results = pd.DataFrame(y_test_price)

# Menambahkan kolom prediksi
df_results['Lasso KBest Prediction']=Lasso_predict
df_results['Random Forest KBest Prediction']=RF_predict

# Jika ada kolom lain yang perlu ditambahkan
df_results['Lasso Percentile Prediction']=Lasso_predict
df_results['Random Forest Percentile Prediction']=RF_predict

# Menghitung selisih

df_results['Selisih Price Lasso KBest'] = df_results['Lasso KBest
Prediction'] - df_results['price']
df_results['Selisih Price RF KBest'] = df_results['Random Forest KBest
Prediction'] - df_results['price']

# Menampilkan beberapa data teratas
print(df_results.head())

# Membuat plot
plt.figure(figsize=(20, 5))
data_len = range(len(y_test_price))
plt.scatter(data_len, df_results['price'], label="Actual",
```

```
color="blue")
plt.plot(data_len, df_results['Lasso KBest Prediction'], label="Lasso
KBest Prediction", color="green", linewidth=1, linestyle="dashed")
plt.plot(data_len, df_results['Lasso Percentile Prediction'],
label="Lasso Percentile Prediction", color="red", linewidth=1,
linestyle="dashed")
plt.plot(data_len, df_results['Random Forest KBest Prediction'],
label="Random Forest KBest Prediction", color="yellow", linewidth=1,
linestyle="-.")
plt.plot(data_len, df_results['Random Forest Percentile Prediction'],
label="Random Forest Percentile Prediction", color="black",
linewidth=1, linestyle="-.")

# Menambahkan legenda dan menampilkan plot
plt.legend()
plt.show()
```

```
          price  Lasso KBest Prediction  Random Forest KBest
Prediction  \
2457  6033313.0            6.035400e+06
5.610185e+06
4865  5290006.8            5.285274e+06
5.610185e+06
5288  9235289.5            9.234512e+06
9.373249e+06
1063  7616002.0            7.616129e+06
8.145797e+06
5197  9390420.3            9.391625e+06
9.373249e+06

      Lasso Percentile Prediction  Random Forest Percentile Prediction
\
2457                 6.035400e+06                         5.610185e+06

4865                 5.285274e+06                         5.610185e+06

5288                 9.234512e+06                         9.373249e+06

1063                 7.616129e+06                         8.145797e+06

5197                 9.391625e+06                         9.373249e+06


      Selisih Price Lasso KBest  Selisih Price RF KBest
2457                2087.414519          -423128.277191
4865               -4733.001285           320177.922809
5288                -777.323262           137959.866135
1063                 126.814548           529794.777347
5197                1204.251593           -17170.933865
```




```
import pickle
best_model = GSCV_RF.best_estimator_

with open('BestModel_REG_GSCV_RF_matplotlib.pkl', 'wb') as f:
    pickle.dump(best_model, f)
print("Model Terbaik berhasil disimpan ke
'BestModel_REG_GSCV_RF_matplotlib.pkl")
```

```
Model Terbaik berhasil disimpan ke
'BestModel_REG_GSCV_RF_matplotlib.pkl
```

```
import pandas as pd
import numpy as np
from sklearn.model_selection import train_test_split
from sklearn.preprocessing import OneHotEncoder
from sklearn.compose import make_column_transformer
from sklearn.feature_selection import SelectFromModel, SelectKBest,
SelectPercentile, RFE
from sklearn.model_selection import GridSearchCV, StratifiedKFold
from sklearn.ensemble import GradientBoostingClassifier
from sklearn.ensemble import RandomForestClassifier,
RandomForestRegressor
from sklearn.svm import SVC, SVR
from sklearn.metrics import classification_report, confusion_matrix,
ConfusionMatrixDisplay
from sklearn.preprocessing import StandardScaler, MinMaxScaler
from sklearn.pipeline import Pipeline
from sklearn.tree import DecisionTreeClassifier
from sklearn.linear_model import LogisticRegression
from sklearn.metrics import mean_squared_error, mean_absolute_error
from pandas.api.types import is_numeric_dtype
from sklearn.linear_model import Ridge, Lasso
import matplotlib.pyplot as plt

properti_price = pd.read_csv('Dataset UTS_Gasal 2425.csv')
properti_price.head(100)
```

```
    squaremeters  numberofrooms hasyard haspool  floors  citycode  \
0          75523              3      no     yes      63      9373
1          55712             58      no     yes      19     34457
2          86929            100     yes      no      11     98155
3          51522              3      no      no      61      9047
4          96470             74     yes      no      21     92029
..           ...            ...     ...     ...     ...       ...
95         98868             41      no     yes      67     85917
96         83110             43     yes      no      75     55046
97         71154             67      no     yes      53      8762
98         90841             48     yes      no      15     25300
99         68416             87     yes      no      48     60979

    citypartrange  numprevowners  made isnewbuilt hasstormprotector
basement  \
0               3              8  2005        old               yes
4313
1               6              8  2021        old                no
2937
2               3              4  2003        new                no
6326
3               8              3  2012        new               yes
632
4               4              2  2011        new               yes
```

```
5414
..              ...             ...   ...        ...                ...
...
95                7               3  2021        new                yes
2146
96                7              10  2001        new                 no
4108
97                2               6  2021        new                yes
8418
98                6               5  2003        old                 no
3333
99                8               7  2010        old                 no
1811

    attic  garage hasstorageroom  hasguestroom      price category
0    9005     956             no             7  7559081.5   Luxury
1    8852     135            yes             9  5574642.1   Middle
2    4748     654             no            10  8696869.3   Luxury
3    5792     807            yes             5  5154055.2   Middle
4    1172     716            yes             9  9652258.1   Luxury
..    ...     ...            ...           ...        ...      ...
95   1077     623            yes             3  9892300.1   Luxury
96   5663     380            yes             7  8321631.1   Luxury
97   7187     706             no             8  7122699.1   Luxury
98    149     842             no             9  9086177.3   Luxury
99   6776     424             no             6  6846709.0   Middle

[100 rows x 18 columns]
```

```
properti_price2 = properti_price.drop('category', axis=1)
properti_price2.head(100)
```

```
    squaremeters  numberofrooms hasyard haspool  floors  citycode  \
0          75523              3      no     yes      63      9373
1          55712             58      no     yes      19     34457
2          86929            100     yes      no      11     98155
3          51522              3      no      no      61      9047
4          96470             74     yes      no      21     92029
..           ...            ...     ...     ...     ...       ...
95         98868             41      no     yes      67     85917
96         83110             43     yes      no      75     55046
97         71154             67      no     yes      53      8762
98         90841             48     yes      no      15     25300
99         68416             87     yes      no      48     60979

    citypartrange  numprevowners  made isnewbuilt hasstormprotector
basement  \
0               3              8  2005        old               yes
4313
1               6              8  2021        old                no
```

