vs-logisticregression-julius-ipynb

October 25, 2024

[7]:
```
import pandas as pd
import numpy as np

df_uts = pd.read_csv(r'C:\Users\LENOVO LEGION\Videos\TubesML\Dataset UTS_Gasal 2425.csv')

df_uts.head(10)
```

[7]:

	squaremeters	numberofrooms	hasyard	haspool	floors	citycode	citypartrange	numprevowners	made	isnewbuilt	hasstormprotector	basement	attic	garage	hasstorageroom	hasguestroom	price	category
0	75523	3	no	yes	63	9373	3	8	2005	old	yes	4313	9005	956	no	7	7559081.5	Luxury
1	55712	58	no	yes	19	34457	6	8	2021	old	no	2937	8852	135	yes	9	5574642.1	Middle
2	86929	100	yes	no	11	98155	3	4	2003	new	no	6326	4748	654	no	10	8696869.3	Luxury
3	51522	3	no	no	61	9047	8	3	2012	new	yes	632	5792	807	yes	5	5154055.2	Middle
4	96470	74	yes	no	21	92029	4	2	2011	new	yes	5414						
5	79770	3	no	yes	69	54812	10	5	2018	old	yes	8871						
6	75985	60	yes	no	67	6517	6	9	2009	new	yes	4878						
7	64169	88	no	yes	6	61711	3	9	2011	new	yes	3054						
8	92383	12	no	no	78	71982	3	7	2000	old	no	7507						
9	95121	46	no	yes	3	9382	7	9	1994	old	no	615						

```
4   1172     716            yes             9  9652258.1   Luxury
5   7117     240             no             7  7986665.8   Luxury
6    281     384            yes             5  7607322.9   Luxury
7    129     726             no             9  6420823.1   Middle
8   9056     892            yes             1  9244344.0   Luxury
9   1221     328             no            10  9515440.4   Luxury
```

[8]:
```
print("data null \n",df_uts.isnull().sum())
print("\ndata kosong \n",df_uts.empty)
print("\ndata nan \n",df_uts.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
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
price                0
category             0
dtype: int64
```

[9]:
```
target = 'category'
features_to_drop = ['price']
X = df_uts.drop(columns=features_to_drop)
y = df_uts[target]
```

[10]:
```
X = pd.get_dummies(X, drop_first=True)
```

[11]:
```
from sklearn.model_selection import train_test_split

X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.2,␣
 ↪random_state=99, stratify=y)
```

[12]:
```
from sklearn.model_selection import StratifiedKFold, GridSearchCV
from sklearn.ensemble import RandomForestClassifier
from sklearn.linear_model import LogisticRegression
from sklearn.feature_selection import SelectKBest, SelectPercentile, f_classif
from sklearn.pipeline import Pipeline
from sklearn.preprocessing import StandardScaler, MinMaxScaler
from sklearn.metrics import classification_report, confusion_matrix,␣
 ↪ConfusionMatrixDisplay
import matplotlib.pyplot as plt

SKF = StratifiedKFold(n_splits=5, shuffle=True, random_state=99)


pipe_RF = [
    ('data scaling', StandardScaler()),
    ('feature select', SelectKBest()),
    ('clf', RandomForestClassifier(random_state=99, class_weight='balanced'))
]


params_grid_RF = [{
    'data scaling': [StandardScaler()],
    'feature select__k': np.arange(2, 6),
    'clf__max_depth': np.arange(4, 5),
    'clf__n_estimators': [100, 150]
},
```

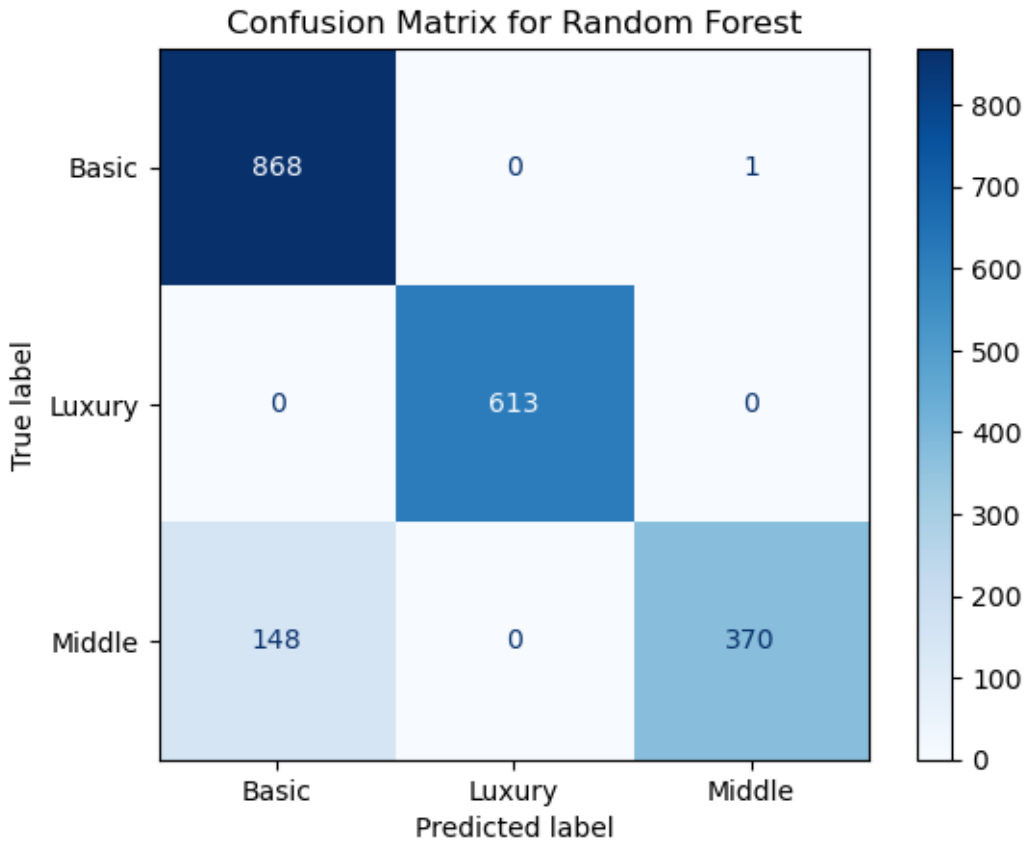
```
{
    'data scaling': [StandardScaler()],
    'feature select': [SelectPercentile()],
    'feature select__percentile': np.arange(20, 50),
    'clf__max_depth': np.arange(4, 5),
    'clf__n_estimators': [100, 150]
},
{
    'data scaling': [MinMaxScaler()],
    'feature select__k': np.arange(2, 6),
    'clf__max_depth': np.arange(4, 5),
    'clf__n_estimators': [100, 150]
},
{
    'data scaling': [MinMaxScaler()],
    'feature select': [SelectPercentile()],
    'feature select__percentile': np.arange(20, 50),
    'clf__max_depth': np.arange(4, 5),
    'clf__n_estimators': [100, 150]
}
]


estimator_RF = Pipeline(pipe_RF)


GSCV_RF = GridSearchCV(estimator_RF, params_grid_RF, cv=SKF, n_jobs=-1)
GSCV_RF.fit(X_train, y_train)

print("GSCV training finished for Random Forest")
```

```
GSCV training finished for Random Forest
```

[13]:
```
print("CV Score: {}".format(GSCV_RF.best_score_))
print("Test Score: {}".format(GSCV_RF.best_estimator_.score(X_test, y_test)))
print("Best model:", GSCV_RF.best_estimator_)


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

RF_pred = GSCV_RF.predict(X_test)

print(f"\nClassification Report for Random Forest:\n",␣
 ↪classification_report(y_test, RF_pred))
```

```
cm_RF = confusion_matrix(y_test, RF_pred)
disp_RF = ConfusionMatrixDisplay(confusion_matrix=cm_RF, display_labels=GSCV_RF.
 ↪classes_)


disp_RF.plot(cmap=plt.cm.Blues)
plt.title('Confusion Matrix for Random Forest')
plt.show()


feature_selector_RF = GSCV_RF.best_estimator_.named_steps['feature select']
selected_features_RF = feature_selector_RF.get_support(indices=True)
feature_names_RF = X.columns[selected_features_RF]

print(f"\nSelected features for Random Forest: {feature_names_RF.tolist()}\n")
```

```
CV Score: 1.0
Test Score: 0.9255
Best model: Pipeline(steps=[('data scaling', StandardScaler()),
                ('feature select', SelectKBest(k=2)),
                ('clf',
                 RandomForestClassifier(class_weight='balanced', max_depth=4,
                                        random_state=99))])
Best features: Index(['squaremeters', 'category_Luxury'], dtype='object')

Classification Report for Random Forest:
               precision    recall  f1-score   support

       Basic       0.85      1.00      0.92       869
      Luxury       1.00      1.00      1.00       613
      Middle       1.00      0.71      0.83       518

    accuracy                           0.93      2000
   macro avg       0.95      0.90      0.92      2000
weighted avg       0.94      0.93      0.92      2000
```




```
Selected features for Random Forest: ['squaremeters', 'category_Luxury']
```

[14]:
```
from sklearn.model_selection import StratifiedKFold, GridSearchCV
from sklearn.linear_model import LogisticRegression
from sklearn.feature_selection import SelectKBest, SelectPercentile, f_classif
from sklearn.pipeline import Pipeline
from sklearn.preprocessing import StandardScaler, MinMaxScaler
from sklearn.metrics import classification_report, confusion_matrix,␣
 ↪ConfusionMatrixDisplay
import numpy as np
import matplotlib.pyplot as plt

SKF = StratifiedKFold(n_splits=5, shuffle=True, random_state=99)

pipe_LR = [
    ('data scaling', StandardScaler()),
    ('feature select', SelectKBest()),
```

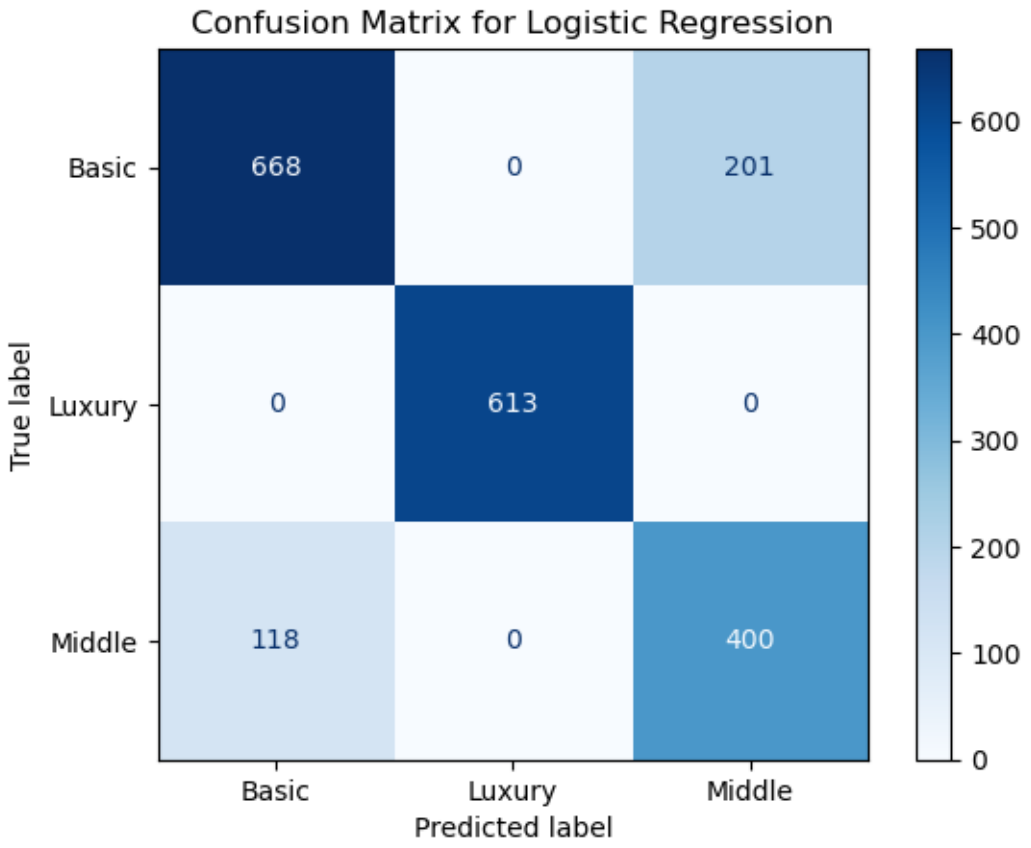
```
    ('clf', LogisticRegression(random_state=99, class_weight='balanced',␣
  ↪max_iter=1000))
]

params_grid_LR = [{
    'data scaling': [StandardScaler()],
    'feature select__k': np.arange(2, 6),
    'clf__C': [0.01, 0.1, 1, 10, 100]
},
{
    'data scaling': [StandardScaler()],
    'feature select': [SelectPercentile()],
    'feature select__percentile': np.arange(20, 50),
    'clf__C': [0.01, 0.1, 1, 10, 100]
},
{
    'data scaling': [MinMaxScaler()],
    'feature select__k': np.arange(2, 6),
    'clf__C': [0.01, 0.1, 1, 10, 100]
},
{
    'data scaling': [MinMaxScaler()],
    'feature select': [SelectPercentile()],
    'feature select__percentile': np.arange(20, 50),
    'clf__C': [0.01, 0.1, 1, 10, 100]
}
]


estimator_LR = Pipeline(pipe_LR)


GSCV_LR = GridSearchCV(estimator_LR, params_grid_LR, cv=SKF, n_jobs=-1)
GSCV_LR.fit(X_train, y_train)

print("GSCV training finished for Logistic Regression")
```

```
GSCV training finished for Logistic Regression
```

