

PROGRAM:

```
In[1]: import pandas as pd
import numpy as np
import missingno as msno
import matplotlib.pyplot as plt
import seaborn as sns
import plotly.express as px
import plotly.graph_objects as go
from plotly.subplots import make_subplots
import warnings
warnings.filterwarnings('ignore')
```

```
In[2]: from sklearn.preprocessing import StandardScaler
from sklearn.preprocessing import LabelEncoder
from sklearn.tree import DecisionTreeClassifier
from sklearn.ensemble import RandomForestClassifier
from sklearn.naive_bayes import GaussianNB
from sklearn.neighbors import KNeighborsClassifier
from sklearn.svm import SVC
from sklearn.neural_network import MLPClassifier
from sklearn.ensemble import AdaBoostClassifier
from sklearn.ensemble import GradientBoostingClassifier
from sklearn.ensemble import ExtraTreesClassifier
from sklearn.linear_model import LogisticRegression
from sklearn.model_selection import train_test_split
from sklearn.metrics import accuracy_score
from xgboost import XGBClassifier
from catboost import CatBoostClassifier
from sklearn import metrics

from sklearn.metrics import roc_curve

from sklearn.metrics import recall_score, confusion_matrix,
precision_score, f1_score, accuracy_score, classification_report
```

```
In [3]:
```

```
df=pd.read_csv('../input/telco-customer-churn/WA_Fn-UseC_-Telco-Customer-
Churn.csv')
```

```
In[4]: df.head()
```

```
Out[4]:
```

	customer ID	gender	Senior Citizen	Partner	Dependents	tenure	Phone Service	Multiple Lines	Internet Service	Online Security		Device Protection	Tech Support	Streaming TV	Streaming Movies	Contact	Paperless Billing	Payment Method	Monthly Charges	Total Charges	Churn
0	7590-VHVEG	Female	0	Yes	No	1	No	No phone service	DSL	No		No	No	No	No	Month-to-month	Yes	Electronic check	29.85	29.85	No
1	5575-GNVDE	Male	0	No	No	34	Yes	No	DSL	Yes		Yes	No	No	No	One year	No	Mailed check	56.95	1889.5	No
2	3668-QPY	Male	0	No	No	2	Yes	No	DSL	Yes		No	No	No	No	Month-to-	Yes	Mailed check	53.85	108.15	Yes

3	7795-CFCW	Male	0	No	No	45	No	No phone service	DSL	Yes	...	Yes	Yes	No	No	One year	No	Bank transfer (automatic)	42.30	1840.75	No
4	9237-HQU	Female	0	No	No	2	Yes	No	Fiber optic	No	...	No	No	No	No	Month-to-month	Yes	Electronic check	70.70	151.65	Yes

```
In [5]: df.shape
```

```
Out[5]: (7043, 21)
```

```
In [6]: df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
```

RangeIndex: 7043 entries, 0 to 7042

Data columns (total 21 columns):

#	Column	Non-Null Count	Dtype
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```

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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    7043 non-null  object
20  Churn           7043 non-null  object
dtypes: float64(1), int64(2), object(18)
memory usage: 1.1+ MB

```

In [7]: `df.columns.values`

```

Out[7]: array(['customerID', 'gender', 'SeniorCitizen', 'Partner',
'Dependents', 'tenure', 'PhoneService', 'MultipleLines',
'InternetService', 'OnlineSecurity', 'OnlineBackup', 'DeviceProtection',
'TechSupport', 'StreamingTV', 'StreamingMovies', 'Contract',
'PaperlessBilling', 'PaymentMethod', 'MonthlyCharges', 'TotalCharges',
'Churn'], dtype=object)

```

In [8]: `df.dtypes`

```

Out[8]:
customerID      object
gender          object
SeniorCitizen   int64

```

Partner	object
Dependents	object
tenure	int64
PhoneService	object
MultipleLines	object
InternetService	object
OnlineSecurity	object
OnlineBackup	object
DeviceProtection	object
TechSupport	object
StreamingTV	object
StreamingMovies	object
Contract	object
PaperlessBilling	object
PaymentMethod	object
MonthlyCharges	float64
TotalCharges	object
Churn	object