In [24]:
```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
from sklearn.preprocessing import LabelEncoder
from sklearn.model_selection import train_test_split
from sklearn.preprocessing import StandardScaler
from sklearn.linear_model import LogisticRegression
from sklearn.ensemble import RandomForestClassifier
from sklearn.metrics import accuracy_score, classification_report, confusion_matrix
```

In [3]:
```
np.random.seed(42)
n_samples = 1000
data = {
    'CustomerID': np.arange(1001, 1001 + n_samples),
    'Gender': np.random.choice(['Male', 'Female'], size=n_samples),
    'Age': np.random.randint(18, 80, size=n_samples),
    'ServiceLength': np.random.randint(1, 60, size=n_samples),
    'ContractType': np.random.choice(['Two-Year', 'One-Year', 'Month-to-Month'], size=n_samples),
    'MonthlyCharges': np.random.uniform(20, 120, size=n_samples),
    'TotalCharges': np.random.uniform(100, 5000, size=n_samples),
    'Churn': np.random.choice(['Yes', 'No'], size=n_samples)
}


df = pd.DataFrame(data)
df.to_csv('CommLink_Telecom_Customer_Data.csv', index=False)
```

In [12]:
```
df.head()
```

Out[12]:

	CustomerID	Gender	Age	ServiceLength	ContractType	MonthlyCharges	TotalCharges	Churn
0	1001	Male	71	23	Two-Year	27.896916	3119.872381	No
1	1002	Female	34	26	One-Year	43.951017	2828.704372	No
2	1003	Male	26	21	Two-Year	99.457828	2137.298007	Yes
3	1004	Male	50	22	Month-to-Month	23.467027	2201.827234	No
4	1005	Male	70	58	One-Year	78.280684	2750.434519	No

In [14]:
```
df[df["Churn"]=='Yes'].shape[0]
```

Out[14]: 518

Encode Categorical Variables:

In [16]:
```
label_encoder = LabelEncoder()
df['Gender_encoded'] = label_encoder.fit_transform(df['Gender'])
```

In [ ]:
```
one_hot_encoded = pd.get_dummies(df['ContractType'], prefix='Contract')
df = pd.concat([df, one_hot_encoded], axis=1)
```

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

Out[19]:

	CustomerID	Gender	Age	ServiceLength	ContractType	MonthlyCharges	TotalCharges	Chur
0	1001	Male	1.269334	-0.419836	Two-Year	-1.432829	0.430072	N
1	1002	Female	-0.808227	-0.243434	One-Year	-0.877852	0.222300	N
2	1003	Male	-1.257430	-0.537437	Two-Year	1.040972	-0.271074	Ye
3	1004	Male	0.090177	-0.478636	Month-to-Month	-1.585966	-0.225027	N
4	1005	Male	1.213183	1.638182	One-Year	0.308896	0.166448	N