```
2937
2               3              4  2003        new                 no
6326
3               8              3  2012        new                yes
632
4               4              2  2011        new                yes
5414
..            ...            ...   ...        ...                ...
...
95              7              3  2021        new                yes
2146
96              7             10  2001        new                 no
4108
97              2              6  2021        new                yes
8418
98              6              5  2003        old                 no
3333
99              8              7  2010        old                 no
1811

    attic  garage hasstorageroom  hasguestroom      price
0    9005     956             no             7  7559081.5
1    8852     135            yes             9  5574642.1
2    4748     654             no            10  8696869.3
3    5792     807            yes             5  5154055.2
4    1172     716            yes             9  9652258.1
..    ...     ...            ...           ...        ...
95   1077     623            yes             3  9892300.1
96   5663     380            yes             7  8321631.1
97   7187     706             no             8  7122699.1
98    149     842             no             9  9086177.3
99   6776     424             no             6  6846709.0

[100 rows x 17 columns]
```

```
properti_price2.info
```

```
<bound method DataFrame.info of       squaremeters  numberofrooms
hasyard haspool  floors  citycode  \
0            75523              3      no      yes      63      9373
1            55712             58      no      yes      19     34457
2            86929            100     yes       no      11     98155
3            51522              3      no       no      61      9047
4            96470             74     yes       no      21     92029
...            ...            ...     ...      ...     ...       ...
9995           341             83      no       no       8      1960
9996         21514              5      no      yes      11     91373
9997          1726             89      no      yes       5     73133
9998         44403             29     yes      yes      12     34606
9999          1440             84      no       no      49     18412
```

```
      citypartrange  numprevowners  made isnewbuilt hasstormprotector  \
0                 3              8  2005        old               yes
1                 6              8  2021        old                no
2                 3              4  2003        new                no
3                 8              3  2012        new               yes
4                 4              2  2011        new               yes
...             ...            ...   ...        ...               ...
9995              4              4  1993        new               yes
9996              1              1  1999        old                no
9997              7              6  2009        old               yes
9998              9              4  1990        old               yes
9999              6             10  1994        new                no

      basement  attic  garage hasstorageroom  hasguestroom      price
0         4313   9005     956             no             7  7559081.5
1         2937   8852     135            yes             9  5574642.1
2         6326   4748     654             no            10  8696869.3
3          632   5792     807            yes             5  5154055.2
4         5414   1172     716            yes             9  9652258.1
...        ...    ...     ...            ...           ...        ...
9995      2366   4016     229            yes             5    35371.3
9996      2584   5266     787             no             3  2153602.9
9997      9311   1698     218             no             4   176425.9
9998      9061   1742     230             no             0  4448474.0
9999      8485   2024     278            yes             6   146708.4

[10000 rows x 17 columns]>
```

```
properti_price2.describe()
```

```
       squaremeters  numberofrooms       floors      citycode
citypartrange  \
count   10000.00000   10000.000000  10000.000000  10000.000000
10000.000000
mean    49870.13120      50.358400     50.276300  50225.486100
5.510100
std     28774.37535      28.816696     28.889171  29006.675799
2.872024
min        89.00000       1.000000      1.000000      3.000000
1.000000
25%     25098.50000      25.000000     25.000000  24693.750000
3.000000
50%     50105.50000      50.000000     50.000000  50693.000000
5.000000
75%     74609.75000      75.000000     76.000000  75683.250000
8.000000
max     99999.00000     100.000000    100.000000  99953.000000
10.000000

       numprevowners         made      basement        attic
garage  \
count   10000.000000  10000.00000  10000.000000  10000.00000
10000.00000
mean        5.521700   2005.48850   5033.103900   5028.01060
553.12120
std         2.856667      9.30809   2876.729545   2894.33221
262.05017
min         1.000000   1990.00000      0.000000      1.00000
100.00000
25%         3.000000   1997.00000   2559.750000   2512.00000
327.75000
50%         5.000000   2005.50000   5092.500000   5045.00000
554.00000
75%         8.000000   2014.00000   7511.250000   7540.50000
777.25000
max        10.000000   2021.00000  10000.000000  10000.00000
1000.00000

       hasguestroom         price
count   10000.00000  1.000000e+04
mean        4.99460  4.993448e+06
std         3.17641  2.877424e+06
min         0.00000  1.031350e+04
25%         2.00000  2.516402e+06
50%         5.00000  5.016180e+06
75%         8.00000  7.469092e+06
max        10.00000  1.000677e+07
```

```
print(properti_price2['price'].value_counts())
```

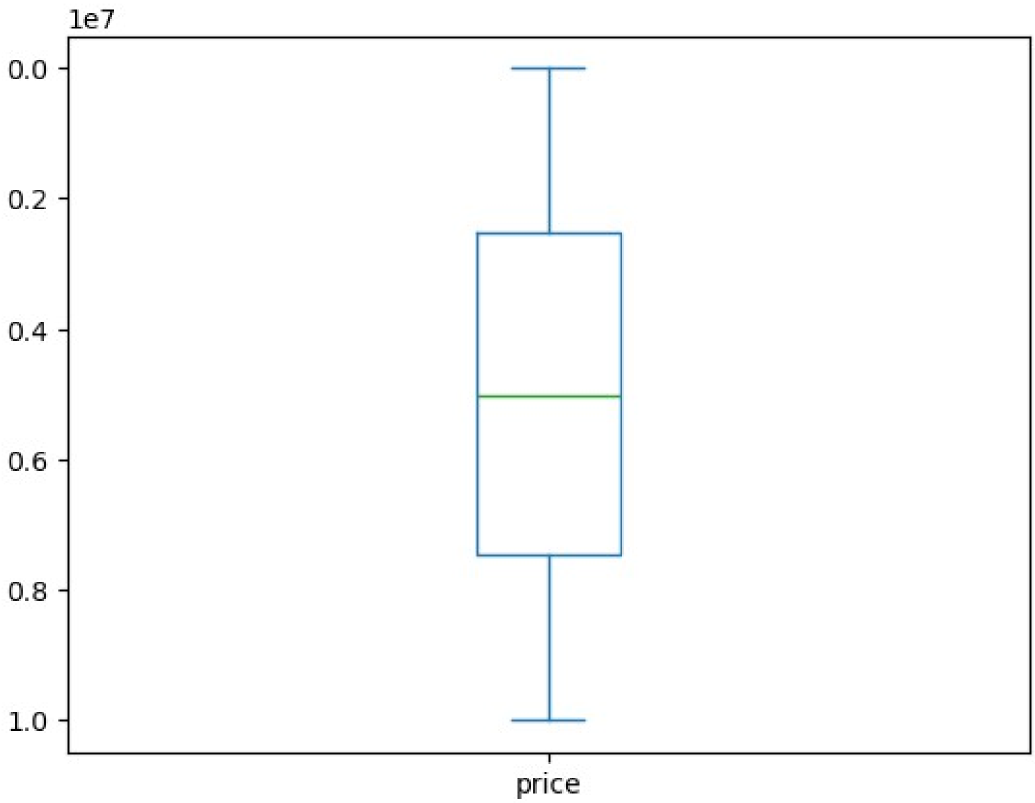
```
price
7559081.5    1
2600292.1    1
3804577.4    1
3658559.7    1
2316639.4    1
            ..
5555606.6    1
5501007.5    1
9986201.2    1
9104801.8    1
146708.4     1
Name: count, Length: 10000, dtype: int64
```

