Demand of Football in European Leagues

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```
import pandas as pd
import numpy as np
import seaborn as sns
import matplotlib.pyplot as plt
```

Background

- Goal is to Analyze factors that impact European Football teams attendance
- Analyzing 21 leagues from 11 countries
- Looking at the effect of:
  - Time/Date
  - The Away Team
  - Betting odds

Dataset

- Combined Data sets from Football-Data.co.uk and worldfootball.net
- Shrunk data from 107 columns to 38
- Data is from 2010-2019
- Conisists of 53,238 rows

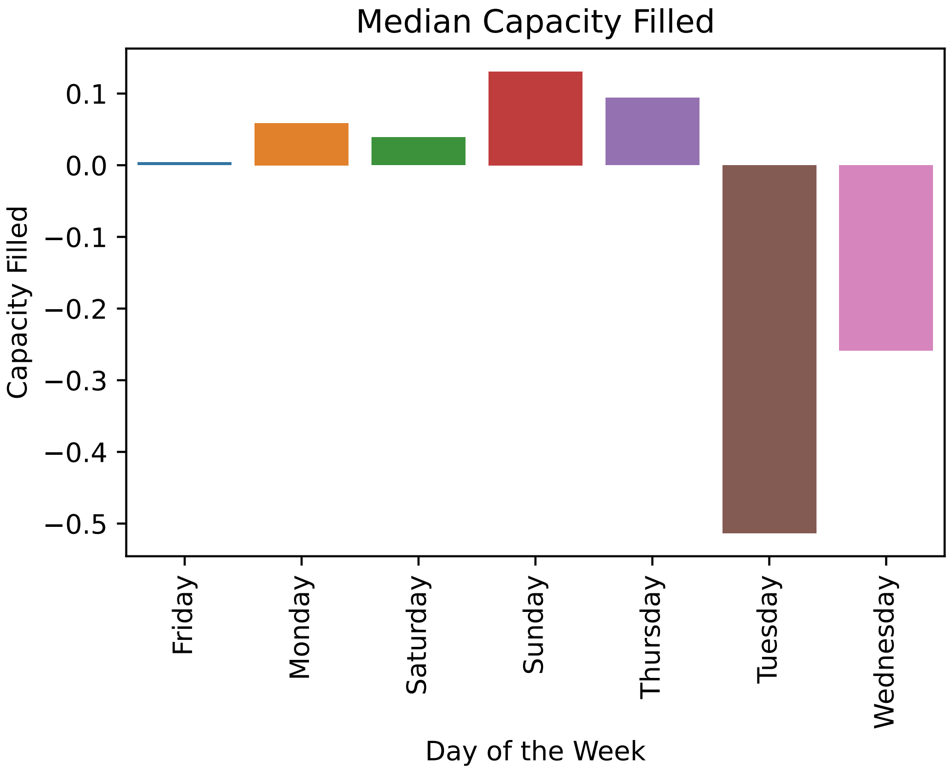
```
total_data_set = pd.read_pickle('d:/Python Work/Capstone/data/final_datasets/data_standard
print(total_data_set.columns)
```

```
Index(['home_team', 'away_team', 'home_score', 'away_score', 'date', 'time',
       'day_of_week', 'raw_attendance', 'stadium', 'city', 'country',
       'capacity', 'url', 'division', 'FTHG', 'FTAG', 'FTR', 'HTHG', 'HTAG',
       'HTR', 'B365H', 'B365D', 'B365A', 'BWH', 'BWD', 'BWA', 'WHH', 'WHD',
       'WHA', 'VCH', 'VCD', 'VCA', 'BbMx>2.5', 'BbAv>2.5', 'BbMx<2.5',
       'BbAv<2.5', 'capacity_filled', 'date_time', 'season', 'mean_attend',
       'std_attend', 'standard_attend'],
      dtype='object')
```

Day of the Week Capacity Filled

```
time_df = pd.read_pickle('d:/Python Work/Capstone/data/final_datasets/time_shrink.pkl')

df_grouped_mean = time_df.groupby('day_of_week')['raw_attendance', 'capacity_filled', 'sta
df_grouped_median = time_df.groupby('day_of_week')['raw_attendance', 'capacity_filled', 's

day_categories = ['Monday', 'Tuesday', 'Wednesday', 'Thursday', 'Friday', 'Saturday', 'Sun
df_grouped_median['day_of_week'] = pd.Categorical(df_grouped_median['day_of_week'], catego
df_grouped_median.sort_values(by = 'day_of_week', inplace = True)

