


## 1.importing the dependencies

```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
import gradio as gr
import joblib
from sklearn.preprocessing import LabelEncoder
from imblearn.over_sampling import SMOTE
from sklearn.model_selection import train_test_split, cross_val_score
from sklearn.tree import DecisionTreeClassifier
from sklearn.ensemble import RandomForestClassifier
from xgboost import XGBClassifier
from sklearn.metrics import accuracy_score, confusion_matrix, classification_report
import pickle
from sklearn.linear_model import LogisticRegression
```

## 2.Data Loading and Understanding

```
#load teh csv data to a pandas dataframe
df = pd.read_csv("/content/WA_Fn-UseC_-Telco-Customer-Churn.csv")
```

```
# Display first few rows
df.head()
```



	customerID	gender	SeniorCitizen	Partner	Dependents	tenure	PhoneService	MultipleLines	InternetService	OnlineSecurity	Onl:
0	7590-VHVEG	Female	0	Yes	No	1	No	No phone service	DSL	No	
1	5575-GNVDE	Male	0	No	No	34	Yes	No	DSL	Yes	
2	3668-QPYBK	Male	0	No	No	2	Yes	No	DSL	Yes	
3	7795-CFOCW	Male	0	No	No	45	No	No phone service	DSL	Yes	
4	9237-HQITU	Female	0	No	No	2	Yes	No	Fiber optic	No	

```
# Shape of the dataset
print("Shape:", df.shape)
# Column names
print("Columns:", df.columns.tolist())
# Data types and non-null values
df.info()
# Summary statistics for numeric features
df.describe()
```

```

Shape: (7043, 21)
Columns: ['customerID', 'gender', 'SeniorCitizen', 'Partner', 'Dependents', 'tenure', 'PhoneService', 'MultipleLines', 'InternetServ
<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          7043 non-null   object
20  Churn                 7043 non-null   object
dtypes: float64(1), int64(2), object(18)
memory usage: 1.1+ MB

```

	SeniorCitizen	tenure	MonthlyCharges
count	7043.000000	7043.000000	7043.000000
mean	0.162147	32.371149	64.761692
std	0.368612	24.559481	30.090047
min	0.000000	0.000000	18.250000
25%	0.000000	9.000000	35.500000
50%	0.000000	29.000000	70.350000
75%	0.000000	55.000000	89.850000
max	1.000000	72.000000	118.750000

### 3.Check for Missing Values and Duplicates

```

# Check for missing values
print(df.isnull().sum())
# Check for duplicates
print("Duplicate rows:", df.duplicated().sum())

```

```

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  0
Churn         0
dtype: int64
Duplicate rows: 0