[15]:
```
print("CV Score: {}".format(GSCV_LR.best_score_))
print("Test Score: {}".format(GSCV_LR.score(X_test, y_test)))

print("Best model:", GSCV_LR.best_estimator_)

feature_selector_LR = GSCV_LR.best_estimator_.named_steps['feature select']
mask = feature_selector_LR.get_support()
print("Best features:", X.columns[mask])
```

```
LR_pred = GSCV_LR.predict(X_test)


print(f"\nClassification Report for Logistic Regression:\n",␣
 ↪classification_report(y_test, LR_pred))

cm_LR = confusion_matrix(y_test, LR_pred)
disp_LR = ConfusionMatrixDisplay(confusion_matrix=cm_LR, display_labels=GSCV_LR.
 ↪classes_)

disp_LR.plot(cmap=plt.cm.Blues)
plt.title('Confusion Matrix for Logistic Regression')
plt.show()

selected_features_LR = feature_selector_LR.get_support(indices=True)
feature_names_LR = X.columns[selected_features_LR]

print(f"\nSelected features for Logistic Regression: {feature_names_LR.
 ↪tolist()}\n")
```

```
CV Score: 1.0
Test Score: 0.8405
Best model: Pipeline(steps=[('data scaling', StandardScaler()),
                ('feature select', SelectKBest(k=2)),
                ('clf',
                 LogisticRegression(C=0.01, class_weight='balanced',
                                    max_iter=1000, random_state=99))])
Best features: Index(['squaremeters', 'category_Luxury'], dtype='object')

Classification Report for Logistic Regression:
               precision    recall  f1-score   support

       Basic       0.85      0.77      0.81       869
      Luxury       1.00      1.00      1.00       613
      Middle       0.67      0.77      0.71       518

    accuracy                           0.84      2000
   macro avg       0.84      0.85      0.84      2000
weighted avg       0.85      0.84      0.84      2000
```




```
Selected features for Logistic Regression: ['squaremeters', 'category_Luxury']
```

er-vs-supportvectormachine-bintang

October 25, 2024

[1]:
```
import pandas as pd
import numpy as np

df_uts=pd.read_csv('D:\Semester 5\Pembelajaran Mesin\Project UTS\Dataset␣
↪UTS_Gasal 2425.csv')
df_uts.head(20)
```

[1]:

	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	
5	79770	3	no	yes	69	54812	
6	75985	60	yes	no	67	6517	
7	64169	88	no	yes	6	61711	
8	92383	12	no	no	78	71982	
9	95121	46	no	yes	3	9382	
10	76485	47	yes	no	9	90254	
11	87060	27	no	yes	91	51803	
12	66683	19	yes	yes	6	50801	
13	84559	29	no	yes	69	53057	
14	76091	38	yes	no	32	59451	
15	92696	49	yes	no	38	74381	
16	59800	47	no	yes	27	44815	
17	54836	25	no	yes	53	64601	
18	70021	52	yes	no	28	95678	
19	54368	11	yes	yes	20	55761	

	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	
5	10	5	2018	old	yes	8871	
6	6	9	2009	new	yes	4878	

7	3	9	2011	new	yes	3054
8	3	7	2000	old	no	7507
9	7	9	1994	old	no	615
10	2	9	2008	new	no	2860
11	8	10	2000	old	no	6629
12	6	2	2001	old	no	7473
13	7	7	2000	new	no	3573
14	5	8	2016	new	no	8150
15	9	2	2021	old	no	1559
16	6	9	2021	old	no	5075
17	10	5	2020	new	no	5278
18	4	6	1992	old	yes	4480
19	3	7	2021	old	no	231

	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
5	7117	240	no	7	7986665.8	Luxury
6	281	384	yes	5	7607322.9	Luxury
7	129	726	no	9	6420823.1	Middle
8	9056	892	yes	1	9244344.0	Luxury
9	1221	328	no	10	9515440.4	Luxury
10	3129	982	no	1	7653300.8	Luxury
11	435	512	no	7	8711426.0	Luxury
12	796	237	yes	3	6677649.1	Middle
13	9556	918	yes	8	8460604.0	Luxury
14	6037	930	no	7	7614076.6	Luxury
15	5111	957	yes	2	9272740.1	Luxury
16	3104	864	no	4	5984462.1	Middle
17	1059	313	yes	6	5492532.0	Middle
18	6919	680	yes	1	7005572.2	Luxury
19	1939	223	no	8	5446398.1	Middle

[2]:
```
import numpy as np
from sklearn.preprocessing import LabelEncoder
from sklearn.model_selection import StratifiedKFold

print("\nPengecekan nilai missing values (null, kosong, NaN):")
missing_values = df_uts.isnull().sum()
empty_strings = (df_uts == '').sum()
nan_values = df_uts.isna().sum()

print("\nMissing values per column:\n", missing_values)
print("\nKolom dengan string kosong:\n", empty_strings)
```

```
print("\nNaN values per column:\n", nan_values)

df_uts_numeric = df_uts.select_dtypes(include=['number'])

Q1 = df_uts_numeric.quantile(0.25)
Q3 = df_uts_numeric.quantile(0.75)
IQR = Q3 - Q1

outliers = ((df_uts_numeric < (Q1 - 1.5 * IQR)) | (df_uts_numeric > (Q3 + 1.5 *␣
 ↪IQR))).sum()
print("\nOutlier per column:\n", outliers)

duplicates = df_uts.duplicated().sum()
print(f"\nJumlah data duplikat: {duplicates}")

categorical_columns = df_uts.select_dtypes(include=['object']).columns
label_encoders = {}

for col in categorical_columns:
    le = LabelEncoder()
    df_uts[col] = le.fit_transform(df_uts[col].astype(str))
    label_encoders[col] = le

print("\nData setelah diubah menjadi numerik:\n", df_uts.head())


target = 'category'
class_distribution = df_uts[target].value_counts()
print("\nDistribusi kelas:\n", class_distribution)

X = df_uts
y = df_uts[target]

skf = StratifiedKFold(n_splits=5)

for fold, (train_index, test_index) in enumerate(skf.split(X, y)):
    print(f"\nFold {fold + 1}: {len(train_index)} data latih, {len(test_index)}␣
 ↪data uji")
```

```
Pengecekan nilai missing values (null, kosong, NaN):

Missing values per column:
 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
category             0
dtype: int64

Kolom dengan string kosong:
 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
category             0
dtype: int64

NaN values per column:
 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
category             0
dtype: int64

Outlier per column:
 squaremeters     0
numberofrooms    0
floors           0
citycode         0
citypartrange    0
numprevowners    0
made             0
basement         0
attic            0
garage           0
hasguestroom     0
price            0
dtype: int64

Jumlah data duplikat: 0

Data setelah diubah menjadi numerik:
    squaremeters  numberofrooms  hasyard  haspool  floors  citycode  \
0         75523              3        0        1      63      9373
1         55712             58        0        1      19     34457
2         86929            100        1        0      11     98155
3         51522              3        0        0      61      9047
4         96470             74        1        0      21     92029

   citypartrange  numprevowners  made  isnewbuilt  hasstormprotector  \
0              3              8  2005           1                  1
1              6              8  2021           1                  0
2              3              4  2003           0                  0
3              8              3  2012           0                  1
4              4              2  2011           0                  1

   basement  attic  garage  hasstorageroom  hasguestroom      price  category
0      4313   9005     956               0             7  7559081.5         1
1      2937   8852     135               1             9  5574642.1         2
2      6326   4748     654               0            10  8696869.3         1
3       632   5792     807               1             5  5154055.2         2
4      5414   1172     716               1             9  9652258.1         1
```

```
Distribusi kelas:
 category
0    4344
1    3065
2    2591
Name: count, dtype: int64

Fold 1: 8000 data latih, 2000 data uji

Fold 2: 8000 data latih, 2000 data uji

Fold 3: 8000 data latih, 2000 data uji

Fold 4: 8000 data latih, 2000 data uji

Fold 5: 8000 data latih, 2000 data uji
```

[3]:
```
target = 'category'

features_to_drop = ['price']

X = df_uts.drop(columns=features_to_drop)
y = df_uts[target]

print("\nFitur (X) shape:", X.shape)
print("Target (y) shape:", y.shape)

print("\nFitur (X) setelah penghapusan kolom Harga:\n", X.head())
print("\nTarget (y):\n", y.head())

skf = StratifiedKFold(n_splits=5)

for fold, (train_index, test_index) in enumerate(skf.split(X, y)):
    print(f"\nFold {fold + 1}: {len(train_index)} data latih, {len(test_index)}␣
 ↪data uji")
```

```
Fitur (X) shape: (10000, 17)
Target (y) shape: (10000,)

Fitur (X) setelah penghapusan kolom Harga:
    squaremeters  numberofrooms  hasyard  haspool  floors  citycode  \
0         75523              3        0        1      63      9373
1         55712             58        0        1      19     34457
2         86929            100        1        0      11     98155
3         51522              3        0        0      61      9047
4         96470             74        1        0      21     92029
```

```
   citypartrange  numprevowners  made  isnewbuilt  hasstormprotector  \
0              3              8  2005           1                  1
1              6              8  2021           1                  0
2              3              4  2003           0                  0
3              8              3  2012           0                  1
4              4              2  2011           0                  1

   basement  attic  garage  hasstorageroom  hasguestroom  category
0      4313   9005     956               0             7         1
1      2937   8852     135               1             9         2
2      6326   4748     654               0            10         1
3       632   5792     807               1             5         2
4      5414   1172     716               1             9         1

Target (y):
 0    1
1    2
2    1
3    2
4    1
Name: category, dtype: int32

Fold 1: 8000 data latih, 2000 data uji

Fold 2: 8000 data latih, 2000 data uji

Fold 3: 8000 data latih, 2000 data uji

Fold 4: 8000 data latih, 2000 data uji

Fold 5: 8000 data latih, 2000 data uji
```

[4]:
```python
from sklearn.model_selection import train_test_split
from sklearn.preprocessing import LabelEncoder

def train_test_split_custom(X, y, test_size, random_state=99):
    X_train, X_test, y_train, y_test = train_test_split(X, y,␣
 ↪test_size=test_size, random_state=random_state, stratify=y)

    print(f"\nTrain-test split dengan rasio {int((1 - test_size) * 100)}:
 ↪{int(test_size * 100)}")
    print(f"Jumlah data latih: {len(X_train)}")
    print(f"Jumlah data uji: {len(X_test)}\n")

    return X_train, X_test, y_train, y_test
```

```
split_ratios = [0.2, 0.25, 0.3]

for ratio in split_ratios:
    X_train, X_test, y_train, y_test = train_test_split_custom(X, y,␣
 ↪test_size=ratio, random_state=99)
```

```
Train-test split dengan rasio 80:20
Jumlah data latih: 8000
Jumlah data uji: 2000


Train-test split dengan rasio 75:25
Jumlah data latih: 7500
Jumlah data uji: 2500


Train-test split dengan rasio 70:30
Jumlah data latih: 7000
Jumlah data uji: 3000
```

[5]:
```
from sklearn.ensemble import GradientBoostingClassifier
from sklearn.svm import SVC
from sklearn.preprocessing import StandardScaler, MinMaxScaler
from sklearn.feature_selection import SelectKBest, SelectPercentile, f_classif
from sklearn.pipeline import Pipeline
from sklearn.model_selection import StratifiedKFold, GridSearchCV
from sklearn.metrics import classification_report, accuracy_score,␣
 ↪ConfusionMatrixDisplay, confusion_matrix
import matplotlib.pyplot as plt
import pandas as pd

classifiers = {
    'GradientBoosting': GradientBoostingClassifier(random_state=99),
    'SVM': SVC(random_state=99)
}

scalers = {
    'StandardScaler': StandardScaler(),
    'MinMaxScaler': MinMaxScaler()
}

feature_selectors = {
    'SelectKBest': SelectKBest(f_classif),
    'SelectPercentile': SelectPercentile(f_classif)
}
```

```
param_grid = {
    'scaler': list(scalers.values()),
    'feature_selector__k': [5, 10, 15],
    'feature_selector__percentile': [10, 20, 30],
    'classifier__learning_rate': [0.01, 0.1, 0.2],
    'classifier__n_estimators': [50, 100],
    'classifier__C': [0.1, 1, 10],
    'classifier__kernel': ['linear', 'rbf']
}

skf = StratifiedKFold(n_splits=5, shuffle=True, random_state=99)

label_mapping = {0: 'basic', 1: 'luxury', 2: 'middle'}

for classifier_name, classifier in classifiers.items():
    print(f"\nEvaluasi untuk {classifier_name}:")

    for scaler_name, scaler in scalers.items():
        for selector_name, selector in feature_selectors.items():
            print(f"\nMenggunakan {scaler_name} dan {selector_name} untuk␣
 ↪{classifier_name}")

            pipeline = Pipeline([
                ('scaler', scaler),
                ('feature_selector', selector),
                ('classifier', classifier)
            ])

            grid_params = param_grid.copy()
            if selector_name == 'SelectKBest':
                grid_params.pop('feature_selector__percentile')
            elif selector_name == 'SelectPercentile':
                grid_params.pop('feature_selector__k')

            if classifier_name == 'GradientBoosting':
                grid_params = {k: v for k, v in grid_params.items() if not k.
 ↪startswith('classifier__C') and not k.startswith('classifier__kernel')}
            elif classifier_name == 'SVM':
                grid_params = {k: v for k, v in grid_params.items() if not k.
 ↪startswith('classifier__learning_rate') and not k.
 ↪startswith('classifier__n_estimators')}

            grid_search = GridSearchCV(pipeline, grid_params, cv=skf,␣
 ↪scoring='accuracy')
            grid_search.fit(X_train, y_train)
```

```
            print("\nParameter terbaik:", grid_search.best_params_)
            print("Akurasi validasi silang terbaik:", grid_search.best_score_)

            y_pred = grid_search.predict(X_test)

            y_test_mapped = y_test.map(label_mapping)
            y_pred_mapped = pd.Series(y_pred).map(label_mapping)

            print("Akurasi set uji:", accuracy_score(y_test_mapped,␣
↪y_pred_mapped))
            print("\nLaporan klasifikasi:\n",␣
↪classification_report(y_test_mapped, y_pred_mapped))

            cm = confusion_matrix(y_test_mapped, y_pred_mapped,␣
↪labels=['basic', 'luxury', 'middle'])
            disp = ConfusionMatrixDisplay(confusion_matrix=cm,␣
↪display_labels=['basic', 'luxury', 'middle'])
            disp.plot(cmap='Blues')
            plt.title(f'Matriks Confusion untuk {classifier_name} menggunakan␣
↪{scaler_name} dan {selector_name}')
            plt.show()

            if selector_name in ['SelectKBest', 'SelectPercentile']:
                selector.fit(X_train, y_train)
                feature_indices = selector.get_support(indices=True)
                selected_features = X_train.columns[feature_indices]
                print("\nFitur yang dipilih:", selected_features.tolist())
```

```
Evaluasi untuk GradientBoosting:

Menggunakan StandardScaler dan SelectKBest untuk GradientBoosting
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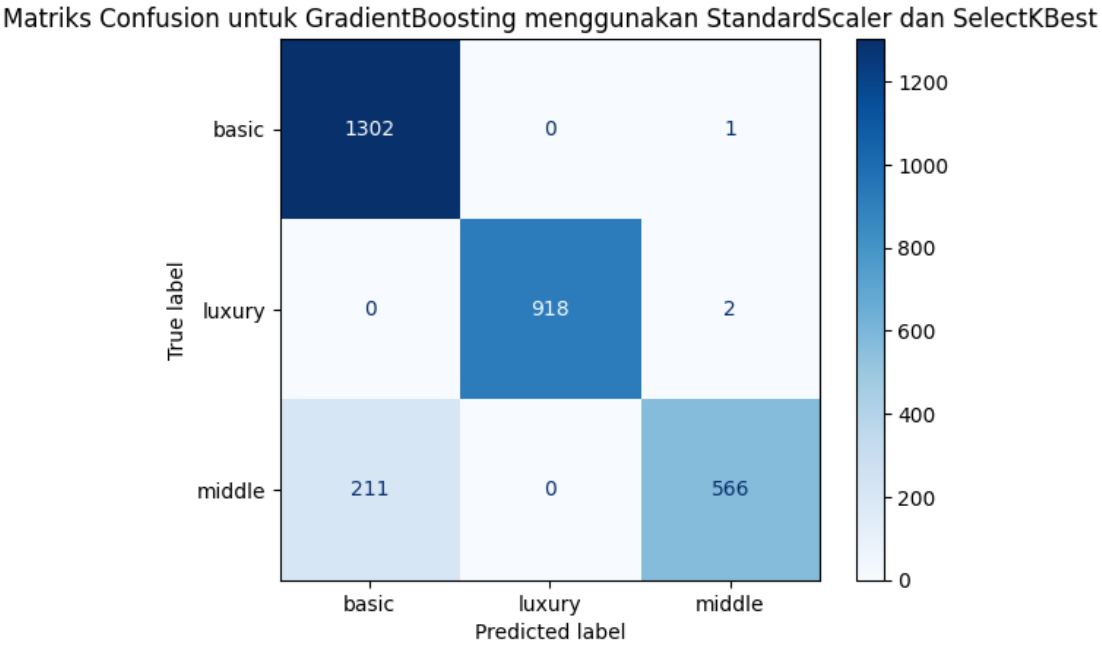
Parameter terbaik: {'classifier__learning_rate': 0.01,
'classifier__n_estimators': 50, 'feature_selector__k': 5, 'scaler':
StandardScaler()}
Akurasi validasi silang terbaik: 0.9997142857142858
Akurasi set uji: 0.9286666666666666

Laporan klasifikasi:
              precision    recall  f1-score   support

       basic       0.86      1.00      0.92      1303
      luxury       1.00      1.00      1.00       920
      middle       0.99      0.73      0.84       777

    accuracy                           0.93      3000
   macro avg       0.95      0.91      0.92      3000
weighted avg       0.94      0.93      0.93      3000
```



