```python
import pandas as pd
import numpy as np
```

```python
!pip install mysql-connector-python
```

Requirement already satisfied: mysql-connector-python in c:\anaconda3\
lib\site-packages (9.3.0)

```python
from sqlalchemy import create_engine
import mysql.connector

import matplotlib.pyplot as plt
import seaborn as sns

import ipywidgets as widgets
from IPython.display import display, clear_output

from sklearn.model_selection import train_test_split
from sklearn.preprocessing import StandardScaler
from sklearn.ensemble import RandomForestClassifier
from sklearn.metrics import classification_report, roc_auc_score,
confusion_matrix
```

```python
!pip install lime
```

Requirement already satisfied: lime in c:\anaconda3\lib\site-packages
(0.2.0.1)
Requirement already satisfied: matplotlib in c:\anaconda3\lib\site-
packages (from lime) (3.10.0)
Requirement already satisfied: numpy in c:\anaconda3\lib\site-packages
(from lime) (1.26.4)
Requirement already satisfied: scipy in c:\anaconda3\lib\site-packages
(from lime) (1.15.3)
Requirement already satisfied: tqdm in c:\anaconda3\lib\site-packages
(from lime) (4.67.1)
Requirement already satisfied: scikit-learn>=0.18 in c:\anaconda3\lib\
site-packages (from lime) (1.6.1)
Requirement already satisfied: scikit-image>=0.12 in c:\anaconda3\lib\
site-packages (from lime) (0.25.2)
Requirement already satisfied: networkx>=3.0 in c:\anaconda3\lib\site-
packages (from scikit-image>=0.12->lime) (3.4.2)
Requirement already satisfied: pillow>=10.1 in c:\anaconda3\lib\site-
packages (from scikit-image>=0.12->lime) (11.1.0)
Requirement already satisfied: imageio!=2.35.0,>=2.33 in c:\anaconda3\
lib\site-packages (from scikit-image>=0.12->lime) (2.37.0)
Requirement already satisfied: tifffile>=2022.8.12 in c:\anaconda3\
lib\site-packages (from scikit-image>=0.12->lime) (2024.12.12)
Requirement already satisfied: packaging>=21 in c:\anaconda3\lib\site-
packages (from scikit-image>=0.12->lime) (24.2)
Requirement already satisfied: lazy-loader>=0.4 in c:\anaconda3\lib\
site-packages (from scikit-image>=0.12->lime) (0.4)

```
Requirement already satisfied: joblib>=1.2.0 in c:\anaconda3\lib\site-
packages (from scikit-learn>=0.18->lime) (1.5.1)
Requirement already satisfied: threadpoolctl>=3.1.0 in c:\anaconda3\
lib\site-packages (from scikit-learn>=0.18->lime) (3.5.0)
Requirement already satisfied: contourpy>=1.0.1 in c:\anaconda3\lib\
site-packages (from matplotlib->lime) (1.3.1)
Requirement already satisfied: cycler>=0.10 in c:\anaconda3\lib\site-
packages (from matplotlib->lime) (0.11.0)
Requirement already satisfied: fonttools>=4.22.0 in c:\anaconda3\lib\
site-packages (from matplotlib->lime) (4.55.3)
Requirement already satisfied: kiwisolver>=1.3.1 in c:\anaconda3\lib\
site-packages (from matplotlib->lime) (1.4.8)
Requirement already satisfied: pyparsing>=2.3.1 in c:\anaconda3\lib\
site-packages (from matplotlib->lime) (3.2.0)
Requirement already satisfied: python-dateutil>=2.7 in c:\anaconda3\
lib\site-packages (from matplotlib->lime) (2.9.0.post0)
Requirement already satisfied: six>=1.5 in c:\anaconda3\lib\site-
packages (from python-dateutil>=2.7->matplotlib->lime) (1.17.0)
Requirement already satisfied: colorama in c:\anaconda3\lib\site-
packages (from tqdm->lime) (0.4.6)
```

```python
import lime
import lime.lime_tabular

import datetime
import warnings
```

```
!pip install sqlalchemy mysql-connector-python
```

```
Requirement already satisfied: sqlalchemy in c:\anaconda3\lib\site-
packages (2.0.39)
Requirement already satisfied: mysql-connector-python in c:\anaconda3\
lib\site-packages (9.3.0)
Requirement already satisfied: greenlet!=0.4.17 in c:\anaconda3\lib\
site-packages (from sqlalchemy) (3.1.1)
Requirement already satisfied: typing-extensions>=4.6.0 in c:\
anaconda3\lib\site-packages (from sqlalchemy) (4.12.2)
```

```python
from sqlalchemy import create_engine
```

```python
from sqlalchemy import create_engine
import pandas as pd

from urllib.parse import quote_plus

DB_USER = 'root'
DB_PASSWORD = quote_plus('AniRedd@2141')
DB_HOST = 'localhost'
DB_PORT = '3306'
DB_NAME = 'cohortiq'
```

```python
engine = create_engine(f"mysql+mysqlconnector://{DB_USER}:
{DB_PASSWORD}@{DB_HOST}:{DB_PORT}/{DB_NAME}")

users_df = pd.read_sql("SELECT * FROM users", engine)
sessions_df = pd.read_sql("SELECT * FROM sessions", engine)

print("Users Table:")
display(users_df.head())
```

Users Table:

	user_id	username	full_name	user_email	signup_date
0	1	astroTom	Tom Nielsen	tom@spacemail.com	2025-06-01
1	2	bananaBecca	Rebecca Wong	becca@gmail.com	2025-06-03
2	3	coolCarl	Carl Mendoza	carl@penguins.io	2025-06-05
3	4	laptopLarry	Larry Gupta	larry@techhaze.net	2025-06-07
4	5	zoomZara	Zara Ali	zara@lookatme.biz	2025-06-09

	signup_platform	referral_source
0	web	ads
1	iOS	invite
2	Android	organic
3	web	ads
4	iOS	invite

```python
print("Sessions Table:")
display(sessions_df.head())
```

Sessions Table:

	session_id	user_id	session_start	session_end	device_type
0	101	1	2025-06-01 10:00:00	2025-06-01 10:30:00	desktop
1	102	1	2025-06-08 11:00:00	2025-06-08 11:20:00	mobile
2	103	2	2025-06-04 09:15:00	2025-06-04 09:45:00	mobile
3	104	3	2025-06-06 14:00:00	2025-06-06 14:50:00	desktop
4	105	4	2025-06-08 16:30:00	2025-06-08 16:55:00	mobile

	session_type	pages_viewed	is_conversion
0	tutorial	5	1

```
1         usage              7              0
2         usage             10              1
3         usage             12              0
4         support            3              0
```

```python
users_df['signup_date'] = pd.to_datetime(users_df['signup_date'])

sessions_df['session_start'] =
pd.to_datetime(sessions_df['session_start'])

merged_df = pd.merge(sessions_df, users_df[['user_id',
'signup_date']], on='user_id', how='left')

merged_df['signup_week'] =
merged_df['signup_date'].dt.to_period('W').apply(lambda r:
r.start_time)

merged_df['activity_week'] =
merged_df['session_start'].dt.to_period('W').apply(lambda r:
r.start_time)

merged_df['week_offset'] = ((merged_df['activity_week'] -
merged_df['signup_week']).dt.days // 7)

cohort_data = merged_df.groupby(['signup_week', 'week_offset'])
['user_id'].nunique().unstack(fill_value=0)

cohort_sizes = cohort_data.iloc[:, 0]
retention = cohort_data.divide(cohort_sizes, axis=0)

plt.figure(figsize=(10, 6))
sns.heatmap(retention, annot=True, fmt='.0%', cmap='YlGnBu')
plt.title('User Retention by Signup Cohort')
plt.xlabel('Week Offset')
plt.ylabel('Signup Week')
plt.show()
```