```

### 4.Visualize a Few Features

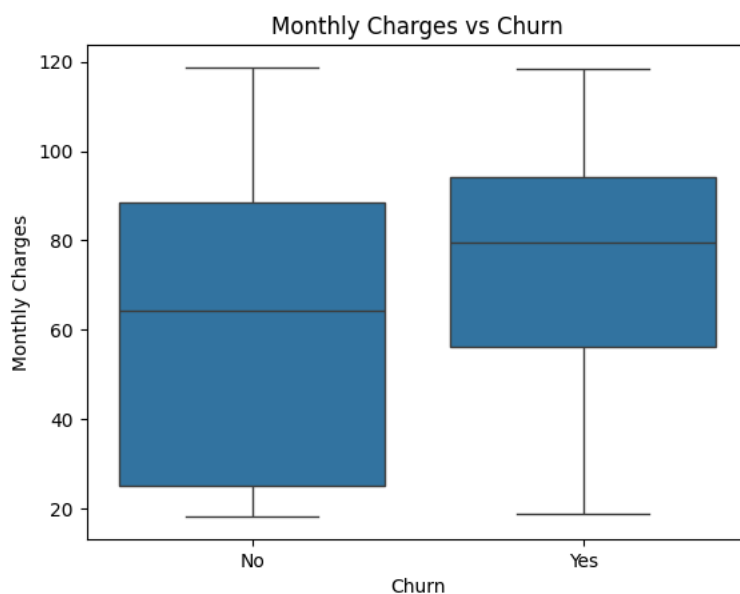
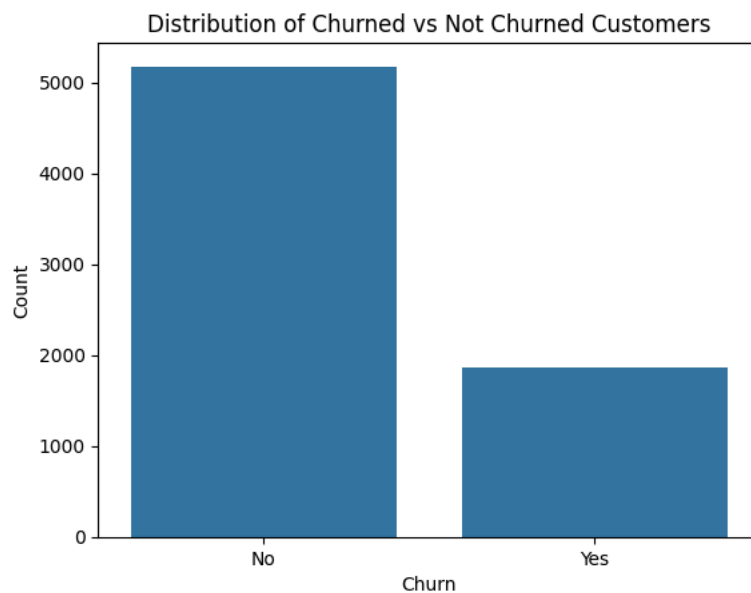
```

# Distribution of Churn
sns.countplot(x='Churn', data=df)
plt.title('Distribution of Churned vs Not Churned Customers')

```

```
plt.xlabel('Churn')
plt.ylabel('Count')
plt.show()
```

```
# Relationship between Monthly Charges and Churn
sns.boxplot(x='Churn', y='MonthlyCharges', data=df)
plt.title('Monthly Charges vs Churn')
plt.xlabel('Churn')
plt.ylabel('Monthly Charges')
plt.show()
```



## 5. Identify Target and Features

```
#Identify target and features for churn prediction
target = 'Churn'
features = df.columns.drop(target)
print("Features:", features)
```



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

## 6. Convert Categorical Columns to Numerical

```
# Identify categorical columns
categorical_cols = df.select_dtypes(include=['object']).columns
print("Categorical Columns:", categorical_cols.tolist())
```

```
# Convert binary categorical columns using LabelEncoder
label_encoder = LabelEncoder()
for col in categorical_cols:
    if df[col].nunique() == 2:
        df[col] = label_encoder.fit_transform(df[col])
    else:
        df = pd.get_dummies(df, columns=[col], drop_first=True)
```

→ Categorical Columns: ['customerID', 'gender', 'Partner', 'Dependents', 'PhoneService', 'MultipleLines', 'InternetService', 'OnlineSe

## 7.One-Hot Encoding

### 1.Separate features and target first:

```
# Save target variable separately
target = 'Churn'
y = df[target]
```

```
# Drop target from features
X = df.drop(columns=[target])
```

### 2.One-hot encode only the features:

```
# One-hot encode features
X_encoded = pd.get_dummies(X, drop_first=True)

# If needed, encode the target (binary label)
from sklearn.preprocessing import LabelEncoder
label_encoder = LabelEncoder()
y_encoded = label_encoder.fit_transform(y) # "Yes"/"No" → 1/0
```

## 8.Feature Scaling

```
# Separate target variable
target = 'Churn'
y = df[target]

# Drop target from features
X = df.drop(columns=[target])

# One-hot encode features
X_encoded = pd.get_dummies(X, drop_first=True)

# Encode the target ("Yes"/"No") to 1/0
label_encoder = LabelEncoder()
y_encoded = label_encoder.fit_transform(y)
```

## 9.Train-Test Split

```
# Split data
X_train, X_test, y_train, y_test = train_test_split(X_encoded, y_encoded, test_size=0.2, random_state=42)
```