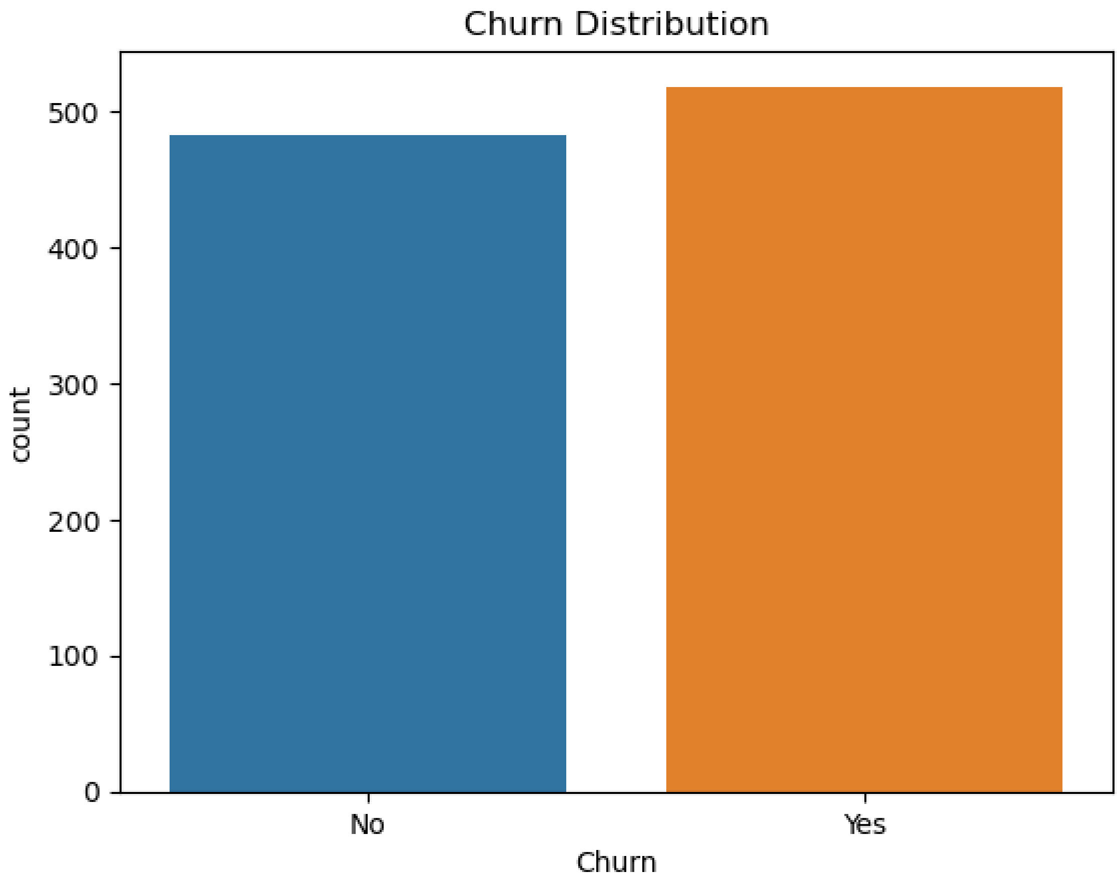
Feature Scaling

In [18]:
```
from sklearn.preprocessing import StandardScaler

scaler = StandardScaler()
scaled_features = scaler.fit_transform(df[['Age', 'ServiceLength', 'MonthlyCharges', 'TotalCharges']])
df[['Age', 'ServiceLength', 'MonthlyCharges', 'TotalCharges']] = scaled_features
```

