Website performance analysis project

June 24, 2025

[17]:
```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
```

[18]:
```
df = pd.read_csv("data-export (1).csv")
```

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

[19]:

	# ----------	Unnamed: 1	Unnamed: 2	Unnamed: 3	Unnamed: 4	\
0	Session primary channel group (Default channel…	Date + hour (YYYYMMDDHH)	Users	Sessions	Engaged sessions	
1	Direct	2024041623	237	300	144	
2	Organic Social	2024041719	208	267	132	
3	Direct	2024041723	188	233	115	
4	Organic Social	2024041718	187	256	125	

	Unnamed: 5	Unnamed: 6	\
0	Average engagement time per session	Engaged sessions per user	
1	47.526666666666700	0.6075949367088610	
2	32.09737827715360	0.6346153846153850	
3	39.93991416309010	0.6117021276595740	
4	32.16015625	0.6684491978609630	

	Unnamed: 7	Unnamed: 8	Unnamed: 9
0	Events per session	Engagement rate	Event count
1	4.673333333333330	0.48	1402
2	4.295880149812730	0.4943820224719100	1147
3	4.587982832618030	0.49356223175965700	1069
4	4.078125	0.48828125	1044

[21]:
```
df.columns = df.iloc[0]
df = df.drop(index = 0).reset_index(drop = True)
df.columns = ["Channel Group", "DateHour", "Users", "Sessions", "Engaged␣
 ↪sessions",        "Average engagement time per session", "Engaged sessions␣
 ↪per user",        "Events per session", "Engagement rate", "Event count"]
```

[22]:
```
df.head()
```

[22]:

	Channel Group	DateHour	Users	Sessions	Engaged sessions	Average engagement time per session	Engaged sessions per user	Events per session	Engagement rate	Event count
0	Direct	2024041623	237	300	144	47.526666666666700	0.6075949367088610	4.673333333333330	0.48	1402
1	Organic Social	2024041719	208	267	132	32.09737827715360	0.6346153846153850	4.295880149812730	0.4943820224719100	1147
2	Direct	2024041723	188	233	115	39.93991416309010	0.6117021276595740	4.587982832618030	0.49356223175965700	1069
3	Organic Social	2024041718	187	256	125	32.16015625	0.6684491978609630	4.078125	0.48828125	1044
4	Organic Social	2024041720	175	221	112	46.918552036199100	0.64	4.529411764705880	0.5067873303167420	1001

[23]:
```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 3182 entries, 0 to 3181
Data columns (total 10 columns):
 #   Column                                Non-Null Count  Dtype
---  ------                                --------------  -----
 0   Channel Group                         3182 non-null   object
 1   DateHour                              3182 non-null   object
 2   Users                                 3182 non-null   object
 3   Sessions                              3182 non-null   object
 4   Engaged sessions                      3182 non-null   object
 5   Average engagement time per session   3182 non-null   object
 6   Engaged sessions per user             3182 non-null   object
 7   Events per session                    3182 non-null   object
 8   Engagement rate                       3182 non-null   object
 9   Event count                           3182 non-null   object
dtypes: object(10)
```

```
memory usage: 248.7+ KB
```

[24]:
```
df["DateHour"] = pd.to_datetime(df["DateHour"], format="%Y%m%d%H",␣
↪errors='coerce')
numeric_cols = df.columns.drop(["Channel Group", "DateHour"])
df[numeric_cols] = df[numeric_cols].apply(pd.to_numeric, errors='coerce')
df["Hour"] = df["DateHour"].dt.hour
```

[25]:
```
df.head()
```

[25]:

	Channel Group	DateHour	Users	Sessions	Engaged sessions	\
0	Direct	2024-04-16 23:00:00	237	300	144	
1	Organic Social	2024-04-17 19:00:00	208	267	132	
2	Direct	2024-04-17 23:00:00	188	233	115	
3	Organic Social	2024-04-17 18:00:00	187	256	125	
4	Organic Social	2024-04-17 20:00:00	175	221	112	

	Average engagement time per session	Engaged sessions per user	\
0	47.526667	0.607595	
1	32.097378	0.634615	
2	39.939914	0.611702	
3	32.160156	0.668449	
4	46.918552	0.640000	