## 10.Model Building

```
# Train model
model = LogisticRegression(max_iter=1000)
model.fit(X_train, y_train)

# Predict
y_pred = model.predict(X_test)
```

## 11.Evaluation

```
# Evaluate
print("Accuracy:", accuracy_score(y_test, y_pred))
print("\nClassification Report:\n", classification_report(y_test, y_pred))
```

```
print("\nConfusion Matrix:\n", confusion_matrix(y_test, y_pred))
```

Accuracy: 0.8246983676366217

Classification Report:		precision	recall	f1-score	support
0	0.86	0.91	0.88	1036	
1	0.70	0.59	0.64	373	
accuracy				0.82	1409
macro avg		0.78	0.75	0.76	1409
weighted avg		0.82	0.82	0.82	1409

Confusion Matrix:  
[[942 94]  
[153 220]]

## 12.Make Predictions from New Input

```
#new inputs values
new_customer = {
    'gender': 'Female',
    'SeniorCitizen': 0,
    'Partner': 'Yes',
    'Dependents': 'No',
    'tenure': 5,
    'PhoneService': 'Yes',
    'MultipleLines': 'No',
    'InternetService': 'DSL',
    'OnlineSecurity': 'Yes',
    'OnlineBackup': 'No',
    'DeviceProtection': 'Yes',
    'TechSupport': 'No',
    'StreamingTV': 'No',
    'StreamingMovies': 'No',
    'Contract': 'Month-to-month',
    'PaperlessBilling': 'Yes',
    'PaymentMethod': 'Electronic check',
    'MonthlyCharges': 70.35,
    'TotalCharges': 350.5
}
```

## 13.Convert to DataFrame and Encode

```
# Convert to DataFrame
new_df = pd.DataFrame([new_customer])

# Combine with original df to match columns
df_temp = pd.concat([df.drop('Churn', axis=1), new_df], ignore_index=True)

# One-hot encode the combined DataFrame
df_temp_encoded = pd.get_dummies(df_temp, drop_first=True)

# Match the encoded feature order (use df_encoded which is the encoded training features)
df_temp_encoded = df_temp_encoded.reindex(columns=X_encoded.columns, fill_value=0)
```

## 14.Predict the Churn

```
# Predict churn for new customer input
predicted_churn = model.predict(df_temp_encoded)

# Output result
print("🔴 Churn Prediction:", "Yes" if predicted_churn[0] == 1 else "No")
```