User Retention by Signup Cohort
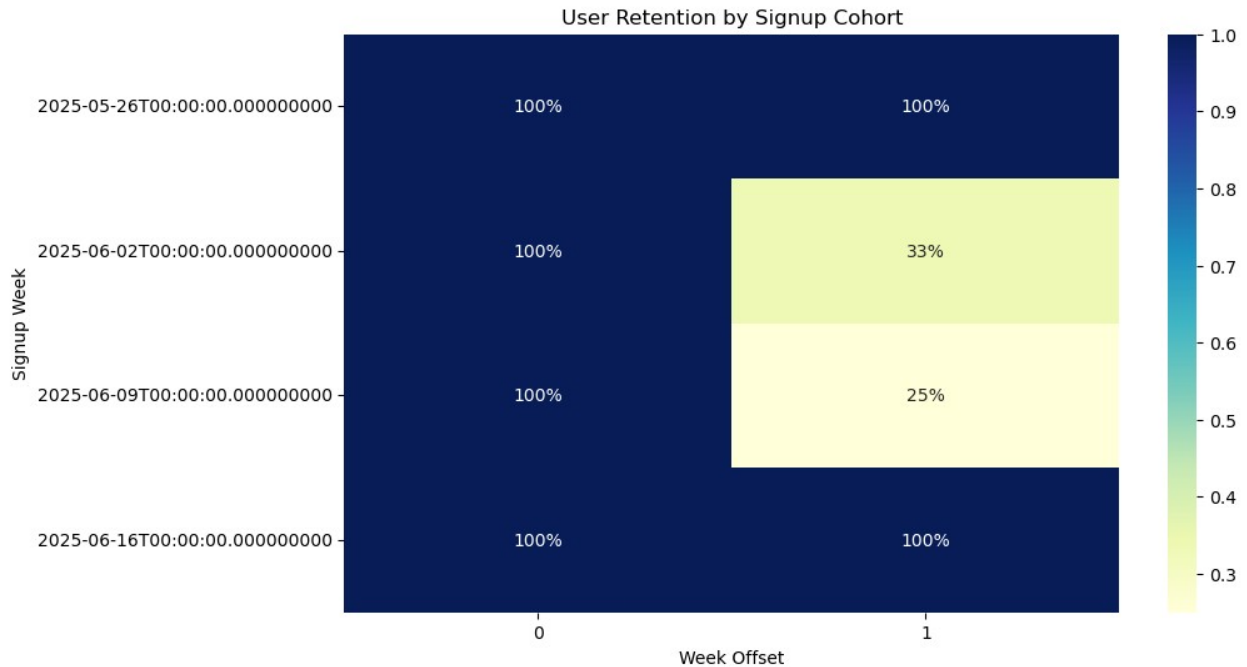

```
sessions_df['session_start'] =
pd.to_datetime(sessions_df['session_start'])
sessions_df['session_end'] =
pd.to_datetime(sessions_df['session_end'])
sessions_df['session_duration'] = (sessions_df['session_end'] -
sessions_df['session_start']).dt.total_seconds() / 60

user_features = sessions_df.groupby('user_id').agg(
    total_sessions=('session_id', 'count'),
    avg_session_duration=('session_duration', 'mean'),
    last_session=('session_end', 'max'),
    first_session=('session_start', 'min')
).reset_index()

today = pd.to_datetime("2025-07-01")
user_features['days_since_last_session'] = (today -
user_features['last_session']).dt.days

user_features = pd.merge(user_features, users_df[['user_id',
'signup_date']], on='user_id', how='left')
user_features['time_to_first_session'] =
(user_features['first_session'] -
user_features['signup_date']).dt.days

sessions_df = pd.merge(sessions_df, users_df[['user_id',
'signup_date']], on='user_id', how='left')
sessions_df['days_since_signup'] = (sessions_df['session_start'] -
sessions_df['signup_date']).dt.days
sessions_df['activity_week'] =
```

```python
sessions_df['session_start'].dt.to_period('W').apply(lambda r:
r.start_time)

first_week = sessions_df[sessions_df['days_since_signup'] <= 7]
first_week_counts =
first_week.groupby('user_id').size().reset_index(name='first_week_sess
ions')

weekly_consistency = sessions_df.groupby('user_id')
['activity_week'].nunique().reset_index(name='weekly_activity_consiste
ncy')

features_df = user_features.merge(first_week_counts, on='user_id',
how='left')
features_df = features_df.merge(weekly_consistency, on='user_id',
how='left')
features_df.fillna(0, inplace=True)

CHURN_THRESHOLD = 30

features_df['churned'] = features_df['days_since_last_session'] >
CHURN_THRESHOLD
features_df['churned'] = features_df['churned'].astype(int)

!pip install tensorflow
```

```
Requirement already satisfied: tensorflow in c:\anaconda3\lib\site-
packages (2.19.0)
Requirement already satisfied: absl-py>=1.0.0 in c:\anaconda3\lib\
site-packages (from tensorflow) (2.3.1)
Requirement already satisfied: astunparse>=1.6.0 in c:\anaconda3\lib\
site-packages (from tensorflow) (1.6.3)
Requirement already satisfied: flatbuffers>=24.3.25 in c:\anaconda3\
lib\site-packages (from tensorflow) (25.2.10)
Requirement already satisfied: gast!=0.5.0,!=0.5.1,!=0.5.2,>=0.2.1 in
c:\anaconda3\lib\site-packages (from tensorflow) (0.6.0)
Requirement already satisfied: google-pasta>=0.1.1 in c:\anaconda3\
lib\site-packages (from tensorflow) (0.2.0)
Requirement already satisfied: libclang>=13.0.0 in c:\anaconda3\lib\
site-packages (from tensorflow) (18.1.1)
Requirement already satisfied: opt-einsum>=2.3.2 in c:\anaconda3\lib\
site-packages (from tensorflow) (3.4.0)
Requirement already satisfied: packaging in c:\anaconda3\lib\site-
packages (from tensorflow) (24.2)
Requirement already satisfied: protobuf!=4.21.0,!=4.21.1,!=4.21.2,!
=4.21.3,!=4.21.4,!=4.21.5,<6.0.0dev,>=3.20.3 in c:\anaconda3\lib\site-
packages (from tensorflow) (5.29.3)
Requirement already satisfied: requests<3,>=2.21.0 in c:\anaconda3\
lib\site-packages (from tensorflow) (2.32.4)
Requirement already satisfied: setuptools in c:\anaconda3\lib\site-
packages (from tensorflow) (78.1.1)
```

```
Requirement already satisfied: six>=1.12.0 in c:\anaconda3\lib\site-
packages (from tensorflow) (1.17.0)
Requirement already satisfied: termcolor>=1.1.0 in c:\anaconda3\lib\
site-packages (from tensorflow) (3.1.0)
Requirement already satisfied: typing-extensions>=3.6.6 in c:\
anaconda3\lib\site-packages (from tensorflow) (4.12.2)
Requirement already satisfied: wrapt>=1.11.0 in c:\anaconda3\lib\site-
packages (from tensorflow) (1.17.0)
Requirement already satisfied: grpcio<2.0,>=1.24.3 in c:\anaconda3\
lib\site-packages (from tensorflow) (1.73.1)
Requirement already satisfied: tensorboard~=2.19.0 in c:\anaconda3\
lib\site-packages (from tensorflow) (2.19.0)
Requirement already satisfied: keras>=3.5.0 in c:\anaconda3\lib\site-
packages (from tensorflow) (3.10.0)
Requirement already satisfied: numpy<2.2.0,>=1.26.0 in c:\anaconda3\
lib\site-packages (from tensorflow) (1.26.4)
Requirement already satisfied: h5py>=3.11.0 in c:\anaconda3\lib\site-
packages (from tensorflow) (3.12.1)
Requirement already satisfied: ml-dtypes<1.0.0,>=0.5.1 in c:\
anaconda3\lib\site-packages (from tensorflow) (0.5.1)
Requirement already satisfied: charset_normalizer<4,>=2 in c:\
anaconda3\lib\site-packages (from requests<3,>=2.21.0->tensorflow)
(3.3.2)
Requirement already satisfied: idna<4,>=2.5 in c:\anaconda3\lib\site-
packages (from requests<3,>=2.21.0->tensorflow) (3.7)
Requirement already satisfied: urllib3<3,>=1.21.1 in c:\anaconda3\lib\
site-packages (from requests<3,>=2.21.0->tensorflow) (2.3.0)
Requirement already satisfied: certifi>=2017.4.17 in c:\anaconda3\lib\
site-packages (from requests<3,>=2.21.0->tensorflow) (2025.4.26)
Requirement already satisfied: markdown>=2.6.8 in c:\anaconda3\lib\
site-packages (from tensorboard~=2.19.0->tensorflow) (3.8)
Requirement already satisfied: tensorboard-data-server<0.8.0,>=0.7.0
in c:\anaconda3\lib\site-packages (from tensorboard~=2.19.0-
>tensorflow) (0.7.2)
Requirement already satisfied: werkzeug>=1.0.1 in c:\anaconda3\lib\
site-packages (from tensorboard~=2.19.0->tensorflow) (3.1.3)
Requirement already satisfied: wheel<1.0,>=0.23.0 in c:\anaconda3\lib\
site-packages (from astunparse>=1.6.0->tensorflow) (0.45.1)
Requirement already satisfied: rich in c:\anaconda3\lib\site-packages
(from keras>=3.5.0->tensorflow) (13.9.4)
Requirement already satisfied: namex in c:\anaconda3\lib\site-packages
(from keras>=3.5.0->tensorflow) (0.1.0)
Requirement already satisfied: optree in c:\anaconda3\lib\site-
packages (from keras>=3.5.0->tensorflow) (0.16.0)
Requirement already satisfied: MarkupSafe>=2.1.1 in c:\anaconda3\lib\
site-packages (from werkzeug>=1.0.1->tensorboard~=2.19.0->tensorflow)
(3.0.2)
Requirement already satisfied: markdown-it-py>=2.2.0 in c:\anaconda3\
lib\site-packages (from rich->keras>=3.5.0->tensorflow) (2.2.0)
```

```
Requirement already satisfied: pygments<3.0.0,>=2.13.0 in c:\
anaconda3\lib\site-packages (from rich->keras>=3.5.0->tensorflow)
(2.19.1)
Requirement already satisfied: mdurl~=0.1 in c:\anaconda3\lib\site-
packages (from markdown-it-py>=2.2.0->rich->keras>=3.5.0->tensorflow)
(0.1.0)
```

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

X = features_df[['total_sessions',
                 'avg_session_duration',
                 'days_since_last_session',
                 'weekly_activity_consistency',
                 'first_week_sessions',
                 'time_to_first_session']]
y = features_df['churned']

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)

import tensorflow as tf
from tensorflow.keras.models import Sequential
from tensorflow.keras.layers import Dense

model = Sequential([
    Dense(32, input_dim=X_train.shape[1], activation='relu'),
    Dense(16, activation='relu'),
    Dense(1, activation='sigmoid')
])
```

```
C:\Anaconda3\Lib\site-packages\keras\src\layers\core\dense.py:93:
UserWarning: Do not pass an `input_shape`/`input_dim` argument to a
layer. When using Sequential models, prefer using an `Input(shape)`
object as the first layer in the model instead.
  super().__init__(activity_regularizer=activity_regularizer,
**kwargs)
```

```python
model.compile(loss='binary_crossentropy', optimizer='adam',
metrics=['accuracy'])

history = model.fit(X_train, y_train, epochs=100, batch_size=4,
validation_data=(X_test, y_test), verbose=0)

loss, accuracy = model.evaluate(X_test, y_test, verbose=0)
print(f"Test Accuracy: {accuracy:.2f}")
```

```
Test Accuracy: 1.00
```

```python
def keras_predict_fn(x):
    return np.hstack([1 - model.predict(x), model.predict(x)])

import lime
import lime.lime_tabular

explainer = lime.lime_tabular.LimeTabularExplainer(
    training_data=X_train,
    feature_names=['total_sessions',
                   'avg_session_duration',
                   'days_since_last_session',
                   'weekly_activity_consistency',
                   'first_week_sessions',
                   'time_to_first_session'],
    class_names=['Not Churned',
                 'Churned'],
    mode='classification'
)

i = 0
exp = explainer.explain_instance(X_test[i], keras_predict_fn,
num_features=6)
```

```
157/157 ━━━━━━━━━━━━━━━━━━━ 0s 968us/step
157/157 ━━━━━━━━━━━━━━━━━━━ 0s 649us/step
```

```python
exp.show_in_notebook(show_table=True)
```

```
<IPython.core.display.HTML object>
```

```python
exp.as_list()
```

```
[('0.00 < total_sessions <= 1.00', -0.034123265584912355),
 ('first_week_sessions > -0.11', -0.029200089563542368),
 ('avg_session_duration > 0.18', -0.008857689713124194),
 ('-1.33 < time_to_first_session <= 0.33', 0.0062623555449234395),
 ('days_since_last_session <= -0.32', -0.00255040843681756566),
 ('0.00 < weekly_activity_consistency <= 1.00', -
0.0007129738038424365)]
```

```python
import ipywidgets as widgets
from IPython.display import display, clear_output

test_user_indices = features_df.iloc[y_test.index].reset_index()

user_dropdown = widgets.Dropdown(
    options=[(f"User ID {uid}", i) for i, uid in
enumerate(test_user_indices['user_id'])],
    description='Select User:',
    style={'description_width': 'initial'},
    layout=widgets.Layout(width='50%')
)
```

```python
explain_button = widgets.Button(
    description='Explain Churn Prediction',
    button_style='info'
)

output = widgets.Output()

def on_explain_button_clicked(b):
    output.clear_output()
    with output:
        i = user_dropdown.value
        exp = explainer.explain_instance(X_test[i], keras_predict_fn,
num_features=6)
        exp.show_in_notebook(show_table=True)

explain_button.on_click(on_explain_button_clicked)

display(user_dropdown, explain_button, output)
```

{"model_id":"4a930eb43e064a08b9bfab3c431e1a8b","version_major":2,"version_minor":0}

{"model_id":"2225797b16e24b5d95abd93d3a3468a3","version_major":2,"version_minor":0}

{"model_id":"bb827bd0569c4fdfbc0f5a0d41cd6592","version_major":2,"version_minor":0}

```python
from sklearn.mixture import GaussianMixture

cluster_features = features_df[['total_sessions',
                                'avg_session_duration',
                                'days_since_last_session',
                                'weekly_activity_consistency',
                                'first_week_sessions',
                                'time_to_first_session']]

scaler = StandardScaler()
X_cluster = scaler.fit_transform(cluster_features)

gmm = GaussianMixture(n_components=3, random_state=42)
gmm.fit(X_cluster)
features_df['user_segment'] = gmm.predict(X_cluster)