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```
Fitur yang dipilih: ['squaremeters', 'numberofrooms', 'hasyard', 'haspool',
'floors', 'citycode', 'numprevowners', 'isnewbuilt', 'basement', 'category']

Menggunakan StandardScaler dan SelectPercentile untuk GradientBoosting
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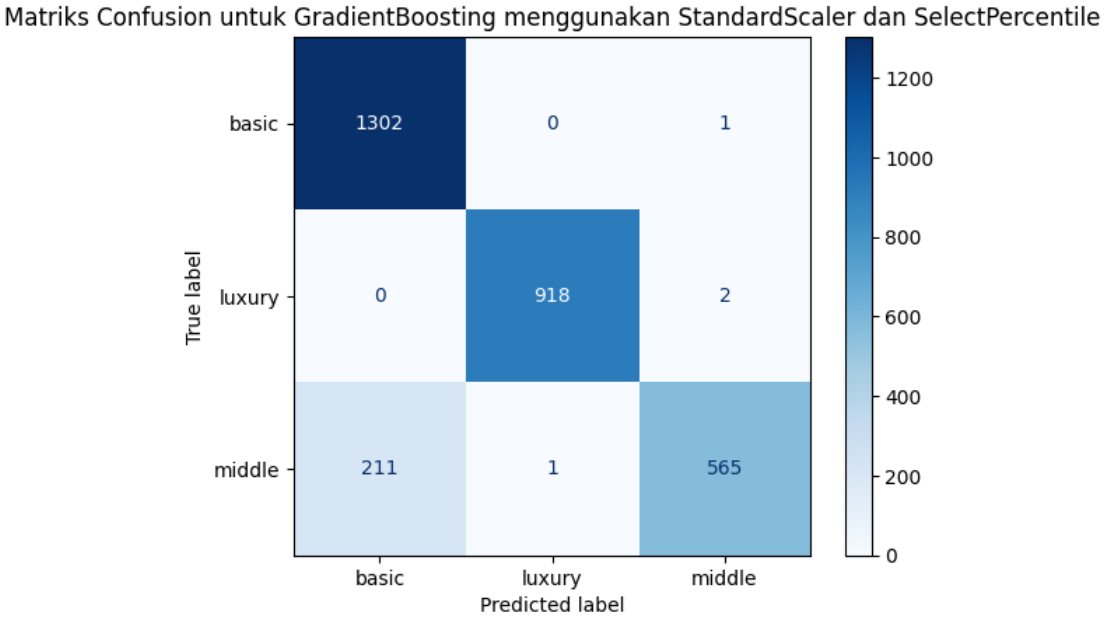
Parameter terbaik: {'classifier__learning_rate': 0.01,
'classifier__n_estimators': 50, 'feature_selector__percentile': 10, 'scaler':
StandardScaler()}
Akurasi validasi silang terbaik: 0.9997142857142858
Akurasi set uji: 0.9283333333333333

Laporan klasifikasi:
               precision    recall  f1-score   support
```

```
              basic       0.86      1.00      0.92      1303
             luxury       1.00      1.00      1.00       920
             middle       0.99      0.73      0.84       777

           accuracy                           0.93      3000
          macro avg       0.95      0.91      0.92      3000
       weighted avg       0.94      0.93      0.93      3000
```

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Fitur yang dipilih: ['squaremeters', 'category']

Menggunakan MinMaxScaler dan SelectKBest untuk GradientBoosting

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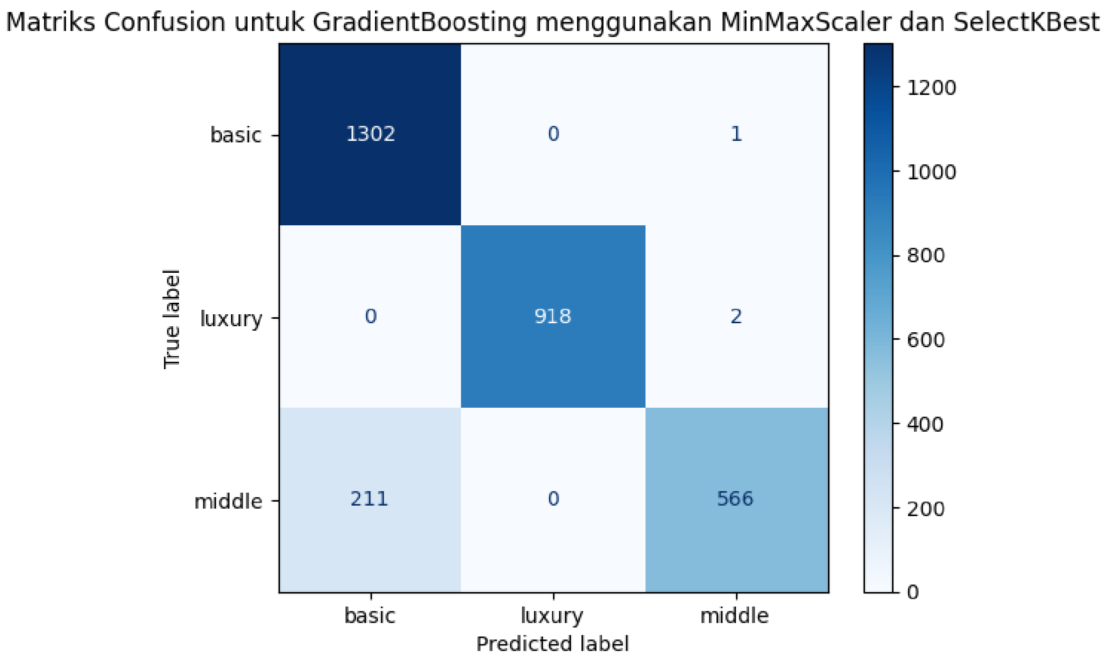
Parameter terbaik: {'classifier__learning_rate': 0.01,
'classifier__n_estimators': 50, 'feature_selector__k': 5, 'scaler':
StandardScaler()}
Akurasi validasi silang terbaik: 0.9997142857142858
Akurasi set uji: 0.9286666666666666

Laporan klasifikasi:
              precision    recall  f1-score   support

       basic       0.86      1.00      0.92      1303
      luxury       1.00      1.00      1.00       920
      middle       0.99      0.73      0.84       777

    accuracy                           0.93      3000
   macro avg       0.95      0.91      0.92      3000
weighted avg       0.94      0.93      0.93      3000
```




```
Fitur yang dipilih: ['squaremeters', 'numberofrooms', 'hasyard', 'haspool',
'floors', 'citycode', 'numprevowners', 'isnewbuilt', 'basement', 'category']

Menggunakan MinMaxScaler dan SelectPercentile untuk GradientBoosting

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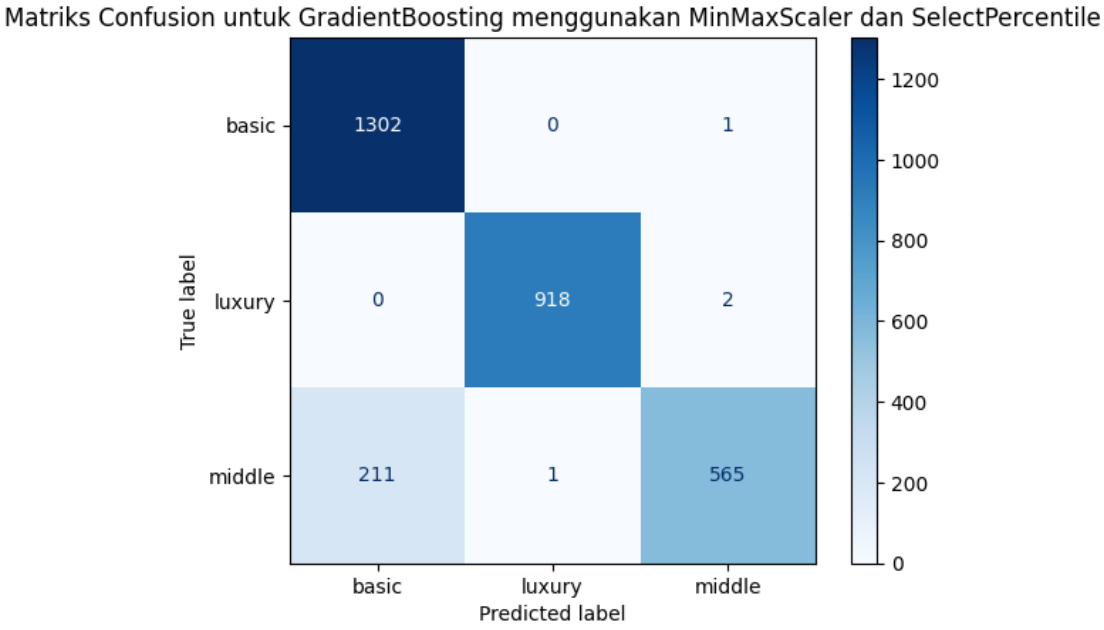
Parameter terbaik: {'classifier__learning_rate': 0.01,
'classifier__n_estimators': 50, 'feature_selector__percentile': 10, 'scaler':
StandardScaler()}
Akurasi validasi silang terbaik: 0.9997142857142858
Akurasi set uji: 0.9283333333333333

Laporan klasifikasi:
              precision    recall  f1-score   support

       basic       0.86      1.00      0.92      1303
      luxury       1.00      1.00      1.00       920
      middle       0.99      0.73      0.84       777

    accuracy                           0.93      3000
   macro avg       0.95      0.91      0.92      3000
weighted avg       0.94      0.93      0.93      3000
```



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Fitur yang dipilih: ['squaremeters', 'category']

Evaluasi untuk SVM:

Menggunakan StandardScaler dan SelectKBest untuk SVM

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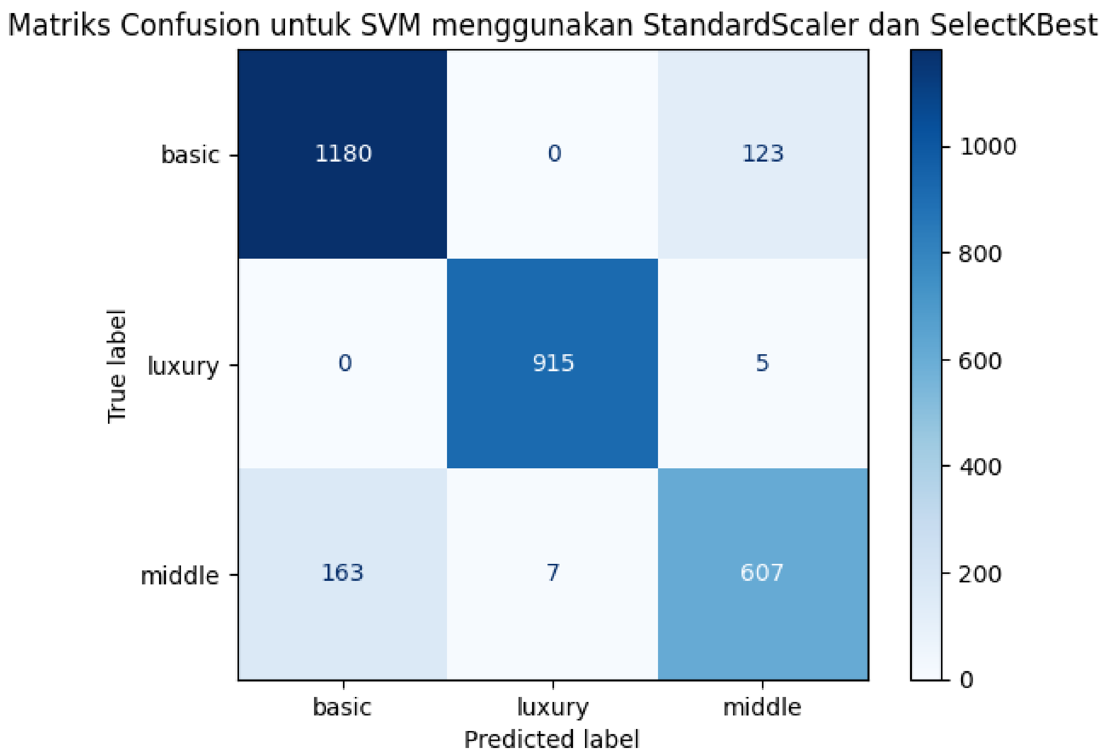
Parameter terbaik: {'classifier__C': 0.1, 'classifier__kernel': 'linear',
'feature_selector__k': 5, 'scaler': StandardScaler()}
Akurasi validasi silang terbaik: 1.0
Akurasi set uji: 0.9006666666666666

