CustomerChrun_finalversion

April 3, 2025

[3]:
```
# Importing necessary libraries
import pandas as pd
import numpy as np
import seaborn as sns
import matplotlib.pyplot as plt
from sklearn.preprocessing import StandardScaler
```

[4]:
```
# Reading the dataset file
df = pd.read_csv("Customer_data - customer_data.csv")
```

[5]:
```
df.head()
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 7043 entries, 0 to 7042
Data columns (total 21 columns):
 #   Column            Non-Null Count  Dtype
---  ------            --------------  -----
 0   customerID        7043 non-null   object
 1   gender            7043 non-null   object
 2   SeniorCitizen     7043 non-null   int64
 3   Partner           7043 non-null   object
 4   Dependents        7043 non-null   object
 5   tenure            7043 non-null   int64
 6   PhoneService      7043 non-null   object
 7   MultipleLines     7043 non-null   object
 8   InternetService   7043 non-null   object
 9   OnlineSecurity    7043 non-null   object
 10  OnlineBackup      7043 non-null   object
 11  DeviceProtection  7043 non-null   object
 12  TechSupport       7043 non-null   object
 13  StreamingTV       7043 non-null   object
 14  StreamingMovies   7043 non-null   object
 15  Contract          7043 non-null   object
 16  PaperlessBilling  7043 non-null   object
 17  PaymentMethod     7043 non-null   object
 18  MonthlyCharges    7043 non-null   float64
 19  TotalCharges      7032 non-null   float64
```

```
 20  Churn             7043 non-null   object
dtypes: float64(2), int64(2), object(17)
memory usage: 1.1+ MB
```

[6]:
```
# checking for null values in the dataset
df.isnull().sum()
```

[6]:
```
customerID           0
gender               0
SeniorCitizen        0
Partner              0
Dependents           0
tenure               0
PhoneService         0
MultipleLines        0
InternetService      0
OnlineSecurity       0
OnlineBackup         0
DeviceProtection     0
TechSupport          0
StreamingTV          0
StreamingMovies      0
Contract             0
PaperlessBilling     0
PaymentMethod        0
MonthlyCharges       0
TotalCharges        11
Churn                0
dtype: int64
```

[7]:
```
# Dropping all the missing rows from the dataset
df.dropna(inplace = True)
```

[8]:
```
df.shape
```

[8]:
```
(7032, 21)
```

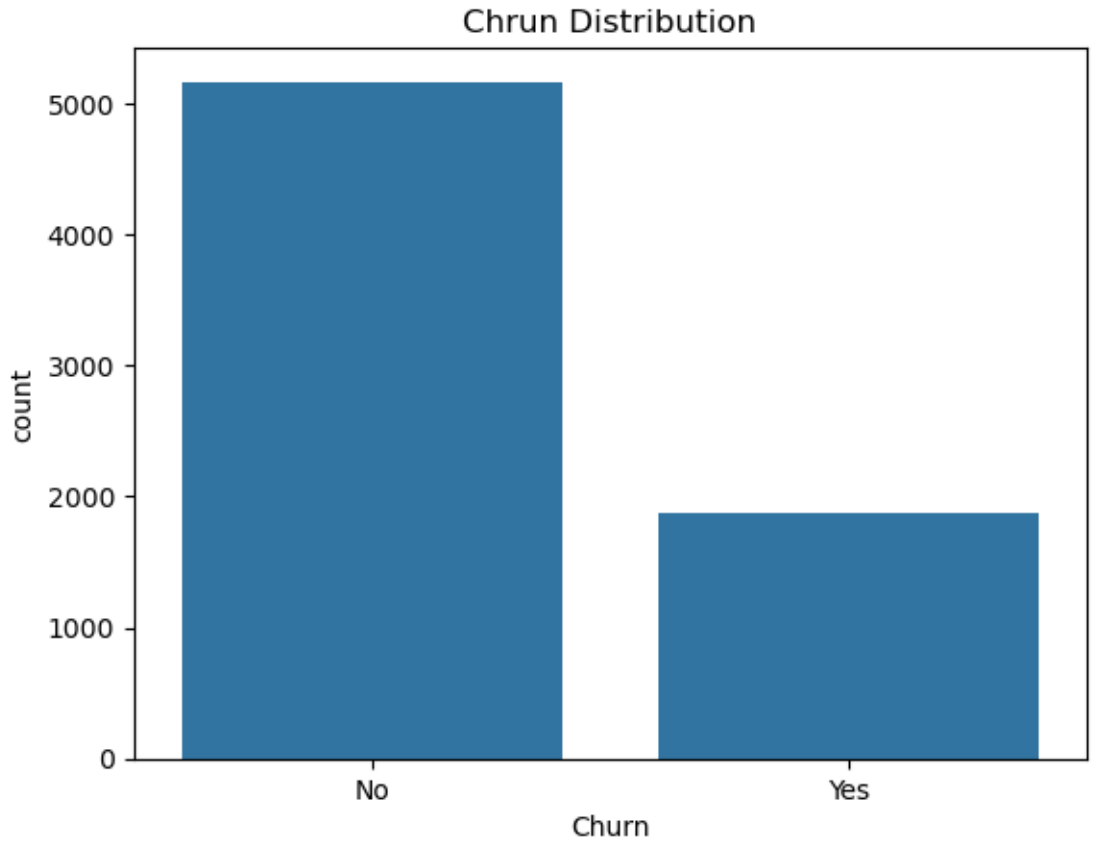
[9]:
```
# Getting the statistical summary for the data
df.describe()
```