segment_labels = {
    0: 'One-Night Stands',
    1: 'Power Users',
    2: 'Window Shoppers'
}
features_df['segment_label'] =
features_df['user_segment'].map(segment_labels)
```
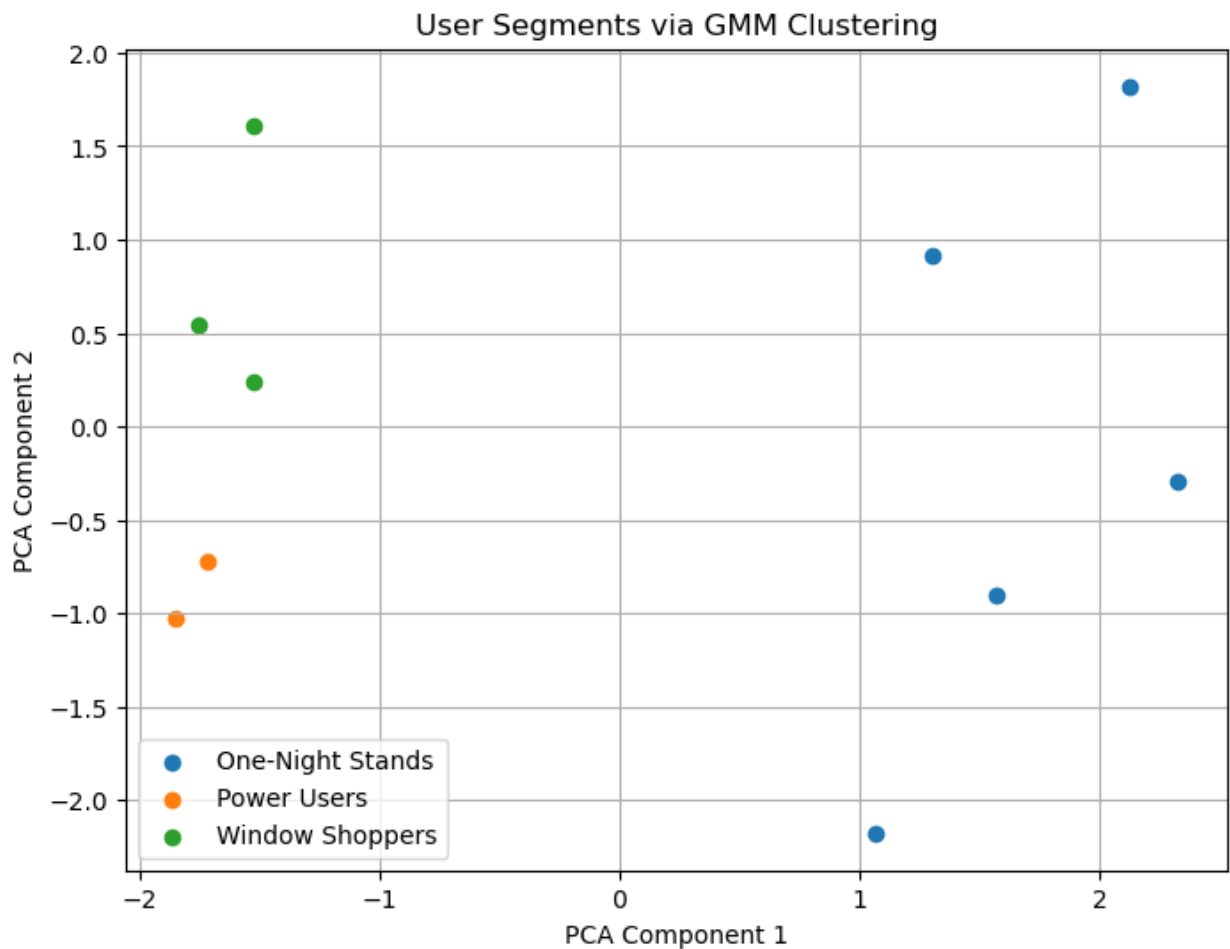
```
from sklearn.decomposition import PCA

pca = PCA(n_components=2)
X_pca = pca.fit_transform(X_cluster)

plt.figure(figsize=(8, 6))
for label, group in features_df.groupby('segment_label'):
    idx = group.index
    plt.scatter(X_pca[idx, 0], X_pca[idx, 1], label=label)
plt.legend()
plt.title('User Segments via GMM Clustering')
plt.xlabel('PCA Component 1')
plt.ylabel('PCA Component 2')
plt.grid(True)
plt.show()
```



```
!pip install lifelines

Requirement already satisfied: lifelines in c:\anaconda3\lib\site-
packages (0.30.0)
```

```
Requirement already satisfied: numpy>=1.14.0 in c:\anaconda3\lib\site-
packages (from lifelines) (1.26.4)
Requirement already satisfied: scipy>=1.7.0 in c:\anaconda3\lib\site-
packages (from lifelines) (1.15.3)
Requirement already satisfied: pandas>=2.1 in c:\anaconda3\lib\site-
packages (from lifelines) (2.3.0)
Requirement already satisfied: matplotlib>=3.0 in c:\anaconda3\lib\
site-packages (from lifelines) (3.10.0)
Requirement already satisfied: autograd>=1.5 in c:\anaconda3\lib\site-
packages (from lifelines) (1.8.0)
Requirement already satisfied: autograd-gamma>=0.3 in c:\anaconda3\
lib\site-packages (from lifelines) (0.5.0)
Requirement already satisfied: formulaic>=0.2.2 in c:\anaconda3\lib\
site-packages (from lifelines) (1.1.1)
Requirement already satisfied: interface-meta>=1.2.0 in c:\anaconda3\
lib\site-packages (from formulaic>=0.2.2->lifelines) (1.3.0)
Requirement already satisfied: typing-extensions>=4.2.0 in c:\
anaconda3\lib\site-packages (from formulaic>=0.2.2->lifelines)
(4.12.2)
Requirement already satisfied: wrapt>=1.0 in c:\anaconda3\lib\site-
packages (from formulaic>=0.2.2->lifelines) (1.17.0)
Requirement already satisfied: contourpy>=1.0.1 in c:\anaconda3\lib\
site-packages (from matplotlib>=3.0->lifelines) (1.3.1)
Requirement already satisfied: cycler>=0.10 in c:\anaconda3\lib\site-
packages (from matplotlib>=3.0->lifelines) (0.11.0)
Requirement already satisfied: fonttools>=4.22.0 in c:\anaconda3\lib\
site-packages (from matplotlib>=3.0->lifelines) (4.55.3)
Requirement already satisfied: kiwisolver>=1.3.1 in c:\anaconda3\lib\
site-packages (from matplotlib>=3.0->lifelines) (1.4.8)
Requirement already satisfied: packaging>=20.0 in c:\anaconda3\lib\
site-packages (from matplotlib>=3.0->lifelines) (24.2)
Requirement already satisfied: pillow>=8 in c:\anaconda3\lib\site-
packages (from matplotlib>=3.0->lifelines) (11.1.0)
Requirement already satisfied: pyparsing>=2.3.1 in c:\anaconda3\lib\
site-packages (from matplotlib>=3.0->lifelines) (3.2.0)
Requirement already satisfied: python-dateutil>=2.7 in c:\anaconda3\
lib\site-packages (from matplotlib>=3.0->lifelines) (2.9.0.post0)
Requirement already satisfied: pytz>=2020.1 in c:\anaconda3\lib\site-
packages (from pandas>=2.1->lifelines) (2025.2)
Requirement already satisfied: tzdata>=2022.7 in c:\anaconda3\lib\
site-packages (from pandas>=2.1->lifelines) (2025.2)
Requirement already satisfied: six>=1.5 in c:\anaconda3\lib\site-
packages (from python-dateutil>=2.7->matplotlib>=3.0->lifelines)
(1.17.0)

from lifelines import KaplanMeierFitter
import pandas as pd

survival_df = features_df.copy()
survival_df['duration'] = (survival_df['last_session'] -
```

```
survival_df['signup_date']).dt.days
survival_df['event_observed'] = survival_df['churned']
survival_df = pd.merge(survival_df, users_df[['user_id',
'signup_platform']], on='user_id', how='left')

kmf = KaplanMeierFitter()

kmf.fit(durations=survival_df['duration'],
event_observed=survival_df['event_observed'])

<lifelines.KaplanMeierFitter:"KM_estimate", fitted with 10 total
observations, 10 right-censored observations>

kmf.plot_survival_function()
plt.title('User Survival Curve')
plt.xlabel('Days Since Signup')
plt.ylabel('Probability User is Still Active')
plt.grid(True)
plt.show()
```
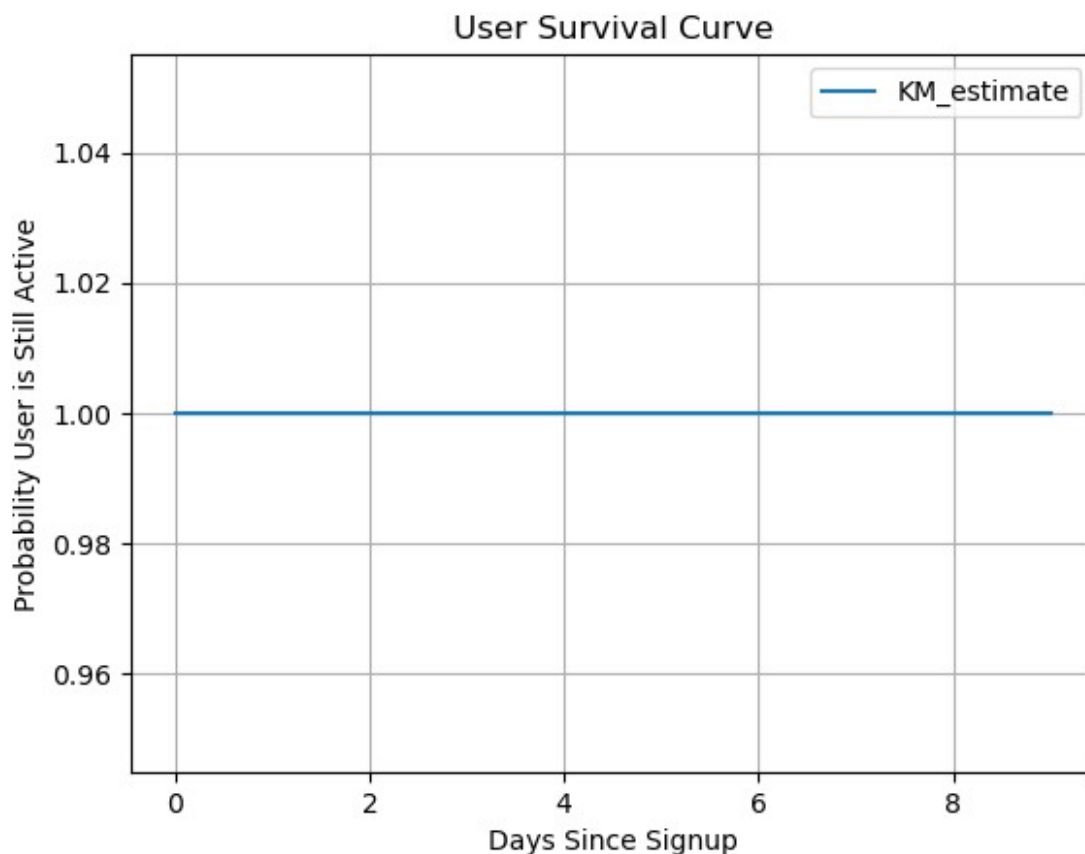


```
plt.figure(figsize=(8,6))
for platform in survival_df['signup_platform'].unique():
    kmf.fit(
```