	Events per session	Engagement rate	Event count	Hour
0	4.673333	0.480000	1402	23
1	4.295880	0.494382	1147	19
2	4.587983	0.493562	1069	23
3	4.078125	0.488281	1044	18
4	4.529412	0.506787	1001	20

[26]:
```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 3182 entries, 0 to 3181
Data columns (total 11 columns):
 #   Column                                Non-Null Count  Dtype
---  ------                                --------------  -----
 0   Channel Group                         3182 non-null   object
 1   DateHour                              3182 non-null   datetime64[ns]
 2   Users                                 3182 non-null   int64
 3   Sessions                              3182 non-null   int64
 4   Engaged sessions                      3182 non-null   int64
 5   Average engagement time per session   3182 non-null   float64
 6   Engaged sessions per user             3182 non-null   float64
 7   Events per session                    3182 non-null   float64
 8   Engagement rate                       3182 non-null   float64
 9   Event count                           3182 non-null   int64
```

```
 10  Hour                                    3182 non-null   int32
dtypes: datetime64[ns](1), float64(4), int32(1), int64(4), object(1)
memory usage: 261.2+ KB
```

[27]:
```
df.describe()
```

[27]:

	DateHour	Users	Sessions
count	3182	3182.000000	3182.000000
mean	2024-04-20 01:17:07.278441216	41.935889	51.192646
min	2024-04-06 00:00:00	0.000000	1.000000
25%	2024-04-13 02:15:00	20.000000	24.000000
50%	2024-04-20 02:00:00	42.000000	51.000000
75%	2024-04-26 22:00:00	60.000000	71.000000
max	2024-05-03 23:00:00	237.000000	300.000000
std	NaN	29.582258	36.919962

	Engaged sessions	Average engagement time per session
count	3182.000000	3182.000000
mean	28.325581	66.644581
min	0.000000	0.000000
25%	13.000000	32.103034
50%	27.000000	49.020202
75%	41.000000	71.487069
max	144.000000	4525.000000
std	20.650569	127.200659

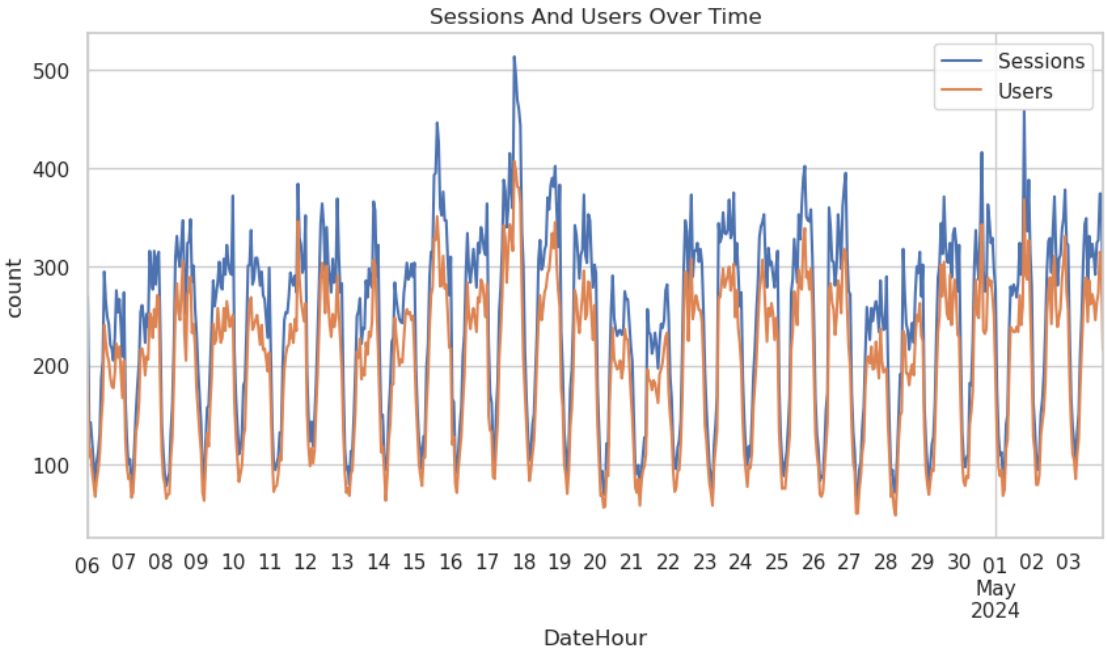
	Engaged sessions per user	Events per session	Engagement rate
count	3182.000000	3182.000000	3182.000000
mean	0.606450	4.675969	0.503396
min	0.000000	1.000000	0.000000
25%	0.561404	3.750000	0.442902
50%	0.666667	4.410256	0.545455
75%	0.750000	5.217690	0.633333
max	2.000000	56.000000	1.000000
std	0.264023	2.795228	0.228206

