```
from google.colab import files
import io
import pandas as pd


data = files.upload()


filename = next(iter(data))
file_content = data[filename]


data = pd.read_csv(io.BytesIO(file_content))
```

```
Choose Files No file chosen  Upload widget is only available when the cell has been executed in the current browser session. Please rerun this cell to enable.
Saving pre_model_data.csv to pre_model_data.csv
```

```
missing_data = data.isnull().sum()


data_types = data.dtypes

missing_data, data_types
```

```
(player_id                  0
 Year                       0
 matches_appearances        0
 yellow_permatch            0
 red_permatch               0
 goals_permatch             0
 assists_permatch           0
 min_permatch               0
 name                       0
 country_of_birth         479
 country_of_citizenship   424
 city_of_birth             55
 Year_birth                 0
 position                   0
 foot                       6
 height_in_cm               6
 mat                        0
 win_percentage             0
 major_league               0
 Age                        0
 market_value_in_eur        0
 value_increase             0
 matches                    0
 club_changed               0
 type_ratio                 0
 ever_captain               0
 dtype: int64,
 player_id                  int64
 Year                       int64
 matches_appearances        int64
 yellow_permatch          float64
 red_permatch             float64
 goals_permatch           float64
 assists_permatch         float64
 min_permatch             float64
 name                      object
 country_of_birth          object
 country_of_citizenship    object
 city_of_birth             object
 Year_birth                 int64
 position                  object
 foot                      object
 height_in_cm             float64
 mat                        int64
 win_percentage           float64
 major_league               int64
 Age                        int64
 market_value_in_eur        int64
 value_increase             int64
 matches                    int64
 club_changed               int64
 type_ratio               float64
 ever_captain               int64
 dtype: object)
```

```
data.fillna({'country_of_birth': 'Unknown', 'country_of_citizenship': 'Unknown', 'city_of_birth': 'Unknown'}, inplace=True)


data_encoded = pd.get_dummies(data, columns=['name', 'country_of_birth', 'country_of_citizenship', 'city_of_birth', 'position', 'foot'])


data_encoded.shape, data_encoded.columns
```

```
((11587, 2700),
 Index(['player_id', 'Year', 'matches_appearances', 'yellow_permatch',
        'red_permatch', 'goals_permatch', 'assists_permatch', 'min_permatch',
        'Year_birth', 'height_in_cm',
        ...
        'city_of_birth_Żnin', 'city_of_birth_Žiar nad Hronom',
        'city_of_birth_Žilina', 'position_Attack', 'position_Defender',
        'position_Goalkeeper', 'position_Midfield', 'foot_both', 'foot_left',
        'foot_right'],
       dtype='object', length=2700))
```

```
data_encoded.sort_values(by=['player_id', 'Year'], inplace=True)


data_encoded['market_value_change'] = data_encoded.groupby('player_id')['market_value_in_eur'].diff()

data_encoded['market_value_trend'] = pd.cut(data_encoded['market_value_change'],
                                            bins=[-float('inf'), -1, 1, float('inf')],
                                            labels=['Fall', 'Same', 'Rise'])

data_encoded.dropna(subset=['market_value_trend'], inplace=True)

data_encoded['market_value_trend'].value_counts()
```

```
market_value_trend
Fall    5249
Rise    3543
Same    1332
Name: count, dtype: int64
```

```
from sklearn.preprocessing import StandardScaler
from sklearn.model_selection import train_test_split

X = data_encoded.drop(['player_id', 'Year', 'market_value_in_eur', 'market_value_change', 'market_value_trend'], axis=1)
y = data_encoded['market_value_trend']

scaler = StandardScaler()
X_scaled = scaler.fit_transform(X)

X_train, X_test, y_train, y_test = train_test_split(X_scaled, y, test_size=0.2, random_state=42, stratify=y)

X_train.shape, X_test.shape, y_train.shape, y_test.shape
```

```
((8099, 2697), (2025, 2697), (8099,), (2025,))
```

```
from sklearn.metrics import classification_report

data_encoded_clean = data_encoded.dropna()

X_clean = data_encoded_clean.drop(['player_id', 'Year', 'market_value_in_eur', 'market_value_change', 'market_value_trend'], axis=1)
y_clean = data_encoded_clean['market_value_trend']

X_clean_scaled = scaler.fit_transform(X_clean)

X_train_clean, X_test_clean, y_train_clean, y_test_clean = train_test_split(X_clean_scaled, y_clean, test_size=0.2, random_state=42, st

from sklearn.svm import SVC

svm_model_clean = SVC(kernel='linear', probability=True, random_state=42)
svm_model_clean.fit(X_train_clean, y_train_clean)

y_pred_clean = svm_model_clean.predict(X_test_clean)
report_clean = classification_report(y_test_clean, y_pred_clean)

print(report_clean)
```

