Prediksi Harga Saham Tesla Menggunakan Support Vector Regression

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IMPORT

In [1]:

```
import pandas as pd
import numpy as np
from sklearn.model_selection import train_test_split
from sklearn.preprocessing import StandardScaler
import matplotlib.pyplot as plt
from sklearn.preprocessing import MinMaxScaler
from sklearn.svm import SVR
from sklearn.metrics import accuracy_score, confusion_matrix
from sklearn.metrics import mean_squared_error, r2_score
from sklearn.metrics import mean_absolute_error
```

Read Dataset

In [2]:

```
tesla = pd.read_csv('Tesla.csv')
tesla.head()
```

Out[2]:

	Date	Open	High	Low	Close	Volume	Adj Close
0	6/29/2010	19.000000	25.00	17.540001	23.889999	18766300	23.889999
1	6/30/2010	25.790001	30.42	23.299999	23.830000	17187100	23.830000
2	7/1/2010	25.000000	25.92	20.270000	21.959999	8218800	21.959999
3	7/2/2010	23.000000	23.10	18.709999	19.200001	5139800	19.200001
4	7/6/2010	20.000000	20.00	15.830000	16.110001	6866900	16.110001

In [3]:

```
tesla.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 1692 entries, 0 to 1691
Data columns (total 7 columns):
 #   Column     Non-Null Count  Dtype  
---  ------     --------------  -----  
 0   Date       1692 non-null   object 
 1   Open       1692 non-null   float64
 2   High       1692 non-null   float64
 3   Low        1692 non-null   float64
 4   Close      1692 non-null   float64
 5   Volume     1692 non-null   int64  
 6   Adj Close  1692 non-null   float64
dtypes: float64(5), int64(1), object(1)
memory usage: 92.7+ KB
```

In [4]:

```
#Melakukan Check terhadapa data apakah memiliki nilai null atau tidak
tesla.isnull().sum()
```

Out[4]:

```
Date         0
Open         0
High         0
Low          0
Close        0
Volume       0
Adj Close    0
dtype: int64
```

In [5]:

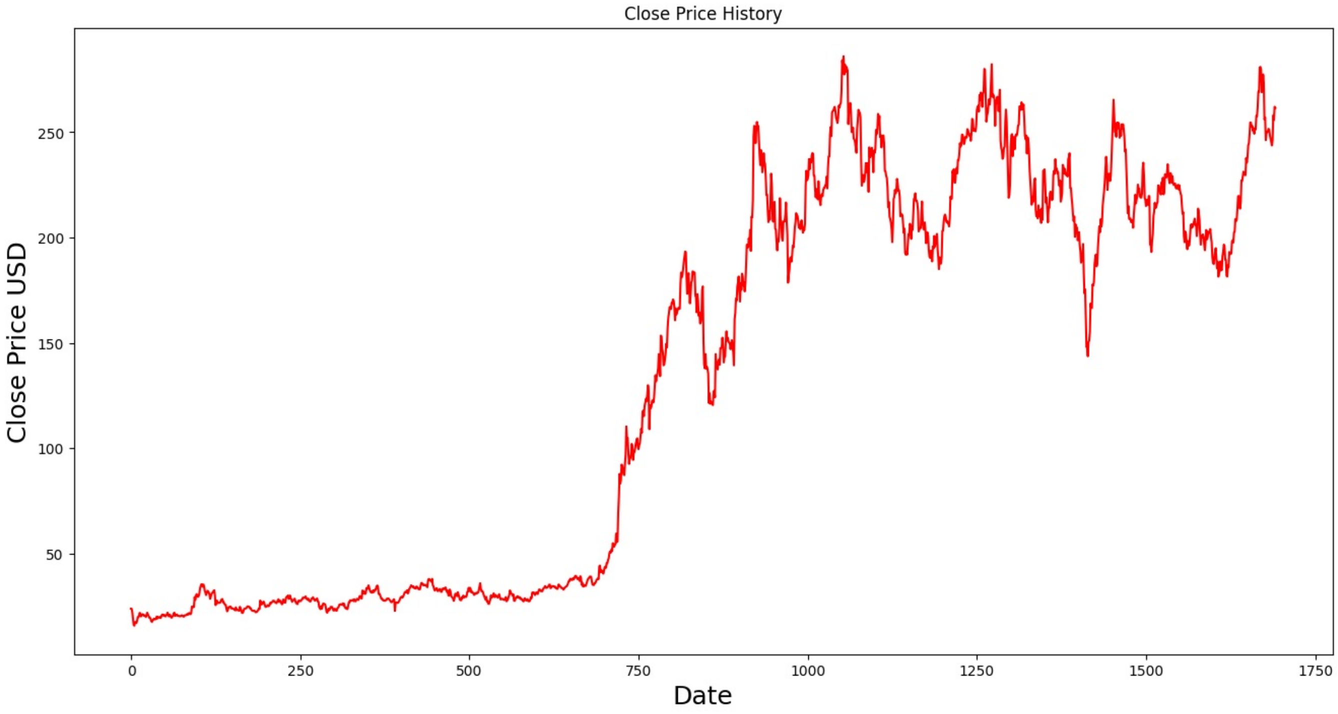
```
tesla.head()
```

Out[5]:

	Date	Open	High	Low	Close	Volume	Adj Close
0	6/29/2010	19.000000	25.00	17.540001	23.889999	18766300	23.889999
1	6/30/2010	25.790001	30.42	23.299999	23.830000	17187100	23.830000
2	7/1/2010	25.000000	25.92	20.270000	21.959999	8218800	21.959999
3	7/2/2010	23.000000	23.10	18.709999	19.200001	5139800	19.200001
4	7/6/2010	20.000000	20.00	15.830000	16.110001	6866900	16.110001

In [6]:

```
#plotting the data
plt.figure(figsize=(16,8))
plt.title('Close Price History')
plt.plot(tesla['Close'], color='red')
plt.xlabel('Date', fontsize=18)
plt.ylabel('Close Price USD', fontsize = 18)
plt.show()
```



In [7]:

```
#Menentukan Variable X dan Y
X = tesla[['Open', 'High', 'Low']].values
y = tesla['Close'].values
```

In [8]:

```
#pembagian data menjadi set pelatihan (training set) dan set pengujian (testing set) menggunakan fungsi train_t
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=42)
```

In [9]:

```
# Melakukan Uji Korelasi antar variabel X Dan Y
import numpy as np

correlation_matrix = np.corrcoef(X.T, y)
correlation_with_target = correlation_matrix[-1, :-1]

print(correlation_with_target)
```

```
[0.99923326 0.99969092 0.9996561 ]
```

In [10]:

```
#Melakukan PreProcessing data menggunakan teknik MinMaxScaler
scaler = MinMaxScaler()
X_scaled = scaler.fit_transform(X)
```

RBF

C = 0.1 , Epsilon = 0.1 , Gamma = 0.1

In [11]:

```
svr = SVR(kernel='rbf', C=0.1, gamma=0.1, epsilon=0.1)
```

In [12]:

```
from sklearn.model_selection import cross_val_score
scores = cross_val_score(svr, X, y, cv=5, scoring='r2')
```

In [13]:

```
# Menampilkan hasil validasi silang
print('R-squared scores:', scores)
print('R-squared mean:', scores.mean())
print('R-squared std:', scores.std())
```

```
R-squared scores: [-2019.38960196 -2684.90951015    -3.30158869   -62.45166163
   -49.20031584]
R-squared mean: -963.8505356542116
R-squared std: 1153.079871338242
```

In [14]:
```
svr.fit(X_train, y_train)
```

Out[14]:
```
SVR(C=0.1, gamma=0.1)
```

In [15]:
```
y_pred = svr.predict(X_test)
```

In [16]:
```
mse = mean_squared_error(y_test, y_pred)
rmse = np.sqrt(mse)
mae = mean_absolute_error(y_test, y_pred)
r2 = r2_score(y_test, y_pred)

print("Mean Squared Error:", mse)
print("Root Mean Squared Error:", rmse)
print("Mean Absolute Error:", mae)
print("R-squared:", r2)
```

```
Mean Squared Error: 9778.692437946775
Root Mean Squared Error: 98.88727136465428
Mean Absolute Error: 89.75919412717663
R-squared: -0.04855369558381595
```

C = 0.1 , Epsilon = 0.01 , Gamma = 0.1

In [17]:
```
svr = SVR(kernel='rbf', C=0.1, gamma=0.1, epsilon=0.01)
```

In [18]:
```
from sklearn.model_selection import cross_val_score
scores = cross_val_score(svr, X, y, cv=5, scoring='r2')
```

In [19]:
```
# Menampilkan hasil validasi silang
print('R-squared scores:', scores)
print('R-squared mean:', scores.mean())
print('R-squared std:', scores.std())
```

```
R-squared scores: [-2020.49249401 -2686.44247439    -3.30454679   -62.47306825
   -49.21883306]
R-squared mean: -964.3862832997313
R-squared std: 1153.7326265024037
```

In [20]:
```
svr.fit(X_train, y_train)
```

Out[20]:
```
SVR(C=0.1, epsilon=0.01, gamma=0.1)
```

In [21]:
```
y_pred = svr.predict(X_test)
```

In [22]:
```
mse = mean_squared_error(y_test, y_pred)
rmse = np.sqrt(mse)
mae = mean_absolute_error(y_test, y_pred)
r2 = r2_score(y_test, y_pred)

print("Mean Squared Error:", mse)
print("Root Mean Squared Error:", rmse)
print("Mean Absolute Error:", mae)
print("R-squared:", r2)
```

```
Mean Squared Error: 9785.311386347861
Root Mean Squared Error: 98.92073284376669
Mean Absolute Error: 89.76901713602618
R-squared: -0.04926343493300611
```

C = 0.1 , Epsilon = 0.001 , Gamma = 0.1

In [23]:
```
svr = SVR(kernel='rbf', C=0.1, gamma=0.1, epsilon=0.001)
```

In [24]:
```
from sklearn.model_selection import cross_val_score
scores = cross_val_score(svr, X, y, cv=5, scoring='r2')
```

In [25]:
```
# Menampilkan hasil validasi silang
print('R-squared scores:', scores)
print('R-squared mean:', scores.mean())
print('R-squared std:', scores.std())
```

```
R-squared scores: [-2020.70749192 -2686.74131275    -3.30454679   -62.47459018
   -49.22014957]
R-squared mean: -964.4896182442253
R-squared std: 1153.8607497097312
```

In [26]:

```
svr.fit(X_train, y_train)
```

Out[26]:

```
SVR(C=0.1, epsilon=0.001, gamma=0.1)
```

In [27]:

```
y_pred = svr.predict(X_test)
```

In [28]:

```
mse = mean_squared_error(y_test, y_pred)
rmse = np.sqrt(mse)
mae = mean_absolute_error(y_test, y_pred)
r2 = r2_score(y_test, y_pred)

print("Mean Squared Error:", mse)
print("Root Mean Squared Error:", rmse)
print("Mean Absolute Error:", mae)
print("R-squared:", r2)
```

```
Mean Squared Error: 9785.974172187969
Root Mean Squared Error: 98.92408287261485
Mean Absolute Error: 89.76999943691114
R-squared: -0.049334504408443225
```

C = 0.1 , Epsilon = 0.0001 , Gamma = 0.1

In [29]:

```
svr = SVR(kernel='rbf', C=0.1, gamma=0.1, epsilon=0.0001)
```

In [30]:

```
from sklearn.model_selection import cross_val_score
scores = cross_val_score(svr, X, y, cv=5, scoring='r2')
```

In [31]:

```
# Menampilkan hasil validasi silang
print('R-squared scores:', scores)
print('R-squared mean:', scores.mean())
print('R-squared std:', scores.std())
```

```
R-squared scores: [-2020.72899234 -2686.7711975     -3.30454679   -62.47451504
   -49.22008458]
R-squared mean: -964.4998672507885
R-squared std: 1153.8736291596886
```

In [32]:

```
svr.fit(X_train, y_train)
```

Out[32]:

```
SVR(C=0.1, epsilon=0.0001, gamma=0.1)
```

In [33]:

```
y_pred = svr.predict(X_test)
```

In [34]:

```
mse = mean_squared_error(y_test, y_pred)
rmse = np.sqrt(mse)
mae = mean_absolute_error(y_test, y_pred)
r2 = r2_score(y_test, y_pred)

print("Mean Squared Error:", mse)
print("Root Mean Squared Error:", rmse)
print("Mean Absolute Error:", mae)
print("R-squared:", r2)
```

```
Mean Squared Error: 9786.040459681979
Root Mean Squared Error: 98.92441791429444
Mean Absolute Error: 89.77009766699963
R-squared: -0.04934161231139211
```