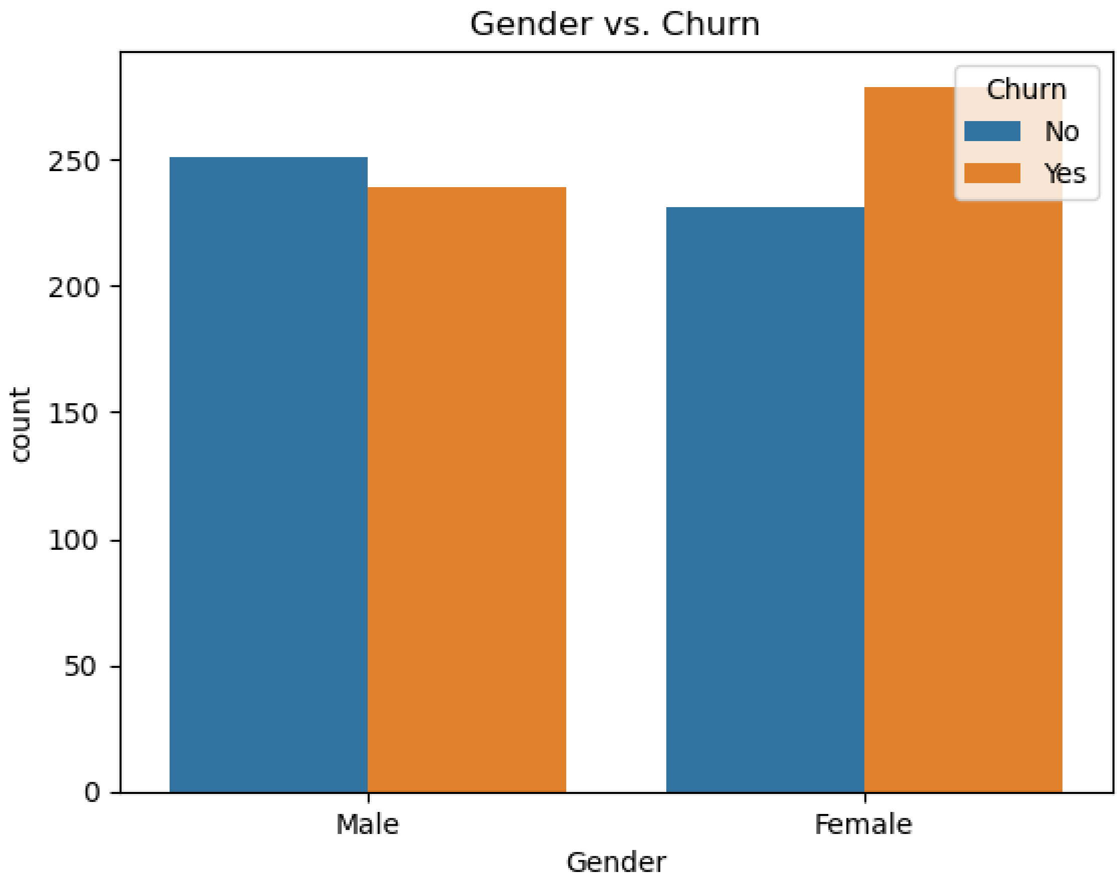
Churn distribution

In [20]:
```
sns.countplot(x='Churn', data=df)
plt.title('Churn Distribution')
plt.show()
```