🔴 Churn Prediction: No

## 15.Deployment-Building an Interactive App

```
!pip install gradio
```



```
Collecting starlette==0.10.0 (from gradio)
```

```

Collecting starlette<1.0,>=0.40.0 (from gradio)
  Downloading starlette-0.46.2-py3-none-any.whl.metadata (6.2 kB)
Collecting tomlkit<0.14.0,>=0.12.0 (from gradio)
  Downloading tomlkit-0.13.2-py3-none-any.whl.metadata (2.7 kB)
Requirement already satisfied: typer<1.0,>=0.12 in /usr/local/lib/python3.11/dist-packages (from gradio) (0.15.3)
Requirement already satisfied: typing-extensions~=4.0 in /usr/local/lib/python3.11/dist-packages (from gradio) (4.13.2)
Collecting uvicorn>=0.14.0 (from gradio)
  Downloading uvicorn-0.34.2-py3-none-any.whl.metadata (6.5 kB)
Requirement already satisfied: fsspec in /usr/local/lib/python3.11/dist-packages (from gradio-client==1.10.0->gradio) (2025.3.2)
Requirement already satisfied: websockets<16.0,>=10.0 in /usr/local/lib/python3.11/dist-packages (from gradio-client==1.10.0->gradio) (10.7)
Requirement already satisfied: idna>=2.8 in /usr/local/lib/python3.11/dist-packages (from anyio<5.0,>=3.0->gradio) (3.10)
Requirement already satisfied: sniffio>=1.1 in /usr/local/lib/python3.11/dist-packages (from anyio<5.0,>=3.0->gradio) (1.3.1)
Requirement already satisfied: certifi in /usr/local/lib/python3.11/dist-packages (from httpx>=0.24.1->gradio) (2025.4.26)
Requirement already satisfied: httpcore==1.* in /usr/local/lib/python3.11/dist-packages (from httpx>=0.24.1->gradio) (1.0.9)
Requirement already satisfied: h11>=0.16 in /usr/local/lib/python3.11/dist-packages (from httpcore==1.*->httpx>=0.24.1->gradio) (0.14.0)
Requirement already satisfied: filelock in /usr/local/lib/python3.11/dist-packages (from huggingface-hub>=0.28.1->gradio) (3.18.0)
Requirement already satisfied: requests in /usr/local/lib/python3.11/dist-packages (from huggingface-hub>=0.28.1->gradio) (2.32.3)
Requirement already satisfied: tqdm>=4.42.1 in /usr/local/lib/python3.11/dist-packages (from huggingface-hub>=0.28.1->gradio) (4.67.1)
Requirement already satisfied: python-dateutil>=2.8.2 in /usr/local/lib/python3.11/dist-packages (from pandas<3.0,>=1.0->gradio) (2.9.0)
Requirement already satisfied: pytz>=2020.1 in /usr/local/lib/python3.11/dist-packages (from pandas<3.0,>=1.0->gradio) (2025.2)
Requirement already satisfied: tzdata>=2022.7 in /usr/local/lib/python3.11/dist-packages (from pandas<3.0,>=1.0->gradio) (2025.2)
Requirement already satisfied: annotated-types>=0.6.0 in /usr/local/lib/python3.11/dist-packages (from pydantic<2.12,>=2.0->gradio) (0.7.0)
Requirement already satisfied: pydantic-core==2.33.1 in /usr/local/lib/python3.11/dist-packages (from pydantic<2.12,>=2.0->gradio) (2.33.1)
Requirement already satisfied: typing-inspection>=0.4.0 in /usr/local/lib/python3.11/dist-packages (from pydantic<2.12,>=2.0->gradio) (0.10.0)
Requirement already satisfied: click>=8.0.0 in /usr/local/lib/python3.11/dist-packages (from typer<1.0,>=0.12->gradio) (8.1.8)
Requirement already satisfied: shellingham>=1.3.0 in /usr/local/lib/python3.11/dist-packages (from typer<1.0,>=0.12->gradio) (1.5.4)
Requirement already satisfied: rich>=10.11.0 in /usr/local/lib/python3.11/dist-packages (from typer<1.0,>=0.12->gradio) (13.9.4)
Requirement already satisfied: six>=1.5 in /usr/local/lib/python3.11/dist-packages (from python-dateutil>=2.8.2->pandas<3.0,>=1.0) (1.17.0)
Requirement already satisfied: markdown-it-py>=2.2.0 in /usr/local/lib/python3.11/dist-packages (from rich>=10.11.0->typer<1.0,>=0.12->gradio) (3.0.0)
Requirement already satisfied: pygments<3.0.0,>=2.13.0 in /usr/local/lib/python3.11/dist-packages (from rich>=10.11.0->typer<1.0,>=0.12->gradio) (2.19.1)
Requirement already satisfied: charset-normalizer<4,>=2 in /usr/local/lib/python3.11/dist-packages (from requests->huggingface-hub>=0.28.1->gradio) (3.4.0)
Requirement already satisfied: urllib3<3,>=1.21.1 in /usr/local/lib/python3.11/dist-packages (from requests->huggingface-hub>=0.28.1->gradio) (2.3.0)
Requirement already satisfied: mdurl~0.1 in /usr/local/lib/python3.11/dist-packages (from markdown-it-py>=2.2.0->rich>=10.11.0->typer<1.0,>=0.12->gradio) (0.1.2)
Downloading gradio-5.29.0-py3-none-any.whl (54.1 MB)
 54.1/54.1 MB 13.6 MB/s eta 0:00:00
Downloading gradio_client-1.10.0-py3-none-any.whl (322 kB)
 322.9/322.9 kB 22.4 MB/s eta 0:00:00
Downloading aiofiles-24.1.0-py3-none-any.whl (15 kB)
Downloading fastapi-0.115.12-py3-none-any.whl (95 kB)
 95.2/95.2 kB 9.1 MB/s eta 0:00:00
Downloading groovy-0.1.2-py3-none-any.whl (14 kB)
Downloading python_multipart-0.0.20-py3-none-any.whl (24 kB)
Downloading ruff-0.11.8-py3-none-manylinux_2_17_x86_64.manylinux2014_x86_64.whl (11.5 MB)
 11.5/11.5 MB 115.8 MB/s eta 0:00:00
Downloading safehttpx-0.1.6-py3-none-any.whl (8.7 kB)
Downloading semantic_version-2.10.0-py2.py3-none-any.whl (15 kB)
Downloading starlette-0.46.2-py3-none-any.whl (72 kB)
 72.0/72.0 kB 6.6 MB/s eta 0:00:00
Downloading tomlkit-0.13.2-py3-none-any.whl (37 kB)
Downloading uvicorn-0.34.2-py3-none-any.whl (62 kB)
 62.5/62.5 kB 5.5 MB/s eta 0:00:00
Downloading ffmpeg-0.5.0-py3-none-any.whl (6.0 kB)
Downloading pydub-0.25.1-py2.py3-none-any.whl (32 kB)
Installing collected packages: pydub, uvicorn, tomlkit, semantic-version, ruff, python-multipart, groovy, ffmpeg, aiofiles, starlette
Successfully installed aiofiles-24.1.0 fastapi-0.115.12 ffmpeg-0.5.0 gradio-5.29.0 gradio-client-1.10.0 groovy-0.1.2 pydub-0.25.1