C = 0.1 , Epsilon = 0.1 , Gamma = 0.01

In [35]:

```
svr = SVR(kernel='rbf', C=0.1, gamma=0.01, epsilon=0.1)
```

In [36]:

```
from sklearn.model_selection import cross_val_score
scores = cross_val_score(svr, X, y, cv=5, scoring='r2')
```

In [37]:

```
# Menampilkan hasil validasi silang
print('R-squared scores:', scores)
print('R-squared mean:', scores.mean())
print('R-squared std:', scores.std())
```

```
R-squared scores: [-1.77839806e+03 -2.32726553e+03 -1.74466663e+00 -4.84142674e+01
 -3.68495161e+01]
R-squared mean: -838.5344070015005
R-squared std: 1006.6647507196483
```

In [38]:

```
svr.fit(X_train, y_train)
```

Out[38]:

```
SVR(C=0.1, gamma=0.01)
```

In [39]:

```python
y_pred = svr.predict(X_test)
```

In [40]:

```python
mse = mean_squared_error(y_test, y_pred)
rmse = np.sqrt(mse)
mae = mean_absolute_error(y_test, y_pred)
r2 = r2_score(y_test, y_pred)

print("Mean Squared Error:", mse)
print("Root Mean Squared Error:", rmse)
print("Mean Absolute Error:", mae)
print("R-squared:", r2)
```

```
Mean Squared Error: 7576.57624150215
Root Mean Squared Error: 87.0435307274593
Mean Absolute Error: 79.33478140357875
R-squared: 0.18757573486300294
```

C = 0.1 , Epsilon = 0.1 , Gamma = 0.001

In [41]:

```python
svr = SVR(kernel='rbf', C=0.1, gamma=0.001, epsilon=0.1)
```

In [42]:

```python
from sklearn.model_selection import cross_val_score
scores = cross_val_score(svr, X, y, cv=5, scoring='r2')
```

In [43]:

```python
# Menampilkan hasil validasi silang
print('R-squared scores:', scores)
print('R-squared mean:', scores.mean())
print('R-squared std:', scores.std())
```

```
R-squared scores: [-1.25758953e+03 -1.60899790e+03 -4.11705432e-01 -3.18808385e+01
 -2.21923125e+01]
R-squared mean: -584.2144578488567
R-squared std: 702.1940003715492
```

In [44]:

```python
svr.fit(X_train, y_train)
```

Out[44]:

```
SVR(C=0.1, gamma=0.001)
```

In [45]:

```python
y_pred = svr.predict(X_test)
```

In [46]:

```python
mse = mean_squared_error(y_test, y_pred)
rmse = np.sqrt(mse)
mae = mean_absolute_error(y_test, y_pred)
r2 = r2_score(y_test, y_pred)

print("Mean Squared Error:", mse)
print("Root Mean Squared Error:", rmse)
print("Mean Absolute Error:", mae)
print("R-squared:", r2)
```

```
Mean Squared Error: 4835.13255162105
Root Mean Squared Error: 69.5351173984847
Mean Absolute Error: 62.25300227266322
R-squared: 0.48153639785562374
```

C = 0.1 , Epsilon = 0.1 , Gamma = 0.0001

In [47]:

```python
svr = SVR(kernel='rbf', C=0.1, gamma=0.0001, epsilon=0.1)
```

In [48]:

```python
from sklearn.model_selection import cross_val_score
scores = cross_val_score(svr, X, y, cv=5, scoring='r2')
```

In [49]:

```python
# Menampilkan hasil validasi silang
print('R-squared scores:', scores)
print('R-squared mean:', scores.mean())
print('R-squared std:', scores.std())
```

```
R-squared scores: [-8.06830614e+02 -1.01010361e+03  5.08481788e-01 -1.87234389e+01
 -1.11283482e+01]
R-squared mean: -369.2555060137676
R-squared std: 444.97448615727114
```

In [50]:

```python
svr.fit(X_train, y_train)
```

Out[50]:

```
SVR(C=0.1, gamma=0.0001)
```

In [51]:

```python
y_pred = svr.predict(X_test)
```

In [52]:

```
mse = mean_squared_error(y_test, y_pred)
rmse = np.sqrt(mse)
mae = mean_absolute_error(y_test, y_pred)
r2 = r2_score(y_test, y_pred)

print("Mean Squared Error:", mse)
print("Root Mean Squared Error:", rmse)
print("Mean Absolute Error:", mae)
print("R-squared:", r2)
```

```
Mean Squared Error: 2548.3977677130915
Root Mean Squared Error: 50.4816577353903
Mean Absolute Error: 44.61614665642437
R-squared: 0.7267393453562616
```

C = 0.1 , Epsilon = 0.01 , Gamma = 0.01

In [53]:

```
svr = SVR(kernel='rbf', C=0.1, gamma=0.01, epsilon=0.01)
```

In [54]:

```
from sklearn.model_selection import cross_val_score
scores = cross_val_score(svr, X, y, cv=5, scoring='r2')
```

In [55]:

```
# Menampilkan hasil validasi silang
print('R-squared scores:', scores)
print('R-squared mean:', scores.mean())
print('R-squared std:', scores.std())
```

```
R-squared scores: [-1.77824595e+03 -2.32705541e+03 -1.74466663e+00 -4.84316221e+01
 -3.68642979e+01]
R-squared mean: -838.4683889066677
R-squared std: 1006.5691213614599
```

In [56]:

```
svr.fit(X_train, y_train)
```

Out[56]:

```
SVR(C=0.1, epsilon=0.01, gamma=0.01)
```

In [57]:

```
y_pred = svr.predict(X_test)
```

In [58]:

```
mse = mean_squared_error(y_test, y_pred)
rmse = np.sqrt(mse)
mae = mean_absolute_error(y_test, y_pred)
r2 = r2_score(y_test, y_pred)

print("Mean Squared Error:", mse)
print("Root Mean Squared Error:", rmse)
print("Mean Absolute Error:", mae)
print("R-squared:", r2)
```

```
Mean Squared Error: 7578.462023220843
Root Mean Squared Error: 87.05436245944739
Mean Absolute Error: 79.33743977652306
R-squared: 0.18737352547736708
```

C = 0.1 , Epsilon = 0.01 , Gamma = 0.001

In [59]:

```
svr = SVR(kernel='rbf', C=0.1, gamma=0.001, epsilon=0.01)
```

In [60]:

```
from sklearn.model_selection import cross_val_score
scores = cross_val_score(svr, X, y, cv=5, scoring='r2')
```

In [61]:

```
# Menampilkan hasil validasi silang
print('R-squared scores:', scores)
print('R-squared mean:', scores.mean())
print('R-squared std:', scores.std())
```

```
R-squared scores: [-1.25689351e+03 -1.60804812e+03 -4.11705432e-01 -3.18786175e+01
 -2.21904888e+01]
R-squared mean: -583.8844877810259
R-squared std: 701.7839272701302
```

In [62]:

```
svr.fit(X_train, y_train)
```

Out[62]:

```
SVR(C=0.1, epsilon=0.01, gamma=0.001)
```

In [63]:

```
y_pred = svr.predict(X_test)
```

In [64]:

```
mse = mean_squared_error(y_test, y_pred)
rmse = np.sqrt(mse)
mae = mean_absolute_error(y_test, y_pred)
r2 = r2_score(y_test, y_pred)

print("Mean Squared Error:", mse)
print("Root Mean Squared Error:", rmse)
print("Mean Absolute Error:", mae)
print("R-squared:", r2)
```

```
Mean Squared Error: 4831.369105627526
Root Mean Squared Error: 69.50805065334177
Mean Absolute Error: 62.24669590664343
R-squared: 0.48193994620625247
```

C = 0.1 , Epsilon = 0.01 , Gamma = 0.0001

In [65]:

```
svr = SVR(kernel='rbf', C=0.1, gamma=0.0001, epsilon=0.01)
```

In [66]:

```
from sklearn.model_selection import cross_val_score
scores = cross_val_score(svr, X, y, cv=5, scoring='r2')
```

In [67]:

```
# Menampilkan hasil validasi silang
print('R-squared scores:', scores)
print('R-squared mean:', scores.mean())
print('R-squared std:', scores.std())
```

```
R-squared scores: [-8.07065229e+02 -1.01029381e+03  5.08481788e-01 -1.87435657e+01
 -1.11445000e+01]
R-squared mean: -369.34772460692795
R-squared std: 445.06964353515224
```

In [68]:

```
svr.fit(X_train, y_train)
```

Out[68]:

```
SVR(C=0.1, epsilon=0.01, gamma=0.0001)
```

In [69]:

```
y_pred = svr.predict(X_test)
```

In [70]:

```
mse = mean_squared_error(y_test, y_pred)
rmse = np.sqrt(mse)
mae = mean_absolute_error(y_test, y_pred)
r2 = r2_score(y_test, y_pred)

print("Mean Squared Error:", mse)
print("Root Mean Squared Error:", rmse)
print("Mean Absolute Error:", mae)
print("R-squared:", r2)
```

```
Mean Squared Error: 2549.420564015889
Root Mean Squared Error: 50.49178709469381
Mean Absolute Error: 44.61553151439951
R-squared: 0.7266296725293543
```

C = 0.1 , Epsilon = 0.001 , Gamma = 0.01

In [71]:

```
svr = SVR(kernel='rbf', C=0.1, gamma=0.01, epsilon=0.001)
```

In [72]:

```
from sklearn.model_selection import cross_val_score
scores = cross_val_score(svr, X, y, cv=5, scoring='r2')
```

In [73]:

```
# Menampilkan hasil validasi silang
print('R-squared scores:', scores)
print('R-squared mean:', scores.mean())
print('R-squared std:', scores.std())
```

```
R-squared scores: [-1.77844727e+03 -2.32733351e+03 -1.74466663e+00 -4.84298775e+01
 -3.68628119e+01]
R-squared mean: -838.5636266878976
R-squared std: 1006.6894787517568
```

In [74]:

```
svr.fit(X_train, y_train)
```

Out[74]:

```
SVR(C=0.1, epsilon=0.001, gamma=0.01)
```

In [75]:

```
y_pred = svr.predict(X_test)
```

In [76]:

```
mse = mean_squared_error(y_test, y_pred)
rmse = np.sqrt(mse)
mae = mean_absolute_error(y_test, y_pred)
r2 = r2_score(y_test, y_pred)

print("Mean Squared Error:", mse)
print("Root Mean Squared Error:", rmse)
print("Mean Absolute Error:", mae)
print("R-squared:", r2)
```

```
Mean Squared Error: 7579.00104709407
Root Mean Squared Error: 87.05745830825794
Mean Absolute Error: 79.3382666407961
R-squared: 0.1873157268015352
```

C = 0.1 , Epsilon = 0.001 , Gamma = 0.001

In [77]:
```
svr = SVR(kernel='rbf', C=0.1, gamma=0.001, epsilon=0.001)
```

In [78]:
```
from sklearn.model_selection import cross_val_score
scores = cross_val_score(svr, X, y, cv=5, scoring='r2')
```

In [79]:
```
# Menampilkan hasil validasi silang
print('R-squared scores:', scores)
print('R-squared mean:', scores.mean())
print('R-squared std:', scores.std())
```

```
R-squared scores: [-1.25689351e+03 -1.60804812e+03 -4.11705432e-01 -3.18772736e+01
 -2.21893853e+01]
R-squared mean: -583.8839982863731
R-squared std: 701.7843153415885
```

In [80]:
```
svr.fit(X_train, y_train)
```

Out[80]:
```
SVR(C=0.1, epsilon=0.001, gamma=0.001)
```

In [81]:
```
y_pred = svr.predict(X_test)
```

In [82]:
```
mse = mean_squared_error(y_test, y_pred)
rmse = np.sqrt(mse)
mae = mean_absolute_error(y_test, y_pred)
r2 = r2_score(y_test, y_pred)

print("Mean Squared Error:", mse)
print("Root Mean Squared Error:", rmse)
print("Mean Absolute Error:", mae)
print("R-squared:", r2)
```

```
Mean Squared Error: 4831.369105627526
Root Mean Squared Error: 69.50805065334177
Mean Absolute Error: 62.24669590664343
R-squared: 0.48193994620625247
```

C = 0.1 , Epsilon = 0.001 , Gamma = 0.0001

In [83]:
```
svr = SVR(kernel='rbf', C=0.1, gamma=0.0001, epsilon=0.001)
```

In [84]:
```
from sklearn.model_selection import cross_val_score
scores = cross_val_score(svr, X, y, cv=5, scoring='r2')
```

In [85]:
```
# Menampilkan hasil validasi silang
print('R-squared scores:', scores)
print('R-squared mean:', scores.mean())
print('R-squared std:', scores.std())
```

```
R-squared scores: [-8.07000839e+02 -1.01011058e+03  5.08481788e-01 -1.87439764e+01
 -1.11445000e+01]
R-squared mean: -369.29828193619113
R-squared std: 445.0041393084436
```

In [86]:
```
svr.fit(X_train, y_train)
```

Out[86]:
```
SVR(C=0.1, epsilon=0.001, gamma=0.0001)
```

In [87]:
```
y_pred = svr.predict(X_test)
```

In [88]:
```
mse = mean_squared_error(y_test, y_pred)
rmse = np.sqrt(mse)
mae = mean_absolute_error(y_test, y_pred)
r2 = r2_score(y_test, y_pred)

print("Mean Squared Error:", mse)
print("Root Mean Squared Error:", rmse)
print("Mean Absolute Error:", mae)
print("R-squared:", r2)
```

```
Mean Squared Error: 2549.4205640158875
Root Mean Squared Error: 50.4917870946938
Mean Absolute Error: 44.6155315143995
R-squared: 0.7266296725293544
```

C = 0.1 , Epsilon = 0.0001 , Gamma = 0.01

C = 0.1 , Epsilon = 0.0001 , Gamma = 0.01

In [89]:

```
svr = SVR(kernel='rbf', C=0.1, gamma=0.01, epsilon=0.0001)
```

In [90]:

```
from sklearn.model_selection import cross_val_score
scores = cross_val_score(svr, X, y, cv=5, scoring='r2')
```

In [91]:

```
# Menampilkan hasil validasi silang
print('R-squared scores:', scores)
print('R-squared mean:', scores.mean())
print('R-squared std:', scores.std())
```

```
R-squared scores: [-1.77846740e+03 -2.32736132e+03 -1.74466749e+00 -4.84298775e+01
 -3.68628119e+01]
R-squared mean: -838.5732155576504
R-squared std: 1006.7014636833238
```

In [92]:

```
svr.fit(X_train, y_train)
```

Out[92]:

```
SVR(C=0.1, epsilon=0.0001, gamma=0.01)
```

In [93]:

```
y_pred = svr.predict(X_test)
```

In [94]:

```
mse = mean_squared_error(y_test, y_pred)
rmse = np.sqrt(mse)
mae = mean_absolute_error(y_test, y_pred)
r2 = r2_score(y_test, y_pred)

print("Mean Squared Error:", mse)
print("Root Mean Squared Error:", rmse)
print("Mean Absolute Error:", mae)
print("R-squared:", r2)
```

```
Mean Squared Error: 7579.054950984987
Root Mean Squared Error: 87.0577678957196
Mean Absolute Error: 79.33834894168106
R-squared: 0.18730994677272395
```

C = 0.1 , Epsilon = 0.0001 , Gamma = 0.001

In [95]:

```
svr = SVR(kernel='rbf', C=0.1, gamma=0.001, epsilon=0.0001)
```

In [96]:

```
from sklearn.model_selection import cross_val_score
scores = cross_val_score(svr, X, y, cv=5, scoring='r2')
```

In [97]:

```
# Menampilkan hasil validasi silang
print('R-squared scores:', scores)
print('R-squared mean:', scores.mean())
print('R-squared std:', scores.std())
```

```
R-squared scores: [-1.25689351e+03 -1.60804812e+03 -4.11705432e-01 -3.18772736e+01
 -2.21893853e+01]
R-squared mean: -583.8839982863727
R-squared std: 701.7843153415881
```

In [98]:

```
svr.fit(X_train, y_train)
```

Out[98]:

```
SVR(C=0.1, epsilon=0.0001, gamma=0.001)
```

In [99]:

```
y_pred = svr.predict(X_test)
```

In [100…

```
mse = mean_squared_error(y_test, y_pred)
rmse = np.sqrt(mse)
mae = mean_absolute_error(y_test, y_pred)
r2 = r2_score(y_test, y_pred)

print("Mean Squared Error:", mse)
print("Root Mean Squared Error:", rmse)
print("Mean Absolute Error:", mae)
print("R-squared:", r2)
```

```
Mean Squared Error: 4831.369105627526
Root Mean Squared Error: 69.50805065334177
Mean Absolute Error: 62.24669590664343
R-squared: 0.48193994620625247
```

C = 0.1 , Epsilon = 0.0001 , Gamma = 0.0001

In [101…

```
svr = SVR(kernel='rbf', C=0.1, gamma=0.0001, epsilon=0.0001)
```

In [102…

```
from sklearn.model_selection import cross_val_score
```

In [102…

```
from sklearn.model_selection import cross_val_score
scores = cross_val_score(svr, X, y, cv=5, scoring='r2')
```

In [103…

```
# Menampilkan hasil validasi silang
print('R-squared scores:', scores)
print('R-squared mean:', scores.mean())
print('R-squared std:', scores.std())
```

```
R-squared scores: [-8.07000839e+02 -1.01009225e+03  5.08481788e-01 -1.87439764e+01
 -1.11445000e+01]
R-squared mean: -369.2946174458489
R-squared std: 444.9988624192593
```

In [104…

```
svr.fit(X_train, y_train)
```

Out[104]:

```
SVR(C=0.1, epsilon=0.0001, gamma=0.0001)
```

In [105…

```
y_pred = svr.predict(X_test)
```

In [106…

```
mse = mean_squared_error(y_test, y_pred)
rmse = np.sqrt(mse)
mae = mean_absolute_error(y_test, y_pred)
r2 = r2_score(y_test, y_pred)

print("Mean Squared Error:", mse)
print("Root Mean Squared Error:", rmse)
print("Mean Absolute Error:", mae)
print("R-squared:", r2)
```

```
Mean Squared Error: 2549.420564015889
Root Mean Squared Error: 50.49178709469381
Mean Absolute Error: 44.61553151439951
R-squared: 0.7266296725293542
```

C = 1 , Epsilon = 0.1 , Gamma = 0.1

In [107…

```
svr = SVR(kernel='rbf', C=1, gamma=0.1, epsilon=0.1)
```

In [108…

```
from sklearn.model_selection import cross_val_score
scores = cross_val_score(svr, X, y, cv=5, scoring='r2')
```

In [109…

```
# Menampilkan hasil validasi silang
print('R-squared scores:', scores)
print('R-squared mean:', scores.mean())
print('R-squared std:', scores.std())
```

```
R-squared scores: [-1.41733308e+03 -1.71915004e+03 -2.73084636e-02 -2.16727341e+01
 -1.44619579e+01]
R-squared mean: -634.5290223389621
R-squared std: 768.3558222571648
```

In [110…

```
svr.fit(X_train, y_train)
```

Out[110]:

```
SVR(C=1, gamma=0.1)
```

In [111…

```
y_pred = svr.predict(X_test)
```

In [112…

```
mse = mean_squared_error(y_test, y_pred)
rmse = np.sqrt(mse)
mae = mean_absolute_error(y_test, y_pred)
r2 = r2_score(y_test, y_pred)

print("Mean Squared Error:", mse)
print("Root Mean Squared Error:", rmse)
print("Mean Absolute Error:", mae)
print("R-squared:", r2)
```

```
Mean Squared Error: 3115.928738412167
Root Mean Squared Error: 55.82050464132483
Mean Absolute Error: 46.65183009000264
R-squared: 0.6658838986325751
```

C = 1 , Epsilon = 0.01 , Gamma = 0.1

In [113…

```
svr = SVR(kernel='rbf', C=1, gamma=0.1, epsilon=0.01)
```

In [114…

```
from sklearn.model_selection import cross_val_score
scores = cross_val_score(svr, X, y, cv=5, scoring='r2')
```

In [115…

```
# Menampilkan hasil validasi silang
print('R-squared scores:', scores)
print('R-squared mean:', scores.mean())
print('R-squared std:', scores.std())
```

```
R-squared scores: [-1.41811134e+03 -1.72020837e+03 -2.76727668e-02 -2.16767049e+01
 -1.44651427e+01]
R-squared mean: -634.8978462234617
R-squared std: 768.8119873003299
```

In [116…
```
svr.fit(X_train, y_train)
```

Out[116]:
```
SVR(C=1, epsilon=0.01, gamma=0.1)
```

In [117…
```
y_pred = svr.predict(X_test)
```

In [118…
```
mse = mean_squared_error(y_test, y_pred)
rmse = np.sqrt(mse)
mae = mean_absolute_error(y_test, y_pred)
r2 = r2_score(y_test, y_pred)

print("Mean Squared Error:", mse)
print("Root Mean Squared Error:", rmse)
print("Mean Absolute Error:", mae)
print("R-squared:", r2)
```

```
Mean Squared Error: 3115.866782113317
Root Mean Squared Error: 55.81994967852727
Mean Absolute Error: 46.64615551051413
R-squared: 0.6658905421083299
```

C = 1 , Epsilon = 0.001 , Gamma = 0.1

In [119…
```
svr = SVR(kernel='rbf', C=1, gamma=0.1, epsilon=0.001)
```

In [120…
```
from sklearn.model_selection import cross_val_score
scores = cross_val_score(svr, X, y, cv=5, scoring='r2')
```

In [121…
```
# Menampilkan hasil validasi silang
print('R-squared scores:', scores)
print('R-squared mean:', scores.mean())
print('R-squared std:', scores.std())
```

```
R-squared scores: [-1.41816993e+03 -1.72028806e+03 -2.76655942e-02 -2.16760102e+01
 -1.44645855e+01]
R-squared mean: -634.9252503944748
R-squared std: 768.8466254775408
```

In [122…
```
svr.fit(X_train, y_train)
```

Out[122]:
```
SVR(C=1, epsilon=0.001, gamma=0.1)
```

In [123…
```
y_pred = svr.predict(X_test)
```

In [124…
```
mse = mean_squared_error(y_test, y_pred)
rmse = np.sqrt(mse)
mae = mean_absolute_error(y_test, y_pred)
r2 = r2_score(y_test, y_pred)

print("Mean Squared Error:", mse)
print("Root Mean Squared Error:", rmse)
print("Mean Absolute Error:", mae)
print("R-squared:", r2)
```

```
Mean Squared Error: 3115.8998650388207
Root Mean Squared Error: 55.82024601377909
Mean Absolute Error: 46.647433054246534
R-squared: 0.6658869946786486
```

C = 1 , Epsilon = 0.0001 , Gamma = 0.1

In [125…
```
svr = SVR(kernel='rbf', C=1, gamma=0.1, epsilon=0.0001)
```

In [126…
```
from sklearn.model_selection import cross_val_score
scores = cross_val_score(svr, X, y, cv=5, scoring='r2')
```

In [127…
```
# Menampilkan hasil validasi silang
print('R-squared scores:', scores)
print('R-squared mean:', scores.mean())
print('R-squared std:', scores.std())
```

```
R-squared scores: [-1.41817699e+03 -1.72029766e+03 -2.76649113e-02 -2.16759750e+01
 -1.44645572e+01]
R-squared mean: -634.9285709196472
R-squared std: 768.8507863454987
```

In [128…
```
svr.fit(X_train, y_train)
```
Out[128]:
```
SVR(C=1, epsilon=0.0001, gamma=0.1)
```

In [129…
```
y_pred = svr.predict(X_test)
```

In [130…
```
mse = mean_squared_error(y_test, y_pred)
rmse = np.sqrt(mse)
mae = mean_absolute_error(y_test, y_pred)
r2 = r2_score(y_test, y_pred)

print("Mean Squared Error:", mse)
print("Root Mean Squared Error:", rmse)
print("Mean Absolute Error:", mae)
print("R-squared:", r2)
```
```
Mean Squared Error: 3115.903160822177
Root Mean Squared Error: 55.82027553516891
Mean Absolute Error: 46.647562404384026
R-squared: 0.6658866412770215
```

C = 1 , Epsilon = 0.1 , Gamma = 0.01

In [131…
```
svr = SVR(kernel='rbf', C=1, gamma=0.01, epsilon=0.1)
```

In [132…
```
from sklearn.model_selection import cross_val_score
scores = cross_val_score(svr, X, y, cv=5, scoring='r2')
```

In [133…
```
# Menampilkan hasil validasi silang
print('R-squared scores:', scores)
print('R-squared mean:', scores.mean())
print('R-squared std:', scores.std())
```
```
R-squared scores: [-5.87905151e+02 -3.46730887e+02  1.54369791e-01 -5.16348684e+00
 -2.25047693e-01]
R-squared mean: -187.97404061348686
R-squared std: 240.50376758602658
```

In [134…
```
svr.fit(X_train, y_train)
```
Out[134]:
```
SVR(C=1, gamma=0.01)
```

In [135…
```
y_pred = svr.predict(X_test)
```

In [136…
```
mse = mean_squared_error(y_test, y_pred)
rmse = np.sqrt(mse)
mae = mean_absolute_error(y_test, y_pred)
r2 = r2_score(y_test, y_pred)

print("Mean Squared Error:", mse)
print("Root Mean Squared Error:", rmse)
print("Mean Absolute Error:", mae)
print("R-squared:", r2)
```
```
Mean Squared Error: 741.1941038872787
Root Mean Squared Error: 27.224880236417548
Mean Absolute Error: 13.982137785079981
R-squared: 0.920522930677312
```

C = 1 , Epsilon = 0.1 , Gamma = 0.001

In [137…
```
svr = SVR(kernel='rbf', C=1, gamma=0.001, epsilon=0.1)
```

In [138…
```
from sklearn.model_selection import cross_val_score
scores = cross_val_score(svr, X, y, cv=5, scoring='r2')
```

In [139…
```
# Menampilkan hasil validasi silang
print('R-squared scores:', scores)
print('R-squared mean:', scores.mean())
print('R-squared std:', scores.std())
```
```
R-squared scores: [-49.89318586  -8.32141376   0.66116131  -1.78139135   0.77185111]
R-squared mean: -11.71259571217712
R-squared std: 19.374507347142913
```

In [140…
```
svr.fit(X_train, y_train)
```
Out[140]:
```
SVR(C=1, gamma=0.001)
```

In [141…
```
y_pred = svr.predict(X_test)
```

In [142…

```
mse = mean_squared_error(y_test, y_pred)
rmse = np.sqrt(mse)
mae = mean_absolute_error(y_test, y_pred)
r2 = r2_score(y_test, y_pred)

print("Mean Squared Error:", mse)
print("Root Mean Squared Error:", rmse)
print("Mean Absolute Error:", mae)
print("R-squared:", r2)
```

```
Mean Squared Error: 182.76205399167696
Root Mean Squared Error: 13.518951660231535
Mean Absolute Error: 5.723994619769737
R-squared: 0.9804027145406672
```

C = 1 , Epsilon = 0.1 , Gamma = 0.0001

In [143…

```
svr = SVR(kernel='rbf', C=1, gamma=0.0001, epsilon=0.1)
```

In [144…

```
from sklearn.model_selection import cross_val_score
scores = cross_val_score(svr, X, y, cv=5, scoring='r2')
```

In [145…

```
# Menampilkan hasil validasi silang
print('R-squared scores:', scores)
print('R-squared mean:', scores.mean())
print('R-squared std:', scores.std())
```

```
R-squared scores: [-4.05330594  0.70054172  0.93959371  0.09328926  0.92864236]
R-squared mean: -0.27824777539987283
R-squared std: 1.9124253980903627
```

In [146…

```
svr.fit(X_train, y_train)
```

Out[146]:

```
SVR(C=1, gamma=0.0001)
```

In [147…

```
y_pred = svr.predict(X_test)
```

In [148…

```
mse = mean_squared_error(y_test, y_pred)
rmse = np.sqrt(mse)
mae = mean_absolute_error(y_test, y_pred)
r2 = r2_score(y_test, y_pred)

print("Mean Squared Error:", mse)
print("Root Mean Squared Error:", rmse)
print("Mean Absolute Error:", mae)
print("R-squared:", r2)
```

```
Mean Squared Error: 38.83615023859141
Root Mean Squared Error: 6.231865710891997
Mean Absolute Error: 3.1107459272957545
R-squared: 0.9958356611465864
```

C = 1 , Epsilon = 0.01 , Gamma = 0.01

In [149…

```
svr = SVR(kernel='rbf', C=1, gamma=0.01, epsilon=0.01)
```

In [150…

```
from sklearn.model_selection import cross_val_score
scores = cross_val_score(svr, X, y, cv=5, scoring='r2')
```

In [151…

```
# Menampilkan hasil validasi silang
print('R-squared scores:', scores)
print('R-squared mean:', scores.mean())
print('R-squared std:', scores.std())
```

```
R-squared scores: [-5.87901944e+02 -3.46439910e+02  1.53713609e-01 -5.16461121e+00
 -2.24893379e-01]
R-squared mean: -187.91552888608052
R-squared std: 240.46406129242695
```

In [152…

```
svr.fit(X_train, y_train)
```

Out[152]:

```
SVR(C=1, epsilon=0.01, gamma=0.01)
```

In [153…

```
y_pred = svr.predict(X_test)
```

In [154…

```
mse = mean_squared_error(y_test, y_pred)
rmse = np.sqrt(mse)
mae = mean_absolute_error(y_test, y_pred)
r2 = r2_score(y_test, y_pred)

print("Mean Squared Error:", mse)
print("Root Mean Squared Error:", rmse)
print("Mean Absolute Error:", mae)
print("R-squared:", r2)
```

```
Mean Squared Error: 741.4947150211656
Root Mean Squared Error: 27.230400566667498
Mean Absolute Error: 13.985534221284254
R-squared: 0.9204906966217498
```

C = 1 , Epsilon = 0.01 , Gamma = 0.001

In [155…
```
svr = SVR(kernel='rbf', C=1, gamma=0.001, epsilon=0.01)
```

In [156…
```
from sklearn.model_selection import cross_val_score
scores = cross_val_score(svr, X, y, cv=5, scoring='r2')
```

In [157…
```
# Menampilkan hasil validasi silang
print('R-squared scores:', scores)
print('R-squared mean:', scores.mean())
print('R-squared std:', scores.std())
```

```
R-squared scores: [-49.56682404  -8.23790372   0.66087281  -1.78264359   0.77162529]
R-squared mean: -11.630974651614945
R-squared std: 19.248611500647957
```

In [158…
```
svr.fit(X_train, y_train)
```

Out[158]:
```
SVR(C=1, epsilon=0.01, gamma=0.001)
```

In [159…
```
y_pred = svr.predict(X_test)
```

In [160…
```
mse = mean_squared_error(y_test, y_pred)
rmse = np.sqrt(mse)
mae = mean_absolute_error(y_test, y_pred)
r2 = r2_score(y_test, y_pred)

print("Mean Squared Error:", mse)
print("Root Mean Squared Error:", rmse)
print("Mean Absolute Error:", mae)
print("R-squared:", r2)
```

```
Mean Squared Error: 182.82516642013775
Root Mean Squared Error: 13.521285679259119
Mean Absolute Error: 5.727556473525405
R-squared: 0.9803959470949662
```

C = 1 , Epsilon = 0.01 , Gamma = 0.0001

In [161…
```
svr = SVR(kernel='rbf', C=1, gamma=0.0001, epsilon=0.01)
```

In [162…
```
from sklearn.model_selection import cross_val_score
scores = cross_val_score(svr, X, y, cv=5, scoring='r2')
```

In [163…
```
# Menampilkan hasil validasi silang
print('R-squared scores:', scores)
print('R-squared mean:', scores.mean())
print('R-squared std:', scores.std())
```

```
R-squared scores: [-4.02765314  0.70032896  0.93921423  0.09026825  0.92837553]
R-squared mean: -0.2738932322759272
R-squared std: 1.902078642232936
```

In [164…
```
svr.fit(X_train, y_train)
```

Out[164]:
```
SVR(C=1, epsilon=0.01, gamma=0.0001)
```

In [165…
```
y_pred = svr.predict(X_test)
```

In [166…
```
mse = mean_squared_error(y_test, y_pred)
rmse = np.sqrt(mse)
mae = mean_absolute_error(y_test, y_pred)
r2 = r2_score(y_test, y_pred)

print("Mean Squared Error:", mse)
print("Root Mean Squared Error:", rmse)
print("Mean Absolute Error:", mae)
print("R-squared:", r2)
```

```
Mean Squared Error: 38.82746626320429
Root Mean Squared Error: 6.231168932327569
Mean Absolute Error: 3.1085548511122325
R-squared: 0.9958365923155073
```

C = 1 , Epsilon = 0.001 , Gamma = 0.01

In [167…

```
svr = SVR(kernel='rbf', C=1, gamma=0.01, epsilon=0.001)
```

In [168…

```
from sklearn.model_selection import cross_val_score
scores = cross_val_score(svr, X, y, cv=5, scoring='r2')
```

In [169…

```
# Menampilkan hasil validasi silang
print('R-squared scores:', scores)
print('R-squared mean:', scores.mean())
print('R-squared std:', scores.std())
```

```
R-squared scores: [-5.87831399e+02 -3.46315047e+02  1.53672156e-01 -5.16499701e+00
 -2.24752948e-01]
R-squared mean: -187.87650473334833
R-squared std: 240.4240885065563
```

In [170…

```
svr.fit(X_train, y_train)
```

Out[170]:

```
SVR(C=1, epsilon=0.001, gamma=0.01)
```

In [171…

```
y_pred = svr.predict(X_test)
```

C = 1 , Epsilon = 0.001 , Gamma = 0.01

In [172…

```
svr = SVR(kernel='rbf', C=1, gamma=0.01, epsilon=0.001)
```

In [173…

```
from sklearn.model_selection import cross_val_score
scores = cross_val_score(svr, X, y, cv=5, scoring='r2')
```

In [174…

```
# Menampilkan hasil validasi silang
print('R-squared scores:', scores)
print('R-squared mean:', scores.mean())
print('R-squared std:', scores.std())
```

```
R-squared scores: [-5.87831399e+02 -3.46315047e+02  1.53672156e-01 -5.16499701e+00
 -2.24752948e-01]
R-squared mean: -187.87650473334833
R-squared std: 240.4240885065563
```

In [175…

```
svr.fit(X_train, y_train)
```

Out[175]:

```
SVR(C=1, epsilon=0.001, gamma=0.01)
```

In [176…

```
y_pred = svr.predict(X_test)
```

In [177…

```
mse = mean_squared_error(y_test, y_pred)
rmse = np.sqrt(mse)
mae = mean_absolute_error(y_test, y_pred)
r2 = r2_score(y_test, y_pred)

print("Mean Squared Error:", mse)
print("Root Mean Squared Error:", rmse)
print("Mean Absolute Error:", mae)
print("R-squared:", r2)
```

```
Mean Squared Error: 741.4545832722796
Root Mean Squared Error: 27.229663664325336
Mean Absolute Error: 13.985415832557267
R-squared: 0.9204949998855932
```

In [178…

```
mse = mean_squared_error(y_test, y_pred)
rmse = np.sqrt(mse)
mae = mean_absolute_error(y_test, y_pred)
r2 = r2_score(y_test, y_pred)

print("Mean Squared Error:", mse)
print("Root Mean Squared Error:", rmse)
print("Mean Absolute Error:", mae)
print("R-squared:", r2)
```

```
Mean Squared Error: 741.4545832722796
Root Mean Squared Error: 27.229663664325336
Mean Absolute Error: 13.985415832557267
R-squared: 0.9204949998855932
```

C = 1 , Epsilon = 0.001 , Gamma = 0.001

In [179…

```
svr = SVR(kernel='rbf', C=1, gamma=0.001, epsilon=0.001)
```

In [180…

```
from sklearn.model_selection import cross_val_score
scores = cross_val_score(svr, X, y, cv=5, scoring='r2')
```

In [181…

```
# Menampilkan hasil validasi silang
print('R-squared scores:', scores)
print('R-squared mean:', scores.mean())
print('R-squared std:', scores.std())
```

```
R-squared scores: [-49.56715056  -8.25617835   0.66094925  -1.78233726   0.77155577]
R-squared mean: -11.634632229647334
R-squared std: 19.248129457175207
```

In [182…

```
svr.fit(X_train, y_train)
```

Out[182]:

```
SVR(C=1, epsilon=0.001, gamma=0.001)
```

In [183…

```
y_pred = svr.predict(X_test)
```

In [184…

```
mse = mean_squared_error(y_test, y_pred)
rmse = np.sqrt(mse)
mae = mean_absolute_error(y_test, y_pred)
r2 = r2_score(y_test, y_pred)

print("Mean Squared Error:", mse)
print("Root Mean Squared Error:", rmse)
print("Mean Absolute Error:", mae)
print("R-squared:", r2)
```

```
Mean Squared Error: 182.79947123645465
Root Mean Squared Error: 13.520335470558955
Mean Absolute Error: 5.727464023723256
R-squared: 0.9803987023487981
```

C = 1 , Epsilon = 0.001 , Gamma = 0.0001

In [185…

```
svr = SVR(kernel='rbf', C=1, gamma=0.0001, epsilon=0.001)
```

In [186…

```
from sklearn.model_selection import cross_val_score
scores = cross_val_score(svr, X, y, cv=5, scoring='r2')
```

In [187…

```
# Menampilkan hasil validasi silang
print('R-squared scores:', scores)
print('R-squared mean:', scores.mean())
print('R-squared std:', scores.std())
```

```
R-squared scores: [-4.03600803  0.70024465  0.93913663  0.09072434  0.92832333]
R-squared mean: -0.27551581601006764
R-squared std: 1.9053687960508894
```

In [188…

```
svr.fit(X_train, y_train)
```

Out[188]:

```
SVR(C=1, epsilon=0.001, gamma=0.0001)
```

In [189…

```
y_pred = svr.predict(X_test)
```

In [190…

```
mse = mean_squared_error(y_test, y_pred)
rmse = np.sqrt(mse)
mae = mean_absolute_error(y_test, y_pred)
r2 = r2_score(y_test, y_pred)

print("Mean Squared Error:", mse)
print("Root Mean Squared Error:", rmse)
print("Mean Absolute Error:", mae)
print("R-squared:", r2)
```

```
Mean Squared Error: 38.90382732650471
Root Mean Squared Error: 6.237293269239848
Mean Absolute Error: 3.109878984468498
R-squared: 0.9958284042396852
```

C = 1 , Epsilon = 0.0001 , Gamma = 0.01

In [191…

```
svr = SVR(kernel='rbf', C=1, gamma=0.01, epsilon=0.0001)
```

In [192…

```
from sklearn.model_selection import cross_val_score
scores = cross_val_score(svr, X, y, cv=5, scoring='r2')
```

In [193…

```
# Menampilkan hasil validasi silang
print('R-squared scores:', scores)
print('R-squared mean:', scores.mean())
print('R-squared std:', scores.std())
```

```
R-squared scores: [-5.87825678e+02 -3.46302438e+02  1.53670161e-01 -5.16508113e+00
 -2.24748602e-01]
R-squared mean: -187.87285517434216
R-squared std: 240.42051083438238
```

In [194…

```
svr.fit(X_train, y_train)
```

Out[194]:

```
SVR(C=1, epsilon=0.0001, gamma=0.01)
```

In [195…

```
y_pred = svr.predict(X_test)
```

In [196…

```
mse = mean_squared_error(y_test, y_pred)
rmse = np.sqrt(mse)
mae = mean_absolute_error(y_test, y_pred)
r2 = r2_score(y_test, y_pred)

print("Mean Squared Error:", mse)
print("Root Mean Squared Error:", rmse)
print("Mean Absolute Error:", mae)
print("R-squared:", r2)
```

```
Mean Squared Error: 741.4407753078965
Root Mean Squared Error: 27.229410116781754
Mean Absolute Error: 13.985395039852294
R-squared: 0.920496480491735
```

C = 1 , Epsilon = 0.0001 , Gamma = 0.001

In [197…

```
svr = SVR(kernel='rbf', C=1, gamma=0.001, epsilon=0.0001)
```

In [198…

```
from sklearn.model_selection import cross_val_score
scores = cross_val_score(svr, X, y, cv=5, scoring='r2')
```

In [199…

```
# Menampilkan hasil validasi silang
print('R-squared scores:', scores)
print('R-squared mean:', scores.mean())
print('R-squared std:', scores.std())
```

```
R-squared scores: [-49.55786204  -8.25151954   0.66094538  -1.78222591   0.77154004]
R-squared mean: -11.63182441353666
R-squared std: 19.244640920625887
```

In [200…

```
svr.fit(X_train, y_train)
```

Out[200]:

```
SVR(C=1, epsilon=0.0001, gamma=0.001)
```

In [201…

```
y_pred = svr.predict(X_test)
```

In [202…

```
mse = mean_squared_error(y_test, y_pred)
rmse = np.sqrt(mse)
mae = mean_absolute_error(y_test, y_pred)
r2 = r2_score(y_test, y_pred)

print("Mean Squared Error:", mse)
print("Root Mean Squared Error:", rmse)
print("Mean Absolute Error:", mae)
print("R-squared:", r2)
```

```
Mean Squared Error: 182.79846095733873
Root Mean Squared Error: 13.52029810904104
Mean Absolute Error: 5.727515103465411
R-squared: 0.9803988106794269
```

C = 1 , Epsilon = 0.0001 , Gamma = 0.0001

In [203…

```
svr = SVR(kernel='rbf', C=1, gamma=0.0001, epsilon=0.0001)
```

In [204…

```
from sklearn.model_selection import cross_val_score
scores = cross_val_score(svr, X, y, cv=5, scoring='r2')
```

In [205…

```
# Menampilkan hasil validasi silang
print('R-squared scores:', scores)
print('R-squared mean:', scores.mean())
print('R-squared std:', scores.std())
```

```
R-squared scores: [-4.03744063  0.70017422  0.93912643  0.09070414  0.92831405]
R-squared mean: -0.27582435804590333
R-squared std: 1.905923822971147
```

In [206…

```
svr.fit(X_train, y_train)
```

Out[206]:
```
SVR(C=1, epsilon=0.0001, gamma=0.0001)
```

In [207…
```python
y_pred = svr.predict(X_test)
```

In [208…
```python
mse = mean_squared_error(y_test, y_pred)
rmse = np.sqrt(mse)
mae = mean_absolute_error(y_test, y_pred)
r2 = r2_score(y_test, y_pred)

print("Mean Squared Error:", mse)
print("Root Mean Squared Error:", rmse)
print("Mean Absolute Error:", mae)
print("R-squared:", r2)
```

```
Mean Squared Error: 38.90759830455955
Root Mean Squared Error: 6.237595554743795
Mean Absolute Error: 3.1100533373413217
R-squared: 0.9958279998836835
```

C = 10 , Epsilon = 0.1 , Gamma = 0.1

In [209…
```python
svr = SVR(kernel='rbf', C=10, gamma=0.1, epsilon=0.1)
```

In [210…
```python
from sklearn.model_selection import cross_val_score
scores = cross_val_score(svr, X, y, cv=5, scoring='r2')
```

In [211…
```python
# Menampilkan hasil validasi silang
print('R-squared scores:', scores)
print('R-squared mean:', scores.mean())
print('R-squared std:', scores.std())
```

```
R-squared scores: [-1.05031499e+03 -1.34444692e+02 -4.29959723e-01 -2.86932334e+00
  4.19898943e-01]
R-squared mean: -237.52781310430424
R-squared std: 409.6701690006602
```

In [212…
```python
svr.fit(X_train, y_train)
```

Out[212]:
```
SVR(C=10, gamma=0.1)
```

In [213…
```python
y_pred = svr.predict(X_test)
```

In [214…
```python
mse = mean_squared_error(y_test, y_pred)
rmse = np.sqrt(mse)
mae = mean_absolute_error(y_test, y_pred)
r2 = r2_score(y_test, y_pred)

print("Mean Squared Error:", mse)
print("Root Mean Squared Error:", rmse)
print("Mean Absolute Error:", mae)
print("R-squared:", r2)
```

```
Mean Squared Error: 593.5526798803174
Root Mean Squared Error: 24.36293660214871
Mean Absolute Error: 10.931244296627888
R-squared: 0.9363542866327368
```

C = 10 , Epsilon = 0.01 , Gamma = 0.1

In [215…
```python
svr = SVR(kernel='rbf', C=10, gamma=0.1, epsilon=0.01)
```

In [216…
```python
from sklearn.model_selection import cross_val_score
scores = cross_val_score(svr, X, y, cv=5, scoring='r2')
```

In [217…
```python
# Menampilkan hasil validasi silang
print('R-squared scores:', scores)
print('R-squared mean:', scores.mean())
print('R-squared std:', scores.std())
```

```
R-squared scores: [-1.05060559e+03 -1.34502140e+02 -4.30287369e-01 -2.86937251e+00
  4.19859900e-01]
R-squared mean: -237.59750668975545
R-squared std: 409.78254163583324
```

In [218…
```python
svr.fit(X_train, y_train)
```

Out[218]:
```
SVR(C=10, epsilon=0.01, gamma=0.1)
```

In [219…
```python
y_pred = svr.predict(X_test)
```

In [220…
```python
mse = mean_squared_error(y_test, y_pred)
```

In [220…

```
mse = mean_squared_error(y_test, y_pred)
rmse = np.sqrt(mse)
mae = mean_absolute_error(y_test, y_pred)
r2 = r2_score(y_test, y_pred)

print("Mean Squared Error:", mse)
print("Root Mean Squared Error:", rmse)
print("Mean Absolute Error:", mae)
print("R-squared:", r2)
```

```
Mean Squared Error: 593.5711205734611
Root Mean Squared Error: 24.36331505713993
Mean Absolute Error: 10.933293100053778
R-squared: 0.9363523092264306
```

C = 10 , Epsilon = 0.001 , Gamma = 0.1

In [221…

```
svr = SVR(kernel='rbf', C=10, gamma=0.1, epsilon=0.001)
```

In [222…

```
from sklearn.model_selection import cross_val_score
scores = cross_val_score(svr, X, y, cv=5, scoring='r2')
```

In [223…

```
# Menampilkan hasil validasi silang
print('R-squared scores:', scores)
print('R-squared mean:', scores.mean())
print('R-squared std:', scores.std())
```

```
R-squared scores: [-1.05064036e+03 -1.34512996e+02 -4.30352137e-01 -2.86935969e+00
  4.19867295e-01]
R-squared mean: -237.6066407420929
R-squared std: 409.79578699352174
```

In [224…

```
svr.fit(X_train, y_train)
```

Out[224]:

```
SVR(C=10, epsilon=0.001, gamma=0.1)
```

In [225…

```
y_pred = svr.predict(X_test)
```

In [226…

```
mse = mean_squared_error(y_test, y_pred)
rmse = np.sqrt(mse)
mae = mean_absolute_error(y_test, y_pred)
r2 = r2_score(y_test, y_pred)

print("Mean Squared Error:", mse)
print("Root Mean Squared Error:", rmse)
print("Mean Absolute Error:", mae)
print("R-squared:", r2)
```

```
Mean Squared Error: 593.5817068018748
Root Mean Squared Error: 24.363532313724026
Mean Absolute Error: 10.933022304760422
R-squared: 0.9363511741219319
```

C = 10 , Epsilon = 0.0001 , Gamma = 0.1

In [227…

```
svr = SVR(kernel='rbf', C=10, gamma=0.1, epsilon=0.0001)
```

In [228…

```
from sklearn.model_selection import cross_val_score
scores = cross_val_score(svr, X, y, cv=5, scoring='r2')
```

In [229…

```
# Menampilkan hasil validasi silang
print('R-squared scores:', scores)
print('R-squared mean:', scores.mean())
print('R-squared std:', scores.std())
```

```
R-squared scores: [-1.05064442e+03 -1.34513291e+02 -4.30354369e-01 -2.86936827e+00
  4.19867335e-01]
R-squared mean: -237.60751243927356
R-squared std: 409.79737880763804
```

In [230…

```
svr.fit(X_train, y_train)
```

Out[230]:

```
SVR(C=10, epsilon=0.0001, gamma=0.1)
```

In [231…

```
y_pred = svr.predict(X_test)
```

In [232…

```
mse = mean_squared_error(y_test, y_pred)
rmse = np.sqrt(mse)
mae = mean_absolute_error(y_test, y_pred)
r2 = r2_score(y_test, y_pred)

print("Mean Squared Error:", mse)
print("Root Mean Squared Error:", rmse)
print("Mean Absolute Error:", mae)
print("R-squared:", r2)
```

```
Mean Squared Error: 593.5841952362899
Root Mean Squared Error: 24.363583382505333
Mean Absolute Error: 10.933080400771745
R-squared: 0.9363509072910526
```

C = 10 , Epsilon = 0.1 , Gamma = 0.01

In [233…

```
svr = SVR(kernel='rbf', C=10, gamma=0.01, epsilon=0.1)
```

In [234…

```
from sklearn.model_selection import cross_val_score
scores = cross_val_score(svr, X, y, cv=5, scoring='r2')
```

In [235…

```
# Menampilkan hasil validasi silang
print('R-squared scores:', scores)
print('R-squared mean:', scores.mean())
print('R-squared std:', scores.std())
```

```
R-squared scores: [-2.61040766e+02  8.67409039e-01  1.53948446e-01 -1.09361699e-01
  9.41529900e-01]
R-squared mean: -51.83744811975613
R-squared std: 104.60243884523832
```

In [236…

```
svr.fit(X_train, y_train)
```

Out[236]:

```
SVR(C=10, gamma=0.01)
```

In [237…

```
y_pred = svr.predict(X_test)
```

In [238…

```
mse = mean_squared_error(y_test, y_pred)
rmse = np.sqrt(mse)
mae = mean_absolute_error(y_test, y_pred)
r2 = r2_score(y_test, y_pred)

print("Mean Squared Error:", mse)
print("Root Mean Squared Error:", rmse)
print("Mean Absolute Error:", mae)
print("R-squared:", r2)
```

```
Mean Squared Error: 38.68663553997865
Root Mean Squared Error: 6.219858160760473
Mean Absolute Error: 2.600888830648178
R-squared: 0.9958516933708096
```

C = 10 , Epsilon = 0.1 , Gamma = 0.001

In [239…

```
svr = SVR(kernel='rbf', C=10, gamma=0.001, epsilon=0.1)
```

In [240…

```
from sklearn.model_selection import cross_val_score
scores = cross_val_score(svr, X, y, cv=5, scoring='r2')
```

In [241…

```
# Menampilkan hasil validasi silang
print('R-squared scores:', scores)
print('R-squared mean:', scores.mean())
print('R-squared std:', scores.std())
```

```
R-squared scores: [-5.4196484   0.98078866  0.72022279  0.83709419  0.99152955]
R-squared mean: -0.37800264310943704
R-squared std: 2.522803346338801
```

In [242…

```
svr.fit(X_train, y_train)
```

Out[242]:

```
SVR(C=10, gamma=0.001)
```

In [243…

```
y_pred = svr.predict(X_test)
```

In [244…

```
mse = mean_squared_error(y_test, y_pred)
rmse = np.sqrt(mse)
mae = mean_absolute_error(y_test, y_pred)
r2 = r2_score(y_test, y_pred)

print("Mean Squared Error:", mse)
print("Root Mean Squared Error:", rmse)
print("Mean Absolute Error:", mae)
print("R-squared:", r2)
```

```
Mean Squared Error: 3.44360923652481
Root Mean Squared Error: 1.8556964289788376
Mean Absolute Error: 1.1049455163286541
R-squared: 0.9996307472380364
```

C = 10 , Epsilon = 0.1 , Gamma = 0.0001

In [245…

```
svr = SVR(kernel='rbf', C=10, gamma=0.01, epsilon=0.1)
```

In [246…

```
from sklearn.model_selection import cross_val_score
scores = cross_val_score(svr, X, y, cv=5, scoring='r2')
```

In [247…

```
# Menampilkan hasil validasi silang
print('R-squared scores:', scores)
print('R-squared mean:', scores.mean())
print('R-squared std:', scores.std())
```

```
R-squared scores: [-2.61040766e+02  8.67409039e-01  1.53948446e-01 -1.09361699e-01
  9.41529900e-01]
R-squared mean: -51.83744811975613
R-squared std: 104.60243884523832
```

In [248…

```
svr.fit(X_train, y_train)
```

Out[248]:

```
SVR(C=10, gamma=0.01)
```

In [249…

```
y_pred = svr.predict(X_test)
```

In [250…

```
mse = mean_squared_error(y_test, y_pred)
rmse = np.sqrt(mse)
mae = mean_absolute_error(y_test, y_pred)
r2 = r2_score(y_test, y_pred)

print("Mean Squared Error:", mse)
print("Root Mean Squared Error:", rmse)
print("Mean Absolute Error:", mae)
print("R-squared:", r2)
```

```
Mean Squared Error: 38.68663553997865
Root Mean Squared Error: 6.219858160760473
Mean Absolute Error: 2.600888830648178
R-squared: 0.9958516933708096
```

C = 10 , Epsilon = 0.01 , Gamma = 0.01

In [251…

```
svr = SVR(kernel='rbf', C=10, gamma=0.01, epsilon=0.01)
```

In [252…

```
from sklearn.model_selection import cross_val_score
scores = cross_val_score(svr, X, y, cv=5, scoring='r2')
```

In [253…

```
# Menampilkan hasil validasi silang
print('R-squared scores:', scores)
print('R-squared mean:', scores.mean())
print('R-squared std:', scores.std())
```

```
R-squared scores: [-2.58859001e+02  8.67131761e-01  1.54504214e-01 -1.11686868e-01
  9.41400949e-01]
R-squared mean: -51.40153010013919
R-squared std: 103.7295234589222
```

In [254…

```
svr.fit(X_train, y_train)
```

Out[254]:

```
SVR(C=10, epsilon=0.01, gamma=0.01)
```

In [255…

```
y_pred = svr.predict(X_test)
```

In [256…

```
mse = mean_squared_error(y_test, y_pred)
rmse = np.sqrt(mse)
mae = mean_absolute_error(y_test, y_pred)
r2 = r2_score(y_test, y_pred)

print("Mean Squared Error:", mse)
print("Root Mean Squared Error:", rmse)
print("Mean Absolute Error:", mae)
print("R-squared:", r2)
```

```
Mean Squared Error: 38.56972078868568
Root Mean Squared Error: 6.210452542986355
Mean Absolute Error: 2.5978530401191806
R-squared: 0.9958642299543369
```

C = 10 , Epsilon = 0.01 , Gamma = 0.001

In [257…
```
svr = SVR(kernel='rbf', C=10, gamma=0.001, epsilon=0.01)
```

In [258…
```
from sklearn.model_selection import cross_val_score
scores = cross_val_score(svr, X, y, cv=5, scoring='r2')
```

In [259…
```
# Menampilkan hasil validasi silang
print('R-squared scores:', scores)
print('R-squared mean:', scores.mean())
print('R-squared std:', scores.std())
```

```
R-squared scores: [-5.3142368   0.98124224  0.72055152  0.83811179  0.99150755]
R-squared mean: -0.3565647424823163
R-squared std: 2.480845425177572
```

In [260…
```
svr.fit(X_train, y_train)
```

Out[260]:
```
SVR(C=10, epsilon=0.01, gamma=0.001)
```

In [261…
```
y_pred = svr.predict(X_test)
```

In [262…
```
mse = mean_squared_error(y_test, y_pred)
rmse = np.sqrt(mse)
mae = mean_absolute_error(y_test, y_pred)
r2 = r2_score(y_test, y_pred)

print("Mean Squared Error:", mse)
print("Root Mean Squared Error:", rmse)
print("Mean Absolute Error:", mae)
print("R-squared:", r2)
```

```
Mean Squared Error: 3.431406507378138
Root Mean Squared Error: 1.8524056001259923
Mean Absolute Error: 1.1030264339302216
R-squared: 0.9996320557173473
```

C = 10 , Epsilon = 0.01 , Gamma = 0.0001

In [263…
```
svr = SVR(kernel='rbf', C=10, gamma=0.0001, epsilon=0.01)
```

In [264…
```
from sklearn.model_selection import cross_val_score
scores = cross_val_score(svr, X, y, cv=5, scoring='r2')
```

In [265…
```
# Menampilkan hasil validasi silang
print('R-squared scores:', scores)
print('R-squared mean:', scores.mean())
print('R-squared std:', scores.std())
```

```
R-squared scores: [0.55393612 0.96222393 0.99152583 0.94088271 0.99063584]
R-squared mean: 0.8878408890550741
R-squared std: 0.16802144990605025
```

In [266…
```
svr.fit(X_train, y_train)
```

Out[266]:
```
SVR(C=10, epsilon=0.01, gamma=0.0001)
```

In [267…
```
y_pred = svr.predict(X_test)
```

In [268…
```
mse = mean_squared_error(y_test, y_pred)
rmse = np.sqrt(mse)
mae = mean_absolute_error(y_test, y_pred)
r2 = r2_score(y_test, y_pred)

print("Mean Squared Error:", mse)
print("Root Mean Squared Error:", rmse)
print("Mean Absolute Error:", mae)
print("R-squared:", r2)
```

```
Mean Squared Error: 4.514465332460753
Root Mean Squared Error: 2.124727119528706
Mean Absolute Error: 1.3212154822135076
R-squared: 0.9995159210356624
```

C = 10 , Epsilon = 0.001 , Gamma = 0.01

In [269…
```
svr = SVR(kernel='rbf', C=10, gamma=0.01, epsilon=0.001)
```

In [270…
```
from sklearn.model_selection import cross_val_score
scores = cross_val_score(svr, X, y, cv=5, scoring='r2')
```

In [271…

```
# Menampilkan hasil validasi silang
print('R-squared scores:', scores)
print('R-squared mean:', scores.mean())
print('R-squared std:', scores.std())
```

```
R-squared scores: [-2.58931194e+02  8.67403505e-01  1.54287836e-01 -1.12007780e-01
  9.41414579e-01]
R-squared mean: -51.4160191837561
R-squared std: 103.75837615735776
```

In [272…

```
svr.fit(X_train, y_train)
```

Out[272]:

```
SVR(C=10, epsilon=0.001, gamma=0.01)
```

In [273…

```
y_pred = svr.predict(X_test)
```

In [274…

```
mse = mean_squared_error(y_test, y_pred)
rmse = np.sqrt(mse)
mae = mean_absolute_error(y_test, y_pred)
r2 = r2_score(y_test, y_pred)

print("Mean Squared Error:", mse)
print("Root Mean Squared Error:", rmse)
print("Mean Absolute Error:", mae)
print("R-squared:", r2)
```

```
Mean Squared Error: 38.58944369927392
Root Mean Squared Error: 6.212040220352241
Mean Absolute Error: 2.598992798053232
R-squared: 0.9958621150978859
```

C = 10 , Epsilon = 0.001 , Gamma = 0.001

In [275…

```
svr = SVR(kernel='rbf', C=10, gamma=0.001, epsilon=0.001)
```

In [276…

```
from sklearn.model_selection import cross_val_score
scores = cross_val_score(svr, X, y, cv=5, scoring='r2')
```

In [277…

```
# Menampilkan hasil validasi silang
print('R-squared scores:', scores)
print('R-squared mean:', scores.mean())
print('R-squared std:', scores.std())
```

```
R-squared scores: [-5.37618925  0.98107087  0.72060018  0.83817171  0.99150593]
R-squared mean: -0.36896811015586917
R-squared std: 2.5055978962028393
```

In [278…

```
svr.fit(X_train, y_train)
```

Out[278]:

```
SVR(C=10, epsilon=0.001, gamma=0.001)
```

In [279…

```
y_pred = svr.predict(X_test)
```

In [280…

```
mse = mean_squared_error(y_test, y_pred)
rmse = np.sqrt(mse)
mae = mean_absolute_error(y_test, y_pred)
r2 = r2_score(y_test, y_pred)

print("Mean Squared Error:", mse)
print("Root Mean Squared Error:", rmse)
print("Mean Absolute Error:", mae)
print("R-squared:", r2)
```

```
Mean Squared Error: 3.4288990348301756
Root Mean Squared Error: 1.8517286612325725
Mean Absolute Error: 1.103194643733742
R-squared: 0.9996323245896555
```

C = 10 , Epsilon = 0.001 , Gamma = 0.0001

In [281…

```
svr = SVR(kernel='rbf', C=10, gamma=0.0001, epsilon=0.001)
```

In [282…

```
from sklearn.model_selection import cross_val_score
scores = cross_val_score(svr, X, y, cv=5, scoring='r2')
```

In [283…

```
# Menampilkan hasil validasi silang
print('R-squared scores:', scores)
print('R-squared mean:', scores.mean())
print('R-squared std:', scores.std())
```

```
R-squared scores: [0.55858489 0.96282835 0.99149878 0.94073362 0.99064381]
R-squared mean: 0.888857891124253
R-squared std: 0.16621582413407984
```

In [284…

```python
svr.fit(X_train, y_train)
```

Out[284]:

```
SVR(C=10, epsilon=0.001, gamma=0.0001)
```

In [285…

```python
y_pred = svr.predict(X_test)
```

In [286…

```python
mse = mean_squared_error(y_test, y_pred)
rmse = np.sqrt(mse)
mae = mean_absolute_error(y_test, y_pred)
r2 = r2_score(y_test, y_pred)

print("Mean Squared Error:", mse)
print("Root Mean Squared Error:", rmse)
print("Mean Absolute Error:", mae)
print("R-squared:", r2)
```

```
Mean Squared Error: 4.543810374860177
Root Mean Squared Error: 2.1316215364975504
Mean Absolute Error: 1.324803154624826
R-squared: 0.9995127744132638
```

C = 10 , Epsilon = 0.0001 , Gamma = 0.01

In [287…

```python
svr = SVR(kernel='rbf', C=10, gamma=0.01, epsilon=0.0001)
```

In [288…

```python
from sklearn.model_selection import cross_val_score
scores = cross_val_score(svr, X, y, cv=5, scoring='r2')
```

In [289…

```python
# Menampilkan hasil validasi silang
print('R-squared scores:', scores)
print('R-squared mean:', scores.mean())
print('R-squared std:', scores.std())
```

```
R-squared scores: [-2.58920447e+02  8.67422665e-01  1.54297664e-01 -1.12060191e-01
  9.41416067e-01]
R-squared mean: -51.41387416435939
R-squared std: 103.7540752521381
```

In [290…

```python
svr.fit(X_train, y_train)
```

Out[290]:

```
SVR(C=10, epsilon=0.0001, gamma=0.01)
```

In [291…

```python
y_pred = svr.predict(X_test)
```

In [292…

```python
mse = mean_squared_error(y_test, y_pred)
rmse = np.sqrt(mse)
mae = mean_absolute_error(y_test, y_pred)
r2 = r2_score(y_test, y_pred)

print("Mean Squared Error:", mse)
print("Root Mean Squared Error:", rmse)
print("Mean Absolute Error:", mae)
print("R-squared:", r2)
```

```
Mean Squared Error: 38.591440593303844
Root Mean Squared Error: 6.212200945985557
Mean Absolute Error: 2.599068906516067
R-squared: 0.9958619009741032
```

In [293…

```python
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=42)
```

Hasil dengan Error Terkecil

C = 10 , Epsilon = 0.001 , Gamma = 0.001

In [294…

```python
svr = SVR(kernel='rbf', C=10, gamma=0.001, epsilon=0.001)
```

In [295…

```python
from sklearn.model_selection import cross_val_score
scores = cross_val_score(svr, X, y, cv=5, scoring='r2')
```

In [296…

```python
# Menampilkan hasil validasi silang
print('R-squared scores:', scores)
print('R-squared mean:', scores.mean())
print('R-squared std:', scores.std())
```

```
R-squared scores: [-5.37618925  0.98107087  0.72060018  0.83817171  0.99150593]
R-squared mean: -0.36896811015586917
R-squared std: 2.5055978962028393
```

In [297…
```
svr.fit(X_train, y_train)
```

Out[297]:
```
SVR(C=10, epsilon=0.001, gamma=0.001)
```

In [298…
```
y_pred = svr.predict(X_test)
```

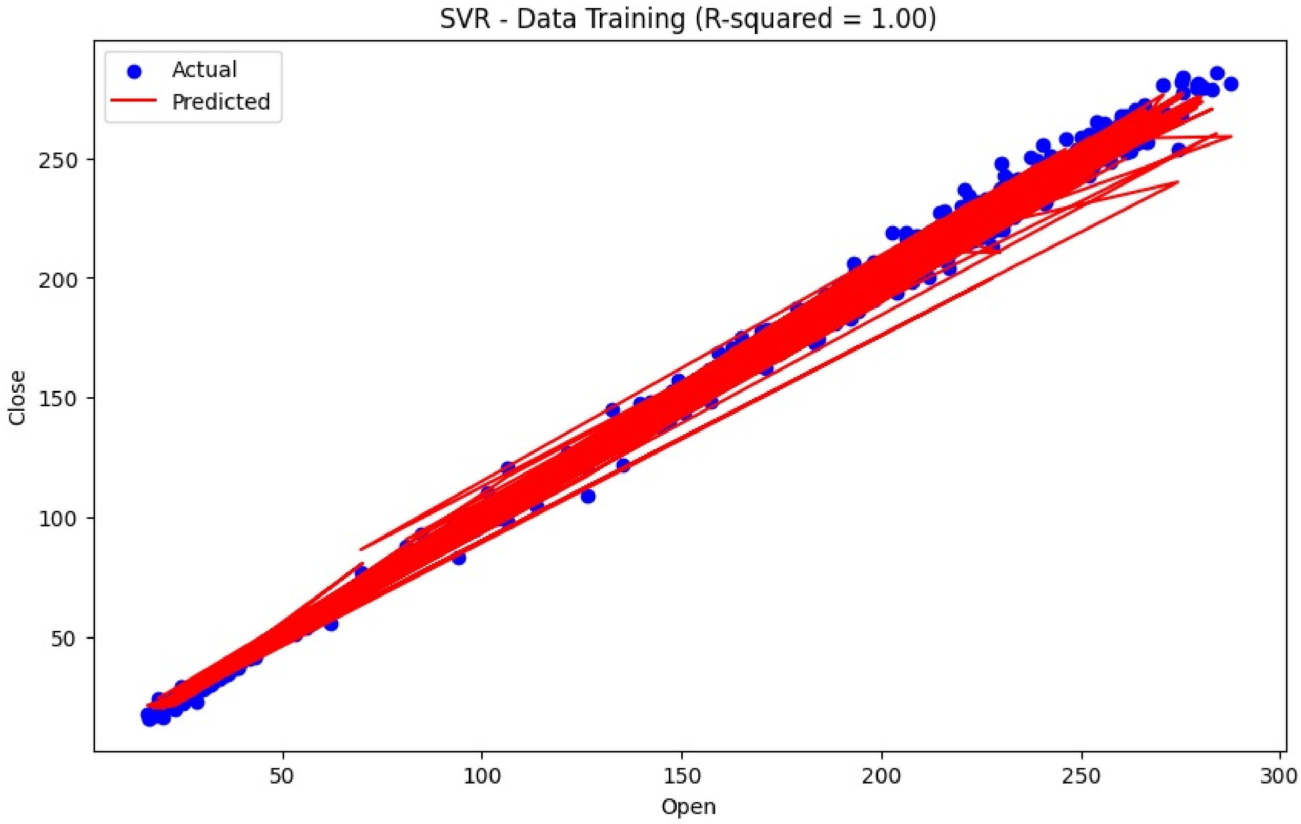
In [299…
```
mse = mean_squared_error(y_test, y_pred)
rmse = np.sqrt(mse)
mae = mean_absolute_error(y_test, y_pred)
r2 = r2_score(y_test, y_pred)

print("Mean Squared Error:", mse)
print("Root Mean Squared Error:", rmse)
print("Mean Absolute Error:", mae)
print("R-squared:", r2)
```

```
Mean Squared Error: 3.4288990348301756
Root Mean Squared Error: 1.8517286612325725
Mean Absolute Error: 1.103194643733742
R-squared: 0.9996323245896555
```

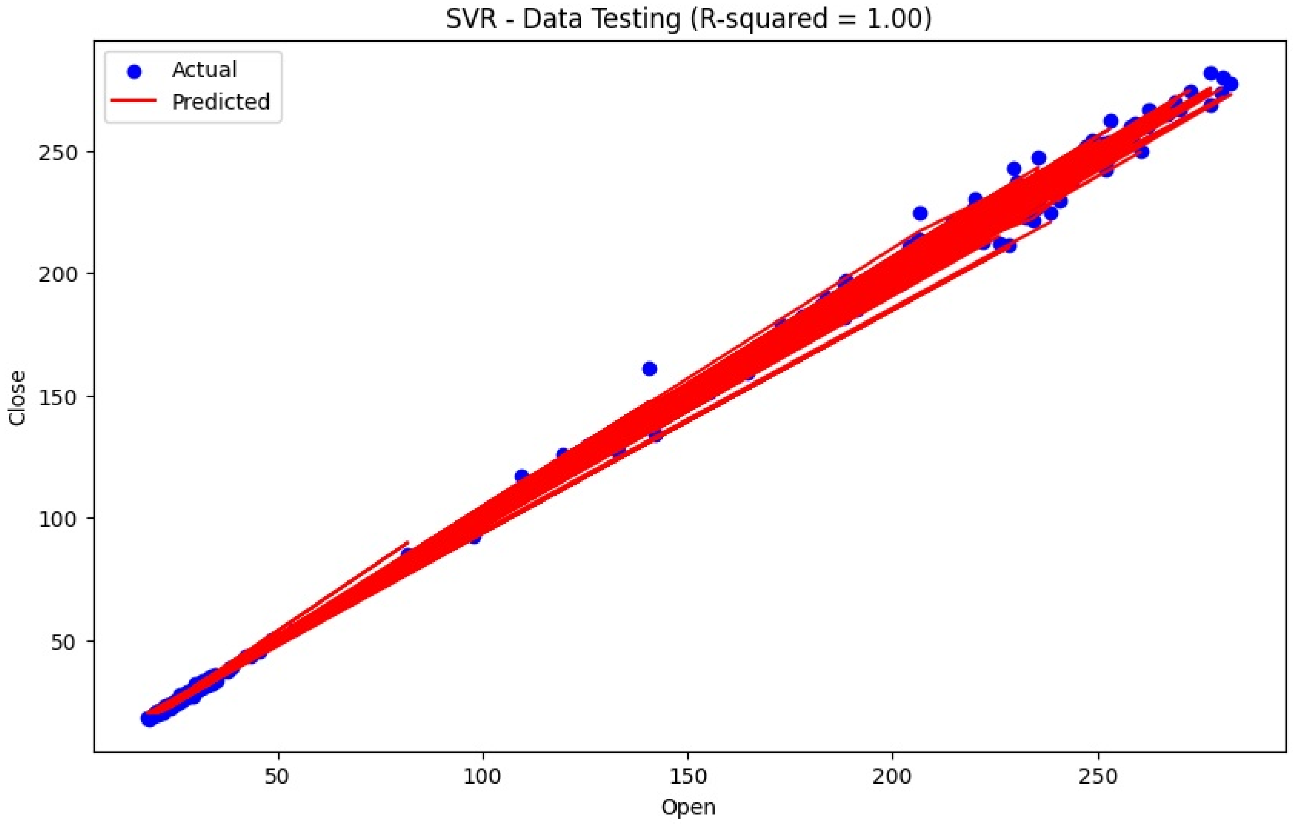
In [300…
```
# Melakukan prediksi pada data latih dan data uji
y_train_pred = svr.predict(X_train)
y_test_pred = svr.predict(X_test)

# Menghitung koefisien determinasi (R-squared) untuk data latih dan data uji
r_squared_train = r2_score(y_train, y_train_pred)
r_squared_test = r2_score(y_test, y_test_pred)

print("Koefisien Determinasi (R-squared) untuk Data Latih:", r_squared_train)
print("Koefisien Determinasi (R-squared) untuk Data Uji:", r_squared_test)
```

```
Koefisien Determinasi (R-squared) untuk Data Latih: 0.999436928173908
Koefisien Determinasi (R-squared) untuk Data Uji: 0.9996323245896555
```

In [301…
```
# Visualisasi data training
plt.figure(figsize=(10, 6))
plt.scatter(X_train[:, 0], y_train, color='blue', label='Actual')
plt.plot(X_train[:, 0], y_train_pred, color='red', label='Predicted')
plt.title('SVR - Data Training (R-squared = {:.2f})'.format(r_squared_train))
plt.xlabel('Open')
plt.ylabel('Close')
plt.legend()
plt.show()
```



In [302…
```
# Visualisasi data testing
plt.figure(figsize=(10, 6))
plt.scatter(X_test[:, 0], y_test, color='blue', label='Actual')
plt.plot(X_test[:, 0], y_test_pred, color='red', label='Predicted')
plt.title('SVR - Data Testing (R-squared = {:.2f})'.format(r_squared_test))
plt.xlabel('Open')
plt.ylabel('Close')
plt.legend()
plt.show()
```

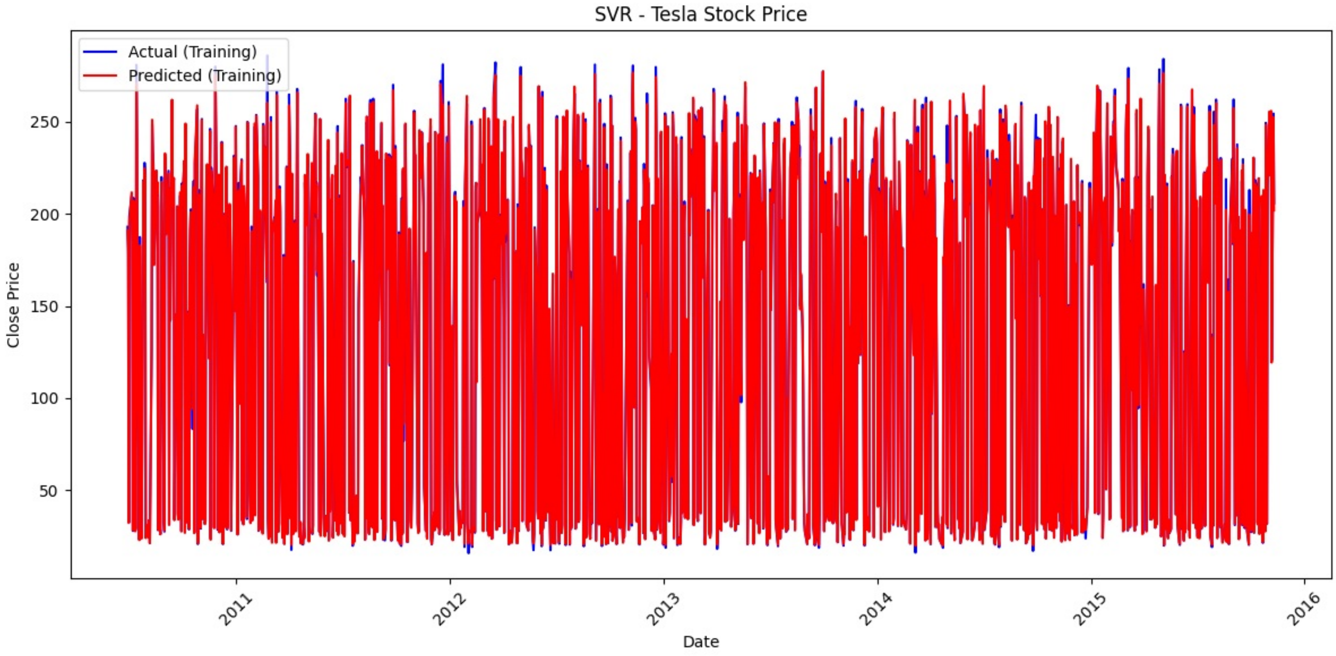


In [303…

```
tesla['Date'] = pd.to_datetime(tesla['Date'])
```

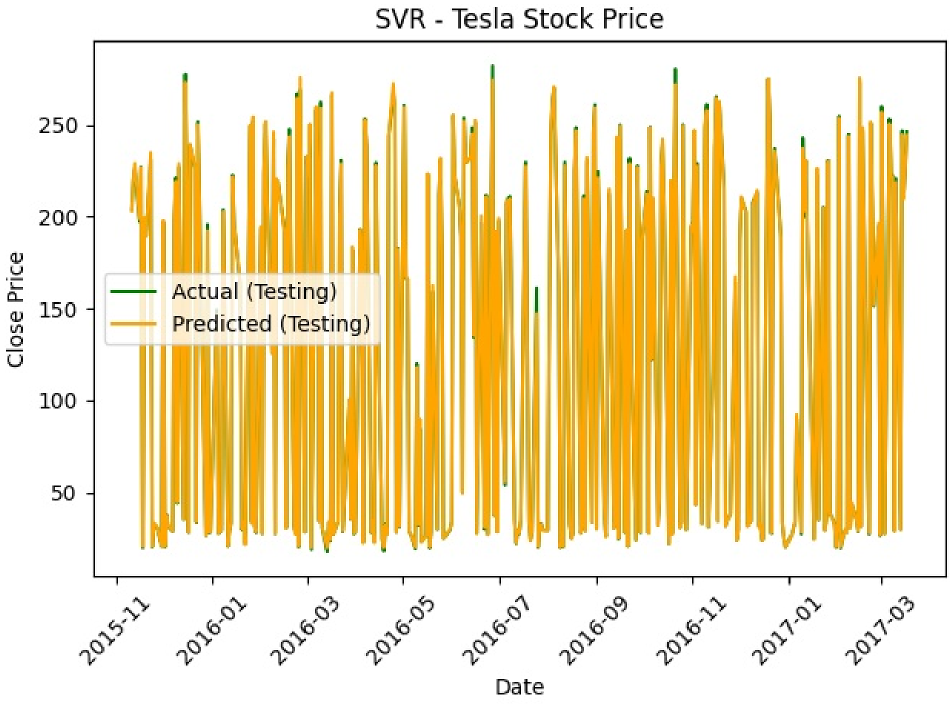
In [304…

```
# Visualisasi tren perubahan harga saham
plt.figure(figsize=(12, 6))

# Plot data training
plt.plot(tesla['Date'].iloc[:len(X_train)], y_train, color='blue', label='Actual (Training)')
plt.plot(tesla['Date'].iloc[:len(X_train)], y_train_pred, color='red', label='Predicted (Training)')

plt.title('SVR - Tesla Stock Price')
plt.xlabel('Date')
plt.ylabel('Close Price')
plt.legend()
plt.xticks(rotation=45)
plt.tight_layout()
plt.show()
```



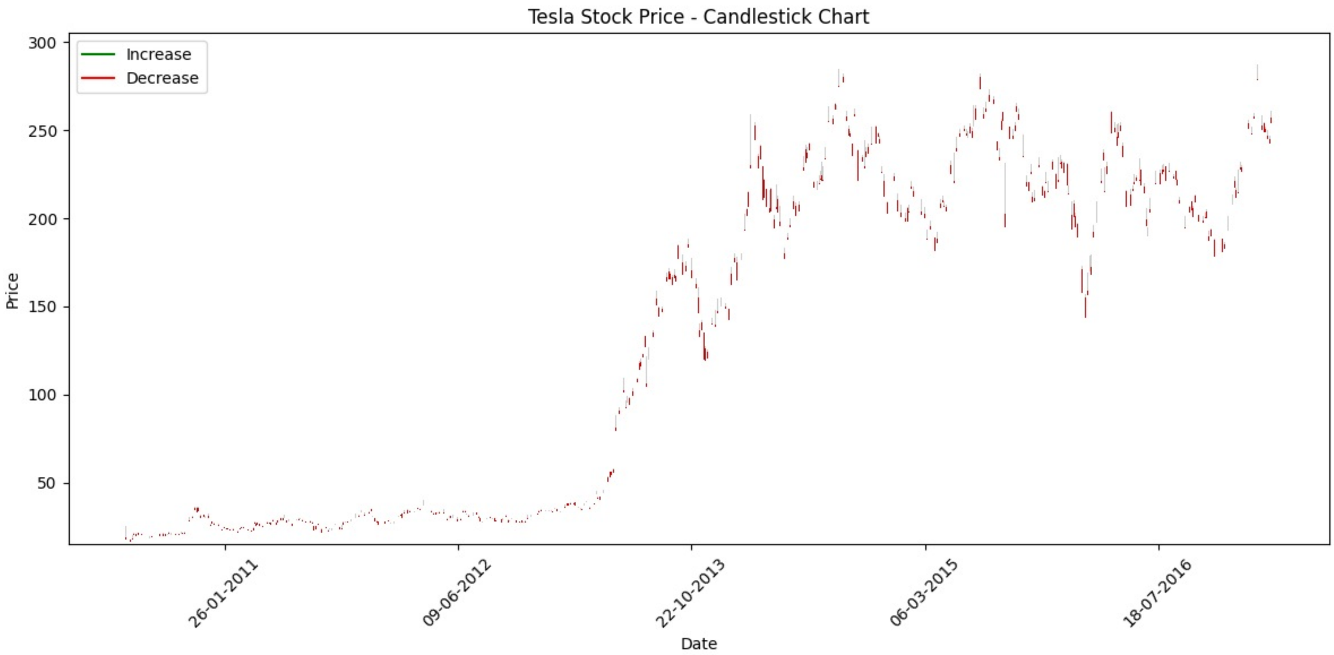
In [305…

```
# Plot data testing
plt.plot(tesla['Date'].iloc[-len(X_test):], y_test, color='green', label='Actual (Testing)')
plt.plot(tesla['Date'].iloc[-len(X_test):], y_test_pred, color='orange', label='Predicted (Testing)')

plt.title('SVR - Tesla Stock Price')
plt.xlabel('Date')
plt.ylabel('Close Price')
plt.legend()
plt.xticks(rotation=45)
plt.tight_layout()
plt.show()
```



In [306…

```
import matplotlib.dates as mpl_dates
# Menggabungkan kolom 'Date' dengan fitur lainnya
ohlc = tesla[['Date', 'Open', 'High', 'Low', 'Close']].values

# Membuat grafik saham dengan candlestick chart
fig, ax = plt.subplots(figsize=(12, 6))
candlestick_data = np.column_stack((mpl_dates.date2num(ohlc[:, 0]), ohlc[:, 1:]))
ax.plot([], [], color='green', label='Increase')
ax.plot([], [], color='red', label='Decrease')
ax.legend()

candlestick_width = 0.6
ax.bar(ohlc[:, 0], ohlc[:, 3] - ohlc[:, 1], width=candlestick_width, bottom=ohlc[:, 1], color=np.where(ohlc[:,
ax.bar(ohlc[:, 0], ohlc[:, 2] - ohlc[:, 3], width=candlestick_width, bottom=ohlc[:, 3], color='black', alpha=0.

ax.xaxis.set_major_locator(plt.MaxNLocator(6))
ax.xaxis.set_major_formatter(mpl_dates.DateFormatter('%d-%m-%Y'))
plt.xticks(rotation=45)

plt.title('Tesla Stock Price - Candlestick Chart')
plt.xlabel('Date')
plt.ylabel('Price')
plt.tight_layout()
plt.show()
```



Linear

In [307…
```
svr = SVR(kernel='linear', C=0.1, gamma=0.1)
```

In [308…
```
svr.fit(X_train, y_train)
```

Out[308]:
```
SVR(C=0.1, gamma=0.1, kernel='linear')
```

In [309…
```
y_pred = svr.predict(X_test)
```

In [310…
```
mse = mean_squared_error(y_test, y_pred)
rmse = np.sqrt(mse)
mae = mean_absolute_error(y_test, y_pred)
r2 = r2_score(y_test, y_pred)

print("Mean Squared Error:", mse)
print("Root Mean Squared Error:", rmse)
print("Mean Absolute Error:", mae)
print("R-squared:", r2)
```

```
Mean Squared Error: 1.8688319110334317
Root Mean Squared Error: 1.3670522707758588
Mean Absolute Error: 0.9056468396128907
R-squared: 0.999799608115382
```

Polynomial

In [311…
```
svr = SVR(kernel='poly', C=0.1, gamma=0.1)
```

In [312…
```
svr.fit(X_train, y_train)
```

Out[312]:
```
SVR(C=0.1, gamma=0.1, kernel='poly')
```

In [313…
```
y_pred = svr.predict(X_test)
```

In [314…
```
mse = mean_squared_error(y_test, y_pred)
rmse = np.sqrt(mse)
r2 = r2_score(y_test, y_pred)

print("Mean Squared Error:", mse)
print("Root Mean Squared Error:", rmse)
print("R-squared:", r2)
```

```
Mean Squared Error: 413728616.07087857
Root Mean Squared Error: 20340.3199598944
R-squared: -44362.46393986655
```

Sigmoid

In [315…
```
svr = SVR(kernel='sigmoid', C=0.1, gamma=0.1)
```

In [316…
```
svr.fit(X_train, y_train)
```

Out[316]:
```
SVR(C=0.1, gamma=0.1, kernel='sigmoid')
```

In [317…
```python
y_pred = svr.predict(X_test)
```

In [318…
```python
mse = mean_squared_error(y_test, y_pred)
rmse = np.sqrt(mse)
r2 = r2_score(y_test, y_pred)

print("Mean Squared Error:", mse)
print("Root Mean Squared Error:", rmse)
print("R-squared:", r2)
```

```
Mean Squared Error: 10992.334070999796
Root Mean Squared Error: 104.8443325649975
R-squared: -0.1786905648562198
```

Kesimpulan

Setelah melakukan analisis, dapat disimpulkan bahwa model SVR terbaik menggunakan fungsi kernel RBF dengan parameter C = 10, gamma = 0,001, dan epsilon = 0,001. Model ini memiliki tingkat akurasi yang cukup tinggi, yaitu 99,94% untuk data training dan 99,96% untuk data testing, sehingga dapat diandalkan dalam memprediksi harga saham Tesla.

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