Laporan klasifikasi:
              precision    recall  f1-score   support

       basic       0.88      0.91      0.89      1303
      luxury       0.99      0.99      0.99       920
      middle       0.83      0.78      0.80       777
```

```
    accuracy                           0.90      3000
   macro avg       0.90      0.89      0.90      3000
weighted avg       0.90      0.90      0.90      3000
```




```
C:\Users\ROG\AppData\Roaming\Python\Python39\site-
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```

```
packages\sklearn\feature_selection\_univariate_selection.py:113: RuntimeWarning:
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```

```
Fitur yang dipilih: ['squaremeters', 'numberofrooms', 'hasyard', 'haspool',
'floors', 'citycode', 'numprevowners', 'isnewbuilt', 'basement', 'category']

Menggunakan StandardScaler dan SelectPercentile untuk SVM
```

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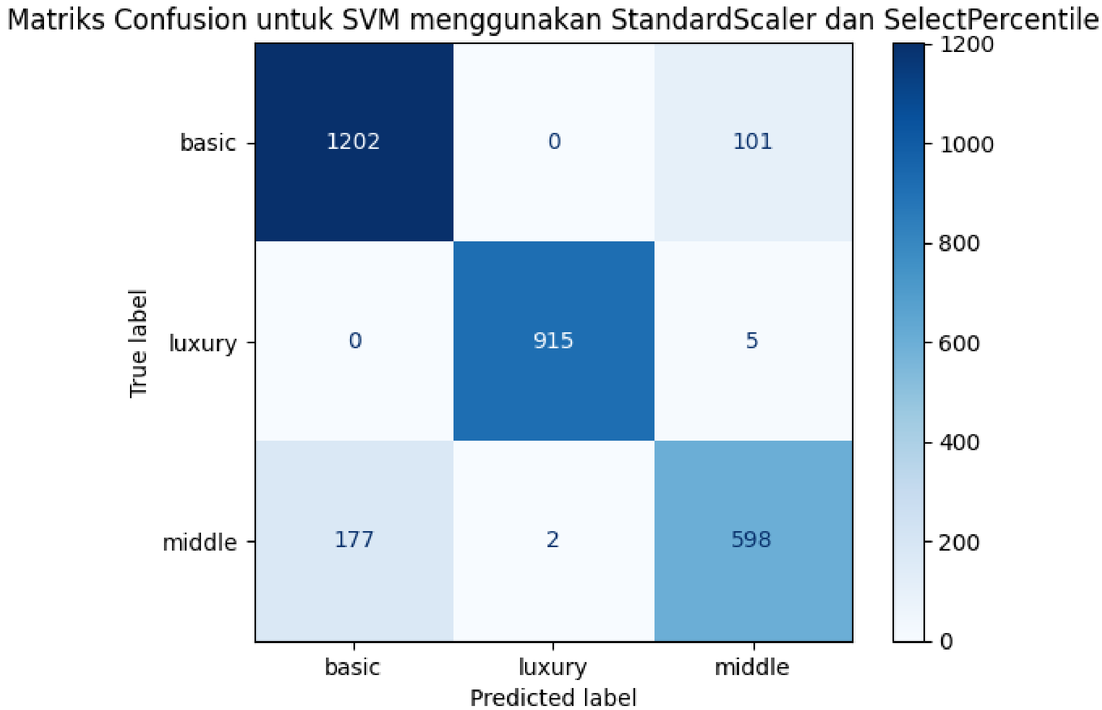
Parameter terbaik: {'classifier__C': 0.1, 'classifier__kernel': 'linear',
'feature_selector__percentile': 10, 'scaler': StandardScaler()}
Akurasi validasi silang terbaik: 1.0
Akurasi set uji: 0.905

Laporan klasifikasi:
              precision    recall  f1-score   support

       basic       0.87      0.92      0.90      1303
      luxury       1.00      0.99      1.00       920
      middle       0.85      0.77      0.81       777

    accuracy                           0.91      3000
   macro avg       0.91      0.90      0.90      3000
weighted avg       0.90      0.91      0.90      3000
```

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```
Fitur yang dipilih: ['squaremeters', 'category']
```

Menggunakan MinMaxScaler dan SelectKBest untuk SVM

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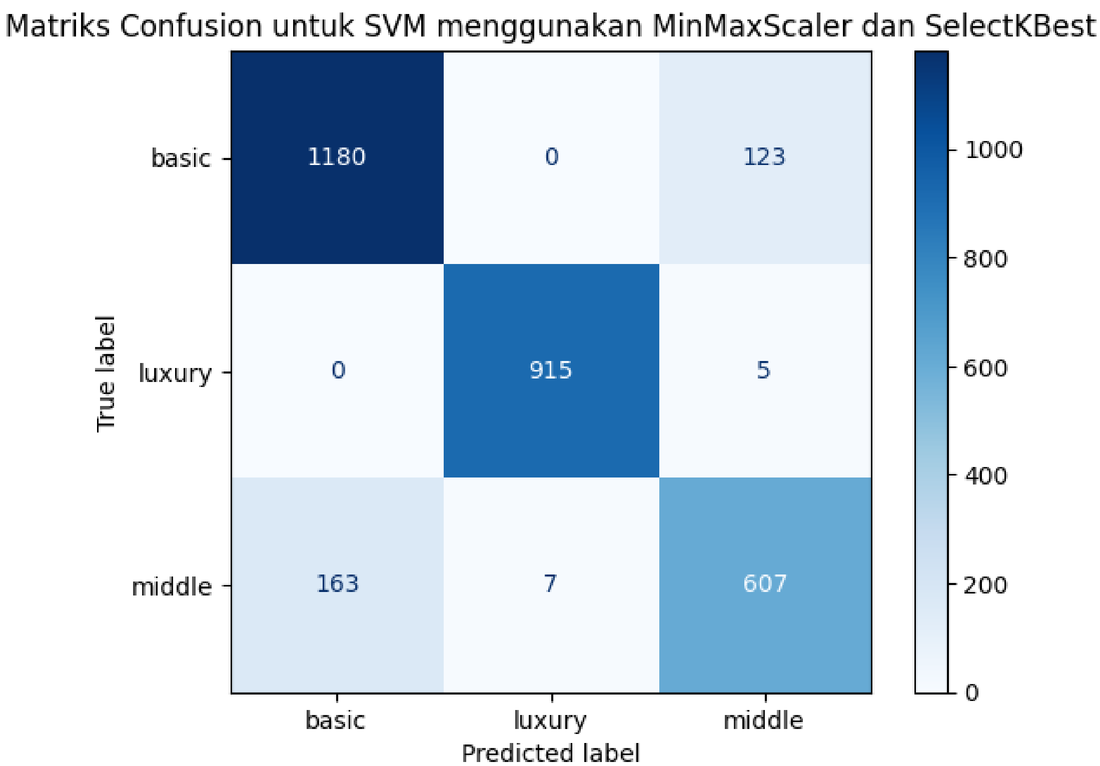
Parameter terbaik: {'classifier__C': 0.1, 'classifier__kernel': 'linear',
'feature_selector__k': 5, 'scaler': StandardScaler()}
Akurasi validasi silang terbaik: 1.0
Akurasi set uji: 0.9006666666666666

Laporan klasifikasi:
              precision    recall  f1-score   support

       basic       0.88      0.91      0.89      1303
      luxury       0.99      0.99      0.99       920
      middle       0.83      0.78      0.80       777

    accuracy                           0.90      3000
   macro avg       0.90      0.89      0.90      3000
weighted avg       0.90      0.90      0.90      3000
```

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```
Fitur yang dipilih: ['squaremeters', 'numberofrooms', 'hasyard', 'haspool',
'floors', 'citycode', 'numprevowners', 'isnewbuilt', 'basement', 'category']
```

```
Menggunakan MinMaxScaler dan SelectPercentile untuk SVM
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C:\Users\ROG\AppData\Roaming\Python\Python39\site-
packages\sklearn\feature_selection\_univariate_selection.py:113: RuntimeWarning:
divide by zero encountered in divide
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```

```
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```

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C:\Users\ROG\AppData\Roaming\Python\Python39\site-
packages\sklearn\feature_selection\_univariate_selection.py:113: RuntimeWarning:
divide by zero encountered in divide
  f = msb / msw
```

```
C:\Users\ROG\AppData\Roaming\Python\Python39\site-
packages\sklearn\feature_selection\_univariate_selection.py:113: RuntimeWarning:
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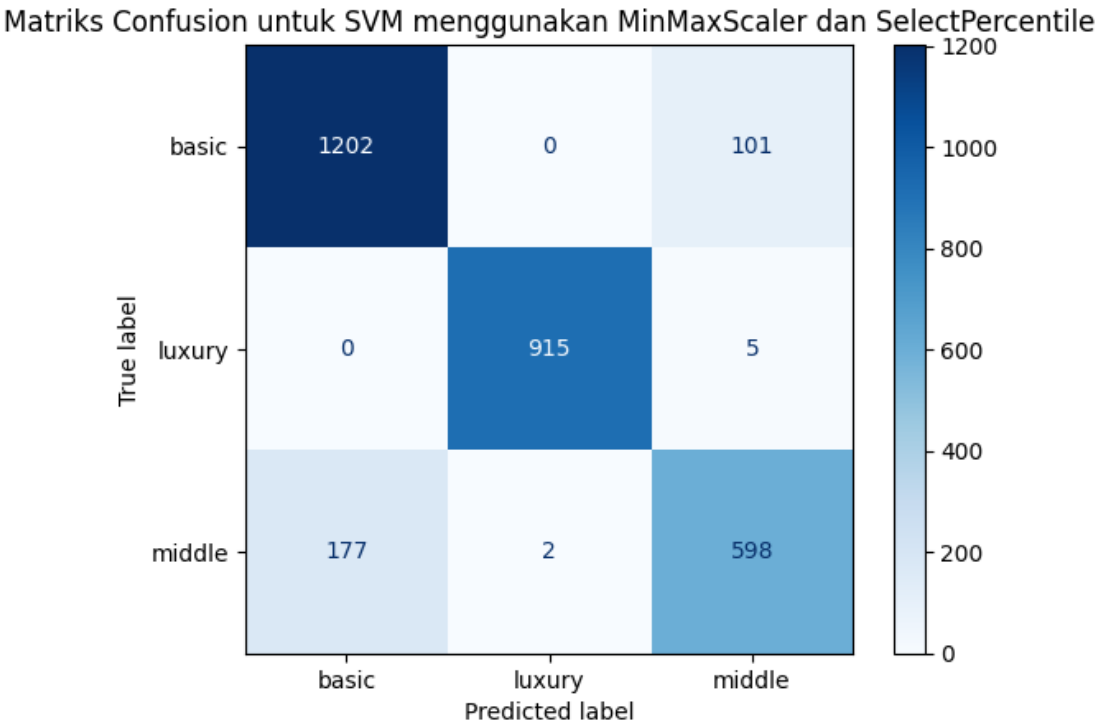
C:\Users\ROG\AppData\Roaming\Python\Python39\site-
packages\sklearn\feature_selection\_univariate_selection.py:113: RuntimeWarning:
divide by zero encountered in divide
  f = msb / msw


Parameter terbaik: {'classifier__C': 0.1, 'classifier__kernel': 'linear',
'feature_selector__percentile': 10, 'scaler': StandardScaler()}
Akurasi validasi silang terbaik: 1.0
Akurasi set uji: 0.905

Laporan klasifikasi:
              precision    recall  f1-score   support

       basic       0.87      0.92      0.90      1303
      luxury       1.00      0.99      1.00       920
      middle       0.85      0.77      0.81       777

    accuracy                           0.91      3000
   macro avg       0.91      0.90      0.90      3000
weighted avg       0.90      0.91      0.90      3000
```




```
Fitur yang dipilih: ['squaremeters', 'category']
```

```
C:\Users\ROG\AppData\Roaming\Python\Python39\site-
packages\sklearn\feature_selection\_univariate_selection.py:113: RuntimeWarning:
divide by zero encountered in divide
  f = msb / msw
```

[11]:
```
import pickle

with open('BestModel_CLF_GBC_Bokeh.pkl','wb') as r:
        pickle.dump((grid_search),r)

print("Model GBT berhasill disimpan")
```

```
Model GBT berhasill disimpan
```

regresi-b-bokeh-ridge-vs-svr-panji

October 25, 2024

[16]:
```
import pandas as pd
import numpy as np

df_uts= pd.read_csv(r'C:\Users\bravo\Downloads\Documents\test\Dataset UTS_Gasal␣
↪2425.csv')
df_uts.head(10)
```

[16]:

	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	
5	79770	3	no	yes	69	54812	
6	75985	60	yes	no	67	6517	
7	64169	88	no	yes	6	61711	
8	92383	12	no	no	78	71982	
9	95121	46	no	yes	3	9382	

	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	
5	10	5	2018	old	yes	8871	
6	6	9	2009	new	yes	4878	
7	3	9	2011	new	yes	3054	
8	3	7	2000	old	no	7507	
9	7	9	1994	old	no	615	

	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

```
5   7117     240            no             7  7986665.8   Luxury
6    281     384           yes             5  7607322.9   Luxury
7    129     726            no             9  6420823.1   Middle
8   9056     892           yes             1  9244344.0   Luxury
9   1221     328            no            10  9515440.4   Luxury
```