[9]:

	SeniorCitizen	tenure	MonthlyCharges	TotalCharges
count	7032.000000	7032.000000	7032.000000	7032.000000
mean	0.162400	32.421786	64.798208	2283.300441
std	0.368844	24.545260	30.085974	2266.771362
min	0.000000	1.000000	18.250000	18.800000
25%	0.000000	9.000000	35.587500	401.450000
50%	0.000000	29.000000	70.350000	1397.475000
75%	0.000000	55.000000	89.862500	3794.737500

```
max          1.000000     72.000000       118.750000    8684.800000
```

[10]:
```
# Plotting a count plot to visualize the Churn Distribution
sns.countplot(x="Churn", data=df)
plt.title("Chrun Distribution")
plt.show()
```



[11]:
```
# Convert categorical variables with "Yes/No" values numeircal 1/0
cat_cols = ["Partner", "Dependents", "PhoneService", "PaperlessBilling",␣
 ↪"Churn"]
for col in cat_cols:
    df[col] = df[col].map({"Yes": 1, "No": 0})
```

[12]:
```
df.shape
```

[12]:
```
(7032, 21)
```

[13]:
```
# Convert gender to numerical (male=1, female=0)
df["gender"] = df["gender"].map({"Male": 1, "Female": 0})
```

[14]:
```
df.shape
```

[14]:
```
(7032, 21)
```

[15]:
```
# Keep SeniorCitizen as a numerical feature
df["SeniorCitizen"] = df["SeniorCitizen"].astype(int)
```

[16]:
```
# Identify categorical variables with more than two unique values
multi_cat_cols = ["Contract", "InternetService", "PaymentMethod",␣
 ↪"MultipleLines", "OnlineSecurity",
                       "OnlineBackup", "DeviceProtection", "TechSupport",␣
 ↪"StreamingTV", "StreamingMovies"]
```

[17]:
```
# Apply one-hot encoding to multi-category variables
df = pd.get_dummies(df, columns=multi_cat_cols, drop_first=True)
```

[18]:
```
# Feature scaling the columns
scaler = StandardScaler()
df[['tenure', 'MonthlyCharges', 'TotalCharges']] = scaler.
 ↪fit_transform(df[['tenure', 'MonthlyCharges', 'TotalCharges']])
```