```
        durations=survival_df[survival_df['signup_platform'] ==
platform]['duration'],
        event_observed=survival_df[survival_df['signup_platform'] ==
platform]['event_observed'],
        label=platform
    )
    kmf.plot_survival_function()
plt.title('Survival Curve by Platform')
plt.xlabel('Days Since Signup')
plt.ylabel('Survival Probability')
plt.grid(True)
plt.legend()
plt.show()
```
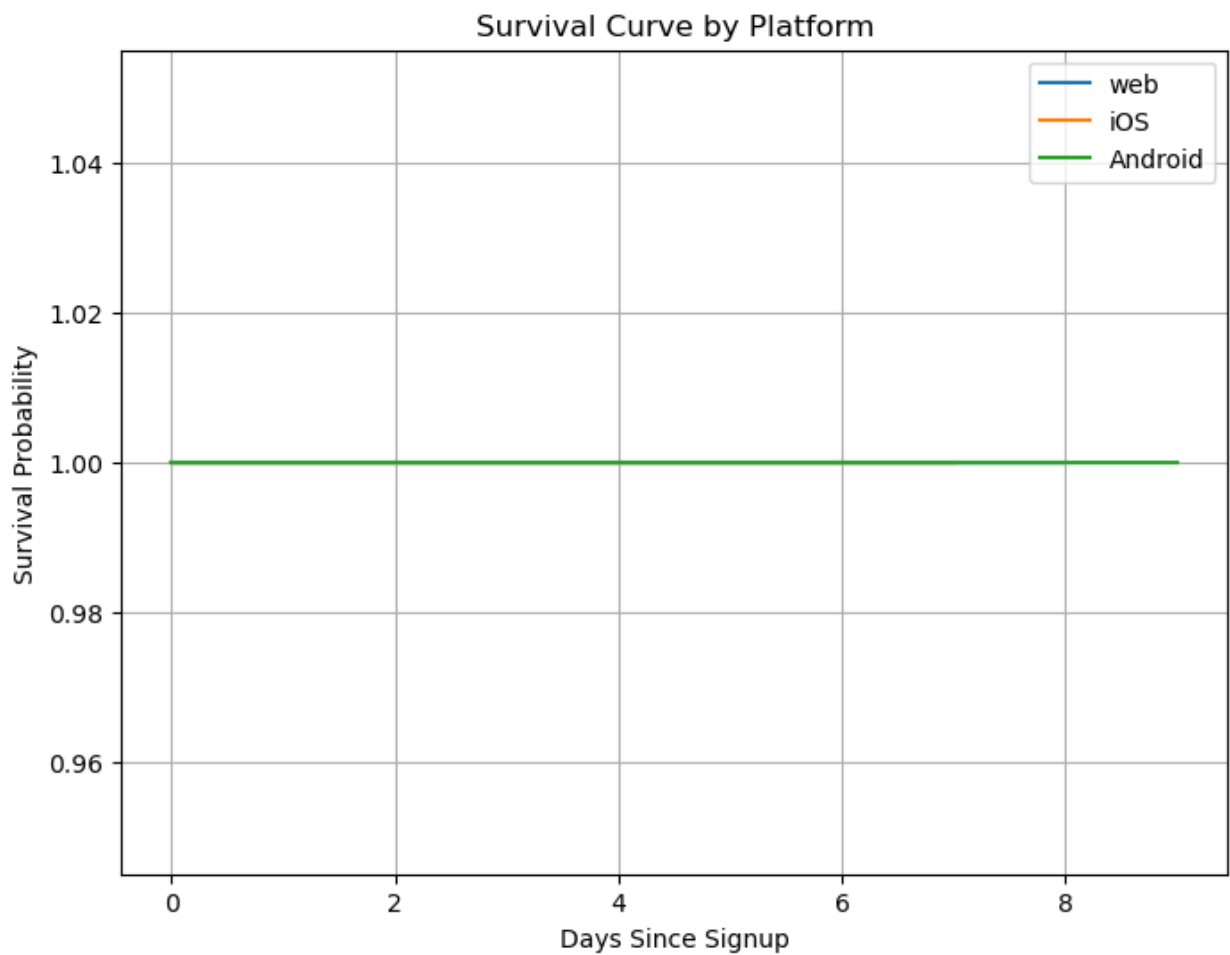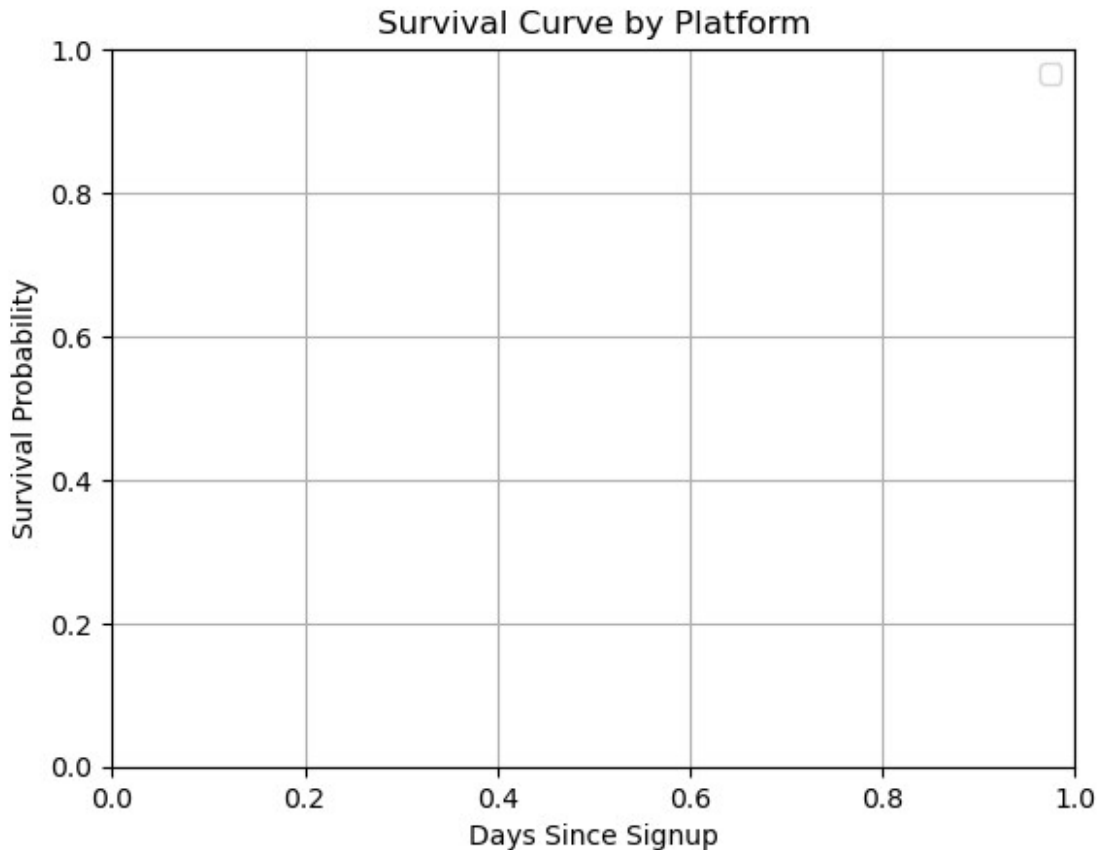


```
plt.title('Survival Curve by Platform')
plt.xlabel('Days Since Signup')
plt.ylabel('Survival Probability')
plt.grid(True)
plt.legend()
plt.show()
```

```
C:\Users\aniru\AppData\Local\Temp\ipykernel_12176\1482521772.py:5:
UserWarning: No artists with labels found to put in legend.  Note that
artists whose label start with an underscore are ignored when legend()
is called with no argument.
  plt.legend()
```


Survival Curve by Platform

```
!pip install transformers sentence-transformers langchain faiss-cpu

Requirement already satisfied: transformers in c:\anaconda3\lib\site-
packages (4.48.2)
Requirement already satisfied: sentence-transformers in c:\anaconda3\
lib\site-packages (4.1.0)
Requirement already satisfied: langchain in c:\anaconda3\lib\site-
packages (0.3.26)
Requirement already satisfied: faiss-cpu in c:\anaconda3\lib\site-
packages (1.11.0)
Requirement already satisfied: filelock in c:\anaconda3\lib\site-
packages (from transformers) (3.17.0)
Requirement already satisfied: huggingface-hub<1.0,>=0.24.0 in c:\
anaconda3\lib\site-packages (from transformers) (0.32.3)
Requirement already satisfied: numpy>=1.17 in c:\anaconda3\lib\site-
packages (from transformers) (1.26.4)
```

```
Requirement already satisfied: packaging>=20.0 in c:\anaconda3\lib\
site-packages (from transformers) (24.2)
Requirement already satisfied: pyyaml>=5.1 in c:\anaconda3\lib\site-
packages (from transformers) (6.0.2)
Requirement already satisfied: regex!=2019.12.17 in c:\anaconda3\lib\
site-packages (from transformers) (2024.11.6)
Requirement already satisfied: requests in c:\anaconda3\lib\site-
packages (from transformers) (2.32.4)
Requirement already satisfied: tokenizers<0.22,>=0.21 in c:\anaconda3\
lib\site-packages (from transformers) (0.21.1)
Requirement already satisfied: safetensors>=0.4.1 in c:\anaconda3\lib\
site-packages (from transformers) (0.5.3)
Requirement already satisfied: tqdm>=4.27 in c:\anaconda3\lib\site-
packages (from transformers) (4.67.1)
Requirement already satisfied: fsspec>=2023.5.0 in c:\anaconda3\lib\
site-packages (from huggingface-hub<1.0,>=0.24.0->transformers)
(2025.3.2)
Requirement already satisfied: typing-extensions>=3.7.4.3 in c:\
anaconda3\lib\site-packages (from huggingface-hub<1.0,>=0.24.0-
>transformers) (4.12.2)
Requirement already satisfied: torch>=1.11.0 in c:\anaconda3\lib\site-
packages (from sentence-transformers) (2.7.0)
Requirement already satisfied: scikit-learn in c:\anaconda3\lib\site-
packages (from sentence-transformers) (1.6.1)
Requirement already satisfied: scipy in c:\anaconda3\lib\site-packages
(from sentence-transformers) (1.15.3)
Requirement already satisfied: Pillow in c:\anaconda3\lib\site-
packages (from sentence-transformers) (11.1.0)
Requirement already satisfied: langchain-core<1.0.0,>=0.3.66 in c:\
anaconda3\lib\site-packages (from langchain) (0.3.68)
Requirement already satisfied: langchain-text-splitters<1.0.0,>=0.3.8
in c:\anaconda3\lib\site-packages (from langchain) (0.3.8)
Requirement already satisfied: langsmith>=0.1.17 in c:\anaconda3\lib\
site-packages (from langchain) (0.4.4)
Requirement already satisfied: pydantic<3.0.0,>=2.7.4 in c:\anaconda3\
lib\site-packages (from langchain) (2.10.3)
Requirement already satisfied: SQLAlchemy<3,>=1.4 in c:\anaconda3\lib\
site-packages (from langchain) (2.0.39)
Requirement already satisfied: tenacity!=8.4.0,<10.0.0,>=8.1.0 in c:\
anaconda3\lib\site-packages (from langchain-core<1.0.0,>=0.3.66-
>langchain) (9.0.0)
Requirement already satisfied: jsonpatch<2.0,>=1.33 in c:\anaconda3\
lib\site-packages (from langchain-core<1.0.0,>=0.3.66->langchain)
(1.33)
Requirement already satisfied: jsonpointer>=1.9 in c:\anaconda3\lib\
site-packages (from jsonpatch<2.0,>=1.33->langchain-
core<1.0.0,>=0.3.66->langchain) (2.1)
Requirement already satisfied: annotated-types>=0.6.0 in c:\anaconda3\
lib\site-packages (from pydantic<3.0.0,>=2.7.4->langchain) (0.6.0)
```