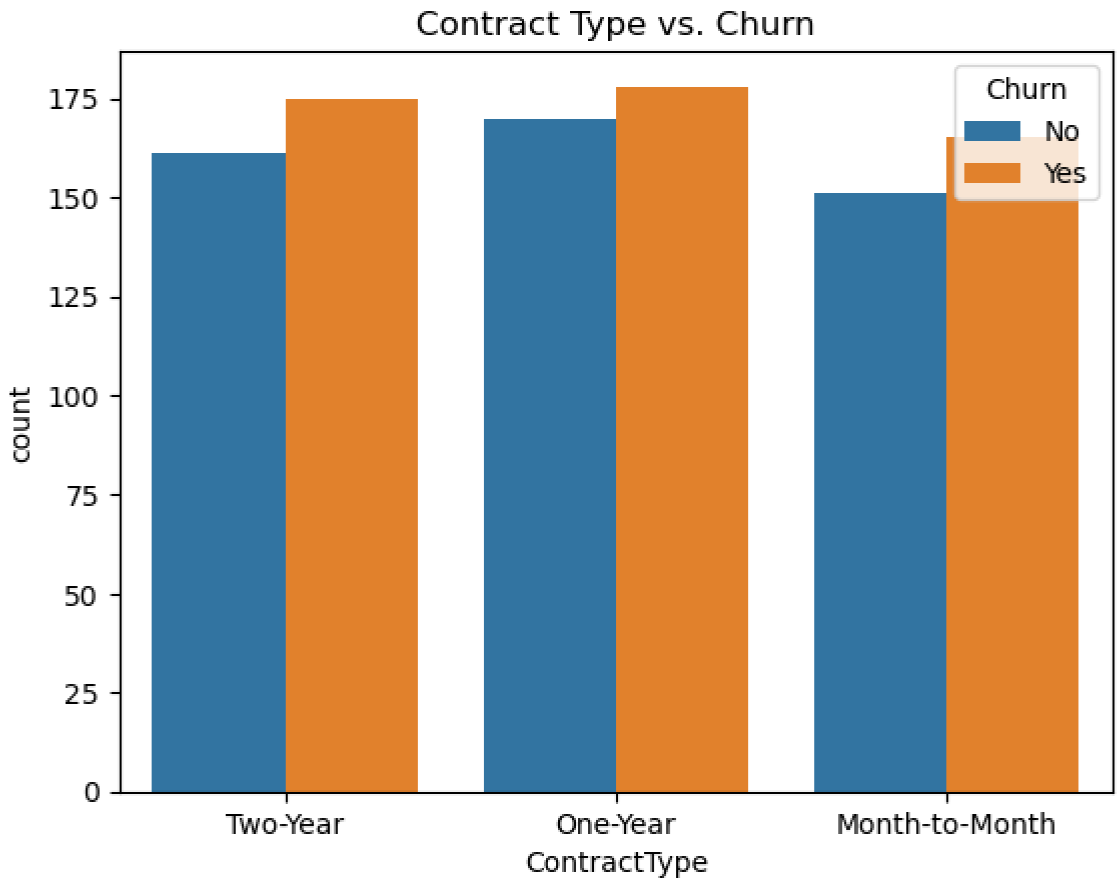
Gender vs. Churn

In [21]:
```
sns.countplot(x='Gender', hue='Churn', data=df)
plt.title('Gender vs. Churn')
plt.show()
```



Contract type vs. Churn

In [22]:
```
sns.countplot(x='ContractType', hue='Churn', data=df)
plt.title('Contract Type vs. Churn')
plt.show()
```