[19]:
```
df.info()
df.head()
```

```
<class 'pandas.core.frame.DataFrame'>
Index: 7032 entries, 0 to 7042
Data columns (total 32 columns):
 #   Column                                 Non-Null Count  Dtype
---  ------                                 --------------  -----
 0   customerID                             7032 non-null   object
 1   gender                                 7032 non-null   int64
 2   SeniorCitizen                          7032 non-null   int32
 3   Partner                                7032 non-null   int64
 4   Dependents                             7032 non-null   int64
 5   tenure                                 7032 non-null   float64
 6   PhoneService                           7032 non-null   int64
 7   PaperlessBilling                       7032 non-null   int64
 8   MonthlyCharges                         7032 non-null   float64
 9   TotalCharges                           7032 non-null   float64
 10  Churn                                  7032 non-null   int64
 11  Contract_One year                      7032 non-null   bool
 12  Contract_Two year                      7032 non-null   bool
 13  InternetService_Fiber optic            7032 non-null   bool
 14  InternetService_No                     7032 non-null   bool
 15  PaymentMethod_Credit card (automatic)  7032 non-null   bool
 16  PaymentMethod_Electronic check         7032 non-null   bool
 17  PaymentMethod_Mailed check             7032 non-null   bool
 18  MultipleLines_No phone service         7032 non-null   bool
```

```
 19  MultipleLines_Yes                       7032 non-null   bool
 20  OnlineSecurity_No internet service      7032 non-null   bool
 21  OnlineSecurity_Yes                      7032 non-null   bool
 22  OnlineBackup_No internet service        7032 non-null   bool
 23  OnlineBackup_Yes                        7032 non-null   bool
 24  DeviceProtection_No internet service    7032 non-null   bool
 25  DeviceProtection_Yes                    7032 non-null   bool
 26  TechSupport_No internet service         7032 non-null   bool
 27  TechSupport_Yes                         7032 non-null   bool
 28  StreamingTV_No internet service         7032 non-null   bool
 29  StreamingTV_Yes                         7032 non-null   bool
 30  StreamingMovies_No internet service     7032 non-null   bool
 31  StreamingMovies_Yes                     7032 non-null   bool
dtypes: bool(21), float64(3), int32(1), int64(6), object(1)
memory usage: 776.0+ KB
```

[19]:

	customerID	gender	SeniorCitizen	Partner	Dependents	tenure	\
0	7590-VHVEG	0	0	1	0	-1.280248	
1	5575-GNVDE	1	0	0	0	0.064303	
2	3668-QPYBK	1	0	0	0	-1.239504	
3	7795-CFOCW	1	0	0	0	0.512486	
4	9237-HQITU	0	0	0	0	-1.239504	

	PhoneService	PaperlessBilling	MonthlyCharges	TotalCharges	…	\
0	0	1	-1.161694	-0.994194	…	
1	1	0	-0.260878	-0.173740	…	
2	1	1	-0.363923	-0.959649	…	
3	0	0	-0.747850	-0.195248	…	
4	1	1	0.196178	-0.940457	…	

	OnlineBackup_No internet service	OnlineBackup_Yes	\
0	False	True	
1	False	False	
2	False	True	
3	False	False	
4	False	False	

	DeviceProtection_No internet service	DeviceProtection_Yes	\
0	False	False	
1	False	True	
2	False	False	
3	False	True	
4	False	False	

	TechSupport_No internet service	TechSupport_Yes	\
0	False	False	
1	False	False	

```
2                              False            False
3                              False             True
4                              False            False

   StreamingTV_No internet service  StreamingTV_Yes  \
0                            False            False
1                            False            False
2                            False            False
3                            False            False
4                            False            False

   StreamingMovies_No internet service  StreamingMovies_Yes
0                                False                False
1                                False                False
2                                False                False
3                                False                False
4                                False                False

[5 rows x 32 columns]
```

[20]:
```
# Dropping "CustomerID" columns as it is not essential for further analysis
df.drop(columns=["customerID"], inplace = True)
```

[21]:
```
df.head()
```

[21]:
```
   gender  SeniorCitizen  Partner  Dependents    tenure  PhoneService  \
0       0              0        1           0 -1.280248             0
1       1              0        0           0  0.064303             1
2       1              0        0           0 -1.239504             1
3       1              0        0           0  0.512486             0
4       0              0        0           0 -1.239504             1

   PaperlessBilling  MonthlyCharges  TotalCharges  Churn  …  \
0                 1       -1.161694     -0.994194      0  …
1                 0       -0.260878     -0.173740      0  …
2                 1       -0.363923     -0.959649      1  …
3                 0       -0.747850     -0.195248      0  …
4                 1        0.196178     -0.940457      1  …

   OnlineBackup_No internet service  OnlineBackup_Yes  \
0                             False              True
1                             False             False
2                             False              True
3                             False             False
4                             False             False

   DeviceProtection_No internet service  DeviceProtection_Yes  \
```

```
0                                  False                 False
1                                  False                  True
2                                  False                 False
3                                  False                  True
4                                  False                 False

   TechSupport_No internet service  TechSupport_Yes  \
0                            False            False
1                            False            False
2                            False            False
3                            False             True
4                            False            False

   StreamingTV_No internet service  StreamingTV_Yes  \
0                            False            False
1                            False            False
2                            False            False
3                            False            False
4                            False            False

   StreamingMovies_No internet service  StreamingMovies_Yes
0                                False                False
1                                False                False
2                                False                False
3                                False                False
4                                False                False

[5 rows x 31 columns]
```