```

## 16. Create a Prediction Function

```

def predict_churn(gender, senior_citizen, partner, dependents, tenure, monthly_charges, total_charges,
                  phone_service, multiple_lines, internet_service, online_security, online_backup,
                  device_protection, tech_support, streaming_tv, streaming_movies, contract,
                  paperless_billing, payment_method):

```

```

# Create input dictionary
input_data = {
    'gender': gender,
    'SeniorCitizen': int(senior_citizen),
    'Partner': partner,
    'Dependents': dependents,
    'tenure': int(tenure),
    'MonthlyCharges': float(monthly_charges),
    'TotalCharges': float(total_charges),
    'PhoneService': phone_service,
    'MultipleLines': multiple_lines,
    'InternetService': internet_service,
    'OnlineSecurity': online_security,
    'OnlineBackup': online_backup,
    'DeviceProtection': device_protection,
    'TechSupport': tech_support,
    'StreamingTV': streaming_tv,
    'StreamingMovies': streaming_movies,
    'Contract': contract,
    'PaperlessBilling': paperless_billing,
    'PaymentMethod': payment_method
}

```

```

# Convert the input data into DataFrame
input_df = pd.DataFrame([input_data])

# Combine the new input with the original DataFrame (except for 'Churn' target column)
df_temp = pd.concat([df.drop('Churn', axis=1), input_df], ignore_index=True)

# One-hot encode the combined DataFrame
df_temp_encoded = pd.get_dummies(df_temp, drop_first=True)

# Reindex to match the training dataset's encoded features
df_temp_encoded = df_temp_encoded.reindex(columns=df_encoded.drop('Churn', axis=1).columns, fill_value=0)

# Scale the features (use the same scaler as during training)
scaled