```
print("data null \n", properti_price2.isnull().sum())
print("data kosong \n", properti_price2.empty)
print("data nan \n", properti_price2.isna().sum())
```

```
data null
 squaremeters         0
numberofrooms        0
hasyard              0
haspool              0
floors               0
citycode             0
citypartrange        0
numprevowners        0
made                 0
isnewbuilt           0
hasstormprotector    0
basement             0
attic                0
garage               0
hasstorageroom       0
hasguestroom         0
price                0
dtype: int64
data kosong
 False
data nan
 squaremeters         0
numberofrooms        0
hasyard              0
haspool              0
floors               0
citycode             0
citypartrange        0
numprevowners        0
```

```
made                    0
isnewbuilt              0
hasstormprotector       0
basement                0
attic                   0
garage                  0
hasstorageroom          0
hasguestroom            0
price                   0
dtype: int64
```

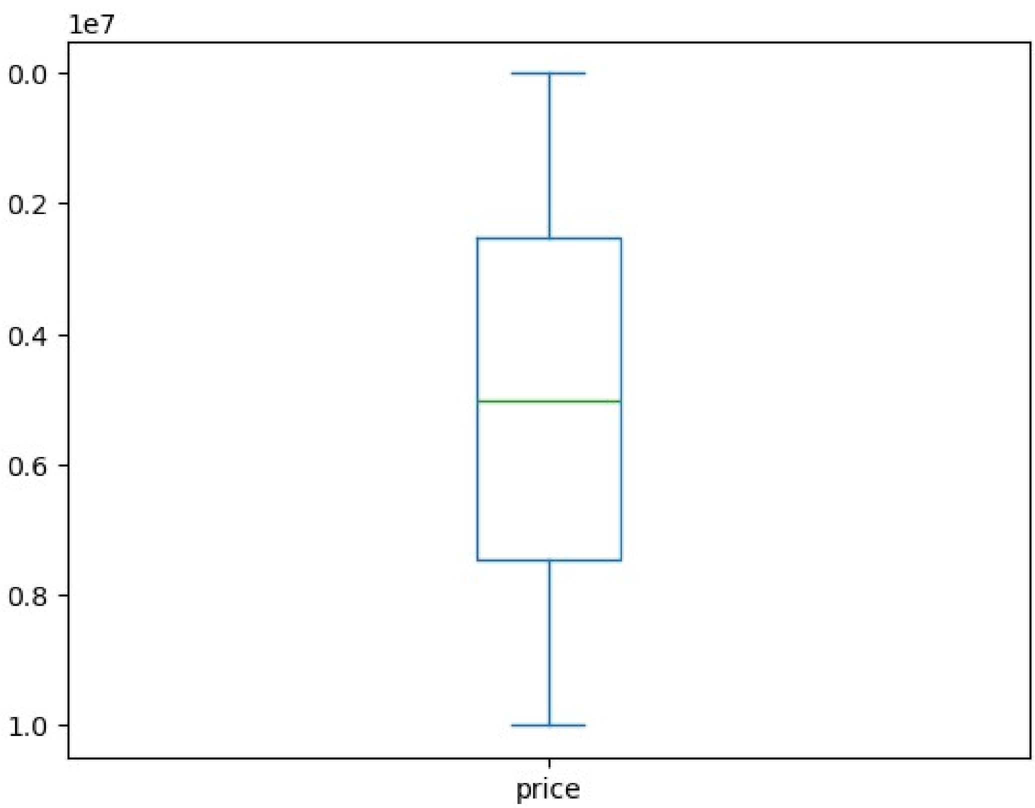
```
properti_price2.price.plot(kind='box')
plt.gca().invert_yaxis()
plt.show()
```




```
def remove_outlier(df_in):
  for col_name in list(df_in):
    if is_numeric_dtype(df_in[col_name]):
      q1 = df_in[col_name].quantile(0.25)
      q3 = df_in[col_name].quantile(0.75)

      iqr = q3-q1
      batas_atas = q3+(iqr*1.5)
      batas_bawah = q1-(iqr*1.5)
```

```
      df_out = df_in.loc[(df_in[col_name]>=batas_bawah) &
(df_in[col_name]<=batas_atas)]

  return df_out

properti_price_clean = remove_outlier(properti_price2)
print("Jumlah baris DataFrame sebelum di
outlier",properti_price2.shape[0])
print("Jumlah baris DataFrame sesudah di
outlier",properti_price_clean.shape[0])
properti_price_clean.price.plot(kind='box', vert=True)

plt.gca().invert_yaxis()
plt.show()
```

```
Jumlah baris DataFrame sebelum di outlier 10000
Jumlah baris DataFrame sesudah di outlier 10000
```




```
print("data null \n", properti_price_clean.isnull().sum())
print("data kosong \n", properti_price_clean.empty)
print("data nan \n", properti_price_clean.isna().sum())
```

```
data null
 squaremeters         0
numberofrooms        0
hasyard              0
haspool              0
floors               0
citycode             0
citypartrange        0
numprevowners        0
made                 0
isnewbuilt           0
hasstormprotector    0
basement             0
attic                0
garage               0
hasstorageroom       0
hasguestroom         0
price                0
dtype: int64
data kosong
 False
data nan
 squaremeters         0
numberofrooms        0
hasyard              0
haspool              0
floors               0
citycode             0
citypartrange        0
numprevowners        0
made                 0
isnewbuilt           0
hasstormprotector    0
basement             0
attic                0
garage               0
hasstorageroom       0
hasguestroom         0
price                0
dtype: int64

X_regress=properti_price_clean.drop('price',axis=1)
y_regress=properti_price_clean.price