[22]:
```
# Modelling the algorithm
from sklearn.model_selection import train_test_split, GridSearchCV
from sklearn.ensemble import RandomForestClassifier
from sklearn.metrics import accuracy_score, classification_report,␣
 ↪precision_score, recall_score, f1_score

# Split the data into features and target variable
X = df.drop(columns=["Churn"])
y = df["Churn"]

# Split into training and testing sets
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.2,␣
 ↪random_state=42)

# Train a Random Forest model
model = RandomForestClassifier(n_estimators=100, random_state=42)
model.fit(X_train, y_train)
```

```
# Make predictions
y_pred = model.predict(X_test)
```

[70]:
```
# Evaluating the model
accuracy = accuracy_score(y_test, y_pred)
precision = precision_score(y_test, y_pred)
recall = recall_score(y_test, y_pred)
f1 = f1_score(y_test, y_pred)

print(f"Accuracy: {accuracy}")
print(f"Precision: {precision}")
print(f"Recall: {recall}")
print(f"F1 Score: {f1}")
print("Classification Report:
 ↪\n----------------------------------------------------")
print(classification_report(y_test, y_pred))
print("----------------------------------------------------")
```

```
Accuracy: 0.7896233120113717
Precision: 0.6382978723404256
Recall: 0.48128342245989303
F1 Score: 0.5487804878048781
Classification Report:
----------------------------------------------------
              precision    recall  f1-score   support

           0       0.83      0.90      0.86      1033
           1       0.64      0.48      0.55       374

    accuracy                           0.79      1407
   macro avg       0.73      0.69      0.71      1407
weighted avg       0.78      0.79      0.78      1407

----------------------------------------------------
```

[24]:
```
# Hyperparameter tuning using GridSearchCV
param_grid = {
    'n_estimators': [50, 100, 150],
    'max_depth': [None, 10, 20],
    'min_samples_split': [2, 5, 10]
                }

g_search = GridSearchCV(RandomForestClassifier(random_state=42), param_grid,␣
 ↪cv=5, scoring='accuracy')
g_search.fit(X_train, y_train)

# Best model
```

```
best_model = g_search.best_estimator_

# Make predictions
y_pred_best = best_model.predict(X_test)

# Evaluate the model
accuracy = accuracy_score(y_test, y_pred_best)
precision = precision_score(y_test, y_pred_best)
recall = recall_score(y_test, y_pred_best)
f1 = f1_score(y_test, y_pred_best)

print("Best Model Parameters:", g_search.best_params_)
print("Accuracy:", accuracy)
print("Precision:", precision)
print("Recall:", recall)
print("F1 Score:", f1)
print("Classification Report:")
print(classification_report(y_test, y_pred))
```