[17]:
```
import numpy as np
from sklearn.preprocessing import LabelEncoder
from sklearn.model_selection import KFold

print("\nPengecekan nilai missing values (null, kosong, NaN):")
missing_values = df_uts.isnull().sum()
empty_strings = (df_uts == '').sum()
nan_values = df_uts.isna().sum()

print("\nMissing values per column:\n", missing_values)
print("\nKolom dengan string kosong:\n", empty_strings)
print("\nNaN values per column:\n", nan_values)

print("\nPengecekan outlier menggunakan metode IQR:")
df_uts_numeric = df_uts.select_dtypes(include=['number'])

Q1 = df_uts_numeric.quantile(0.25)
Q3 = df_uts_numeric.quantile(0.75)
IQR = Q3 - Q1

outliers = ((df_uts_numeric < (Q1 - 1.5 * IQR)) | (df_uts_numeric > (Q3 + 1.5 *␣
 ↪IQR))).sum()
print("\nOutlier per column:\n", outliers)

duplicates = df_uts.duplicated().sum()
print(f"\nJumlah data duplikat: {duplicates}")

categorical_columns = df_uts.select_dtypes(include=['object']).columns
label_encoders = {}

for col in categorical_columns:
    le = LabelEncoder()
    df_uts[col] = le.fit_transform(df_uts[col].astype(str))
    label_encoders[col] = le

print("\nData setelah diubah menjadi numerik:\n", df_uts.head())

target = 'price'
class_distribution = df_uts[target].value_counts()
print("\nDistribusi kelas:\n", class_distribution)
```

```
X = df_uts.drop(columns=[target])
y = df_uts[target]

kf = KFold(n_splits=5)

for fold, (train_index, test_index) in enumerate(kf.split(X, y)):
    print(f"\nFold {fold + 1}: {len(train_index)} data latih, {len(test_index)}␣
 ↪data uji")
target = 'price'

features_to_drop = ['category']

X = df_uts.drop(columns=features_to_drop)
y = df_uts[target]

print("\nFitur (X) shape:", X.shape)
print("Target (y) shape:", y.shape)

print("\nFitur (X) setelah penghapusan kolom Kategori:\n", X.head())
print("\nTarget (y):\n", y.head())

kf = KFold(n_splits=5)

for fold, (train_index, test_index) in enumerate(kf.split(X, y)):
    print(f"\nFold {fold + 1}: {len(train_index)} data latih, {len(test_index)}␣
 ↪data uji")
```

```
Pengecekan nilai missing values (null, kosong, NaN):

Missing values per column:
 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
category             0
dtype: int64

Kolom dengan string kosong:
 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
category             0
dtype: int64

NaN values per column:
 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
category             0
dtype: int64

Pengecekan outlier menggunakan metode IQR:
```

```
Outlier per column:
 squaremeters     0
numberofrooms    0
floors           0
citycode         0
citypartrange    0
numprevowners    0
made             0
basement         0
attic            0
garage           0
hasguestroom     0
price            0
dtype: int64

Jumlah data duplikat: 0

Data setelah diubah menjadi numerik:
    squaremeters  numberofrooms  hasyard  haspool  floors  citycode  \
0          75523              3        0        1      63      9373
1          55712             58        0        1      19     34457
2          86929            100        1        0      11     98155
3          51522              3        0        0      61      9047
4          96470             74        1        0      21     92029

   citypartrange  numprevowners  made  isnewbuilt  hasstormprotector  \
0              3              8  2005           1                  1
1              6              8  2021           1                  0
2              3              4  2003           0                  0
3              8              3  2012           0                  1
4              4              2  2011           0                  1

   basement  attic  garage  hasstorageroom  hasguestroom      price  category
0      4313   9005     956               0             7  7559081.5         1
1      2937   8852     135               1             9  5574642.1         2
2      6326   4748     654               0            10  8696869.3         1
3       632   5792     807               1             5  5154055.2         2
4      5414   1172     716               1             9  9652258.1         1

Distribusi kelas:
 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

Fold 1: 8000 data latih, 2000 data uji

Fold 2: 8000 data latih, 2000 data uji

Fold 3: 8000 data latih, 2000 data uji

Fold 4: 8000 data latih, 2000 data uji

Fold 5: 8000 data latih, 2000 data uji

Fitur (X) shape: (10000, 17)
Target (y) shape: (10000,)

Fitur (X) setelah penghapusan kolom Kategori:
    squaremeters  numberofrooms  hasyard  haspool  floors  citycode  \
0          75523              3        0        1      63      9373
1          55712             58        0        1      19     34457
2          86929            100        1        0      11     98155
3          51522              3        0        0      61      9047
4          96470             74        1        0      21     92029

   citypartrange  numprevowners  made  isnewbuilt  hasstormprotector  \
0              3              8  2005           1                  1
1              6              8  2021           1                  0
2              3              4  2003           0                  0
3              8              3  2012           0                  1
4              4              2  2011           0                  1

   basement  attic  garage  hasstorageroom  hasguestroom      price
0      4313   9005     956               0             7  7559081.5
1      2937   8852     135               1             9  5574642.1
2      6326   4748     654               0            10  8696869.3
3       632   5792     807               1             5  5154055.2
4      5414   1172     716               1             9  9652258.1

Target (y):
 0    7559081.5
1    5574642.1
2    8696869.3
3    5154055.2
4    9652258.1
Name: price, dtype: float64
```

```
Fold 1: 8000 data latih, 2000 data uji

Fold 2: 8000 data latih, 2000 data uji

Fold 3: 8000 data latih, 2000 data uji

Fold 4: 8000 data latih, 2000 data uji

Fold 5: 8000 data latih, 2000 data uji
```

[18]:
```
df_uts2 = X.copy()
df_uts2.head(10)
```

[18]:

	squaremeters	numberofrooms	hasyard	haspool	floors	citycode	\
0	75523	3	0	1	63	9373	
1	55712	58	0	1	19	34457	
2	86929	100	1	0	11	98155	
3	51522	3	0	0	61	9047	
4	96470	74	1	0	21	92029	
5	79770	3	0	1	69	54812	
6	75985	60	1	0	67	6517	
7	64169	88	0	1	6	61711	
8	92383	12	0	0	78	71982	
9	95121	46	0	1	3	9382	

	citypartrange	numprevowners	made	isnewbuilt	hasstormprotector	\
0	3	8	2005	1	1	
1	6	8	2021	1	0	
2	3	4	2003	0	0	
3	8	3	2012	0	1	
4	4	2	2011	0	1	
5	10	5	2018	1	1	
6	6	9	2009	0	1	
7	3	9	2011	0	1	
8	3	7	2000	1	0	
9	7	9	1994	1	0	

	basement	attic	garage	hasstorageroom	hasguestroom	price
0	4313	9005	956	0	7	7559081.5
1	2937	8852	135	1	9	5574642.1
2	6326	4748	654	0	10	8696869.3
3	632	5792	807	1	5	5154055.2
4	5414	1172	716	1	9	9652258.1
5	8871	7117	240	0	7	7986665.8
6	4878	281	384	1	5	7607322.9
7	3054	129	726	0	9	6420823.1

```
8      7507   9056     892                1             1  9244344.0
9       615   1221     328                0            10  9515440.4
```

[19]:
```
from sklearn.model_selection import train_test_split

def train_test_split_custom(X, y, test_size, random_state=99):
    X_train, X_test, y_train, y_test = train_test_split(X, y,␣
 ↪test_size=test_size, random_state=random_state)

    print(f"\nTrain-test split dengan rasio {int((1 - test_size) * 100)}:
 ↪{int(test_size * 100)}")
    print(f"Jumlah data latih: {len(X_train)}")
    print(f"Jumlah data uji: {len(X_test)}\n")

    return X_train, X_test, y_train, y_test

split_ratios = [0.2, 0.25, 0.3]

for ratio in split_ratios:
    X_train, X_test, y_train, y_test = train_test_split_custom(X, y,␣
 ↪test_size=ratio, random_state=99)
```

```
Train-test split dengan rasio 80:20
Jumlah data latih: 8000
Jumlah data uji: 2000


Train-test split dengan rasio 75:25
Jumlah data latih: 7500
Jumlah data uji: 2500


Train-test split dengan rasio 70:30
Jumlah data latih: 7000
Jumlah data uji: 3000
```

[32]:
```
from sklearn.linear_model import Ridge
from sklearn.model_selection import GridSearchCV
from sklearn.pipeline import Pipeline, FeatureUnion
from sklearn.preprocessing import StandardScaler, MinMaxScaler
from sklearn.feature_selection import SelectKBest, SelectPercentile,␣
 ↪f_regression
from sklearn.metrics import mean_absolute_error, mean_squared_error
import numpy as np
import warnings
```

```
warnings.filterwarnings('ignore')

# Pipeline with StandardScaler and MinMaxScaler
pipe_Ridge = Pipeline(steps=[
    ('scalers', FeatureUnion(transformer_list=[
        ('standard_scaler', StandardScaler()),
        ('minmax_scaler', MinMaxScaler())
    ])),
    ('feature_selection', 'passthrough'),  # Placeholder for the feature␣
 ↪selection method
    ('reg', Ridge())  # Ridge regressor
])

# Parameter grid for SelectKBest and SelectPercentile
param_grid_Ridge = [
    {
        'feature_selection': [SelectKBest(score_func=f_regression)],
        'feature_selection__k': np.arange(1, 20),  # Number of features for␣
 ↪SelectKBest
        'reg__alpha': [0.01, 0.1, 1, 10, 100]  # Ridge regression␣
 ↪regularization parameter
    },
    {
        'feature_selection': [SelectPercentile(score_func=f_regression)],
        'feature_selection__percentile': np.arange(10, 101, 10),  # Percentage␣
 ↪of features for SelectPercentile
        'reg__alpha': [0.01, 0.1, 1, 10, 100]  # Ridge regression␣
 ↪regularization parameter
    }
]

# GridSearchCV to find the best model
GSCV_Ridge = GridSearchCV(pipe_Ridge, param_grid_Ridge, cv=5,␣
 ↪scoring='neg_mean_squared_error')

# Fit the model
GSCV_Ridge.fit(X_train, y_train)

# Output the best model and its performance
print("Best model: {}".format(GSCV_Ridge.best_estimator_))
print("Ridge best parameters: {}".format(GSCV_Ridge.best_params_))
print("Coefficients: {}".format(GSCV_Ridge.best_estimator_.named_steps['reg'].
 ↪coef_))
print("Intercept: {}".format(GSCV_Ridge.best_estimator_.named_steps['reg'].
 ↪intercept_))
```

```
# Predictions on the test data
Ridge_predict = GSCV_Ridge.predict(X_test)

# Evaluate model performance
mse_Ridge = mean_squared_error(y_test, Ridge_predict)
mae_Ridge = mean_absolute_error(y_test, 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=[('scalers',
                 FeatureUnion(transformer_list=[('standard_scaler',
                                                 StandardScaler()),
                                                ('minmax_scaler',
                                                 MinMaxScaler())])),
                ('feature_selection',
                 SelectPercentile(percentile=100,
                                  score_func=<function f_regression at
0x000001EE677507C0>)),
                ('reg', Ridge(alpha=0.01))])
Ridge best parameters: {'feature_selection':
SelectPercentile(score_func=<function f_regression at 0x000001EE677507C0>),
'feature_selection__percentile': 100, 'reg__alpha': 0.01}
Coefficients: [ 1.14611076e+06  1.50211883e+01  5.15207713e+02  5.10810845e+02
  6.19092634e+02 -4.74396882e+00  5.47356789e+01 -1.14005731e+01
 -1.68699864e+01 -2.75559355e+01  2.30774959e+01  4.30798037e+00
 -4.27917301e+00  8.67927928e+00  2.25963223e+00 -3.57244194e+00
  1.52214257e+06  3.31712557e+05  4.36605488e+00  2.57570844e+02
  2.55357200e+02  1.80913040e+02 -1.38070346e+00  1.74797083e+01
 -3.61136719e+00 -5.06777122e+00 -1.37778209e+01  1.15378497e+01
  1.24026971e+00 -1.24360895e+00  2.51686306e+00  1.12981063e+00
 -1.13920081e+00  4.40302998e+05]
Intercept: 4608519.462878215
Ridge Mean Squared Error (MSE): 658447.2885532628
Ridge Mean Absolute Error (MAE): 638.5104120024691
Ridge Root Mean Squared Error: 811.447649915423
```

[22]:
```
df_results = pd.DataFrame(y_test, columns=['price'])
df_results = pd.DataFrame(y_test)
df_results['Ridge Prediction'] = Ridge_predict

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

df_results.head()
```

[22]:
```
          price  Ridge Prediction   Selisih_RR
7653  2696414.4      2.696407e+06    -7.053336
7865  4919606.6      4.920987e+06  1380.189639
3226  8974887.0      8.974570e+06  -316.678624
5912   923577.4      9.238598e+05   282.422501
8237  2474395.5      2.476061e+06  1665.545285
```

[23]:
```
df_results.describe()
```

[23]:
```
              price  Ridge Prediction   Selisih_RR
count  3.000000e+03      3.000000e+03  3000.000000
mean   4.992964e+06      4.992935e+06   -28.976968
std    2.843994e+06      2.843963e+06   811.065287
min    1.322910e+04      1.326441e+04 -3037.642622
25%    2.625738e+06      2.624536e+06  -568.734546
50%    5.012312e+06      5.011805e+06   -17.116687
75%    7.440587e+06      7.440375e+06   503.334347
max    9.994093e+06      9.994162e+06  2968.842191
```