	Event count	Hour
count	3182.000000	3182.000000
mean	242.272470	11.807040
min	1.000000	0.000000
25%	103.000000	6.000000
50%	226.000000	12.000000
75%	339.000000	18.000000
max	1402.000000	23.000000
std	184.440313	6.886686

1 Sessions And User Over Time

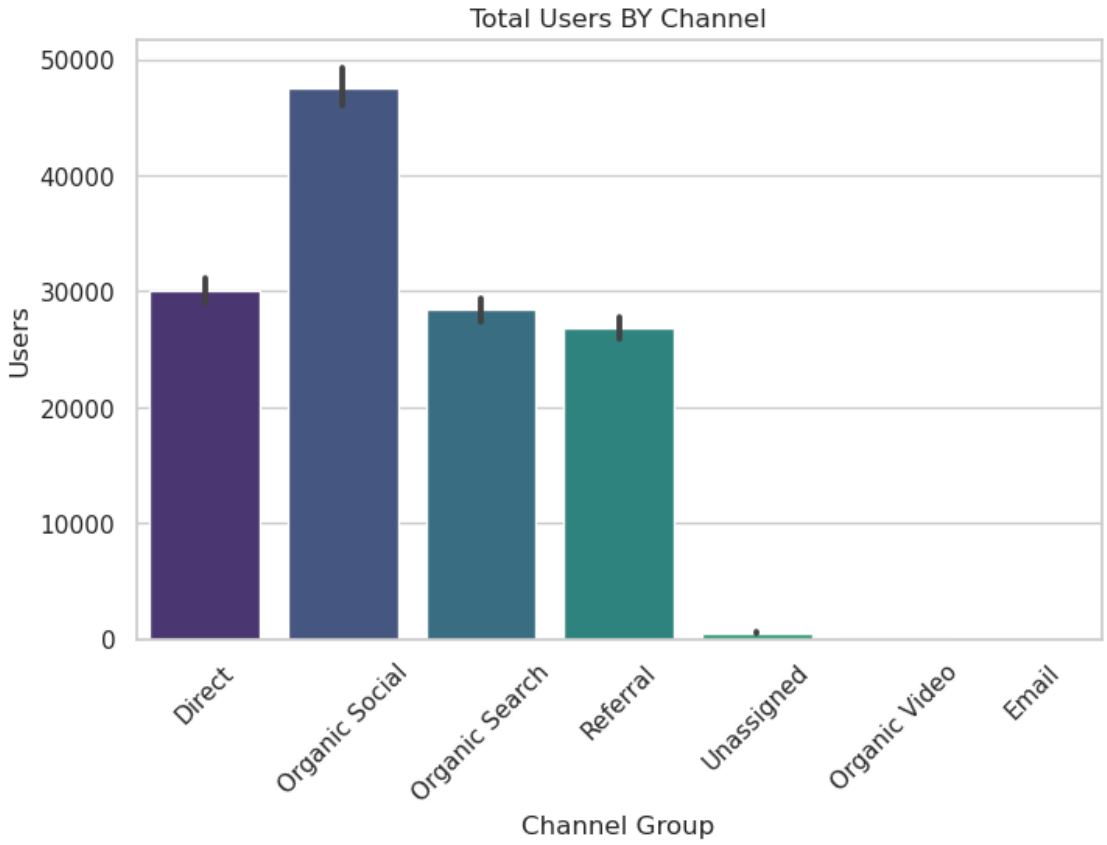
[28]:
```
sns.set(style="whitegrid")
```

[30]:
```
plt.figure(figsize=(10, 5))
df.groupby("DateHour")[["Sessions", "Users"]].sum().plot(ax=plt.gca())
plt.title("Sessions And Users Over Time")
plt.xlabel("DateHour")
plt.ylabel("count")
plt.show()
```