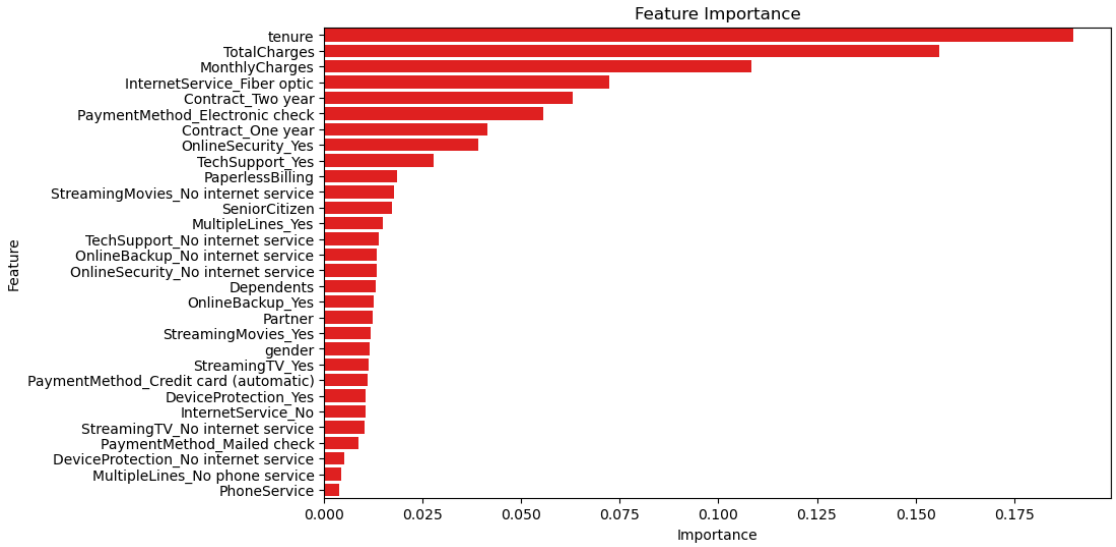
```
Best Model Parameters: {'max_depth': 10, 'min_samples_split': 10,
'n_estimators': 100}
Accuracy: 0.7995735607675906
Precision: 0.6666666666666666
Recall: 0.4919786096256685
F1 Score: 0.5661538461538461
Classification Report:
              precision    recall  f1-score   support

           0       0.83      0.90      0.86      1033
           1       0.64      0.48      0.55       374

    accuracy                           0.79      1407
   macro avg       0.73      0.69      0.71      1407
weighted avg       0.78      0.79      0.78      1407
```

[25]:
```
# Feature importance analysis
f_importance = pd.DataFrame({'Feature': X.columns, 'Importance': best_model.
  ↪feature_importances_})
f_importance = f_importance.sort_values(by='Importance', ascending=False)

plt.figure(figsize=(10, 6))
sns.barplot(x='Importance', y='Feature', data=f_importance, color="red")
plt.title('Feature Importance')
plt.show()
```



[26]:
```python
# Function to predict churn for new data
def predict_churn(new_data):
    new_data = pd.DataFrame(new_data)
    new_data[['tenure', 'MonthlyCharges', 'TotalCharges']] = scaler.
 ↪transform(new_data[['tenure', 'MonthlyCharges', 'TotalCharges']])
    return best_model.predict(new_data)

# Example new customer data
new_customer = {
    'gender': [1],
    'SeniorCitizen': [0],
    'Partner': [1],
    'Dependents': [0],
    'tenure': [12],
    'PhoneService': [1],
    'PaperlessBilling': [1],
    'MonthlyCharges': [50.0],
    'TotalCharges': [600.0],
    'Contract_One year': [0],
    'Contract_Two year': [1],
    'InternetService_Fiber optic': [1],
    'InternetService_No': [0],
    'PaymentMethod_Credit card (automatic)': [0],
    'PaymentMethod_Electronic check': [1],
    'PaymentMethod_Mailed check': [0],
    'MultipleLines_No phone service': [0],
    'MultipleLines_Yes': [1],
    'OnlineSecurity_No internet service': [0],
```

```
    'OnlineSecurity_Yes': [1],
    'OnlineBackup_No internet service': [0],
    'OnlineBackup_Yes': [1],
    'DeviceProtection_No internet service': [0],
    'DeviceProtection_Yes': [1],
    'TechSupport_No internet service': [0],
    'TechSupport_Yes': [1],
    'StreamingTV_No internet service': [0],
    'StreamingTV_Yes': [1],
    'StreamingMovies_No internet service': [0],
    'StreamingMovies_Yes': [1]
}

# Convert to DataFrame and predict
new_customer_df = pd.DataFrame(new_customer)
prediction = predict_churn(new_customer_df)

# Print prediction result
print("Predicted Churn:", "Yes" if prediction[0] == 1 else "No")
```

```
Predicted Churn: No
```

Actionable Insights:

Very high Monthly charges and Tenure: The main contributing factors are high monthly charges and low tenure. – Offering discounts and loyalty programs to retain the customers.

Improve the Internet Service Quality. – Offer targeted promotions to encourage upgrades to higher-tier packages, ensuring high satisfaction with premium services.

TotalCharges and MonthlyCharges are also highly influential. Ensure pricing is competitive and transparent – Highlighting cost-saving benefits for customers using long-term subscriptions.

s

Video Presentation Link

https://drive.google.com/file/d/1ZFMdR2ShWuJCpDeW9R0YUqEoGCQJ2E_-/view?usp=sharing

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