X_train_price, X_test_price, y_train_price, y_test_price =
train_test_split(X_regress, y_regress, test_size=0.20,
random_state=84)

X_regress=properti_price_clean.drop('price',axis=1)
y_regress=properti_price_clean.price
```

```
X_train_ins, X_test_ins, y_train_ins, y_test_ins =
train_test_split(X_regress, y_regress, test_size=0.20,
random_state=84)
cat_cols =
X_train_ins.select_dtypes(include=['object']).columns.tolist()
print("Kolom kategorik:",cat_cols)

transformer = make_column_transformer(
    (OneHotEncoder(), cat_cols),
    remainder = 'passthrough'
)

X_train_enc = transformer.fit_transform(X_train_ins)
X_test_enc = transformer.transform(X_test_ins)

df_train_enc = pd.DataFrame (X_train_enc,
columns=transformer.get_feature_names_out())
df_test_enc = pd.DataFrame (X_test_enc,
columns=transformer.get_feature_names_out())

df_train_enc.head(10)
df_test_enc.head(10)
```

```
Kolom kategorik: ['hasyard', 'haspool', 'isnewbuilt',
'hasstormprotector', 'hasstorageroom']
```

```
   onehotencoder__hasyard_no  onehotencoder__hasyard_yes  \
0                        0.0                         1.0
1                        0.0                         1.0
2                        0.0                         1.0
3                        1.0                         0.0
4                        0.0                         1.0
5                        1.0                         0.0
6                        0.0                         1.0
7                        1.0                         0.0
8                        1.0                         0.0
9                        0.0                         1.0

   onehotencoder__haspool_no  onehotencoder__haspool_yes  \
0                        0.0                         1.0
1                        0.0                         1.0
2                        0.0                         1.0
3                        0.0                         1.0
4                        0.0                         1.0
5                        0.0                         1.0
6                        0.0                         1.0
7                        1.0                         0.0
8                        1.0                         0.0
9                        0.0                         1.0
```

```
   onehotencoder__isnewbuilt_new  onehotencoder__isnewbuilt_old  \
0                            0.0                            1.0   
1                            1.0                            0.0   
2                            1.0                            0.0   
3                            1.0                            0.0   
4                            1.0                            0.0   
5                            1.0                            0.0   
6                            1.0                            0.0   
7                            1.0                            0.0   
8                            1.0                            0.0   
9                            1.0                            0.0   

   onehotencoder__hasstormprotector_no
onehotencoder__hasstormprotector_yes  \
0                                  0.0
1.0   
1                                  1.0
0.0   
2                                  1.0
0.0   
3                                  1.0
0.0   
4                                  0.0
1.0   
5                                  0.0
1.0   
6                                  1.0
0.0   
7                                  0.0
1.0   
8                                  1.0
0.0   
9                                  1.0
0.0   

   onehotencoder__hasstorageroom_no  onehotencoder__hasstorageroom_yes
...  \
0                               1.0                                0.0
...   
1                               1.0                                0.0
...   
2                               0.0                                1.0
...   
3                               1.0                                0.0
...   
4                               1.0                                0.0
...   
5                               0.0                                1.0
...   
```

```
6                                     0.0                                  1.0
...
7                                     1.0                                  0.0
...
8                                     0.0                                  1.0
...
9                                     0.0                                  1.0
...

   remainder__numberofrooms  remainder__floors  remainder__citycode  \
0                      97.0               45.0              62899.0   
1                      76.0               54.0              82737.0   
2                      72.0               26.0               7812.0   
3                      46.0               51.0              91317.0   
4                       4.0               30.0               8424.0   
5                      47.0               14.0              50927.0   
6                      54.0               15.0              61691.0   
7                      42.0               50.0              50833.0   
8                      97.0                3.0              68804.0   
9                      18.0               26.0              67302.0   

   remainder__citypartrange  remainder__numprevowners  remainder__made
\
0                       1.0                       9.0           1990.0

1                       7.0                       3.0           1998.0

2                       6.0                       3.0           1995.0

3                       5.0                       3.0           2020.0

4                       4.0                      10.0           2003.0

5                       9.0                       6.0           1993.0

6                       2.0                       2.0           2002.0

7                       3.0                       8.0           2009.0

8                      10.0                       5.0           1991.0

9                       6.0                       2.0           2005.0


   remainder__basement  remainder__attic  remainder__garage  \
0               4110.0            1675.0              599.0   
1               4010.0            8343.0              260.0   
2               6972.0            3804.0              828.0   
3               3337.0            7250.0              337.0   
4               5655.0            1684.0              453.0   
```

```
5                4078.0            315.0               767.0
6                5925.0           9705.0               342.0
7                9320.0           5752.0               936.0
8                5804.0           2070.0               846.0
9                6111.0            771.0               500.0

   remainder__hasguestroom
0                      4.0
1                     10.0
2                      8.0
3                      1.0
4                      8.0
5                     10.0
6                      8.0
7                      3.0
8                      9.0
9                     10.0

[10 rows x 21 columns]
```

```
from sklearn.linear_model import Ridge
from sklearn.model_selection import GridSearchCV
from sklearn.pipeline import Pipeline
from sklearn.preprocessing import MinMaxScaler
from sklearn.feature_selection import SelectKBest, f_regression
from sklearn.metrics import mean_absolute_error, mean_squared_error

pipe_Ridge = Pipeline(steps=[
    ('scale', MinMaxScaler()),
    ('feature_selection', SelectKBest(score_func=f_regression)),
    ('reg', Ridge())
    ])

param_grid_Ridge = {
    'reg__alpha': [0.01,0.1,1,10,100],
    'feature_selection__k': np.arange(2,11)
}

GSCV_RR = GridSearchCV(pipe_Ridge, param_grid_Ridge, cv=5,
                      scoring='neg_mean_squared_error',
error_score='raise')

GSCV_RR.fit(X_train_enc, y_train_price)

print("Best model:{}".format(GSCV_RR.best_estimator_))
print("Ridge best parameters:{}".format(GSCV_RR.best_params_))
print("Koefisien/bobot:
{}".format(GSCV_RR.best_estimator_.named_steps['reg'].coef_))
print("Intercept/bias:
{}".format(GSCV_RR.best_estimator_.named_steps['reg'].intercept_))
```

```
Ridge_predict = GSCV_RR.predict(X_test_enc)

mse_Ridge = mean_squared_error(y_test_price, Ridge_predict)
mae_Ridge = mean_absolute_error(y_test_price, Ridge_predict)

print("Ridge Mean Squard Error (MSE): {}".format(mse_Ridge))
print("Ridge Mean Absolute Error (MAE): {}".format(mae_Ridge))
print("Ridge Root Mean Squared Error: {}".format(np.sqrt(mse_Ridge)))
```