2 Total Users BY Channel

[32]:
```
plt.figure(figsize =(8,5))
sns.barplot(data=df, x="Channel Group", y="Users", estimator=np.sum,␣
 ↪palette="viridis")
plt.title("Total Users BY Channel")
plt.xticks(rotation=45)
plt.show()
```



[33]:
```
df.head()
```

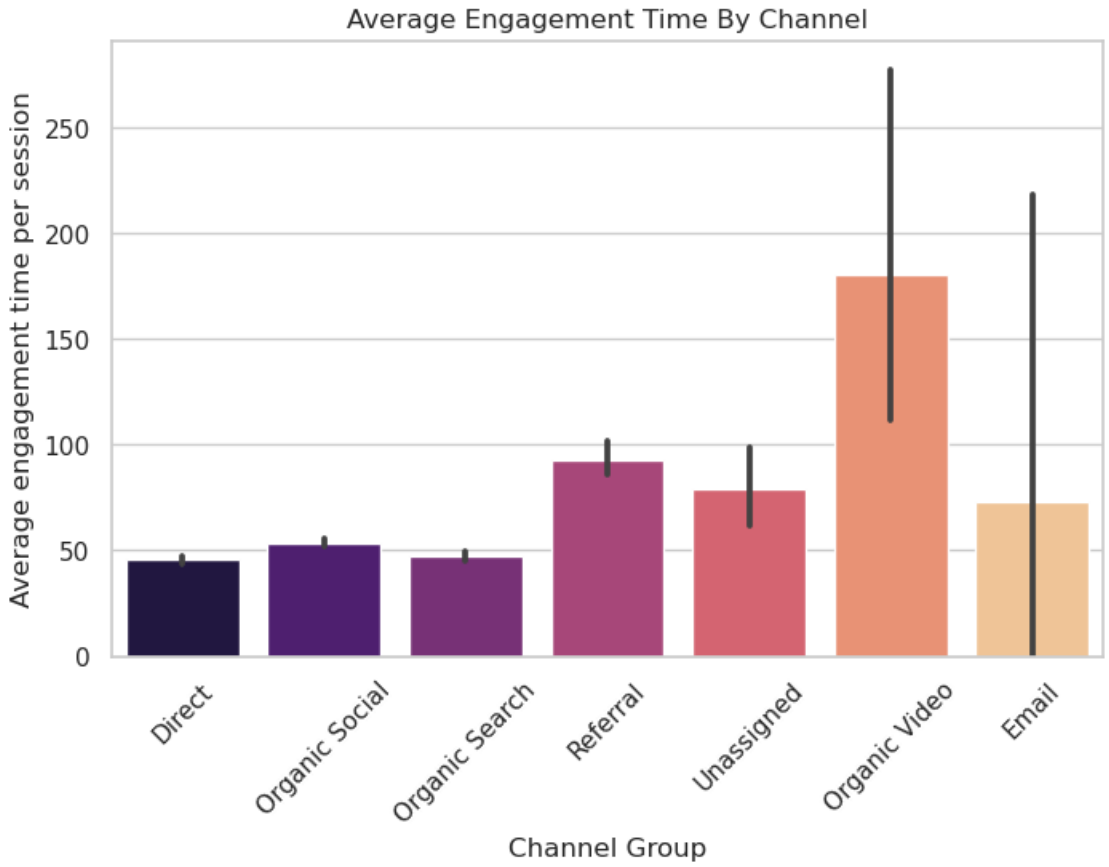
[33]:

	Channel Group	DateHour	Users	Sessions	Engaged sessions	Average engagement time per session	Engaged sessions per user	Events per session	Engagement rate	Event count	Hour
0	Direct	2024-04-16 23:00:00	237	300	144	47.526667	0.607595	4.673333	0.480000	1402	23
1	Organic Social	2024-04-17 19:00:00	208	267	132	32.097378	0.634615	4.295880	0.494382	1147	19
2	Direct	2024-04-17 23:00:00	188	233	115	39.939914	0.611702	4.587983	0.493562	1069	23
3	Organic Social	2024-04-17 18:00:00	187	256	125	32.160156	0.668449				
4	Organic Social	2024-04-17 20:00:00	175	221	112	46.918552	0.640000				

```
3              4.078125          0.488281          1044      18
4              4.529412          0.506787          1001      20
```