[24]:
```
from sklearn.svm import SVR
from sklearn.model_selection import GridSearchCV
from sklearn.pipeline import Pipeline, FeatureUnion
from sklearn.preprocessing import StandardScaler, MinMaxScaler
from sklearn.feature_selection import SelectKBest, SelectPercentile,␣
 ↪f_regression
from sklearn.metrics import mean_absolute_error, mean_squared_error
import numpy as np
import warnings
warnings.filterwarnings('ignore')

# Pipeline with StandardScaler and MinMaxScaler
pipe_SVR = Pipeline(steps=[
    ('scalers', FeatureUnion(transformer_list=[
        ('standard_scaler', StandardScaler()),
        ('minmax_scaler', MinMaxScaler())
    ])),
    ('feature_selection', 'passthrough'),  # Placeholder for the feature␣
 ↪selection method
    ('reg', SVR())  # Support Vector Regressor
])

# Parameter grid for SelectKBest and SelectPercentile with SVR
param_grid_SVR = [
    {
        'feature_selection': [SelectKBest(score_func=f_regression)],
        'feature_selection__k': np.arange(1, 20),  # Number of features for␣
 ↪SelectKBest
```

```
        'reg__kernel': ['linear', 'rbf'],  # Kernel types for SVR
        'reg__C': [0.1, 1, 10, 100],  # Regularization parameter for SVR
        'reg__gamma': ['scale', 'auto']  # Kernel coefficient for 'rbf'
    },
    {
        'feature_selection': [SelectPercentile(score_func=f_regression)],
        'feature_selection__percentile': np.arange(10, 101, 10),  # Percentage␣
 ↪of features for SelectPercentile
        'reg__kernel': ['linear', 'rbf'],  # Kernel types for SVR
        'reg__C': [0.1, 1, 10, 100],  # Regularization parameter for SVR
        'reg__gamma': ['scale', 'auto']  # Kernel coefficient for 'rbf'
    }
]

# GridSearchCV to find the best model
GSCV_SVR = GridSearchCV(pipe_SVR, param_grid_SVR, cv=5,␣
 ↪scoring='neg_mean_squared_error')

# Fit the model
GSCV_SVR.fit(X_train, y_train)

# Output the best model and its performance
print("Best model: {}".format(GSCV_SVR.best_estimator_))
print("SVR best parameters: {}".format(GSCV_SVR.best_params_))

# Predictions on the test data
SVR_predict = GSCV_SVR.predict(X_test)

# Evaluate model performance
mse_SVR = mean_squared_error(y_test, SVR_predict)
mae_SVR = mean_absolute_error(y_test, SVR_predict)

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=[('scalers',
                 FeatureUnion(transformer_list=[('standard_scaler',
                                                 StandardScaler()),
                                                ('minmax_scaler',
                                                 MinMaxScaler())])),
                ('feature_selection',
                 SelectPercentile(percentile=100,
                                  score_func=<function f_regression at
0x000001EE677507C0>)),
                ('reg', SVR(C=100, kernel='linear'))])
SVR best parameters: {'feature_selection': SelectPercentile(score_func=<function
```

```
f_regression at 0x000001EE677507C0>), 'feature_selection__percentile': 100,
'reg__C': 100, 'reg__gamma': 'scale', 'reg__kernel': 'linear'}
SVR Mean Squared Error (MSE): 2409690728666.333
SVR Mean Absolute Error (MAE): 1331891.2948321374
SVR Root Mean Squared Error: 1552317.856840645
```

[25]:
```
df_results['SVR Prediction'] = SVR_predict
df_results = pd.DataFrame(y_test)
df_results['SVR Prediction'] = SVR_predict

df_results['Selisih_price_LR'] = df_results['SVR Prediction'] -␣
 ↪df_results['price']
df_results.head()
```

[25]:

	price	SVR Prediction	Selisih_price_LR
7653	2696414.4	4.007229e+06	1.310814e+06
7865	4919606.6	4.921303e+06	1.696215e+03
3226	8974887.0	6.788677e+06	-2.186210e+06
5912	923577.4	3.150683e+06	2.227106e+06
8237	2474395.5	3.890904e+06	1.416509e+06

[26]:
```
df_results.describe()
```

[26]:

	price	SVR Prediction	Selisih_price_LR
count	3.000000e+03	3.000000e+03	3.000000e+03
mean	4.992964e+06	5.002111e+06	9.147090e+03
std	2.843994e+06	1.291977e+06	1.552550e+06
min	1.322910e+04	2.712058e+06	-2.750518e+06
25%	2.625738e+06	3.917340e+06	-1.329096e+06
50%	5.012312e+06	5.008315e+06	2.025259e+03
75%	7.440587e+06	6.118946e+06	1.306285e+06
max	9.994093e+06	7.317175e+06	2.759431e+06

[28]:
```
import pandas as pd

df_results = pd.DataFrame({
    'Price': y_test,
    'Ridge Prediction': Ridge_predict,
    'SVR Prediction': SVR_predict
})

df_results['Ridge Difference'] = df_results['Ridge Prediction'] -␣
 ↪df_results['Price']
df_results['SVR Difference'] = df_results['SVR Prediction'] -␣
 ↪df_results['Price']

print(df_results.head())
```

```
          Price  Ridge Prediction  SVR Prediction  Ridge Difference  \
7653  2696414.4      2.696407e+06    4.007229e+06         -7.053336
7865  4919606.6      4.920987e+06    4.921303e+06       1380.189639
3226  8974887.0      8.974570e+06    6.788677e+06       -316.678624
5912   923577.4      9.238598e+05    3.150683e+06        282.422501
8237  2474395.5      2.476061e+06    3.890904e+06       1665.545285

      SVR Difference
7653    1.310814e+06
7865    1.696215e+03
3226   -2.186210e+06
5912    2.227106e+06
8237    1.416509e+06
```

[35]:
```
ridge_feature_count = np.sum(GSCV_Ridge.best_estimator_.
 ↪named_steps['feature_selection'].get_support())
svr_feature_count = np.sum(GSCV_SVR.best_estimator_.
 ↪named_steps['feature_selection'].get_support())

performance_comparison = {
    'Model': ['Ridge', 'SVR'],
    'Mean Absolute Error (MAE)': [mae_Ridge, mae_SVR],
    'Mean Squared Error (MSE)': [mse_Ridge, mse_SVR],
    'Root Mean Squared Error (RMSE)': [np.sqrt(mse_Ridge), np.sqrt(mse_SVR)],
    'Number of Features': [ridge_feature_count, svr_feature_count]
}

df_performance = pd.DataFrame(performance_comparison)

print(df_performance)
```

```
   Model  Mean Absolute Error (MAE)  Mean Squared Error (MSE)  \
0  Ridge                6.385104e+02              6.584473e+05
1    SVR                1.331891e+06              2.409691e+12

   Root Mean Squared Error (RMSE)  Number of Features
0                    8.114476e+02                  34
1                    1.552318e+06                  34
```

[38]:
```
import matplotlib.pyplot as plt

df_results.set_index(df_results.index, inplace=True)

plt.figure(figsize=(14, 8))

plt.plot(df_results['Price'], label='Price', color='black', linestyle='--',␣
 ↪marker='o', markersize=3)
```

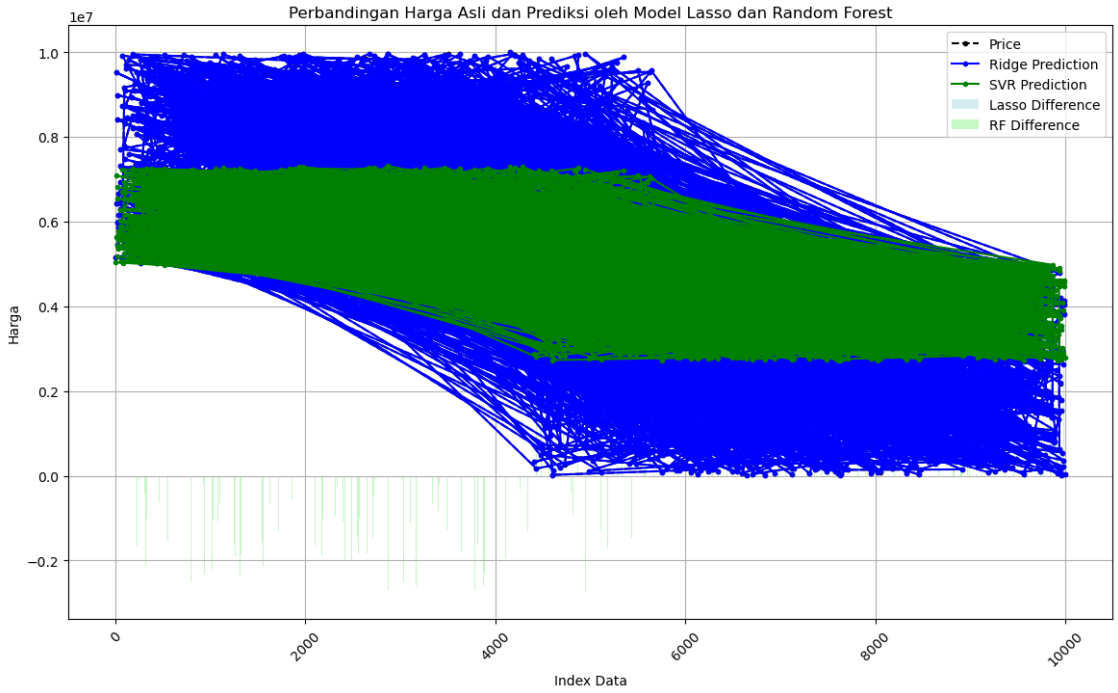
```
plt.plot(df_results['Ridge Prediction'], label='Ridge Prediction',␣
 ↪color='blue', linestyle='-', marker='o', markersize=3)

plt.plot(df_results['SVR Prediction'], label='SVR Prediction', color='green',␣
 ↪linestyle='-', marker='o', markersize=3)

plt.bar(df_results.index, df_results['Ridge Difference'], color='lightblue',␣
 ↪alpha=0.5, label='Lasso Difference', width=0.4)
plt.bar(df_results.index + 0.4, df_results['SVR Difference'],␣
 ↪color='lightgreen', alpha=0.5, label='RF Difference', width=0.4)

plt.title('Perbandingan Harga Asli dan Prediksi oleh Model Lasso dan Random␣
 ↪Forest')
plt.xlabel('Index Data')
plt.ylabel('Harga')
plt.legend()
plt.xticks(rotation=45)
plt.grid()

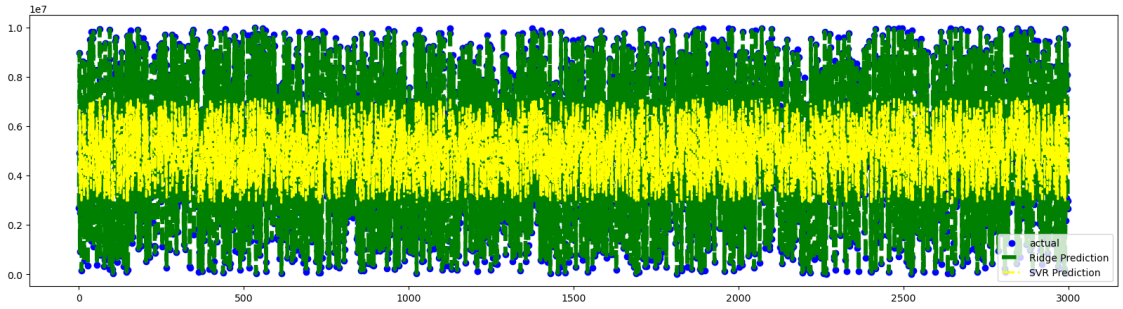
plt.show()
```



[20]:
```
import matplotlib.pyplot as plt
```

```
plt.figure(figsize=(20,5))
data_len = range(len(y_test))
plt.scatter(data_len, df_results.price, label="actual", color="blue")
plt.plot(data_len, df_results['Ridge Prediction'], label="Ridge Prediction",␣
 ↪color="green", linewidth=4, linestyle="dashed")
plt.plot(data_len, df_results['SVR Prediction'], label="SVR Prediction",␣
 ↪color="yellow", linewidth=2, linestyle="-.")
plt.legend()
plt.show
```

[20]: <function matplotlib.pyplot.show(close=None, block=None)>



[39]:
```
import pickle

best_model = GSCV_Ridge.best_estimator_

with open('BestModel_REG_Ridge_Bokeh.pkl', 'wb') as f:
    pickle.dump(best_model, f)

print("Model Terbaik Berhasil Disimpan ke 'BestModel_REG_Ridge_Bokeh.pkl")
```

```
Model Terbaik Berhasil Disimpan ke 'BestModel_REG_Ridge_Bokeh.pkl
```

on-vs-randomforestregressor-gilang

October 25, 2024

[13]:
```
import pandas as pd
import numpy as np

df_uts = pd.read_csv(r'C:\Users\lenovo\Downloads\Projek UTS Gasal␣
↪20242025-20241016\Dataset UTS_Gasal 2425.csv')
df_uts.head(20)
```

[13]:

	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	
5	79770	3	no	yes	69	54812	
6	75985	60	yes	no	67	6517	
7	64169	88	no	yes	6	61711	
8	92383	12	no	no	78	71982	
9	95121	46	no	yes	3	9382	
10	76485	47	yes	no	9	90254	
11	87060	27	no	yes	91	51803	
12	66683	19	yes	yes	6	50801	
13	84559	29	no	yes	69	53057	
14	76091	38	yes	no	32	59451	
15	92696	49	yes	no	38	74381	
16	59800	47	no	yes	27	44815	
17	54836	25	no	yes	53	64601	
18	70021	52	yes	no	28	95678	
19	54368	11	yes	yes	20	55761	

	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	
5	10	5	2018	old	yes	8871	
6	6	9	2009	new	yes	4878	

7	3	9	2011	new	yes	3054
8	3	7	2000	old	no	7507
9	7	9	1994	old	no	615
10	2	9	2008	new	no	2860
11	8	10	2000	old	no	6629
12	6	2	2001	old	no	7473
13	7	7	2000	new	no	3573
14	5	8	2016	new	no	8150
15	9	2	2021	old	no	1559
16	6	9	2021	old	no	5075
17	10	5	2020	new	no	5278
18	4	6	1992	old	yes	4480
19	3	7	2021	old	no	231

	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
5	7117	240	no	7	7986665.8	Luxury
6	281	384	yes	5	7607322.9	Luxury
7	129	726	no	9	6420823.1	Middle
8	9056	892	yes	1	9244344.0	Luxury
9	1221	328	no	10	9515440.4	Luxury
10	3129	982	no	1	7653300.8	Luxury
11	435	512	no	7	8711426.0	Luxury
12	796	237	yes	3	6677649.1	Middle
13	9556	918	yes	8	8460604.0	Luxury
14	6037	930	no	7	7614076.6	Luxury
15	5111	957	yes	2	9272740.1	Luxury
16	3104	864	no	4	5984462.1	Middle
17	1059	313	yes	6	5492532.0	Middle
18	6919	680	yes	1	7005572.2	Luxury
19	1939	223	no	8	5446398.1	Middle