```
Requirement already satisfied: pydantic-core==2.27.1 in c:\anaconda3\
lib\site-packages (from pydantic<3.0.0,>=2.7.4->langchain) (2.27.1)
Requirement already satisfied: charset_normalizer<4,>=2 in c:\
anaconda3\lib\site-packages (from requests->transformers) (3.3.2)
Requirement already satisfied: idna<4,>=2.5 in c:\anaconda3\lib\site-
packages (from requests->transformers) (3.7)
Requirement already satisfied: urllib3<3,>=1.21.1 in c:\anaconda3\lib\
site-packages (from requests->transformers) (2.3.0)
Requirement already satisfied: certifi>=2017.4.17 in c:\anaconda3\lib\
site-packages (from requests->transformers) (2025.4.26)
Requirement already satisfied: greenlet!=0.4.17 in c:\anaconda3\lib\
site-packages (from SQLAlchemy<3,>=1.4->langchain) (3.1.1)
Requirement already satisfied: httpx<1,>=0.23.0 in c:\anaconda3\lib\
site-packages (from langsmith>=0.1.17->langchain) (0.28.1)
Requirement already satisfied: orjson<4.0.0,>=3.9.14 in c:\anaconda3\
lib\site-packages (from langsmith>=0.1.17->langchain) (3.10.18)
Requirement already satisfied: requests-toolbelt<2.0.0,>=1.0.0 in c:\
anaconda3\lib\site-packages (from langsmith>=0.1.17->langchain)
(1.0.0)
Requirement already satisfied: zstandard<0.24.0,>=0.23.0 in c:\
anaconda3\lib\site-packages (from langsmith>=0.1.17->langchain)
(0.23.0)
Requirement already satisfied: anyio in c:\anaconda3\lib\site-packages
(from httpx<1,>=0.23.0->langsmith>=0.1.17->langchain) (4.7.0)
Requirement already satisfied: httpcore==1.* in c:\anaconda3\lib\site-
packages (from httpx<1,>=0.23.0->langsmith>=0.1.17->langchain) (1.0.9)
Requirement already satisfied: h11>=0.16 in c:\anaconda3\lib\site-
packages (from httpcore==1.*->httpx<1,>=0.23.0->langsmith>=0.1.17-
>langchain) (0.16.0)
Requirement already satisfied: sympy>=1.13.3 in c:\anaconda3\lib\site-
packages (from torch>=1.11.0->sentence-transformers) (1.13.3)
Requirement already satisfied: networkx in c:\anaconda3\lib\site-
packages (from torch>=1.11.0->sentence-transformers) (3.4.2)
Requirement already satisfied: jinja2 in c:\anaconda3\lib\site-
packages (from torch>=1.11.0->sentence-transformers) (3.1.6)
Requirement already satisfied: setuptools in c:\anaconda3\lib\site-
packages (from torch>=1.11.0->sentence-transformers) (78.1.1)
Requirement already satisfied: mpmath<1.4,>=1.1.0 in c:\anaconda3\lib\
site-packages (from sympy>=1.13.3->torch>=1.11.0->sentence-
transformers) (1.3.0)
Requirement already satisfied: colorama in c:\anaconda3\lib\site-
packages (from tqdm>=4.27->transformers) (0.4.6)
Requirement already satisfied: sniffio>=1.1 in c:\anaconda3\lib\site-
packages (from anyio->httpx<1,>=0.23.0->langsmith>=0.1.17->langchain)
(1.3.0)
Requirement already satisfied: MarkupSafe>=2.0 in c:\anaconda3\lib\
site-packages (from jinja2->torch>=1.11.0->sentence-transformers)
(3.0.2)
Requirement already satisfied: joblib>=1.2.0 in c:\anaconda3\lib\site-
packages (from scikit-learn->sentence-transformers) (1.5.1)
```

```
Requirement already satisfied: threadpoolctl>=3.1.0 in c:\anaconda3\
lib\site-packages (from scikit-learn->sentence-transformers) (3.5.0)

retention_summary = retention.describe().transpose()
churn_rate = features_df['churned'].mean()
prompt = f"""
Here is our user data summary:
{retention_summary}
Overall churn rate: {churn_rate:.2%}
Write three bullet insights about user retention and churn.
"""

!pip install -U langchain-community

Requirement already satisfied: langchain-community in c:\anaconda3\
lib\site-packages (0.3.27)
Requirement already satisfied: langchain-core<1.0.0,>=0.3.66 in c:\
anaconda3\lib\site-packages (from langchain-community) (0.3.68)
Requirement already satisfied: langchain<1.0.0,>=0.3.26 in c:\
anaconda3\lib\site-packages (from langchain-community) (0.3.26)
Requirement already satisfied: SQLAlchemy<3,>=1.4 in c:\anaconda3\lib\
site-packages (from langchain-community) (2.0.39)
Requirement already satisfied: requests<3,>=2 in c:\anaconda3\lib\
site-packages (from langchain-community) (2.32.4)
Requirement already satisfied: PyYAML>=5.3 in c:\anaconda3\lib\site-
packages (from langchain-community) (6.0.2)
Requirement already satisfied: aiohttp<4.0.0,>=3.8.3 in c:\anaconda3\
lib\site-packages (from langchain-community) (3.11.10)
Requirement already satisfied: tenacity!=8.4.0,<10,>=8.1.0 in c:\
anaconda3\lib\site-packages (from langchain-community) (9.0.0)
Requirement already satisfied: dataclasses-json<0.7,>=0.5.7 in c:\
anaconda3\lib\site-packages (from langchain-community) (0.6.7)
Requirement already satisfied: pydantic-settings<3.0.0,>=2.4.0 in c:\
anaconda3\lib\site-packages (from langchain-community) (2.6.1)
Requirement already satisfied: langsmith>=0.1.125 in c:\anaconda3\lib\
site-packages (from langchain-community) (0.4.4)
Requirement already satisfied: httpx-sse<1.0.0,>=0.4.0 in c:\
anaconda3\lib\site-packages (from langchain-community) (0.4.1)
Requirement already satisfied: numpy>=1.26.2 in c:\anaconda3\lib\site-
packages (from langchain-community) (1.26.4)
Requirement already satisfied: aiohappyeyeballs>=2.3.0 in c:\
anaconda3\lib\site-packages (from aiohttp<4.0.0,>=3.8.3->langchain-
community) (2.4.4)
Requirement already satisfied: aiosignal>=1.1.2 in c:\anaconda3\lib\
site-packages (from aiohttp<4.0.0,>=3.8.3->langchain-community)
(1.2.0)
Requirement already satisfied: attrs>=17.3.0 in c:\anaconda3\lib\site-
packages (from aiohttp<4.0.0,>=3.8.3->langchain-community) (24.3.0)
Requirement already satisfied: frozenlist>=1.1.1 in c:\anaconda3\lib\
site-packages (from aiohttp<4.0.0,>=3.8.3->langchain-community)
```

```
(1.5.0)
Requirement already satisfied: multidict<7.0,>=4.5 in c:\anaconda3\
lib\site-packages (from aiohttp<4.0.0,>=3.8.3->langchain-community)
(6.1.0)
Requirement already satisfied: propcache>=0.2.0 in c:\anaconda3\lib\
site-packages (from aiohttp<4.0.0,>=3.8.3->langchain-community)
(0.3.1)
Requirement already satisfied: yarl<2.0,>=1.17.0 in c:\anaconda3\lib\
site-packages (from aiohttp<4.0.0,>=3.8.3->langchain-community)
(1.18.0)
Requirement already satisfied: marshmallow<4.0.0,>=3.18.0 in c:\
anaconda3\lib\site-packages (from dataclasses-json<0.7,>=0.5.7-
>langchain-community) (3.26.1)
Requirement already satisfied: typing-inspect<1,>=0.4.0 in c:\
anaconda3\lib\site-packages (from dataclasses-json<0.7,>=0.5.7-
>langchain-community) (0.9.0)
Requirement already satisfied: langchain-text-splitters<1.0.0,>=0.3.8
in c:\anaconda3\lib\site-packages (from langchain<1.0.0,>=0.3.26-
>langchain-community) (0.3.8)
Requirement already satisfied: pydantic<3.0.0,>=2.7.4 in c:\anaconda3\
lib\site-packages (from langchain<1.0.0,>=0.3.26->langchain-community)
(2.10.3)
Requirement already satisfied: jsonpatch<2.0,>=1.33 in c:\anaconda3\
lib\site-packages (from langchain-core<1.0.0,>=0.3.66->langchain-
community) (1.33)
Requirement already satisfied: packaging<25,>=23.2 in c:\anaconda3\
lib\site-packages (from langchain-core<1.0.0,>=0.3.66->langchain-
community) (24.2)
Requirement already satisfied: typing-extensions>=4.7 in c:\anaconda3\
lib\site-packages (from langchain-core<1.0.0,>=0.3.66->langchain-
community) (4.12.2)
Requirement already satisfied: jsonpointer>=1.9 in c:\anaconda3\lib\
site-packages (from jsonpatch<2.0,>=1.33->langchain-
core<1.0.0,>=0.3.66->langchain-community) (2.1)
Requirement already satisfied: annotated-types>=0.6.0 in c:\anaconda3\
lib\site-packages (from pydantic<3.0.0,>=2.7.4-
>langchain<1.0.0,>=0.3.26->langchain-community) (0.6.0)
Requirement already satisfied: pydantic-core==2.27.1 in c:\anaconda3\
lib\site-packages (from pydantic<3.0.0,>=2.7.4-
>langchain<1.0.0,>=0.3.26->langchain-community) (2.27.1)
Requirement already satisfied: python-dotenv>=0.21.0 in c:\anaconda3\
lib\site-packages (from pydantic-settings<3.0.0,>=2.4.0->langchain-
community) (1.1.0)
Requirement already satisfied: charset_normalizer<4,>=2 in c:\
anaconda3\lib\site-packages (from requests<3,>=2->langchain-community)
(3.3.2)
Requirement already satisfied: idna<4,>=2.5 in c:\anaconda3\lib\site-
packages (from requests<3,>=2->langchain-community) (3.7)
Requirement already satisfied: urllib3<3,>=1.21.1 in c:\anaconda3\lib\
```

```
site-packages (from requests<3,>=2->langchain-community) (2.3.0)
Requirement already satisfied: certifi>=2017.4.17 in c:\anaconda3\lib\
site-packages (from requests<3,>=2->langchain-community) (2025.4.26)
Requirement already satisfied: greenlet!=0.4.17 in c:\anaconda3\lib\
site-packages (from SQLAlchemy<3,>=1.4->langchain-community) (3.1.1)
Requirement already satisfied: mypy-extensions>=0.3.0 in c:\anaconda3\
lib\site-packages (from typing-inspect<1,>=0.4.0->dataclasses-
json<0.7,>=0.5.7->langchain-community) (1.0.0)
Requirement already satisfied: httpx<1,>=0.23.0 in c:\anaconda3\lib\
site-packages (from langsmith>=0.1.125->langchain-community) (0.28.1)
Requirement already satisfied: orjson<4.0.0,>=3.9.14 in c:\anaconda3\
lib\site-packages (from langsmith>=0.1.125->langchain-community)
(3.10.18)
Requirement already satisfied: requests-toolbelt<2.0.0,>=1.0.0 in c:\
anaconda3\lib\site-packages (from langsmith>=0.1.125->langchain-
community) (1.0.0)
Requirement already satisfied: zstandard<0.24.0,>=0.23.0 in c:\
anaconda3\lib\site-packages (from langsmith>=0.1.125->langchain-
community) (0.23.0)
Requirement already satisfied: anyio in c:\anaconda3\lib\site-packages
(from httpx<1,>=0.23.0->langsmith>=0.1.125->langchain-community)
(4.7.0)
Requirement already satisfied: httpcore==1.* in c:\anaconda3\lib\site-
packages (from httpx<1,>=0.23.0->langsmith>=0.1.125->langchain-
community) (1.0.9)
Requirement already satisfied: h11>=0.16 in c:\anaconda3\lib\site-
packages (from httpcore==1.*->httpx<1,>=0.23.0->langsmith>=0.1.125-
>langchain-community) (0.16.0)
Requirement already satisfied: sniffio>=1.1 in c:\anaconda3\lib\site-
packages (from anyio->httpx<1,>=0.23.0->langsmith>=0.1.125->langchain-
community) (1.3.0)
```

```python
from langchain.embeddings import SentenceTransformerEmbeddings

from transformers import pipeline, AutoTokenizer,
AutoModelForSeq2SeqLM

from langchain.vectorstores import FAISS

from langchain.chains import RetrievalQA

from transformers import AutoTokenizer, AutoModelForSeq2SeqLM

import faiss

!pip install tf-keras
```

```
Requirement already satisfied: tf-keras in c:\anaconda3\lib\site-
packages (2.19.0)
Requirement already satisfied: tensorflow<2.20,>=2.19 in c:\anaconda3\
lib\site-packages (from tf-keras) (2.19.0)
```

```
Requirement already satisfied: absl-py>=1.0.0 in c:\anaconda3\lib\
site-packages (from tensorflow<2.20,>=2.19->tf-keras) (2.3.1)
Requirement already satisfied: astunparse>=1.6.0 in c:\anaconda3\lib\
site-packages (from tensorflow<2.20,>=2.19->tf-keras) (1.6.3)
Requirement already satisfied: flatbuffers>=24.3.25 in c:\anaconda3\
lib\site-packages (from tensorflow<2.20,>=2.19->tf-keras) (25.2.10)
Requirement already satisfied: gast!=0.5.0,!=0.5.1,!=0.5.2,>=0.2.1 in
c:\anaconda3\lib\site-packages (from tensorflow<2.20,>=2.19->tf-keras)
(0.6.0)
Requirement already satisfied: google-pasta>=0.1.1 in c:\anaconda3\
lib\site-packages (from tensorflow<2.20,>=2.19->tf-keras) (0.2.0)
Requirement already satisfied: libclang>=13.0.0 in c:\anaconda3\lib\
site-packages (from tensorflow<2.20,>=2.19->tf-keras) (18.1.1)
Requirement already satisfied: opt-einsum>=2.3.2 in c:\anaconda3\lib\
site-packages (from tensorflow<2.20,>=2.19->tf-keras) (3.4.0)
Requirement already satisfied: packaging in c:\anaconda3\lib\site-
packages (from tensorflow<2.20,>=2.19->tf-keras) (24.2)
Requirement already satisfied: protobuf!=4.21.0,!=4.21.1,!=4.21.2,!
=4.21.3,!=4.21.4,!=4.21.5,<6.0.0dev,>=3.20.3 in c:\anaconda3\lib\site-
packages (from tensorflow<2.20,>=2.19->tf-keras) (5.29.3)
Requirement already satisfied: requests<3,>=2.21.0 in c:\anaconda3\
lib\site-packages (from tensorflow<2.20,>=2.19->tf-keras) (2.32.4)
Requirement already satisfied: setuptools in c:\anaconda3\lib\site-
packages (from tensorflow<2.20,>=2.19->tf-keras) (78.1.1)
Requirement already satisfied: six>=1.12.0 in c:\anaconda3\lib\site-
packages (from tensorflow<2.20,>=2.19->tf-keras) (1.17.0)
Requirement already satisfied: termcolor>=1.1.0 in c:\anaconda3\lib\
site-packages (from tensorflow<2.20,>=2.19->tf-keras) (3.1.0)
Requirement already satisfied: typing-extensions>=3.6.6 in c:\
anaconda3\lib\site-packages (from tensorflow<2.20,>=2.19->tf-keras)
(4.12.2)
Requirement already satisfied: wrapt>=1.11.0 in c:\anaconda3\lib\site-
packages (from tensorflow<2.20,>=2.19->tf-keras) (1.17.0)
Requirement already satisfied: grpcio<2.0,>=1.24.3 in c:\anaconda3\
lib\site-packages (from tensorflow<2.20,>=2.19->tf-keras) (1.73.1)
Requirement already satisfied: tensorboard~=2.19.0 in c:\anaconda3\
lib\site-packages (from tensorflow<2.20,>=2.19->tf-keras) (2.19.0)
Requirement already satisfied: keras>=3.5.0 in c:\anaconda3\lib\site-
packages (from tensorflow<2.20,>=2.19->tf-keras) (3.10.0)
Requirement already satisfied: numpy<2.2.0,>=1.26.0 in c:\anaconda3\
lib\site-packages (from tensorflow<2.20,>=2.19->tf-keras) (1.26.4)
Requirement already satisfied: h5py>=3.11.0 in c:\anaconda3\lib\site-
packages (from tensorflow<2.20,>=2.19->tf-keras) (3.12.1)
Requirement already satisfied: ml-dtypes<1.0.0,>=0.5.1 in c:\
anaconda3\lib\site-packages (from tensorflow<2.20,>=2.19->tf-keras)
(0.5.1)
Requirement already satisfied: charset_normalizer<4,>=2 in c:\
anaconda3\lib\site-packages (from requests<3,>=2.21.0-
>tensorflow<2.20,>=2.19->tf-keras) (3.3.2)
```

```
Requirement already satisfied: idna<4,>=2.5 in c:\anaconda3\lib\site-
packages (from requests<3,>=2.21.0->tensorflow<2.20,>=2.19->tf-keras)
(3.7)
Requirement already satisfied: urllib3<3,>=1.21.1 in c:\anaconda3\lib\
site-packages (from requests<3,>=2.21.0->tensorflow<2.20,>=2.19->tf-
keras) (2.3.0)
Requirement already satisfied: certifi>=2017.4.17 in c:\anaconda3\lib\
site-packages (from requests<3,>=2.21.0->tensorflow<2.20,>=2.19->tf-
keras) (2025.4.26)
Requirement already satisfied: markdown>=2.6.8 in c:\anaconda3\lib\
site-packages (from tensorboard~=2.19.0->tensorflow<2.20,>=2.19->tf-
keras) (3.8)
Requirement already satisfied: tensorboard-data-server<0.8.0,>=0.7.0
in c:\anaconda3\lib\site-packages (from tensorboard~=2.19.0-
>tensorflow<2.20,>=2.19->tf-keras) (0.7.2)
Requirement already satisfied: werkzeug>=1.0.1 in c:\anaconda3\lib\
site-packages (from tensorboard~=2.19.0->tensorflow<2.20,>=2.19->tf-
keras) (3.1.3)
Requirement already satisfied: wheel<1.0,>=0.23.0 in c:\anaconda3\lib\
site-packages (from astunparse>=1.6.0->tensorflow<2.20,>=2.19->tf-
keras) (0.45.1)
Requirement already satisfied: rich in c:\anaconda3\lib\site-packages
(from keras>=3.5.0->tensorflow<2.20,>=2.19->tf-keras) (13.9.4)
Requirement already satisfied: namex in c:\anaconda3\lib\site-packages
(from keras>=3.5.0->tensorflow<2.20,>=2.19->tf-keras) (0.1.0)
Requirement already satisfied: optree in c:\anaconda3\lib\site-
packages (from keras>=3.5.0->tensorflow<2.20,>=2.19->tf-keras)
(0.16.0)
Requirement already satisfied: MarkupSafe>=2.1.1 in c:\anaconda3\lib\
site-packages (from werkzeug>=1.0.1->tensorboard~=2.19.0-
>tensorflow<2.20,>=2.19->tf-keras) (3.0.2)
Requirement already satisfied: markdown-it-py>=2.2.0 in c:\anaconda3\
lib\site-packages (from rich->keras>=3.5.0->tensorflow<2.20,>=2.19-
>tf-keras) (2.2.0)
Requirement already satisfied: pygments<3.0.0,>=2.13.0 in c:\
anaconda3\lib\site-packages (from rich->keras>=3.5.0-
>tensorflow<2.20,>=2.19->tf-keras) (2.19.1)
Requirement already satisfied: mdurl~=0.1 in c:\anaconda3\lib\site-
packages (from markdown-it-py>=2.2.0->rich->keras>=3.5.0-
>tensorflow<2.20,>=2.19->tf-keras) (0.1.0)
```

```
tokenizer = AutoTokenizer.from_pretrained("sshleifer/distilbart-cnn-
12-6")
generator =
AutoModelForSeq2SeqLM.from_pretrained("sshleifer/distilbart-cnn-12-6")
```

```
{"model_id":"0eda4c0b827e43b1a7772916d56075b1","version_major":2,"vers
ion_minor":0}
```

```
C:\Anaconda3\Lib\site-packages\huggingface_hub\file_download.py:143:
UserWarning: `huggingface_hub` cache-system uses symlinks by default
to efficiently store duplicated files but your machine does not
support them in C:\Users\aniru\.cache\huggingface\hub\models--
sshleifer--distilbart-cnn-12-6. Caching files will still work but in a
degraded version that might require more space on your disk. This
warning can be disabled by setting the
`HF_HUB_DISABLE_SYMLINKS_WARNING` environment variable. For more
details, see https://huggingface.co/docs/huggingface_hub/how-to-
cache#limitations.
To support symlinks on Windows, you either need to activate Developer
Mode or to run Python as an administrator. In order to activate
developer mode, see this article:
https://docs.microsoft.com/en-us/windows/apps/get-started/enable-your-
device-for-development
  warnings.warn(message)
```

```
{"model_id":"1e2d425a9dda41bc858ac134391f41da","version_major":2,"vers
ion_minor":0}

{"model_id":"ac9d7d7a04484e019743395d30cfe90a","version_major":2,"vers
ion_minor":0}

{"model_id":"1bce30dcf1374aa1bc43f755d1174f7f","version_major":2,"vers
ion_minor":0}

{"model_id":"816ddb12cb164cb6a769dace975d8e2f","version_major":2,"vers
ion_minor":0}

{"model_id":"9680db67a1664038970d32743653ba59","version_major":2,"vers
ion_minor":0}
```

```python
from langchain.llms import HuggingFacePipeline

hf_pipeline = pipeline("text2text-generation", model=generator,
tokenizer=tokenizer)
llm = HuggingFacePipeline(pipeline=hf_pipeline)
```

```
Device set to use cpu
C:\Users\aniru\AppData\Local\Temp\ipykernel_12176\326743686.py:2:
LangChainDeprecationWarning: The class `HuggingFacePipeline` was
deprecated in LangChain 0.0.37 and will be removed in 1.0. An updated
version of the class exists in the :class:`~langchain-huggingface
package and should be used instead. To use it run `pip install -
U :class:`~langchain-huggingface` and import as
`from :class:`~langchain_huggingface import HuggingFacePipeline``.
  llm = HuggingFacePipeline(pipeline=hf_pipeline)
```

```python
docs = [retention_summary.to_csv(), f"Churn rate: {churn_rate:.2%}"]
embeddings = SentenceTransformerEmbeddings(model_name="sentence-
```

```
transformers/all-MiniLM-L6-v2")
vectorstore = FAISS.from_texts(docs, embeddings)
```

```
C:\Users\aniru\AppData\Local\Temp\ipykernel_12176\267019829.py:2:
LangChainDeprecationWarning: The class `HuggingFaceEmbeddings` was
deprecated in LangChain 0.2.2 and will be removed in 1.0. An updated
version of the class exists in the :class:`~langchain-huggingface
package and should be used instead. To use it run `pip install -
U :class:`~langchain-huggingface` and import as
`from :class:`~langchain_huggingface import HuggingFaceEmbeddings``.
  embeddings = SentenceTransformerEmbeddings(model_name="sentence-
transformers/all-MiniLM-L6-v2")

WARNING:tensorflow:From C:\Anaconda3\Lib\site-packages\tf_keras\src\
losses.py:2976: The name tf.losses.sparse_softmax_cross_entropy is
deprecated. Please use
tf.compat.v1.losses.sparse_softmax_cross_entropy instead.
```

{"model_id":"e14ce6f0c6784151a0d130b74521db84","version_major":2,"version_minor":0}

```
C:\Anaconda3\Lib\site-packages\huggingface_hub\file_download.py:143:
UserWarning: `huggingface_hub` cache-system uses symlinks by default
to efficiently store duplicated files but your machine does not
support them in C:\Users\aniru\.cache\huggingface\hub\models--
sentence-transformers--all-MiniLM-L6-v2. Caching files will still work
but in a degraded version that might require more space on your disk.
This warning can be disabled by setting the
`HF_HUB_DISABLE_SYMLINKS_WARNING` environment variable. For more
details, see https://huggingface.co/docs/huggingface_hub/how-to-
cache#limitations.
To support symlinks on Windows, you either need to activate Developer
Mode or to run Python as an administrator. In order to activate
developer mode, see this article:
https://docs.microsoft.com/en-us/windows/apps/get-started/enable-your-
device-for-development
  warnings.warn(message)
```

{"model_id":"c82f34da43ae4f5bbc53759d6395f9d8","version_major":2,"version_minor":0}

{"model_id":"f634d589d50847e5a55a1b8142020fb9","version_major":2,"version_minor":0}

{"model_id":"eeb81af8d2474dd9a23998ba876a37f2","version_major":2,"version_minor":0}

{"model_id":"daadc1529a964d00b40967e7f5c2cc51","version_major":2,"version_minor":0}

{"model_id":"846cef7c47cb4833938be1a609d36084","version_major":2,"version_minor":0}

{"model_id":"5c335a6a74bc4437936536dadd22bee7","version_major":2,"version_minor":0}

{"model_id":"ca96951b03ba47148af0b6947885a865","version_major":2,"version_minor":0}

{"model_id":"49f1a3813b304c1896ab064f7f82710f","version_major":2,"version_minor":0}

{"model_id":"a39a16a5acd046efbfab9598248b268e","version_major":2,"version_minor":0}

{"model_id":"4e880f433d1f42cda2c164e727d394f5","version_major":2,"version_minor":0}