3 Average Engagement Time By Channel

[36]:
```
plt.figure(figsize=(8, 5))
sns.barplot(data=df, x="Channel Group", y="Average engagement time per␣
 ↪session", estimator=np.mean, palette="magma")
plt.title("Average Engagement Time By Channel")
plt.xticks(rotation=45)
plt.show()
```



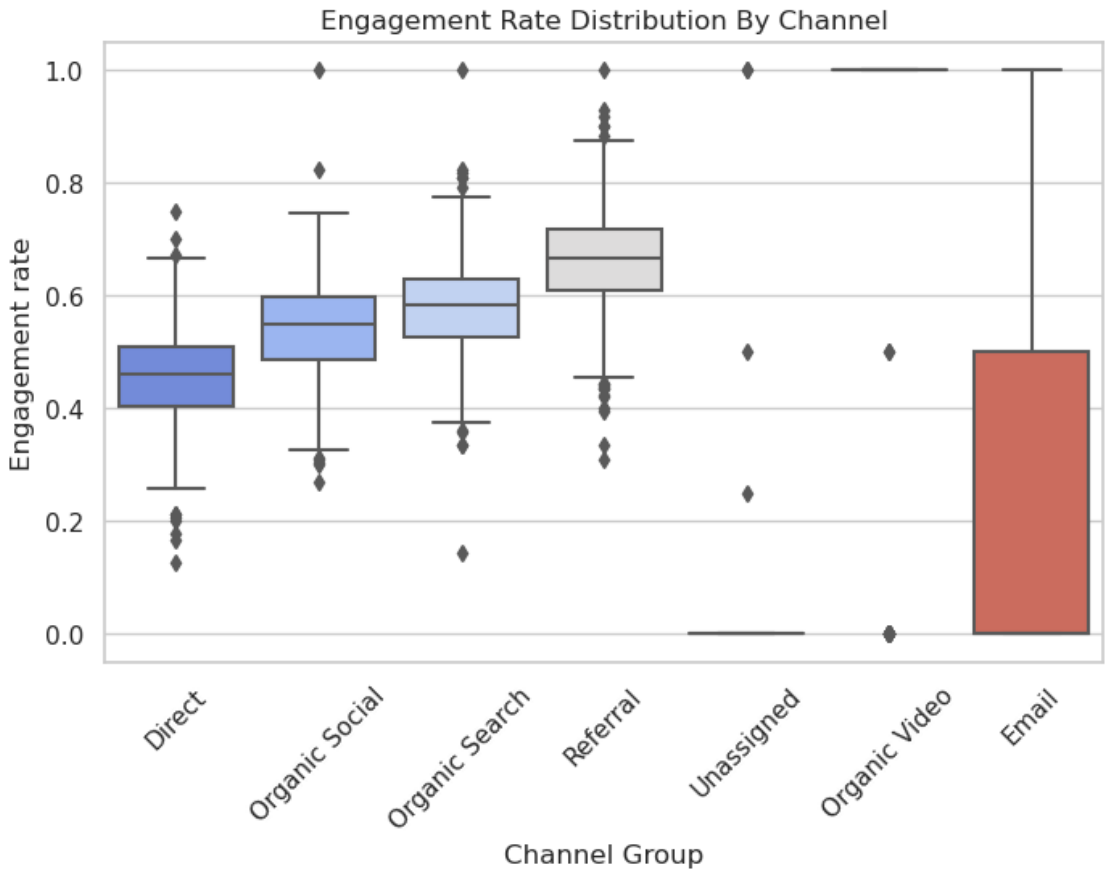
[37]:
```
df.head()
```

[37]:
```
     Channel Group            DateHour  Users  Sessions  Engaged sessions  \
0           Direct 2024-04-16 23:00:00    237       300               144
1   Organic Social 2024-04-17 19:00:00    208       267               132
2           Direct 2024-04-17 23:00:00    188       233               115
```

```
3  Organic Social 2024-04-17 18:00:00    187       256               125
4  Organic Social 2024-04-17 20:00:00    175       221               112

   Average engagement time per session  Engaged sessions per user  \
0                            47.526667                   0.607595
1                            32.097378                   0.634615
2                            39.939914                   0.611702
3                            32.160156                   0.668449
4                            46.918552                   0.640000

   Events per session  Engagement rate  Event count  Hour
0            4.673333         0.480000         1402    23
1            4.295880         0.494382         1147    19
2            4.587983         0.493562         1069    23
3            4.078125         0.488281         1044    18
4            4.529412         0.506787         1001    20
```