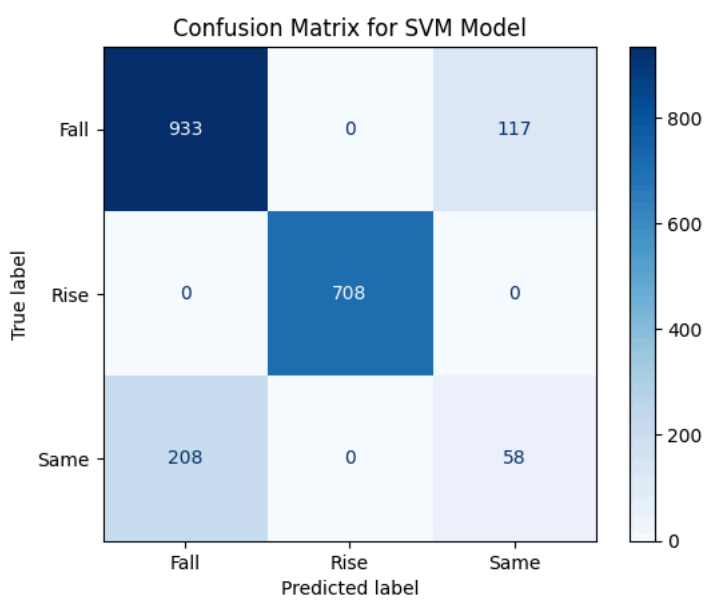
```
              precision    recall  f1-score   support
```

```
              Fall       0.82      0.89      0.85      1050
              Rise       1.00      1.00      1.00       708
              Same       0.33      0.22      0.26       266

          accuracy                           0.84      2024
         macro avg       0.72      0.70      0.70      2024
      weighted avg       0.82      0.84      0.83      2024
```

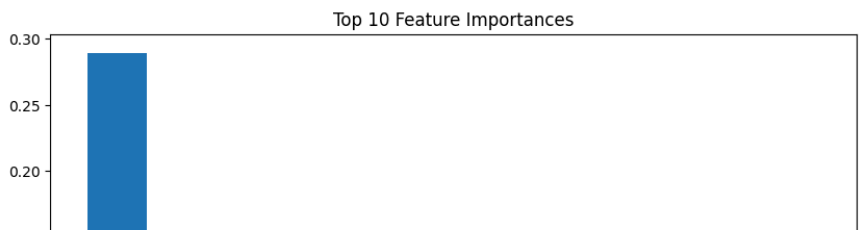
```
import pandas as pd
from sklearn.metrics import classification_report

report_clean = classification_report(y_test_clean, y_pred_clean, output_dict=True)
df_report = pd.DataFrame(report_clean).transpose()

print(df_report)
```

```
              precision    recall  f1-score      support
Fall           0.817704  0.888571  0.851666  1050.000000
Rise           1.000000  1.000000  1.000000   708.000000
Same           0.331429  0.218045  0.263039   266.000000
accuracy       0.839427  0.839427  0.839427     0.839427
macro avg      0.716377  0.702206  0.704901  2024.000000
weighted avg   0.817564  0.839427  0.826194  2024.000000
```

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

cm = confusion_matrix(y_test_clean, y_pred_clean, labels=svm_model_clean.classes_)
disp = ConfusionMatrixDisplay(confusion_matrix=cm, display_labels=svm_model_clean.classes_)

disp.plot(cmap='Blues')
plt.title('Confusion Matrix for SVM Model')
plt.show()
```



```
from sklearn.ensemble import RandomForestClassifier
from sklearn.preprocessing import StandardScaler
from sklearn.model_selection import train_test_split
from sklearn.impute import SimpleImputer
import matplotlib.pyplot as plt
import numpy as np

X_train, X_test, y_train, y_test = train_test_split(X_scaled, y, test_size=0.2, stratify=y)

imputer = SimpleImputer(strategy='median')
X_train_imputed = imputer.fit_transform(X_train)
X_test_imputed = imputer.transform(X_test)

forest = RandomForestClassifier(n_estimators=100, random_state=42)
forest.fit(X_train_imputed, y_train)

importances = forest.feature_importances_
indices = np.argsort(importances)[::-1]
names = [data_encoded.columns[i] for i in indices[:10]]

plt.figure(figsize=(10, 5))
plt.title('Top 10 Feature Importances')
plt.bar(range(10), importances[indices][:10])
plt.xticks(range(10), names, rotation=45, ha='right')
plt.show()
```




```
from google.colab import drive
drive.mount('/content/drive')
```

```
Drive already mounted at /content/drive; to attempt to forcibly remount, call drive.mount("/content/drive", force_remount=True).
```

```
model.save('/content/drive/MyDrive/Colab Notebooks/SVM_football.keras')
```

```
---------------------------------------------------------------------------
NameError                                 Traceback (most recent call last)
<ipython-input-30-3bb5172e899a> in <cell line: 1>()
----> 1 model.save('/content/drive/MyDrive/Colab Notebooks/SVM_football.keras')

NameError: name 'model' is not defined
```

```
from tensorflow.keras.models import load_model

# Load the model
model = load_model(/content/drive/MyDrive/Colab Notebooks/SVM_football.keras)
```