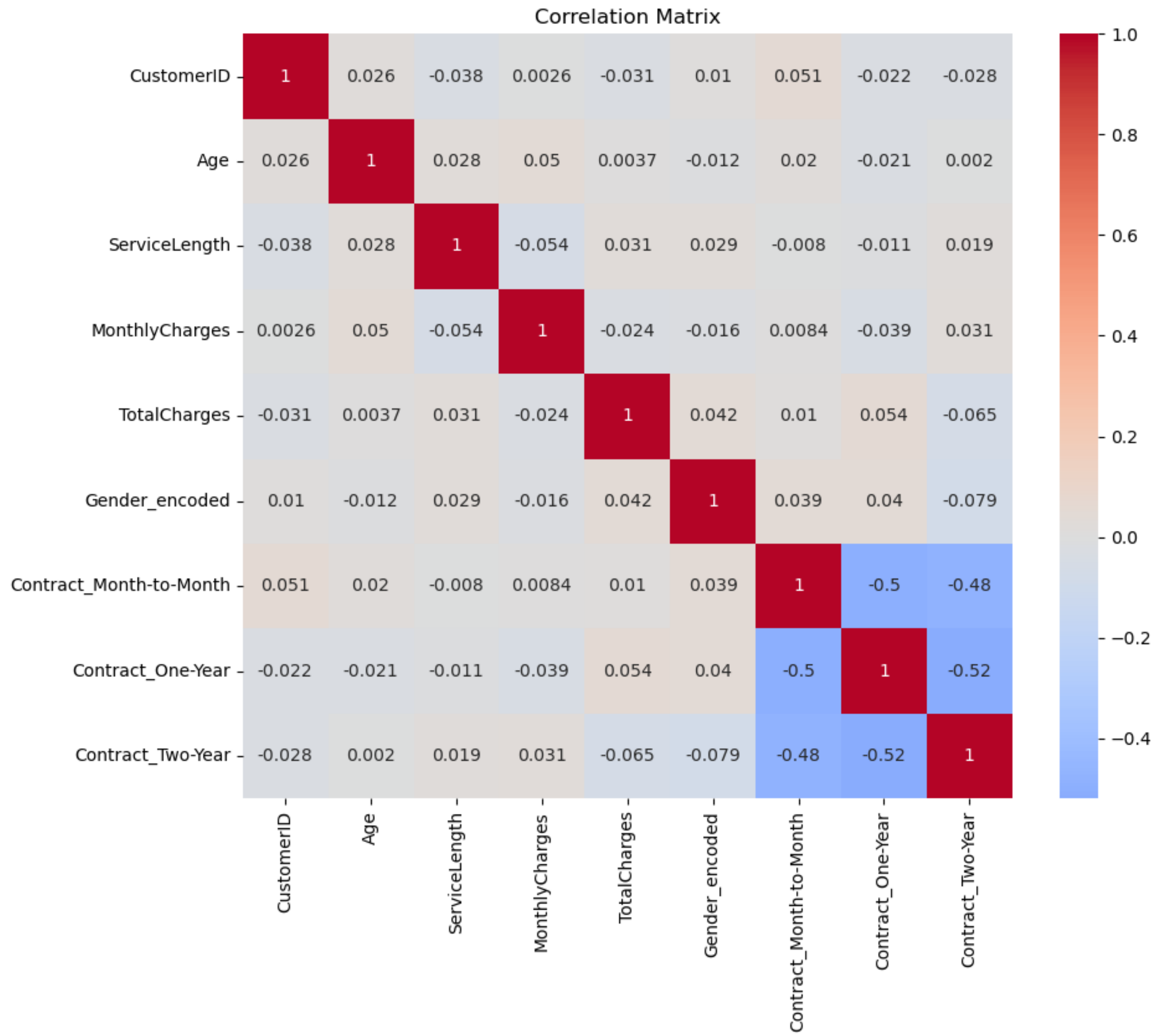


Correlation matrix

In [23]:

```
corr_matrix = df.corr()
plt.figure(figsize=(10, 8))
sns.heatmap(corr_matrix, annot=True, cmap='coolwarm', center=0)
plt.title('Correlation Matrix')
plt.show()
```

```
C:\Users\Qurrat\AppData\Local\Temp\ipykernel_7968\3448318903.py:1: FutureWarning: The default valu
e of numeric_only in DataFrame.corr is deprecated. In a future version, it will default to False. Select only
valid columns or specify the value of numeric_only to silence this warning.
  corr_matrix = df.corr()
```



Churn Prediction(Logistic Regression, Random Forest)

In [26]:
```
features = ['Gender_encoded', 'Age', 'ServiceLength', 'MonthlyCharges', 'TotalCharges',
            'Contract_One-Year', 'Contract_Two-Year', 'Contract_Month-to-Month']
target = 'Churn'

X = df[features]
y = df[target]


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


scaler = StandardScaler()
X_train_scaled = scaler.fit_transform(X_train)
X_test_scaled = scaler.transform(X_test)

# Logistic Regression
logreg_model = LogisticRegression()
logreg_model.fit(X_train_scaled, y_train)
```

```
logreg_pred = logreg_model.predict(X_test_scaled)

# Random Forest
rf_model = RandomForestClassifier(random_state=42)
rf_model.fit(X_train_scaled, y_train)
rf_pred = rf_model.predict(X_test_scaled)

# Model Evaluation
print("Logistic Regression Results:")
print("Accuracy:", accuracy_score(y_test, logreg_pred))
print(classification_report(y_test, logreg_pred))


print("\nRandom Forest Results:")
print("Accuracy:", accuracy_score(y_test, rf_pred))
print(classification_report(y_test, rf_pred))
```

```
Logistic Regression Results:
Accuracy: 0.545
              precision    recall  f1-score   support

          No       0.58      0.37      0.46       102
         Yes       0.53      0.72      0.61        98

    accuracy                           0.55       200
   macro avg       0.56      0.55      0.53       200
weighted avg       0.56      0.55      0.53       200


Random Forest Results:
Accuracy: 0.45
              precision    recall  f1-score   support

          No       0.46      0.40      0.43       102
         Yes       0.45      0.50      0.47        98

    accuracy                           0.45       200
   macro avg       0.45      0.45      0.45       200
weighted avg       0.45      0.45      0.45       200
```

In [ ]:

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