4 Engagement Rate Distribution By Channel

[40]:
```
plt.figure(figsize=(8, 5))
sns.boxplot(data=df, x="Channel Group", y="Engagement rate", palette="coolwarm")
plt.title("Engagement Rate Distribution By Channel")
plt.xticks(rotation=45)
plt.show()
```



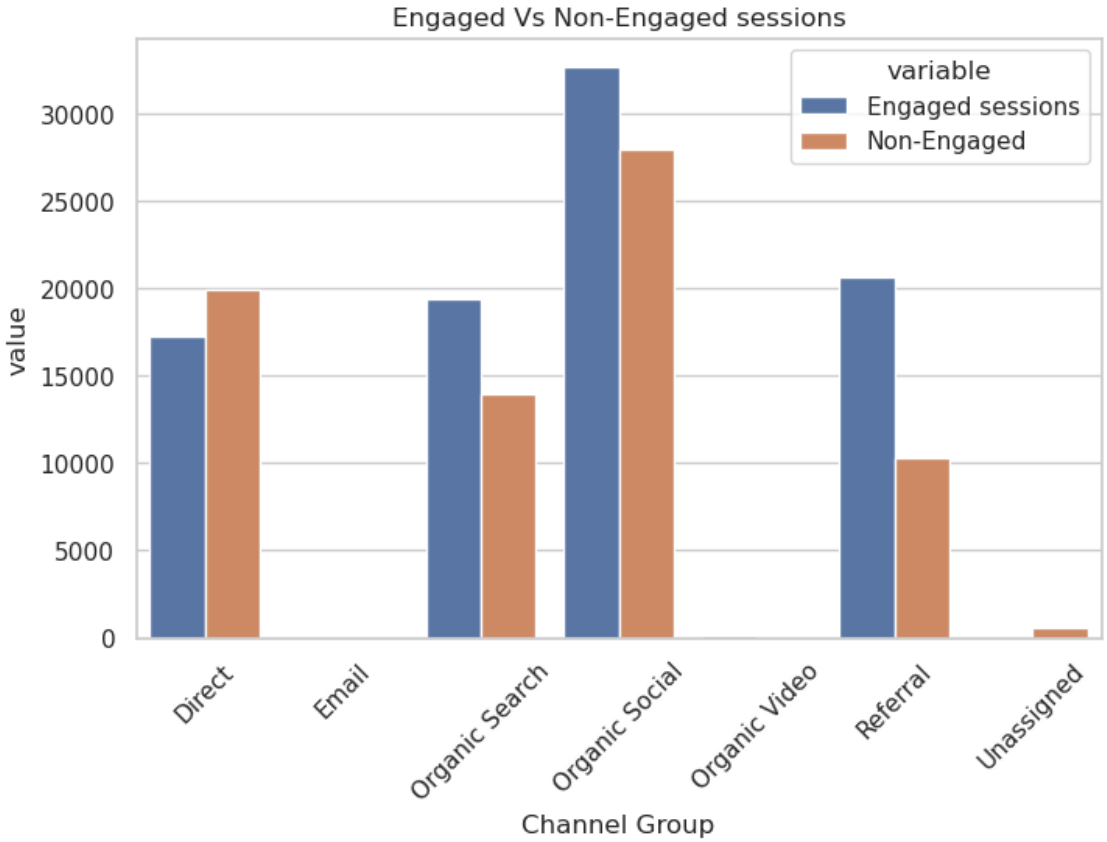
5 Engaged Vs Non-Engaged Sessions

[41]:
```
df.head()
```

[41]:
```
     Channel Group            DateHour  Users  Sessions  Engaged sessions  \
0           Direct 2024-04-16 23:00:00    237       300               144
1   Organic Social 2024-04-17 19:00:00    208       267               132
2           Direct 2024-04-17 23:00:00    188       233               115
3   Organic Social 2024-04-17 18:00:00    187       256               125
4   Organic Social 2024-04-17 20:00:00    175       221               112

   Average engagement time per session  Engaged sessions per user  \
0                            47.526667                   0.607595
1                            32.097378                   0.634615
2                            39.939914                   0.611702
3                            32.160156                   0.668449
4                            46.918552                   0.640000
```