[14]:
```
import numpy as np
from sklearn.preprocessing import LabelEncoder
from sklearn.model_selection import KFold

print("\nPengecekan nilai missing values (null, kosong, NaN):")
missing_values = df_uts.isnull().sum()
empty_strings = (df_uts == '').sum()
nan_values = df_uts.isna().sum()

print("\nMissing values per column:\n", missing_values)
print("\nKolom dengan string kosong:\n", empty_strings)
```

```
print("\nNaN values per column:\n", nan_values)

print("\nPengecekan outlier menggunakan metode IQR:")
df_uts_numeric = df_uts.select_dtypes(include=['number'])

Q1 = df_uts_numeric.quantile(0.25)
Q3 = df_uts_numeric.quantile(0.75)
IQR = Q3 - Q1

outliers = ((df_uts_numeric < (Q1 - 1.5 * IQR)) | (df_uts_numeric > (Q3 + 1.5 *␣
 ↪IQR))).sum()
print("\nOutlier per column:\n", outliers)

duplicates = df_uts.duplicated().sum()
print(f"\nJumlah data duplikat: {duplicates}")

categorical_columns = df_uts.select_dtypes(include=['object']).columns
label_encoders = {}

for col in categorical_columns:
    le = LabelEncoder()
    df_uts[col] = le.fit_transform(df_uts[col].astype(str))
    label_encoders[col] = le

print("\nData setelah diubah menjadi numerik:\n", df_uts.head())

target = 'price'
class_distribution = df_uts[target].value_counts()
print("\nDistribusi kelas:\n", class_distribution)

X = df_uts.drop(columns=[target])
y = df_uts[target]

kf = KFold(n_splits=5)

for fold, (train_index, test_index) in enumerate(kf.split(X, y)):
    print(f"\nFold {fold + 1}: {len(train_index)} data latih, {len(test_index)}␣
 ↪data uji")
target = 'price'

features_to_drop = ['category']

X = df_uts.drop(columns=features_to_drop)
y = df_uts[target]

print("\nFitur (X) shape:", X.shape)
print("Target (y) shape:", y.shape)
```

```python
print("\nFitur (X) setelah penghapusan kolom Kategori:\n", X.head())
print("\nTarget (y):\n", y.head())

kf = KFold(n_splits=5)

for fold, (train_index, test_index) in enumerate(kf.split(X, y)):
    print(f"\nFold {fold + 1}: {len(train_index)} data latih, {len(test_index)} data uji")
```

```
Pengecekan nilai missing values (null, kosong, NaN):

Missing values per column:
 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
category              0
dtype: int64

Kolom dengan string kosong:
 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
category            0
dtype: int64

NaN values per column:
 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
category            0
dtype: int64

Pengecekan outlier menggunakan metode IQR:

Outlier per column:
 squaremeters     0
numberofrooms    0
floors           0
citycode         0
citypartrange    0
numprevowners    0
made             0
basement         0
attic            0
garage           0
hasguestroom     0
price            0
dtype: int64

Jumlah data duplikat: 0
```

```
Data setelah diubah menjadi numerik:
    squaremeters  numberofrooms  hasyard  haspool  floors  citycode  \
0          75523              3        0        1      63      9373
1          55712             58        0        1      19     34457
2          86929            100        1        0      11     98155
3          51522              3        0        0      61      9047
4          96470             74        1        0      21     92029

   citypartrange  numprevowners  made  isnewbuilt  hasstormprotector  \
0              3              8  2005           1                  1
1              6              8  2021           1                  0
2              3              4  2003           0                  0
3              8              3  2012           0                  1
4              4              2  2011           0                  1

   basement  attic  garage  hasstorageroom  hasguestroom      price  category
0      4313   9005     956               0             7  7559081.5         1
1      2937   8852     135               1             9  5574642.1         2
2      6326   4748     654               0            10  8696869.3         1
3       632   5792     807               1             5  5154055.2         2
4      5414   1172     716               1             9  9652258.1         1

Distribusi kelas:
 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

Fold 1: 8000 data latih, 2000 data uji

Fold 2: 8000 data latih, 2000 data uji

Fold 3: 8000 data latih, 2000 data uji

Fold 4: 8000 data latih, 2000 data uji

Fold 5: 8000 data latih, 2000 data uji

Fitur (X) shape: (10000, 17)
```

```
Target (y) shape: (10000,)

Fitur (X) setelah penghapusan kolom Kategori:
    squaremeters  numberofrooms  hasyard  haspool  floors  citycode  \
0          75523              3        0        1      63      9373
1          55712             58        0        1      19     34457
2          86929            100        1        0      11     98155
3          51522              3        0        0      61      9047
4          96470             74        1        0      21     92029

   citypartrange  numprevowners  made  isnewbuilt  hasstormprotector  \
0              3              8  2005           1                  1
1              6              8  2021           1                  0
2              3              4  2003           0                  0
3              8              3  2012           0                  1
4              4              2  2011           0                  1

   basement  attic  garage  hasstorageroom  hasguestroom      price
0      4313   9005     956               0             7  7559081.5
1      2937   8852     135               1             9  5574642.1
2      6326   4748     654               0            10  8696869.3
3       632   5792     807               1             5  5154055.2
4      5414   1172     716               1             9  9652258.1

Target (y):
 0    7559081.5
1    5574642.1
2    8696869.3
3    5154055.2
4    9652258.1
Name: price, dtype: float64

Fold 1: 8000 data latih, 2000 data uji

Fold 2: 8000 data latih, 2000 data uji

Fold 3: 8000 data latih, 2000 data uji

Fold 4: 8000 data latih, 2000 data uji

Fold 5: 8000 data latih, 2000 data uji
```

[15]:
```
df_uts2 = X.copy()
df_uts2.head(10)
```

[15]:
```
    squaremeters  numberofrooms  hasyard  haspool  floors  citycode  \
0          75523              3        0        1      63      9373
```

```
1          55712             58        0        1      19     34457
2          86929            100        1        0      11     98155
3          51522              3        0        0      61      9047
4          96470             74        1        0      21     92029
5          79770              3        0        1      69     54812
6          75985             60        1        0      67      6517
7          64169             88        0        1       6     61711
8          92383             12        0        0      78     71982
9          95121             46        0        1       3      9382

   citypartrange  numprevowners  made  isnewbuilt  hasstormprotector  \
0              3              8  2005           1                  1
1              6              8  2021           1                  0
2              3              4  2003           0                  0
3              8              3  2012           0                  1
4              4              2  2011           0                  1
5             10              5  2018           1                  1
6              6              9  2009           0                  1
7              3              9  2011           0                  1
8              3              7  2000           1                  0
9              7              9  1994           1                  0

   basement  attic  garage  hasstorageroom  hasguestroom      price
0      4313   9005     956               0             7  7559081.5
1      2937   8852     135               1             9  5574642.1
2      6326   4748     654               0            10  8696869.3
3       632   5792     807               1             5  5154055.2
4      5414   1172     716               1             9  9652258.1
5      8871   7117     240               0             7  7986665.8
6      4878    281     384               1             5  7607322.9
7      3054    129     726               0             9  6420823.1
8      7507   9056     892               1             1  9244344.0
9       615   1221     328               0            10  9515440.4
```

[16]:
```python
from sklearn.model_selection import train_test_split

def train_test_split_custom(X, y, test_size, random_state=99):
    X_train, X_test, y_train, y_test = train_test_split(X, y,␣
 ↪test_size=test_size, random_state=random_state)

    print(f"\nTrain-test split dengan rasio {int((1 - test_size) * 100)}:
 ↪{int(test_size * 100)}")
    print(f"Jumlah data latih: {len(X_train)}")
    print(f"Jumlah data uji: {len(X_test)}\n")

    return X_train, X_test, y_train, y_test
```

```
split_ratios = [0.2, 0.25, 0.3]

for ratio in split_ratios:
    X_train, X_test, y_train, y_test = train_test_split_custom(X, y,␣
 ↪test_size=ratio, random_state=99)
```

```
Train-test split dengan rasio 80:20
Jumlah data latih: 8000
Jumlah data uji: 2000


Train-test split dengan rasio 75:25
Jumlah data latih: 7500
Jumlah data uji: 2500


Train-test split dengan rasio 70:30
Jumlah data latih: 7000
Jumlah data uji: 3000
```

[17]:
```
from sklearn.linear_model import Lasso
from sklearn.model_selection import GridSearchCV
from sklearn.pipeline import Pipeline, FeatureUnion
from sklearn.preprocessing import StandardScaler, MinMaxScaler
from sklearn.feature_selection import SelectKBest, SelectPercentile,␣
 ↪f_regression
from sklearn.metrics import mean_absolute_error, mean_squared_error
import numpy as np
import warnings
warnings.filterwarnings('ignore')

pipe_Lasso = Pipeline(steps=[
            ('scalers', FeatureUnion(transformer_list=[
                ('standard_scaler', StandardScaler()),
                ('minmax_scaler', MinMaxScaler())
            ])),
            ('feature_selection', 'passthrough'),
            ('reg', Lasso(max_iter=1000))
            ])

param_grid_Lasso = [
    {
        'feature_selection': [SelectKBest(score_func=f_regression)],
        'feature_selection__k': np.arange(1, 20),
        'reg__alpha': [0.01, 0.1, 1, 10, 100]
```

```
    },
    {
        'feature_selection': [SelectPercentile(score_func=f_regression)],
        'feature_selection__percentile': np.arange(10, 101, 10),
        'reg__alpha': [0.01, 0.1, 1, 10, 100]
    }
]

GSCV_Lasso = GridSearchCV(pipe_Lasso, param_grid_Lasso, cv=5,␣
 ↪scoring='neg_mean_squared_error')

GSCV_Lasso.fit(X_train, y_train)

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)

mse_Lasso = mean_squared_error(y_test, Lasso_predict)
mae_Lasso = mean_absolute_error(y_test, 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=[('scalers',
                 FeatureUnion(transformer_list=[('standard_scaler',
                                                 StandardScaler()),
                                                ('minmax_scaler',
                                                 MinMaxScaler())])),
                ('feature_selection',
                 SelectKBest(k=1,
                             score_func=<function f_regression at
0x000001E77F84E7A0>)),
                ('reg', Lasso(alpha=1))])
Lasso best parameters: {'feature_selection': SelectKBest(score_func=<function
f_regression at 0x000001E77F84E7A0>), 'feature_selection__k': 1, 'reg__alpha':
1}
Koefisien/bobot: [2891625.29964904]
Intercept/bias: 4993654.656085714
Lasso Mean Squared Error (MSE): 10607646.880656686
Lasso Mean Absolute Error (MAE): 2631.2525581931204
Lasso Root Mean Squared Error: 3256.9382678608886
```

[18]:
```
df_results = pd.DataFrame(y_test, columns=['price'])
df_results = pd.DataFrame(y_test)
df_results['Lasso Prediction'] = Lasso_predict

df_results['Selisih_LR'] = df_results['Lasso Prediction'] - df_results['price']

df_results.head()
```

[18]:

	price	Lasso Prediction	Selisih_LR
7653	2696414.4	2.694511e+06	-1903.391681
7865	4919606.6	4.919999e+06	392.797503
3226	8974887.0	8.975078e+06	191.241348
5912	923577.4	9.231203e+05	-457.149982
8237	2474395.5	2.475012e+06	616.653488

[19]:
```
df_results.describe()
```

[19]:

	price	Lasso Prediction	Selisih_LR
count	3.000000e+03	3.000000e+03	3000.000000
mean	4.992964e+06	4.992846e+06	-117.970854
std	2.843994e+06	2.843996e+06	3255.343635
min	1.322910e+04	1.872497e+04	-12063.881795
25%	2.625738e+06	2.624536e+06	-2265.515381
50%	5.012312e+06	5.010099e+06	116.527758
75%	7.440587e+06	7.441861e+06	2270.098818
max	9.994093e+06	9.999573e+06	6050.489550

[20]:
```
from sklearn.ensemble import RandomForestRegressor
from sklearn.model_selection import GridSearchCV
from sklearn.pipeline import Pipeline, FeatureUnion
from sklearn.preprocessing import StandardScaler, MinMaxScaler
from sklearn.feature_selection import SelectKBest, SelectPercentile,␣
 ↪f_regression
from sklearn.metrics import mean_absolute_error, mean_squared_error
import numpy as np
import warnings
warnings.filterwarnings('ignore')

pipe_RF = Pipeline(steps=[
            ('scalers', FeatureUnion(transformer_list=[
                ('standard_scaler', StandardScaler()),
                ('minmax_scaler', MinMaxScaler())
            ])),
            ('feature_selection', 'passthrough'),
            ('reg', RandomForestRegressor())
            ])
```

```
param_grid_RF = [
    {
        'feature_selection': [SelectKBest(score_func=f_regression)],
        'feature_selection__k': np.arange(1, 20),
        'reg__n_estimators': [10, 50, 100, 200],
        'reg__max_depth': [None, 5, 10, 20]
    },
    {
        'feature_selection': [SelectPercentile(score_func=f_regression)],
        'feature_selection__percentile': np.arange(10, 101, 10),
        'reg__n_estimators': [10, 50, 100, 200],
        'reg__max_depth': [None, 5, 10, 20]
    }
]

GSCV_RF = GridSearchCV(pipe_RF, param_grid_RF, cv=5,␣
 ↪scoring='neg_mean_squared_error')

GSCV_RF.fit(X_train, y_train)

print("Best model: {}".format(GSCV_RF.best_estimator_))
print("RF best parameters: {}".format(GSCV_RF.best_params_))
print("Feature Importances: {}".format(GSCV_RF.best_estimator_.
 ↪named_steps['reg'].feature_importances_))

RF_predict = GSCV_RF.predict(X_test)

mse_RF = mean_squared_error(y_test, RF_predict)
mae_RF = mean_absolute_error(y_test, RF_predict)

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

```
Best model: Pipeline(steps=[('scalers',
                 FeatureUnion(transformer_list=[('standard_scaler',
                                                 StandardScaler()),
                                                ('minmax_scaler',
                                                 MinMaxScaler())])),
                ('feature_selection',
                 SelectPercentile(percentile=100,
                                  score_func=<function f_regression at
0x000001E77F84E7A0>)),
                ('reg', RandomForestRegressor(max_depth=20, n_estimators=200))])
RF best parameters: {'feature_selection': SelectPercentile(score_func=<function
f_regression at 0x000001E77F84E7A0>), 'feature_selection__percentile': 100,
'reg__max_depth': 20, 'reg__n_estimators': 200}
```

```
Feature Importances: [1.78574007e-01 3.01261725e-08 7.35168272e-09
6.98636813e-09
 2.92835821e-08 2.86748647e-08 2.10069815e-08 2.24271275e-08
 2.70256191e-08 7.59666315e-09 7.25342109e-09 2.99817291e-08
 3.02621619e-08 2.81852872e-08 7.09362706e-09 2.06487334e-08
 3.09429010e-01 1.91442180e-01 3.00838880e-08 6.98882706e-09
 7.25851094e-09 2.97552472e-08 2.69687418e-08 2.07136577e-08
 2.33190334e-08 2.76078791e-08 7.35325347e-09 7.58653825e-09
 2.86191284e-08 3.07957366e-08 2.79019225e-08 6.46975475e-09
 2.27531213e-08 3.20554196e-01]
RF Mean Squared Error (MSE): 2839446.0481728055
RF Mean Absolute Error (MAE): 1294.3031278335134
RF Root Mean Squared Error: 1685.0655916529795
```

[21]:
```
df_results['RF Prediction'] = RF_predict
df_results = pd.DataFrame(y_test)
df_results['RF Prediction'] = RF_predict

df_results['Selisih_price_RF'] = df_results['RF Prediction'] -␣
 ↪df_results['price']
df_results.head()
```

[21]:

	price	RF Prediction	Selisih_price_RF
7653	2696414.4	2.695541e+06	-873.5765
7865	4919606.6	4.921047e+06	1440.1400
3226	8974887.0	8.975361e+06	474.2490
5912	923577.4	9.233424e+05	-234.9640
8237	2474395.5	2.474390e+06	-5.4320

[22]:
```
df_results.describe()
```

[22]:

	price	RF Prediction	Selisih_price_RF
count	3.000000e+03	3.000000e+03	3000.000000
mean	4.992964e+06	4.992884e+06	-80.668128
std	2.843994e+06	2.843953e+06	1683.414188
min	1.322910e+04	1.584103e+04	-7327.859000
25%	2.625738e+06	2.624875e+06	-1058.850750
50%	5.012312e+06	5.011913e+06	-46.319750
75%	7.440587e+06	7.441299e+06	936.957875
max	9.994093e+06	9.997331e+06	6541.208000

[23]:
```
import pandas as pd

df_results = pd.DataFrame({
    'Harga Asli': y_test,
    'Lasso Prediction': Lasso_predict,
    'RF Prediction': RF_predict
```

```
})

df_results['Lasso Difference'] = df_results['Lasso Prediction'] -␣
 ↪df_results['Harga Asli']
df_results['RF Difference'] = df_results['RF Prediction'] - df_results['Harga␣
 ↪Asli']

print(df_results.head())
```

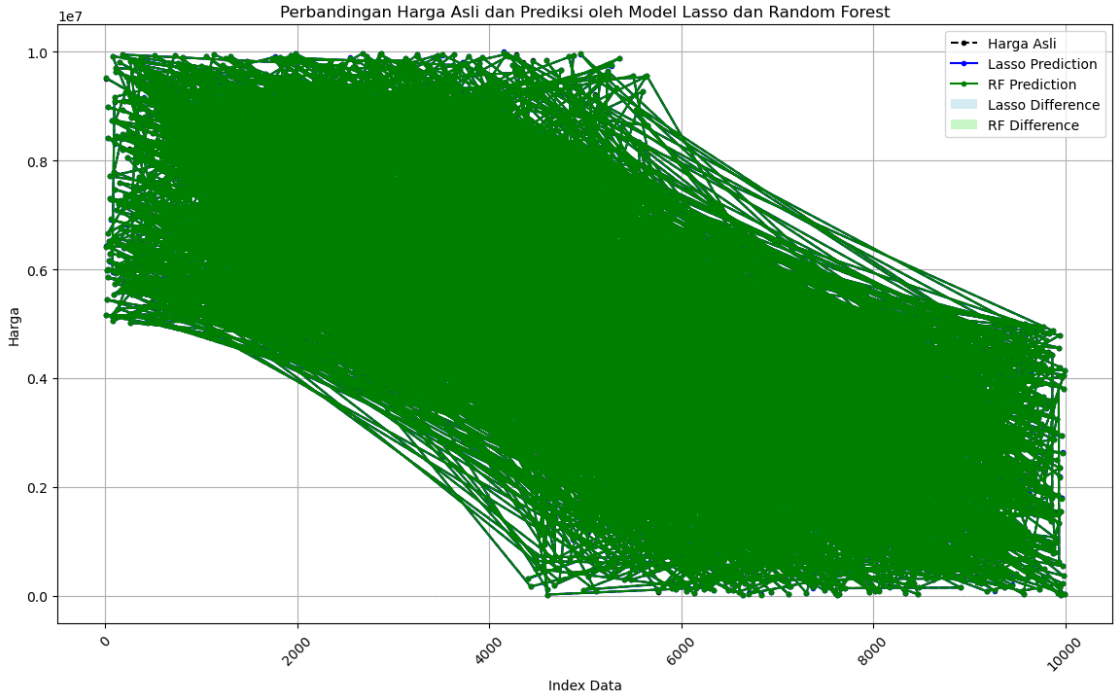
```
      Harga Asli  Lasso Prediction  RF Prediction  Lasso Difference  \
7653   2696414.4      2.694511e+06   2.695541e+06      -1903.391681
7865   4919606.6      4.919999e+06   4.921047e+06        392.797503
3226   8974887.0      8.975078e+06   8.975361e+06        191.241348
5912    923577.4      9.231203e+05   9.233424e+05       -457.149982
8237   2474395.5      2.475012e+06   2.474390e+06        616.653488

      RF Difference
7653      -873.5765
7865      1440.1400
3226       474.2490
5912      -234.9640
8237        -5.4320
```

[24]:
```
lasso_feature_count = np.sum(GSCV_Lasso.best_estimator_.
 ↪named_steps['feature_selection'].get_support())

rf_feature_count = np.sum(GSCV_RF.best_estimator_.
 ↪named_steps['feature_selection'].get_support())

performance_comparison = {
    'Model': ['Lasso', 'Random Forest'],
    'Mean Absolute Error (MAE)': [mae_Lasso, mae_RF],
    'Mean Squared Error (MSE)': [mse_Lasso, mse_RF],
    'Root Mean Squared Error (RMSE)': [np.sqrt(mse_Lasso), np.sqrt(mse_RF)],
    'Number of Features': [lasso_feature_count, rf_feature_count]
}

df_performance = pd.DataFrame(performance_comparison)

print(df_performance)
```

```
           Model  Mean Absolute Error (MAE)  Mean Squared Error (MSE)  \
0          Lasso                2631.252558              1.060765e+07
1  Random Forest                1294.303128              2.839446e+06

   Root Mean Squared Error (RMSE)  Number of Features
0                     3256.938268                   1
```

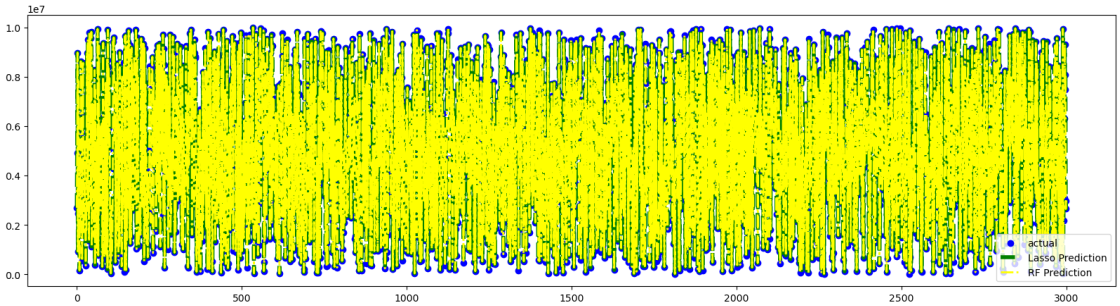
1 1685.065592 34

[25]:
```
import matplotlib.pyplot as plt

df_results.set_index(df_results.index, inplace=True)

plt.figure(figsize=(14, 8))

plt.plot(df_results['Harga Asli'], label='Harga Asli', color='black',␣
 ↪linestyle='--', marker='o', markersize=3)

plt.plot(df_results['Lasso Prediction'], label='Lasso Prediction',␣
 ↪color='blue', linestyle='-', marker='o', markersize=3)

plt.plot(df_results['RF Prediction'], label='RF Prediction', color='green',␣
 ↪linestyle='-', marker='o', markersize=3)

plt.bar(df_results.index, df_results['Lasso Difference'], color='lightblue',␣
 ↪alpha=0.5, label='Lasso Difference', width=0.4)
plt.bar(df_results.index + 0.4, df_results['RF Difference'],␣
 ↪color='lightgreen', alpha=0.5, label='RF Difference', width=0.4)

plt.title('Perbandingan Harga Asli dan Prediksi oleh Model Lasso dan Random␣
 ↪Forest')
plt.xlabel('Index Data')
plt.ylabel('Harga')
plt.legend()
plt.xticks(rotation=45)
plt.grid()

plt.show()
```



[34]:
```
import matplotlib.pyplot as plt

plt.figure(figsize=(20,5))
data_len = range(len(y_test))
plt.scatter(data_len, df_results['Harga Asli'], label="actual", color="blue")
plt.plot(data_len, df_results['Lasso Prediction'], label="Lasso Prediction",␣
 ↪color="green", linewidth=4, linestyle="dashed")
plt.plot(data_len, df_results['RF Prediction'], label="RF Prediction",␣
 ↪color="yellow", linewidth=2, linestyle="-.")
plt.legend()
plt.show
```

[34]:
```
<function matplotlib.pyplot.show(close=None, block=None)>
```



```
import streamlit as st
import pandas as pd
import io
import pickle
import os
PICKLE_DIR = r"C:\Users\Administrator\Downloads\UTSpy"

pilihan = st.sidebar.selectbox(
    "Pilih Jenis Prediksi",
    ("Prediksi Kategori Properti", "Prediksi Harga Properti")
)

def baca_csv():
    uploaded_file = st.file_uploader("Unggah file CSV",
type="csv")
    if uploaded_file is not None:
        try:
            df = pd.read_csv(uploaded_file)
            return df
        except Exception as e:
            st.error(f"Terjadi kesalahan saat membaca file: {e}")
    return None
```

```
def input_data_properti():

    with st.form("form_properti"):

        st.write("Masukkan data properti:")


        squaremeters = st.number_input("Luas Tanah (m²)",
min_value=0.0)

        numberofrooms = st.number_input("Jumlah Kamar",
min_value=0, step=1)

        hasyard = st.checkbox("Ada Halaman")

        haspool = st.checkbox("Ada Kolam Renang")

        floors = st.number_input("Jumlah Lantai", min_value=1,
step=1)

        citycode = st.text_input("Kode Lokasi")

        citypartrange = st.selectbox("citypartrange Kawasan",
["Rendah", "Sedang", "Tinggi"])

        numprevowners = st.number_input("Jumlah Pemilik
Sebelumnya", min_value=0, step=1)

        made = st.number_input("Tahun Pembuatan", min_value=1800,
max_value=2023, step=1)

        isnewbuilt = st.checkbox("Gedung Baru")

        hasstormprotector = st.checkbox("Ada Pelindung Badai")

        basement = st.number_input("Luas Basement (m²)",
min_value=0.0)

        attic = st.number_input("Luas Loteng (m²)",
min_value=0.0)
```

```
        garage = st.number_input("Luas Garasi (m²)",
min_value=0.0)

        hasstorageroom = st.checkbox("Ada Gudang")

        hasguestroom = st.checkbox("Ada Ruang Tamu")


        submitted = st.form_submit_button("Prediksi")


        if submitted:

            return {

                "squaremeters": squaremeters,

                "numberofrooms": numberofrooms,

                "hasyard": hasyard,

                "haspool": haspool,

                "floors": floors,

                "citycode": citycode,

                "citypartrange": citypartrange,

                "numprevowners": numprevowners,

                "made": made,

                "isnewbuilt": isnewbuilt,

                "hasstormprotector": hasstormprotector,

                "basement": basement,

                "attic": attic,

                "garage": garage,
```

```
                "hasstorageroom": hasstorageroom,
                "hasguestroom": hasguestroom
            }
    return None

def muat_model(nama_file):
    path_file = os.path.join(PICKLE_DIR, nama_file)
    try:
        with open(path_file, 'rb') as file:
            model = pickle.load(file)
        return model
    except Exception as e:
        st.error(f"Terjadi kesalahan saat memuat model: {e}")
        return None

def format_data(data):
    return pd.DataFrame([data])

def lakukan_prediksi(model, data):
    try:
        prediksi = model.predict(data)
        return prediksi[0]
    except Exception as e:
```

```
        st.error(f"Terjadi kesalahan saat melakukan prediksi:
{e}")
        return None


if pilihan == "Prediksi Kategori Properti":
    st.title("Prediksi Kategori Properti")


    model_kategori = muat_model("BestModel_CLF_RF_Bokeh.pkl")


    if model_kategori is None:
        st.error("Gagal memuat model prediksi kategori.")
    else:
        metode_input = st.radio("Pilih metode input:", ("Input
Manual", "Unggah CSV"), key="input_kategori")


        if metode_input == "Input Manual":
            data = input_data_properti()
            if data:
                formatted_data = format_data(data)
                prediksi = lakukan_prediksi(model_kategori,
formatted_data)
                if prediksi is not None:
                    st.success(f"Prediksi kategori properti:
{prediksi}")
```

```
                st.write("Data yang diinput:", data)
        else:
            df = baca_csv()
            if df is not None:
                st.write("Data dari file CSV:")
                st.write(df)
                prediksi = lakukan_prediksi(model_kategori, df)
                if prediksi is not None:
                    st.success(f"Prediksi kategori properti:
{prediksi}")

elif pilihan == "Prediksi Harga Properti":
    st.title("Prediksi Harga Properti")

    model_harga = muat_model("BestModel_REG_Ridge_Bokeh.pkl")

    if model_harga is None:
        st.error("Gagal memuat model prediksi harga.")
    else:
        metode_input = st.radio("Pilih metode input:", ("Input
Manual", "Unggah CSV"), key="input_harga")

        if metode_input == "Input Manual":
            data = input_data_properti()
```

```
            if data:
                formatted_data = format_data(data)
                prediksi = lakukan_prediksi(model_harga,
formatted_data)
                if prediksi is not None:
                    st.success(f"Prediksi harga properti: Rp
{prediksi:,.2f}")
                st.write("Data yang diinput:", data)
        else:
            df = baca_csv()
            if df is not None:
                st.write("Data dari file CSV:")
                st.write(df)
                prediksi = lakukan_prediksi(model_harga, df)
                if prediksi is not None:
                    st.success(f"Prediksi harga properti: Rp
{prediksi:,.2f}")
```