```

## 17.Create the Gradio Interface

```

# Define the prediction function (assuming `predict_churn` is already defined)
def predict_churn(gender, senior_citizen, partner, dependents, tenure, monthly_charges, total_charges,
                  phone_service, multiple_lines, internet_service, online_security, online_backup,
                  device_protection, tech_support, streaming_tv, streaming_movies, contract,
                  paperless_billing, payment_method):

    # Create input dictionary
    input_data = {
        'gender': gender,
        'SeniorCitizen': int(senior_citizen),
        'Partner': partner,
        'Dependents': dependents,
        'tenure': int(tenure),
        'MonthlyCharges': float(monthly_charges),
        'TotalCharges': float(total_charges),
        'PhoneService': phone_service,
        'MultipleLines': multiple_lines,
        'InternetService': internet_service,
        'OnlineSecurity': online_security,
        'OnlineBackup': online_backup,
        'DeviceProtection': device_protection,
        'TechSupport': tech_support,
        'StreamingTV': streaming_tv,
        'StreamingMovies': streaming_movies,
        'Contract': contract,
        'PaperlessBilling': paperless_billing,
        'PaymentMethod': payment_method
    }

    # Convert the input data into DataFrame
    input_df = pd.DataFrame([input_data])

    # Combine the new input with the original DataFrame (except for 'Churn' target column)
    df_temp = pd.concat([df.drop('Churn', axis=1), input_df], ignore_index=True)

    # One-hot encode the combined DataFrame
    df_temp_encoded = pd.get_dummies(df_temp, drop_first=True)

    # Reindex to match the training dataset's encoded features
    df_temp_encoded = df_temp_encoded.reindex(columns=df_encoded.drop('Churn', axis=1).columns, fill_value=0)

    # Scale the features (use the same scaler as during training)
    scaled_input = scaler.transform(df_temp_encoded.tail(1))

    # Predict churn using the trained model
    prediction = model.predict(scaled_input)

    return "Yes" if prediction[0] == 1 else "No"

# Create the Gradio interface inputs
inputs = [
    gr.Dropdown(['Female', 'Male'], label="Gender"),
    gr.Slider(0, 1, step=1, label="Senior Citizen (0 = No, 1 = Yes)"),
    gr.Dropdown(['Yes', 'No'], label="Partner"),
    gr.Dropdown(['Yes', 'No'], label="Dependents"),
    gr.Slider(0, 72, step=1, label="Tenure (Months)"),
    gr.Slider(20.0, 120.0, step=0.1, label="Monthly Charges"),
    gr.Slider(0.0, 1000.0, step=0.1, label="Total Charges"),
    gr.Dropdown(['Yes', 'No'], label="Phone Service"),
    gr.Dropdown(['Yes', 'No'], label="Multiple Lines"),
    gr.Dropdown(['DSL', 'Fiber optic', 'No'], label="Internet Service"),
    gr.Dropdown(['Yes', 'No'], label="Online Security"),

```

```

gr.Dropdown(['Yes', 'No'], label="Online Backup"),
gr.Dropdown(['Yes', 'No'], label="Device Protection"),
gr.Dropdown(['Yes', 'No'], label="Tech Support"),
gr.Dropdown(['Yes', 'No'], label="Streaming TV"),
gr.Dropdown(['Yes', 'No'], label="Streaming Movies"),
gr.Dropdown(['Month-to-month', 'One year', 'Two year'], label="Contract"),
gr.Dropdown(['Yes', 'No'], label="Paperless Billing"),
gr.Dropdown(['Electronic check', 'Mailed check', 'Bank transfer', 'Credit card'], label="Payment Method")
]

```

```

# Output for churn prediction
output = gr.Textbox(label="Churn Prediction (Yes/No)")

```

```

# Launch the Gradio interface
gr.Interface(
    fn=predict_churn,          # Prediction function
    inputs=inputs,            # Input features
    outputs=output,           # Output (Churn Prediction)
    title="📊 Customer Churn Prediction",
    description="Enter customer details to predict whether the customer will churn (Yes) or stay (No).",
).launch()

```

➡ It looks like you are running Gradio on a hosted a Jupyter notebook. For the Gradio app to work, sharing must be enabled. Automatic:

Colab notebook detected. To show errors in colab notebook, set debug=True in launch()

\* Running on public URL: <https://ee838531387124050a.gradio.live>

This share link expires in 1 week. For free permanent hosting and GPU upgrades, run `gradio deploy` from the terminal in the working

Gender

Senior Citizen (0 = No, 1 = Yes)  
☐ 0 ☐ 1

Partner

Dependents

Churn Prediction (Yes/No)

**Flag**