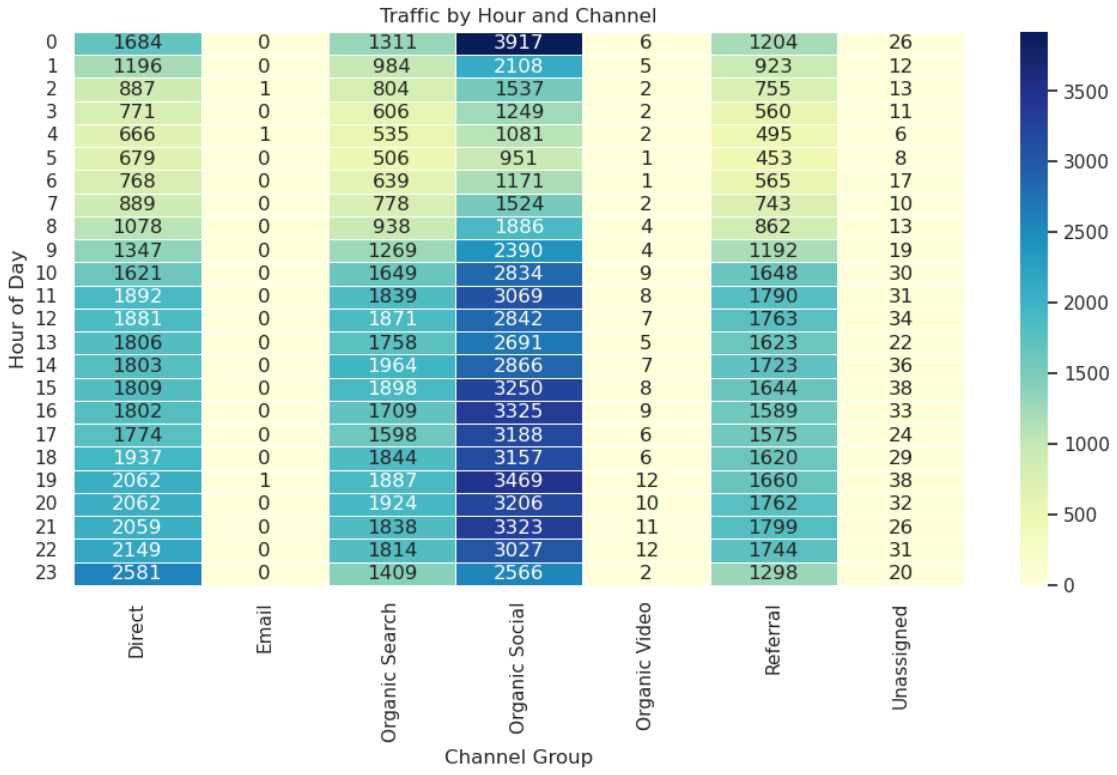
	Events per session	Engagement rate	Event count	Hour
0	4.673333	0.480000	1402	23
1	4.295880	0.494382	1147	19
2	4.587983	0.493562	1069	23
3	4.078125	0.488281	1044	18
4	4.529412	0.506787	1001	20

[44]:
```
session_df=df.groupby("Channel Group")[["Sessions", "Engaged sessions"]].sum().
 ↪reset_index()
session_df["Non-Engaged"] = session_df["Sessions"] - session_df["Engaged␣
 ↪sessions"]
session_df_melted = session_df.melt(id_vars="Channel Group",␣
 ↪value_vars=["Engaged sessions", "Non-Engaged"])

plt.figure(figsize=(8, 5))
sns.barplot(data=session_df_melted, x="Channel Group", y="value",␣
 ↪hue="variable")
plt.title("Engaged Vs Non-Engaged sessions")
plt.xticks(rotation=45)
plt.show()
```



6 Traffic By Hour And Channel

[46]:
```
df['Hour'] = pd.to_datetime(df['DateHour']).dt.hour
heatmap_data = df.groupby(["Hour", "Channel Group"])["Sessions"].sum().
 ↪unstack().fillna(0)

plt.figure(figsize=(12, 6))
sns.heatmap(heatmap_data, cmap="YlGnBu", linewidths=.5, annot=True, fmt='.0f')
plt.title("Traffic by Hour and Channel")
plt.xlabel("Channel Group")
plt.ylabel("Hour of Day")
plt.show()
```