```python
from langchain.llms import HuggingFacePipeline
from transformers import pipeline

qa = RetrievalQA.from_chain_type(
    llm=llm,
    chain_type="stuff",
    retriever=vectorstore.as_retriever()
)

prompt = f"""
Here is our user data summary:
{retention_summary}
Overall churn rate: {churn_rate:.2%}
Write three bullet insights about user retention and churn.
"""

response = qa.run(prompt)
print(response)
```

```
C:\Users\aniru\AppData\Local\Temp\ipykernel_12176\1633458421.py:1:
LangChainDeprecationWarning: The method `Chain.run` was deprecated in
langchain 0.1.0 and will be removed in 1.0. Use :meth:`~invoke`
instead.
  response = qa.run(prompt)

 Use the following pieces of context to answer the question at the end
. If you don't know the answer, just say that you know, don't try to
make up an answer . Write three bullet insights about user retention
and churn rates . Use the question to help you understand the user
data summary .
```

```python
from IPython.display import display
import ipywidgets as widgets
```

```python
question_input = widgets.Text(
    value='Why are users from June churning more?',
    placeholder='Ask a question about churn, retention, or cohorts',
    description='Your Question:',
    layout=widgets.Layout(width='100%')
)

submit_button = widgets.Button(description="Generate Insight")
output_area = widgets.Output()

display(question_input, submit_button, output_area)
```

{"model_id":"ca36f63f7bf6415dac4227c83c47300b","version_major":2,"version_minor":0}

{"model_id":"235a813c0f994517ad4372ec83270ce5","version_major":2,"version_minor":0}

{"model_id":"8d723ed3537349b1ac99e4359f6f9743","version_major":2,"version_minor":0}

```python
def on_generate_clicked(b):
    with output_area:
        output_area.clear_output()
        user_question = question_input.value
        if not user_question.strip():
            print("Please enter a real question, philosopher.")
            return
        try:
            response = qa.run(user_question)
            print("Insight:")
            print(response)
        except Exception as e:
            print("Something broke, probably your ambitions:", e)
submit_button.on_click(on_generate_clicked)

st.title("CohortIQ - Live KPI Dashboard")
```

```
2025-07-06 16:08:34.801 WARNING
streamlit.runtime.scriptrunner_utils.script_run_context: Thread
'MainThread': missing ScriptRunContext! This warning can be ignored
when running in bare mode.
2025-07-06 16:08:35.162
  Warning: to view this Streamlit app on a browser, run it with the
following
  command:

    streamlit run C:\Anaconda3\Lib\site-packages\ipykernel_launcher.py
[ARGUMENTS]
2025-07-06 16:08:35.162 Thread 'MainThread': missing ScriptRunContext!
This warning can be ignored when running in bare mode.
```

```
2025-07-06 16:08:35.162 Thread 'MainThread': missing ScriptRunContext!
This warning can be ignored when running in bare mode.

DeltaGenerator()

from urllib.parse import quote_plus

password = quote_plus("AniRedd@2141")

engine = create_engine(f"mysql+mysqlconnector://root:
{password}@localhost:3306/cohortiq")

def load_data():
    users = pd.read_sql("SELECT * FROM users", engine)
    sessions = pd.read_sql("SELECT * FROM sessions", engine)
    return users, sessions
users_df, sessions_df = load_data()

st.metric("Total Users", users_df['user_id'].nunique())

2025-07-06 16:08:43.275 Thread 'MainThread': missing ScriptRunContext!
This warning can be ignored when running in bare mode.
2025-07-06 16:08:43.276 Thread 'MainThread': missing ScriptRunContext!
This warning can be ignored when running in bare mode.
2025-07-06 16:08:43.276 Thread 'MainThread': missing ScriptRunContext!
This warning can be ignored when running in bare mode.

DeltaGenerator()

platform = st.selectbox("Platform",
users_df['signup_platform'].unique())

2025-07-06 16:08:44.042 Thread 'MainThread': missing ScriptRunContext!
This warning can be ignored when running in bare mode.
2025-07-06 16:08:44.043 Thread 'MainThread': missing ScriptRunContext!
This warning can be ignored when running in bare mode.
2025-07-06 16:08:44.045 Thread 'MainThread': missing ScriptRunContext!
This warning can be ignored when running in bare mode.
2025-07-06 16:08:44.047 Thread 'MainThread': missing ScriptRunContext!
This warning can be ignored when running in bare mode.
2025-07-06 16:08:44.047 Session state does not function when running a
script without `streamlit run`
2025-07-06 16:08:44.048 Thread 'MainThread': missing ScriptRunContext!
This warning can be ignored when running in bare mode.
2025-07-06 16:08:44.048 Thread 'MainThread': missing ScriptRunContext!
This warning can be ignored when running in bare mode.
2025-07-06 16:08:44.049 Thread 'MainThread': missing ScriptRunContext!
This warning can be ignored when running in bare mode.

import random
```

```python
def simulate_push_notifications(users_df, churned_only=True):
    target = users_df[users_df['churned'] == 1] if churned_only else users_df
    results = []
    for _, user in target.iterrows():
        came_back = random.random() < 0.25
        results.append({
            'user_id': user['user_id'],
            'notified': True,
            'reengaged': came_back
        })
    return pd.DataFrame(results)
results_df = simulate_push_notifications(features_df)

!pip install prefect
```

Requirement already satisfied: prefect in c:\anaconda3\lib\site-packages (3.4.7)
Requirement already satisfied: aiosqlite<1.0.0,>=0.17.0 in c:\anaconda3\lib\site-packages (from prefect) (0.21.0)
Requirement already satisfied: alembic<2.0.0,>=1.7.5 in c:\anaconda3\lib\site-packages (from prefect) (1.16.2)
Requirement already satisfied: anyio<5.0.0,>=4.4.0 in c:\anaconda3\lib\site-packages (from prefect) (4.7.0)
Requirement already satisfied: apprise<2.0.0,>=1.1.0 in c:\anaconda3\lib\site-packages (from prefect) (1.9.3)
Requirement already satisfied: asgi-lifespan<3.0,>=1.0 in c:\anaconda3\lib\site-packages (from prefect) (2.1.0)
Requirement already satisfied: asyncpg<1.0.0,>=0.23 in c:\anaconda3\lib\site-packages (from prefect) (0.30.0)
Requirement already satisfied: cachetools<7.0,>=5.3 in c:\anaconda3\lib\site-packages (from prefect) (5.5.1)
Requirement already satisfied: click<8.2,>=8.0 in c:\anaconda3\lib\site-packages (from prefect) (8.1.8)
Requirement already satisfied: cloudpickle<4.0,>=2.0 in c:\anaconda3\lib\site-packages (from prefect) (3.0.0)
Requirement already satisfied: coolname<3.0.0,>=1.0.4 in c:\anaconda3\lib\site-packages (from prefect) (2.2.0)
Requirement already satisfied: cryptography>=36.0.1 in c:\anaconda3\lib\site-packages (from prefect) (44.0.1)
Requirement already satisfied: dateparser<2.0.0,>=1.1.1 in c:\anaconda3\lib\site-packages (from prefect) (1.2.2)
Requirement already satisfied: docker<8.0,>=4.0 in c:\anaconda3\lib\site-packages (from prefect) (7.1.0)
Requirement already satisfied: exceptiongroup>=1.0.0 in c:\anaconda3\lib\site-packages (from prefect) (1.3.0)
Requirement already satisfied: fastapi<1.0.0,>=0.111.0 in c:\anaconda3\lib\site-packages (from prefect) (0.115.13)
Requirement already satisfied: fsspec>=2022.5.0 in c:\anaconda3\lib\site-packages (from prefect) (2025.3.2)

```
Requirement already satisfied: graphviz>=0.20.1 in c:\anaconda3\lib\
site-packages (from prefect) (0.21)
Requirement already satisfied: griffe<2.0.0,>=0.49.0 in c:\anaconda3\
lib\site-packages (from prefect) (1.7.3)
Requirement already satisfied: httpcore<2.0.0,>=1.0.5 in c:\anaconda3\
lib\site-packages (from prefect) (1.0.9)
Requirement already satisfied: httpx!=0.23.2,>=0.23 in c:\anaconda3\
lib\site-packages (from httpx[http2]!=0.23.2,>=0.23->prefect) (0.28.1)
Requirement already satisfied: humanize<5.0.0,>=4.9.0 in c:\anaconda3\
lib\site-packages (from prefect) (4.12.3)
Requirement already satisfied: jinja2-humanize-extension>=0.4.0 in c:\
anaconda3\lib\site-packages (from prefect) (0.4.0)
Requirement already satisfied: jinja2<4.0.0,>=3.1.6 in c:\anaconda3\
lib\site-packages (from prefect) (3.1.6)
Requirement already satisfied: jsonpatch<2.0,>=1.32 in c:\anaconda3\
lib\site-packages (from prefect) (1.33)
Requirement already satisfied: jsonschema<5.0.0,>=4.18.0 in c:\
anaconda3\lib\site-packages (from prefect) (4.23.0)
Requirement already satisfied: opentelemetry-api<2.0.0,>=1.27.0 in c:\
anaconda3\lib\site-packages (from prefect) (1.34.1)
Requirement already satisfied: orjson<4.0,>=3.7 in c:\anaconda3\lib\
site-packages (from prefect) (3.10.18)
Requirement already satisfied: packaging<25.1,>=21.3 in c:\anaconda3\
lib\site-packages (from prefect) (24.2)
Requirement already satisfied: pathspec>=0.8.0 in c:\anaconda3\lib\
site-packages (from prefect) (0.10.3)
Requirement already satisfied: pendulum<4,>=3.0.0 in c:\anaconda3\lib\
site-packages (from prefect) (3.1.0)
Requirement already satisfied: prometheus-client>=0.20.0 in c:\
anaconda3\lib\site-packages (from prefect) (0.21.1)
Requirement already satisfied: pydantic!=2.10.0,!=2.11.0,!=2.11.1,!
=2.11.2,!=2.11.3,!=2.11.4,<3.0.0,>=2.9 in c:\anaconda3\lib\site-
packages (from prefect) (2.10.3)
Requirement already satisfied: pydantic-core<3.0.0,>=2.12.0 in c:\
anaconda3\lib\site-packages (from prefect) (2.27.1)
Requirement already satisfied: pydantic-extra-types<3.0.0,>=2.8.2 in
c:\anaconda3\lib\site-packages (from prefect) (2.10.5)
Requirement already satisfied: pydantic-settings!=2.9.0,<3.0.0,>2.2.1
in c:\anaconda3\lib\site-packages (from prefect) (2.6.1)
Requirement already satisfied: python-dateutil<3.0.0,>=2.8.2 in c:\
anaconda3\lib\site-packages (from prefect) (2.9.0.post0)
Requirement already satisfied: python-slugify<9.0,>=5.0 in c:\
anaconda3\lib\site-packages (from prefect) (5.0.2)
Requirement already satisfied: python-socks<3.0,>=2.5.3 in c:\
anaconda3\lib\site-packages (from python-socks[asyncio]<3.0,>=2.5.3-
>prefect) (2.7.1)
Requirement already satisfied: pytz<2026,>=2021.1 in c:\anaconda3\lib\
site-packages (from prefect) (2025.2)
Requirement already satisfied: pyyaml<7.0.0,>=5.4.1 in c:\anaconda3\
```

```
lib\site-packages (from prefect) (6.0.2)
Requirement already satisfied: readchar<5.0.0,>=4.0.0 in c:\anaconda3\
lib\site-packages (from prefect) (4.0.5)
Requirement already satisfied: rfc3339-validator<0.2.0,>=0.1.4 in c:\
anaconda3\lib\site-packages (from prefect) (0.1.4)
Requirement already satisfied: rich<15.0,>=11.0 in c:\anaconda3\lib\
site-packages (from prefect) (13.9.4)
Requirement already satisfied: ruamel-yaml>=0.17.0 in c:\anaconda3\
lib\site-packages (from prefect) (0.18.10)
Requirement already satisfied: semver>=3.0.4 in c:\anaconda3\lib\site-
packages (from prefect) (3.0.4)
Requirement already satisfied: sniffio<2.0.0,>=1.3.0 in c:\anaconda3\
lib\site-packages (from prefect) (1.3.0)
Requirement already satisfied: sqlalchemy<3.0.0,>=2.0 in c:\anaconda3\
lib\site-packages (from sqlalchemy[asyncio]<3.0.0,>=2.0->prefect)
(2.0.39)
Requirement already satisfied: toml>=0.10.0 in c:\anaconda3\lib\site-
packages (from prefect) (0.10.2)
Requirement already satisfied: typer!=0.12.2,<0.17.0,>=0.12.0 in c:\
anaconda3\lib\site-packages (from prefect) (0.16.0)
Requirement already satisfied: typing-extensions<5.0.0,>=4.10.0 in c:\
anaconda3\lib\site-packages (from prefect) (4.12.2)
Requirement already satisfied: ujson<6.0.0,>=5.8.0 in c:\anaconda3\
lib\site-packages (from prefect) (5.10.0)
Requirement already satisfied: uv>=0.6.0 in c:\anaconda3\lib\site-
packages (from prefect) (0.7.19)
Requirement already satisfied: uvicorn!=0.29.0,>=0.14.0 in c:\
anaconda3\lib\site-packages (from prefect) (0.34.3)
Requirement already satisfied: websockets<16.0,>=13.0 in c:\anaconda3\
lib\site-packages (from prefect) (15.0.1)
Requirement already satisfied: Mako in c:\anaconda3\lib\site-packages
(from alembic<2.0.0,>=1.7.5->prefect) (1.3.10)
Requirement already satisfied: idna>=2.8 in c:\anaconda3\lib\site-
packages (from anyio<5.0.0,>=4.4.0->prefect) (3.7)
Requirement already satisfied: certifi in c:\anaconda3\lib\site-
packages (from apprise<2.0.0,>=1.1.0->prefect) (2025.4.26)
Requirement already satisfied: requests in c:\anaconda3\lib\site-
packages (from apprise<2.0.0,>=1.1.0->prefect) (2.32.4)
Requirement already satisfied: requests-oauthlib in c:\anaconda3\lib\
site-packages (from apprise<2.0.0,>=1.1.0->prefect) (2.0.0)
Requirement already satisfied: markdown in c:\anaconda3\lib\site-
packages (from apprise<2.0.0,>=1.1.0->prefect) (3.8)
Requirement already satisfied: colorama in c:\anaconda3\lib\site-
packages (from click<8.2,>=8.0->prefect) (0.4.6)
Requirement already satisfied: regex>=2024.9.11 in c:\anaconda3\lib\
site-packages (from dateparser<2.0.0,>=1.1.1->prefect) (2024.11.6)
Requirement already satisfied: tzlocal>=0.2 in c:\anaconda3\lib\site-
packages (from dateparser<2.0.0,>=1.1.1->prefect) (5.3.1)
Requirement already satisfied: pywin32>=304 in c:\anaconda3\lib\site-
```

```
packages (from docker<8.0,>=4.0->prefect) (308)
Requirement already satisfied: urllib3>=1.26.0 in c:\anaconda3\lib\
site-packages (from docker<8.0,>=4.0->prefect) (2.3.0)
Requirement already satisfied: starlette<0.47.0,>=0.40.0 in c:\
anaconda3\lib\site-packages (from fastapi<1.0.0,>=0.111.0->prefect)
(0.46.2)
Requirement already satisfied: h11>=0.16 in c:\anaconda3\lib\site-
packages (from httpcore<2.0.0,>=1.0.5->prefect) (0.16.0)
Requirement already satisfied: MarkupSafe>=2.0 in c:\anaconda3\lib\
site-packages (from jinja2<4.0.0,>=3.1.6->prefect) (3.0.2)
Requirement already satisfied: jsonpointer>=1.9 in c:\anaconda3\lib\
site-packages (from jsonpatch<2.0,>=1.32->prefect) (2.1)
Requirement already satisfied: attrs>=22.2.0 in c:\anaconda3\lib\site-
packages (from jsonschema<5.0.0,>=4.18.0->prefect) (24.3.0)
Requirement already satisfied: jsonschema-specifications>=2023.03.6 in
c:\anaconda3\lib\site-packages (from jsonschema<5.0.0,>=4.18.0-
>prefect) (2023.7.1)
Requirement already satisfied: referencing>=0.28.4 in c:\anaconda3\
lib\site-packages (from jsonschema<5.0.0,>=4.18.0->prefect) (0.30.2)
Requirement already satisfied: rpds-py>=0.7.1 in c:\anaconda3\lib\
site-packages (from jsonschema<5.0.0,>=4.18.0->prefect) (0.22.3)
Requirement already satisfied: importlib-metadata<8.8.0,>=6.0 in c:\
anaconda3\lib\site-packages (from opentelemetry-api<2.0.0,>=1.27.0-
>prefect) (8.5.0)
Requirement already satisfied: zipp>=3.20 in c:\anaconda3\lib\site-
packages (from importlib-metadata<8.8.0,>=6.0->opentelemetry-
api<2.0.0,>=1.27.0->prefect) (3.21.0)
Requirement already satisfied: tzdata>=2020.1 in c:\anaconda3\lib\
site-packages (from pendulum<4,>=3.0.0->prefect) (2025.2)
Requirement already satisfied: annotated-types>=0.6.0 in c:\anaconda3\
lib\site-packages (from pydantic!=2.10.0,!=2.11.0,!=2.11.1,!=2.11.2,!
=2.11.3,!=2.11.4,<3.0.0,>=2.9->prefect) (0.6.0)
Requirement already satisfied: python-dotenv>=0.21.0 in c:\anaconda3\
lib\site-packages (from pydantic-settings!=2.9.0,<3.0.0,>2.2.1-
>prefect) (1.1.0)
Requirement already satisfied: six>=1.5 in c:\anaconda3\lib\site-
packages (from python-dateutil<3.0.0,>=2.8.2->prefect) (1.17.0)
Requirement already satisfied: text-unidecode>=1.3 in c:\anaconda3\
lib\site-packages (from python-slugify<9.0,>=5.0->prefect) (1.3)
Requirement already satisfied: setuptools>=41.0 in c:\anaconda3\lib\
site-packages (from readchar<5.0.0,>=4.0.0->prefect) (78.1.1)
Requirement already satisfied: markdown-it-py>=2.2.0 in c:\anaconda3\
lib\site-packages (from rich<15.0,>=11.0->prefect) (2.2.0)
Requirement already satisfied: pygments<3.0.0,>=2.13.0 in c:\
anaconda3\lib\site-packages (from rich<15.0,>=11.0->prefect) (2.19.1)
Requirement already satisfied: greenlet!=0.4.17 in c:\anaconda3\lib\
site-packages (from sqlalchemy<3.0.0,>=2.0-
>sqlalchemy[asyncio]<3.0.0,>=2.0->prefect) (3.1.1)
Requirement already satisfied: shellingham>=1.3.0 in c:\anaconda3\lib\
```

```python
from prefect import flow, task
import pandas as pd
from datetime import datetime
from sqlalchemy import create_engine
from sklearn.linear_model import LogisticRegression
from sklearn.model_selection import train_test_split
from sklearn.preprocessing import StandardScaler

@task
def train_churn_model(sessions_df, users_df):
    print("Training churn model (logistic regression)...")
    sessions_df['session_duration'] = (sessions_df['session_end'] -
sessions_df['session_start']).dt.total_seconds() / 60
    user_features = sessions_df.groupby('user_id').agg(
        total_sessions=('session_id', 'count'),
        avg_session_duration=('session_duration', 'mean'),
        last_session=('session_end', 'max')
    ).reset_index()
    today = pd.to_datetime("2025-07-01")
    user_features['days_since_last_session'] = (today -
user_features['last_session']).dt.days
    user_features['churned'] =
(user_features['days_since_last_session'] > 30).astype(int)
    X = user_features[['total_sessions', 'avg_session_duration',
'days_since_last_session']]
```

```python
    y = user_features['churned']
    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)
    model = LogisticRegression()
    model.fit(X_train, y_train)
    accuracy = model.score(X_test, y_test)
    return f"Trained logistic regression model - Accuracy:
{accuracy:.2%} on {len(user_features)} users"
```

```
!pip install fastapi uvicorn
```

```
Requirement already satisfied: fastapi in c:\anaconda3\lib\site-
packages (0.115.13)
Requirement already satisfied: uvicorn in c:\anaconda3\lib\site-
packages (0.34.3)
Requirement already satisfied: starlette<0.47.0,>=0.40.0 in c:\
anaconda3\lib\site-packages (from fastapi) (0.46.2)
Requirement already satisfied: pydantic!=1.8,!=1.8.1,!=2.0.0,!=2.0.1,!
=2.1.0,<3.0.0,>=1.7.4 in c:\anaconda3\lib\site-packages (from fastapi)
(2.10.3)
Requirement already satisfied: typing-extensions>=4.8.0 in c:\
anaconda3\lib\site-packages (from fastapi) (4.12.2)
Requirement already satisfied: annotated-types>=0.6.0 in c:\anaconda3\
lib\site-packages (from pydantic!=1.8,!=1.8.1,!=2.0.0,!=2.0.1,!
=2.1.0,<3.0.0,>=1.7.4->fastapi) (0.6.0)
Requirement already satisfied: pydantic-core==2.27.1 in c:\anaconda3\
lib\site-packages (from pydantic!=1.8,!=1.8.1,!=2.0.0,!=2.0.1,!
=2.1.0,<3.0.0,>=1.7.4->fastapi) (2.27.1)
Requirement already satisfied: anyio<5,>=3.6.2 in c:\anaconda3\lib\
site-packages (from starlette<0.47.0,>=0.40.0->fastapi) (4.7.0)
Requirement already satisfied: idna>=2.8 in c:\anaconda3\lib\site-
packages (from anyio<5,>=3.6.2->starlette<0.47.0,>=0.40.0->fastapi)
(3.7)
Requirement already satisfied: sniffio>=1.1 in c:\anaconda3\lib\site-
packages (from anyio<5,>=3.6.2->starlette<0.47.0,>=0.40.0->fastapi)
(1.3.0)
Requirement already satisfied: click>=7.0 in c:\anaconda3\lib\site-
packages (from uvicorn) (8.1.8)
Requirement already satisfied: h11>=0.8 in c:\anaconda3\lib\site-
packages (from uvicorn) (0.16.0)
Requirement already satisfied: colorama in c:\anaconda3\lib\site-
packages (from click>=7.0->uvicorn) (0.4.6)
```

```python
from fastapi import FastAPI
from pydantic import BaseModel
import pickle
import numpy as np
```

```python
with open("logistic_model.pkl", "wb") as f:
    pickle.dump(model, f)

with open("scaler.pkl", "wb") as f:
    pickle.dump(scaler, f)

model = pickle.load(open("logistic_model.pkl", "rb"))
scaler = pickle.load(open("scaler.pkl", "rb"))

app = FastAPI()

class UserFeatures(BaseModel):
    total_sessions: int
    avg_session_duration: float
    days_since_last_session: int

def predict_churn(features: UserFeatures):
    X = np.array([[features.total_sessions,
features.avg_session_duration, features.days_since_last_session]])
    X_scaled = scaler.transform(X)
    prob = model.predict_proba(X_scaled)[0][1]
    return {"churn_probability": float(prob)}
```