```
Best model:Pipeline(steps=[('scale', MinMaxScaler()),
                ('feature_selection',
                 SelectKBest(score_func=<function f_regression at
0x0000020133634CC0>)),
                ('reg', Ridge(alpha=0.01))])
Ridge best parameters:{'feature_selection__k': 10, 'reg__alpha': 0.01}
Koefisien/bobot:[-1.53069804e+03  1.53069804e+03  8.37049891e+01 -
8.37049878e+01
 -5.36117068e+01  5.36117075e+01  9.99077325e+06  4.76218243e+02
 -3.30900310e+01 -4.68782145e+01]
Intercept/bias:15269.991580400616
Ridge Mean Squard Error (MSE): 8244727.333072739
Ridge Mean Absolute Error (MAE): 2337.7145753501745
Ridge Root Mean Squared Error: 2871.3633230701994
```

```
df_results['Ridge Prediction'] = Ridge_predict
df_results = pd.DataFrame(y_test_price)
df_results['Ridge Prediction'] = Ridge_predict

df_results['Selisih_price_RR'] = df_results['Ridge Prediction'] -
df_results['price']

df_results.head()
```

	price	Ridge Prediction	Selisih_price_RR
2457	6033313.0	6.034185e+06	872.342258
4865	5290006.8	5.283703e+06	-6304.221330
5288	9235289.5	9.234346e+06	-943.386054
1063	7616002.0	7.617647e+06	1644.933213
5197	9390420.3	9.391224e+06	804.087296

```
df_results.describe()
```

	price	Ridge Prediction	Selisih_price_RR
count	2.000000e+03	2.000000e+03	2000.000000
mean	4.931727e+06	4.931782e+06	55.352778
std	2.848679e+06	2.848562e+06	2871.547718
min	2.381840e+04	2.787007e+04	-10833.184798
25%	2.494605e+06	2.495427e+06	-1843.724940
50%	5.014176e+06	5.017360e+06	297.079502

```
75%    7.338401e+06      7.339645e+06      2355.146005
max    9.994474e+06      9.998520e+06      5919.050249
```

```
from sklearn.svm import SVR
from sklearn.model_selection import GridSearchCV
from sklearn.pipeline import Pipeline
from sklearn.preprocessing import StandardScaler
from sklearn.feature_selection import SelectKBest, f_regression
from sklearn.metrics import mean_absolute_error, mean_squared_error

pipe_SVR = Pipeline(steps=[
    ('scale', StandardScaler()),
    ('feature_selection', SelectKBest(score_func=f_regression)),
    ('reg', SVR(kernel='linear'))
    ])

param_grid_SVR = {
    'reg__C': [0.01,0.1,1,10],
    'reg__epsilon': [0.1, 0.2, 0.5, 1],
    'feature_selection__k': np.arange(2,11)
}

GSCV_SVR = GridSearchCV(pipe_SVR, param_grid_SVR, cv=5,
scoring='neg_mean_squared_error')

GSCV_SVR.fit(X_train_enc, y_train_price)

print("Best model:{}".format(GSCV_SVR.best_estimator_))
print("Ridge best parameters:{}".format(GSCV_SVR.best_params_))
print("Koefisien/bobot:
{}".format(GSCV_SVR.best_estimator_.named_steps['reg'].coef_))
print("Intercept/bias:
{}".format(GSCV_SVR.best_estimator_.named_steps['reg'].intercept_))

SVR_predict = GSCV_SVR.predict(X_test_enc)

mse_SVR = mean_squared_error(y_test_price, SVR_predict)
mae_SVR = mean_absolute_error(y_test_price, SVR_predict)

print("SVR Mean Squard Error (MSE): {}".format(mse_SVR))
print("SVR Mean Absolute Error (MAE): {}".format(mae_SVR))
print("SVR Root Mean Squared Error: {}".format(np.sqrt(mse_SVR)))
```

```
Best model:Pipeline(steps=[('scale', StandardScaler()),
                ('feature_selection',
                 SelectKBest(k=2,
                             score_func=<function f_regression at
0x0000020133634CC0>)),
                ('reg', SVR(C=10, kernel='linear'))])
Ridge best parameters:{'feature_selection__k': 2, 'reg__C': 10,
```

```
'reg__epsilon': 0.1}
Koefisien/bobot:[[69203.83142266  1771.44667832]]
Intercept/bias:[5017389.52551094]
SVR Mean Squard Error (MSE): 7733494955101.608
SVR Mean Absolute Error (MAE): 2392029.6675750944
SVR Root Mean Squared Error: 2780916.2078533773
```

```
df_results['SVR Prediction'] =SVR_predict
df_results = pd.DataFrame(y_test_price)
df_results['SVR Prediction'] =SVR_predict

df_results['Selisih_price_SVR'] = df_results['SVR Prediction'] -
df_results['price']
df_results.head()
```

```
          price  SVR Prediction  Selisih_price_SVR
2457  6033313.0    5.044114e+06      -9.891985e+05
4865  5290006.8    5.022385e+06      -2.676220e+05
5288  9235289.5    5.117175e+06      -4.118115e+06
1063  7616002.0    5.078386e+06      -2.537616e+06
5197  9390420.3    5.125272e+06      -4.265149e+06
```

```
df_results.describe()
```

```
              price  SVR Prediction  Selisih_price_SVR
count  2.000000e+03    2.000000e+03       2.000000e+03
mean   4.931727e+06    5.015550e+06       8.382343e+04
std    2.848679e+06    6.835477e+04       2.780348e+06
min    2.381840e+04    4.896081e+06      -4.858343e+06
25%    2.494605e+06    4.957087e+06      -2.266067e+06
50%    5.014176e+06    5.018407e+06       2.438072e+03
75%    7.338401e+06    5.072981e+06       2.461521e+06
max    9.994474e+06    5.138576e+06       4.874318e+06
```

```
from sklearn.svm import SVR
from sklearn.model_selection import GridSearchCV
from sklearn.pipeline import Pipeline
from sklearn.preprocessing import StandardScaler
from sklearn.feature_selection import SelectPercentile, f_regression
from sklearn.metrics import mean_absolute_error, mean_squared_error
import numpy as np

# Membuat pipeline dengan SelectPercentile
pipe_SVR_percentile = Pipeline(steps=[
    ('scale', StandardScaler()),
    ('feature_selection', SelectPercentile(score_func=f_regression)),
    ('reg', SVR(kernel='linear'))
])