7 Engagement Rate Over Time

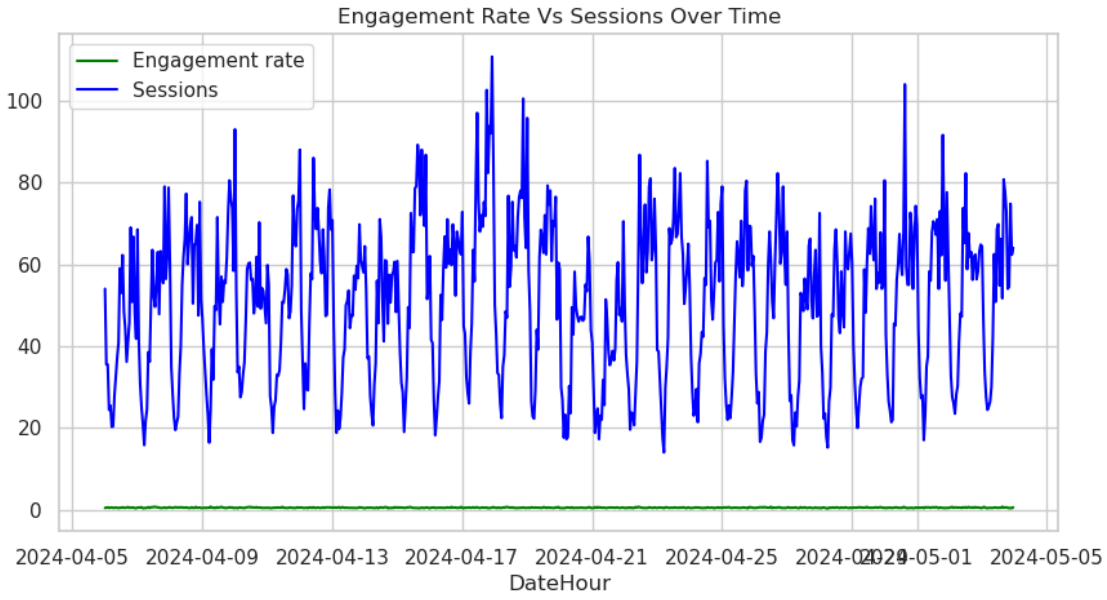
[47]:
```
df.head()
```

[47]:

	Channel Group	DateHour	Users	Sessions	Engaged sessions	\
0	Direct	2024-04-16 23:00:00	237	300	144	
1	Organic Social	2024-04-17 19:00:00	208	267	132	
2	Direct	2024-04-17 23:00:00	188	233	115	

```
3  Organic Social 2024-04-17 18:00:00    187       256               125
4  Organic Social 2024-04-17 20:00:00    175       221               112

   Average engagement time per session  Engaged sessions per user  \
0                            47.526667                   0.607595
1                            32.097378                   0.634615
2                            39.939914                   0.611702
3                            32.160156                   0.668449
4                            46.918552                   0.640000

   Events per session  Engagement rate  Event count  Hour
0            4.673333         0.480000         1402    23
1            4.295880         0.494382         1147    19
2            4.587983         0.493562         1069    23
3            4.078125         0.488281         1044    18
4            4.529412         0.506787         1001    20
```

[52]:
```
df_plot = df.groupby("DateHour")[["Engagement rate", "Sessions"]].mean().
 ↪reset_index()

plt.figure(figsize=(10, 5))
plt.plot(df_plot["DateHour"], df_plot["Engagement rate"], label="Engagement␣
 ↪rate", color="green")
plt.plot(df_plot["DateHour"], df_plot["Sessions"], label="Sessions",␣
 ↪color="blue")
plt.title("Engagement Rate Vs Sessions Over Time")
plt.xlabel("DateHour")
plt.legend()
plt.grid(True)
plt.show()
```


Engagement Rate Vs Sessions Over Time
Engagement rate
Sessions
100
80
60
40
20
0
2024-04-05
2024-04-09
2024-04-13
2024-04-17
2024-04-21
2024-04-25
2024-05-01
2024-05-05
DateHour

[ ]: