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

from statsmodels.tsa.holtwinters import ExponentialSmoothing
from sklearn.metrics import mean_squared_error
```

```
df_bax_m = pd.read_csv(r'/content/drive/MyDrive/PRN23039142546/Holt_data.csv', index_col=0,parse_dates=True)
df_bax_m.head()
```

Date	Price	Open	High	Low	Vol.	Change %
2024-03-27	2068.42	2075.75	2080.66	2046.11	2170000.0	-0.35
2024-03-28	2055.96	2058.33	2058.79	2051.57	3380000.0	-0.60
2024-03-31	2042.67	2053.66	2053.77	2042.67	1110000.0	-0.65
2024-04-01	2033.86	2042.67	2046.26	2030.97	1070000.0	-0.43
2024-04-02	2029.31	2032.07	2034.97	2029.31	1320000.0	-0.22

```
df = df_bax_m.copy()
```

```
series = df['Price']
```

```
# train-test split
train_size = int(len(series)*0.8)
train, test = series[:train_size],series[train_size:]
```

Additive

```
model = ExponentialSmoothing(train, trend='add', seasonal=None).fit()
```

```
/usr/local/lib/python3.11/dist-packages/statsmodels/tsa/base/tsa_model.py:473: ValueWarning: A date index has been provided, but it
  self._init_dates(dates, freq)
```

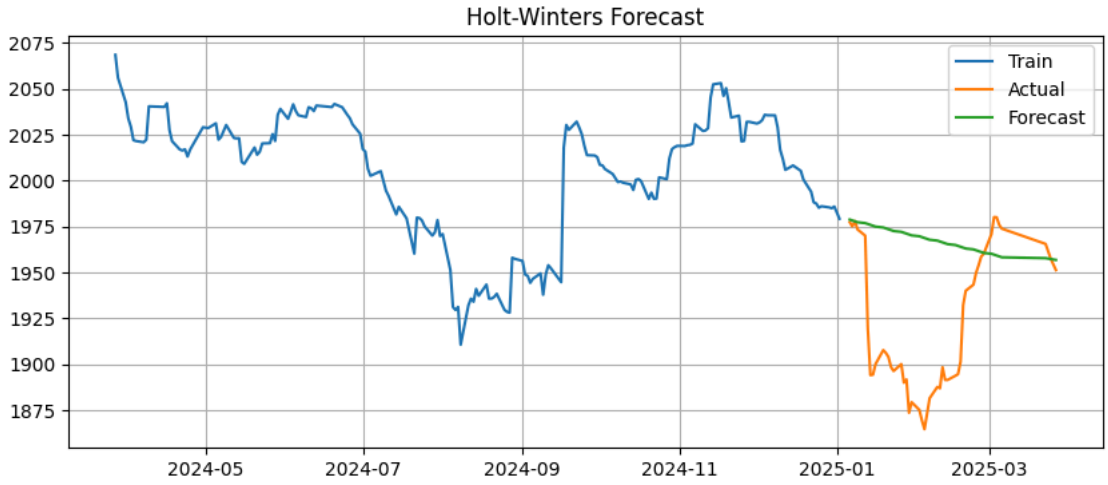
```
preds = model.forecast(len(test))
```

```
/usr/local/lib/python3.11/dist-packages/statsmodels/tsa/base/tsa_model.py:837: ValueWarning: No supported index is available. Predic
  return get_prediction_index(
/usr/local/lib/python3.11/dist-packages/statsmodels/tsa/base/tsa_model.py:837: FutureWarning: No supported index is available. In th
  return get_prediction_index(
```

```
# EValuate
rmse = np.sqrt(mean_squared_error(test, preds))
print(f"Holt-Winters Exponential Smoothing - RMSE: {rmse:.2f}")
```

```
Holt-Winters Exponential Smoothing - RMSE: 61.04
```

```
# Plot
plt.figure(figsize=(10, 4))
plt.plot(train.index, train, label='Train')
plt.plot(test.index, test, label='Actual')
plt.plot(test.index, preds, label='Forecast')
plt.title('Holt-Winters Forecast')
plt.legend()
plt.grid(True)
plt.show()
```



Multiplicative

```
model = ExponentialSmoothing(train, trend='mul', seasonal=None).fit()
```

```
/usr/local/lib/python3.11/dist-packages/statsmodels/tsa/base/tsa_model.py:473: ValueWarning: A date index has been provided, but it
  self._init_dates(dates, freq)
```

```
preds = model.forecast(len(test))
```

```
/usr/local/lib/python3.11/dist-packages/statsmodels/tsa/base/tsa_model.py:837: ValueWarning: No supported index is available. Predic
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```
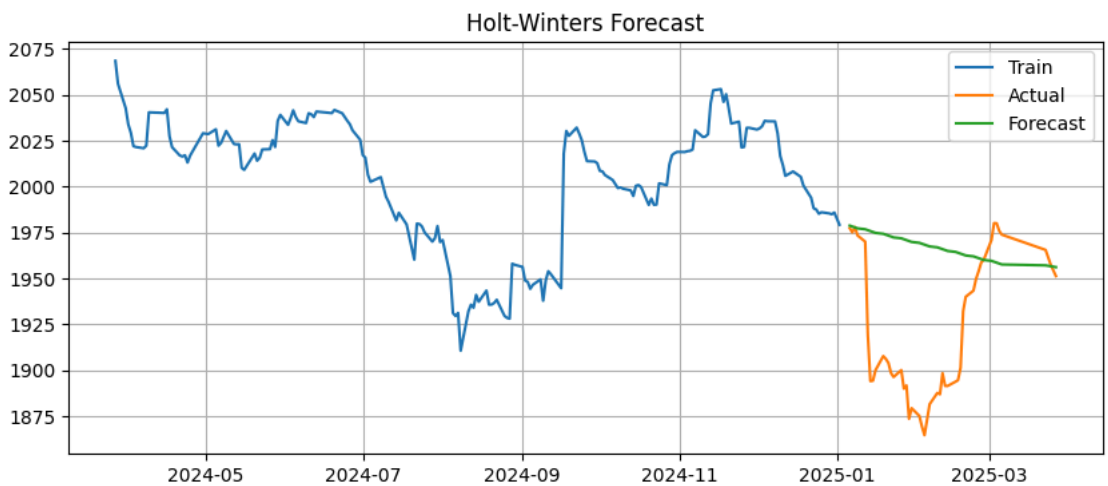

```
# EValuate
rmse = np.sqrt(mean_squared_error(test, preds))
print(f"Holt-Winters Exponential Smoothing - RMSE: {rmse:.2f}")
```

```
Holt-Winters Exponential Smoothing - RMSE: 60.81
```

```
# Plot
plt.figure(figsize=(10, 4))
plt.plot(train.index, train, label='Train')
plt.plot(test.index, test, label='Actual')
plt.plot(test.index, preds, label='Forecast')
plt.title('Holt-Winters Forecast')
plt.legend()
plt.grid(True)
plt.show()
```




```
Start coding or generate with AI.
```