# Parameter grid untuk GridSearchCV
param_grid_SVR_percentile = {
```

```
    'reg__C': [0.01,0.1,1,10],
    'reg__epsilon': [0.1, 0.2, 0.5, 1],
    'feature_selection__percentile': [10, 20, 30, 40, 50, 60, 70, 80,
90]  # Menggunakan percentile
}

# Membuat objek GridSearchCV
GSCV_SVR = GridSearchCV(pipe_SVR_percentile,
param_grid_SVR_percentile, cv=5, scoring='neg_mean_squared_error')

# Fitting model
GSCV_SVR.fit(X_train_enc, y_train_price)

# Output hasil terbaik
print("Best model: {}".format(GSCV_SVR.best_estimator_))
print("SVR best parameters: {}".format(GSCV_SVR.best_params_))

# Menghitung koefisien dan intercept
try:
    print("Koefisien/bobot:
{}".format(GSCV_SVR.best_estimator_.named_steps['reg'].coef_))
    print("Intercept/bias:
{}".format(GSCV_SVR.best_estimator_.named_steps['reg'].intercept_))
except AttributeError:
    print("SVR tidak memiliki koefisien yang dapat diakses secara
langsung.")

# Melakukan prediksi
SVR_predict = GSCV_SVR.predict(X_test_enc)

# Menghitung MSE dan MAE
mse_SVR = mean_squared_error(y_test_price, SVR_predict)
mae_SVR = mean_absolute_error(y_test_price, SVR_predict)

# Menampilkan hasil
print("SVR Mean Squared Error (MSE): {}".format(mse_SVR))
print("SVR Mean Absolute Error (MAE): {}".format(mae_SVR))
print("SVR Root Mean Squared Error: {}".format(np.sqrt(mse_SVR)))
```

```
Best model: Pipeline(steps=[('scale', StandardScaler()),
                ('feature_selection',
                 SelectPercentile(score_func=<function f_regression at
0x0000020133634CC0>)),
                ('reg', SVR(C=10, kernel='linear'))])
SVR best parameters: {'feature_selection__percentile': 10, 'reg__C':
10, 'reg__epsilon': 0.1}
Koefisien/bobot: [[69203.83142266  1771.44667832]]
Intercept/bias: [5017389.52551094]
SVR Mean Squared Error (MSE): 7733494955101.608
```

```
SVR Mean Absolute Error (MAE): 2392029.6675750944
SVR Root Mean Squared Error: 2780916.2078533773

df_results['SVR Percentile Prediction'] =SVR_predict
df_results = pd.DataFrame(y_test_price)
df_results['SVR Percentile Prediction'] =SVR_predict

df_results['Selisih_price_SVR_percentile'] = df_results['SVR
Percentile Prediction'] - df_results['price']
df_results.head()

          price  SVR Percentile Prediction
Selisih_price_SVR_percentile
2457  6033313.0               5.044114e+06                 -
9.891985e+05
4865  5290006.8               5.022385e+06                 -
2.676220e+05
5288  9235289.5               5.117175e+06                 -
4.118115e+06
1063  7616002.0               5.078386e+06                 -
2.537616e+06
5197  9390420.3               5.125272e+06                 -
4.265149e+06

df_results.describe()

              price  SVR Percentile Prediction
Selisih_price_SVR_percentile
count  2.000000e+03               2.000000e+03
2.000000e+03
mean   4.931727e+06               5.015550e+06
8.382343e+04
std    2.848679e+06               6.835477e+04
2.780348e+06
min    2.381840e+04               4.896081e+06                 -
4.858343e+06
25%    2.494605e+06               4.957087e+06                 -
2.266067e+06
50%    5.014176e+06               5.018407e+06
2.438072e+03
75%    7.338401e+06               5.072981e+06
2.461521e+06
max    9.994474e+06               5.138576e+06
4.874318e+06

from sklearn.linear_model import Ridge
from sklearn.model_selection import GridSearchCV
from sklearn.pipeline import Pipeline
from sklearn.preprocessing import StandardScaler
from sklearn.feature_selection import SelectPercentile, f_regression
```

```python
from sklearn.metrics import mean_absolute_error, mean_squared_error


pipe_Ridge_percentile = Pipeline(steps=[
    ('scale', StandardScaler()),
    ('feature_selection', SelectPercentile(score_func=f_regression)),
    ('reg', Ridge())
])

param_grid_Ridge_percentile = {
    'reg__alpha': [0.01, 0.1, 1, 10, 100],
    'feature_selection__percentile': [10, 20, 30, 40, 50, 60, 70, 80,
90]  # Mengganti 'k' dengan 'percentile'
}

GSCV_RR = GridSearchCV(pipe_Ridge_percentile,
param_grid_Ridge_percentile, cv=5,
                       scoring='neg_mean_squared_error',
error_score='raise')

GSCV_RR.fit(X_train_enc, y_train_price)

print("Best model: {}".format(GSCV_RR.best_estimator_))
print("Ridge best parameters: {}".format(GSCV_RR.best_params_))
print("Koefisien/bobot:
{}".format(GSCV_RR.best_estimator_.named_steps['reg'].coef_))
print("Intercept/bias:
{}".format(GSCV_RR.best_estimator_.named_steps['reg'].intercept_))

Ridge_predict = GSCV_RR.predict(X_test_enc)

mse_Ridge = mean_squared_error(y_test_price, Ridge_predict)
mae_Ridge = mean_absolute_error(y_test_price, Ridge_predict)

print("Ridge Mean Squared Error (MSE): {}".format(mse_Ridge))
print("Ridge Mean Absolute Error (MAE): {}".format(mae_Ridge))
print("Ridge Root Mean Squared Error: {}".format(np.sqrt(mse_Ridge)))
```

```
Best model: Pipeline(steps=[('scale', StandardScaler()),
                ('feature_selection',
                 SelectPercentile(percentile=90,
                                  score_func=<function f_regression at
0x0000020133634CC0>)),
                ('reg', Ridge(alpha=0.01))])
Ridge best parameters: {'feature_selection__percentile': 90,
'reg__alpha': 0.01}
Koefisien/bobot: [ 1.49636141e+03 -7.55922006e+02  7.55922004e+02
4.14416376e+01
 -4.14416377e+01 -3.87150865e+01  3.87150862e+01 -6.77404283e+00
  6.77404323e+00  2.88436798e+06 -4.56405366e-02  1.59112848e+03
```

```
  1.48200813e+02 -1.43371744e+01 -1.86279947e+01 -1.15977886e+01
  3.17189986e+01 -8.23109475e+00]
Intercept/bias: 5008877.6749249995
Ridge Mean Squared Error (MSE): 3540144.7107716934
Ridge Mean Absolute Error (MAE): 1463.0366330413735
Ridge Root Mean Squared Error: 1881.527228283368
```

```
df_results['Ridge Percentile Prediction'] = Ridge_predict
df_results = pd.DataFrame(y_test_price)
df_results['Ridge Percentile Prediction'] = Ridge_predict

df_results['Selisih_price_RR_percentile'] = df_results['Ridge
Percentile Prediction'] - df_results['price']

df_results.head()
```

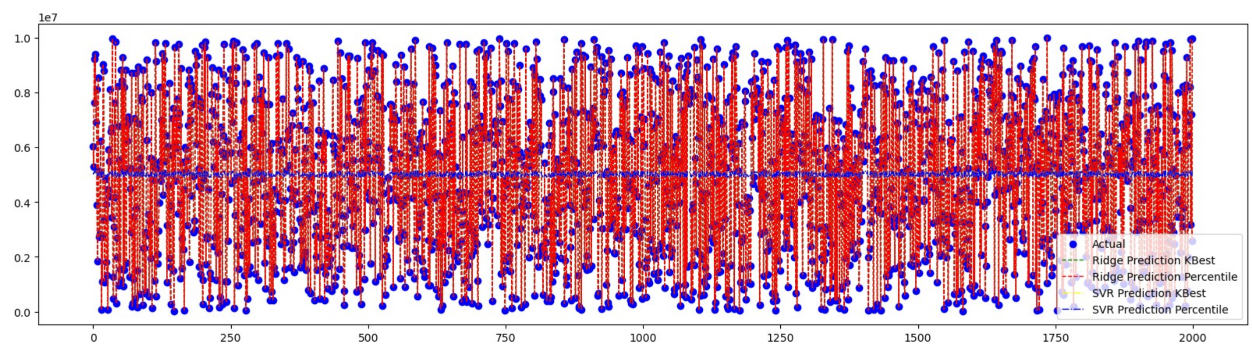
```
          price  Ridge Percentile Prediction
Selisih_price_RR_percentile
2457  6033313.0                 6.034185e+06
872.342258
4865  5290006.8                 5.283703e+06                 -
6304.221330
5288  9235289.5                 9.234346e+06                  -
943.386054
1063  7616002.0                 7.617647e+06
1644.933213
5197  9390420.3                 9.391224e+06
804.087296
```

```
df_results.describe()
```

```
              price  Ridge Percentile Prediction
Selisih_price_RR_percentile
count  2.000000e+03                 2.000000e+03
2000.000000
mean   4.931727e+06                 4.931782e+06
55.352778
std    2.848679e+06                 2.848562e+06
2871.547718
min    2.381840e+04                 2.787007e+04                 -
10833.184798
25%    2.494605e+06                 2.495427e+06                  -
1843.724940
50%    5.014176e+06                 5.017360e+06
297.079502
75%    7.338401e+06                 7.339645e+06
2355.146005
max    9.994474e+06                 9.998520e+06
5919.050249
```

```
import pandas as pd
import matplotlib.pyplot as plt

# Misalkan Ridge_predict dan SVR_predict sudah didefinisikan
sebelumnya
# Ridge_predict = model_ridge.predict(X_test)
# SVR_predict = model_svr.predict(X_test)

# Mengonversi y_test_price menjadi DataFrame
df_results = pd.DataFrame(y_test_price)

# Menambahkan kolom prediksi
df_results['Ridge Prediction'] = Ridge_predict
df_results['SVR Prediction'] = SVR_predict  # Pastikan ini ada

# Jika ada kolom lain yang perlu ditambahkan
df_results['Ridge Percentile Prediction'] = Ridge_predict
df_results['SVR Percentile Prediction'] = SVR_predict  # Pastikan kamu
sudah menambahkan ini juga

# Menghitung selisih
df_results['Selisih_price_RR'] = df_results['Ridge Prediction'] -
df_results['price']
df_results['Selisih_price_SVR'] = df_results['SVR Prediction'] -
df_results['price']
df_results['Selisih_price_RR_percentile'] = df_results['Ridge
Percentile Prediction'] - df_results['price']
df_results['Selisih_price_SVR_percentile'] = df_results['SVR
Percentile Prediction'] - df_results['price']

# Menampilkan beberapa data teratas
print(df_results.head())

# Membuat plot
plt.figure(figsize=(20, 5))
data_len = range(len(y_test_price))
plt.scatter(data_len, df_results['price'], label="Actual",
color="blue")
plt.plot(data_len, df_results['Ridge Prediction'], label="Ridge
Prediction KBest", color="green", linewidth=1, linestyle="dashed")
plt.plot(data_len, df_results['Ridge Percentile Prediction'],
label="Ridge Prediction Percentile", color="red", linewidth=1,
linestyle="dashed")
plt.plot(data_len, df_results['SVR Prediction'], label="SVR Prediction
KBest", color="yellow", linewidth=1, linestyle="-.")
plt.plot(data_len, df_results['SVR Percentile Prediction'], label="SVR
Prediction Percentile", color="blue", linewidth=1, linestyle="-.")

# Menambahkan legenda dan menampilkan plot
```

```
plt.legend()
plt.show()

          price  Ridge Prediction  SVR Prediction  \
2457  6033313.0      6.034185e+06    5.044114e+06
4865  5290006.8      5.283703e+06    5.022385e+06
5288  9235289.5      9.234346e+06    5.117175e+06
1063  7616002.0      7.617647e+06    5.078386e+06
5197  9390420.3      9.391224e+06    5.125272e+06

      Ridge Percentile Prediction  SVR Percentile Prediction  \
2457                 6.034185e+06               5.044114e+06
4865                 5.283703e+06               5.022385e+06
5288                 9.234346e+06               5.117175e+06
1063                 7.617647e+06               5.078386e+06
5197                 9.391224e+06               5.125272e+06

      Selisih_price_RR  Selisih_price_SVR  Selisih_price_RR_percentile
\
2457        872.342258      -9.891985e+05                   872.342258

4865      -6304.221330      -2.676220e+05                 -6304.221330

5288       -943.386054      -4.118115e+06                  -943.386054

1063       1644.933213      -2.537616e+06                  1644.933213

5197        804.087296      -4.265149e+06                   804.087296


      Selisih_price_SVR_percentile
2457                 -9.891985e+05
4865                 -2.676220e+05
5288                 -4.118115e+06
1063                 -2.537616e+06
5197                 -4.265149e+06
```



```python
import streamlit as st
import pandas as pd
import pickle
import os
from streamlit_option_menu import option_menu

import numpy as np

# Navigasi sidebar
with st.sidebar:
    selected = option_menu('Prediksi Harga Properti',
                           ['Klasifikasi', 'Regresi'],
                           default_index=0)

# Fungsi untuk memuat model
def load_model():
    with open('gscv_SVM_percentile_model.pkl', 'rb') as file:
        model = pickle.load(file)
    return model

gscv_SVM_percentile_model = load_model()

def load_model1():
    with open('GSCV_RF_model.pkl', 'rb') as file:
        model1 = pickle.load(file)
    return model1

GSCV_RF_model = load_model1()

# Muat model

# Halaman Klasifikasi
if selected == 'Klasifikasi':
    st.title('Klasifikasi')

    # Inputan file dataset CSV
    file = st.file_uploader("Masukkan File", type=["csv", "txt"])

    # Input data properti
    squaremeters = st.number_input("Masukkan luas tanah dalam meter persegi", min_value=0)
    numberofrooms = st.number_input("Masukkan jumlah kamar", min_value=0)

    # Input untuk kategori yang terpisah
    hasyard_yes = st.selectbox("Memiliki halaman (Ya)", [1, 0])
    hasyard_no = 1 - hasyard_yes

    haspool_yes = st.selectbox("Memiliki kolam renang (Ya)", [1, 0])
    haspool_no = 1 - haspool_yes

    floors = st.number_input("Masukkan jumlah lantai", min_value=0)
    citycode = st.number_input("Masukkan kode lokasi", min_value=0)
    citypartrange = st.number_input("Masukkan eksklusivitas kawasan", min_value=0)
    numprevowners = st.number_input("Masukkan jumlah pemilik sebelumnya", min_value=0)
    made = st.number_input("Masukkan tahun pembuatan", min_value=0)

    isnewbuilt_new = st.selectbox("Bangunan baru (Ya)", [1, 0])
    isnewbuilt_old = 1 - isnewbuilt_new

    hasstormprotector_yes = st.selectbox("Memiliki pelindung badai (Ya)", [1, 0])
    hasstormprotector_no = 1 - hasstormprotector_yes

    basement = st.number_input("Masukkan luas basement", min_value=0)
    attic = st.number_input("Masukkan luas loteng", min_value=0)
    garage = st.number_input("Masukkan luas garase", min_value=0)

    hasstorageroom_yes = st.selectbox("Memiliki gudang (Ya)", [1, 0])
```

```
    hasstorageroom_no = 1 - hasstorageroom_yes+1  # Inversi dari hasstorageroom_yes

    hasguestroom = st.number_input("Masukkan jumlah ruang tamu", min_value=0)

    # Siapkan data input
    input_data = np.array([[
        squaremeters,
        numberofrooms,
        hasyard_yes,
        hasyard_no,
        haspool_yes,
        haspool_no,
        floors,
        citycode,
        citypartrange,
        numprevowners,
        made,
        isnewbuilt_new,
        isnewbuilt_old,
        hasstormprotector_yes,
        hasstormprotector_no,
        basement,
        attic,
        garage,
        hasstorageroom_yes,
        hasstorageroom_no,
        hasguestroom
    ]])

    # Tombol untuk prediksi
    hitung = st.button("Prediksi")

    if hitung:
        # Debug info sebelum prediksi
        st.write("Data yang akan diprediksi:", input_data)

        # Gunakan model untuk prediksi
        rf_model_prediction = gscv_SVM_percentile_model.predict(input_data)

        # Tampilkan hasil dengan format yang lebih baik
        kategori = rf_model_prediction[0]

        st.write("predik:", kategori)

        # Tampilkan hasil dengan warna dan format yang lebih baik
        if kategori == "Basic":
            st.success(f"🏠 Properti termasuk kategori Basic")
        elif kategori == "Middle":
            st.warning(f"🏠 Properti termasuk kategori Middle")
        else:
            st.error(f"🏠 Properti termasuk kategori Luxury")



if selected == 'Regresi':
    st.title('Regresi')

    # Inputan file dataset CSV
    file = st.file_uploader("Masukkan File", type=["csv", "txt"])

    # Input data properti
    squaremeters = st.number_input("Masukkan luas tanah dalam meter persegi", min_value=0)
    numberofrooms = st.number_input("Masukkan jumlah kamar", min_value=0)

    # Perbaikan untuk variabel kategorikal
    hasyard_yes = st.selectbox("Memiliki halaman", [0, 1])
```

```python
    hasyard_no = 1 - hasyard_yes

    haspool_yes = st.selectbox("Memiliki kolam renang", [0, 1])
    haspool_no = 1 - haspool_yes

    floors = st.number_input("Masukkan jumlah lantai", min_value=0)
    citycode = st.number_input("Masukkan kode lokasi", min_value=0)
    citypartrange = st.number_input("Masukkan eksklusivitas kawasan", min_value=0)
    numprevowners = st.number_input("Masukkan jumlah pemilik sebelumnya", min_value=0)
    made = st.number_input("Masukkan tahun pembuatan", min_value=0)

    isnewbuilt_new = st.selectbox("Bangunan baru", [0, 1])
    isnewbuilt_old = 1 - isnewbuilt_new

    hasstormprotector_yes = st.selectbox("Memiliki pelindung badai", [0, 1])
    hasstormprotector_no = 1 - hasstormprotector_yes

    basement = st.number_input("Masukkan luas basement", min_value=0)
    attic = st.number_input("Masukkan luas loteng", min_value=0)
    garage = st.number_input("Masukkan luas garase", min_value=0)

    hasstorageroom_yes = st.selectbox("Memiliki gudang", [0, 1])
    hasstorageroom_no = 1 - hasstorageroom_yes

    hasguestroom = st.number_input("Masukkan jumlah ruang tamu", min_value=0)

    # Siapkan data input
    input_data = np.array([[
        squaremeters,
        numberofrooms,
        hasyard_yes,
        hasyard_no,
        haspool_yes,
        haspool_no,
        floors,
        citycode,
        citypartrange,
        numprevowners,
        made,
        isnewbuilt_new,
        isnewbuilt_old,
        hasstormprotector_yes,
        hasstormprotector_no,
        basement,
        attic,
        garage,
        hasstorageroom_yes,
        hasstorageroom_no,
        hasguestroom
    ]])

    # Tombol untuk prediksi
    hitung = st.button("Prediksi")

    if hitung:
        try:
            # Gunakan model untuk prediksi
            rf_model_prediction = GSCV_RF_model.predict(input_data)
            # Format hasil prediksi dengan 1 angka di belakang koma
            formatted_prediction = "{:,.1f}".format(rf_model_prediction[0])
            st.success(f"Harga properti yang diprediksi: Rp {formatted_prediction}")
        except Exception as e:
            st.error(f"Terjadi kesalahan dalam prediksi: {str(e)}")
```