sns.barplot(data=df_grouped_mean, x = 'day_of_week', y = 'standard_attend').set(title ='Me
plt.xticks(rotation=90)
plt.xlabel('Day of the Week')
plt.ylabel('Capacity Filled')
plt.show()
```

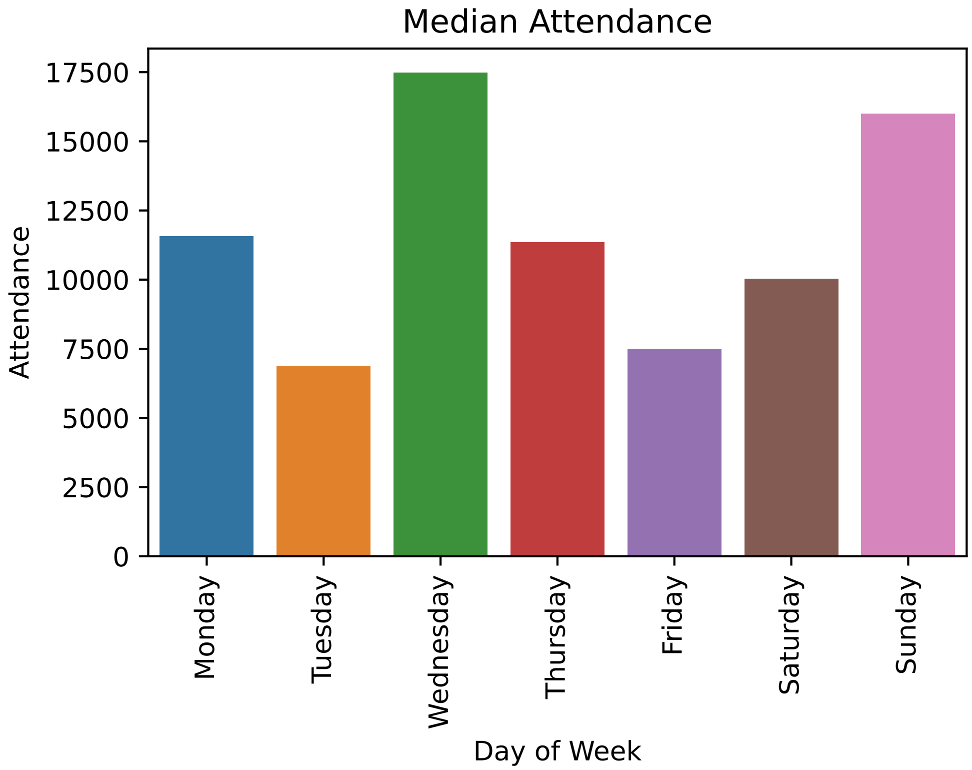
```
C:\Users\matth\AppData\Local\Temp\ipykernel_14924\2745861717.py:3: FutureWarning:

Indexing with multiple keys (implicitly converted to a tuple of keys) will be deprecated, us

C:\Users\matth\AppData\Local\Temp\ipykernel_14924\2745861717.py:4: FutureWarning:

Indexing with multiple keys (implicitly converted to a tuple of keys) will be deprecated, us
```



```
# sns.catplot(data = total_data_set, x = 'day_of_week', y = 'standard_attend', kind = 'swa
# plt.show()
```

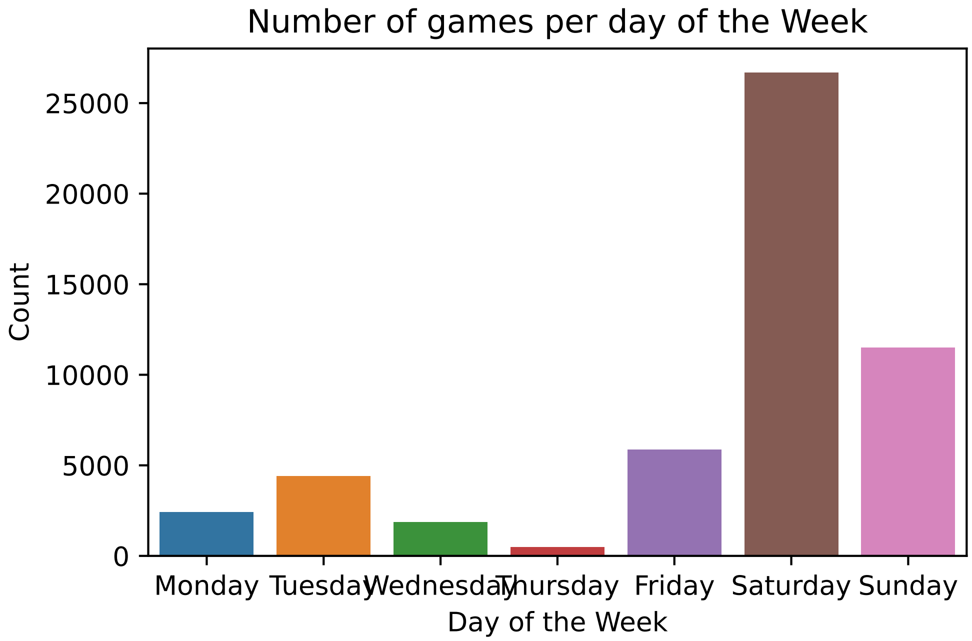
Day of the Week Attendance

```
sns.barplot(data=df_grouped_median, x = 'day_of_week', y = 'raw_attendance').set(title ='M
plt.xticks(rotation=90)
plt.ylabel('Attendance')
plt.xlabel('Day of Week')


plt.show()
```



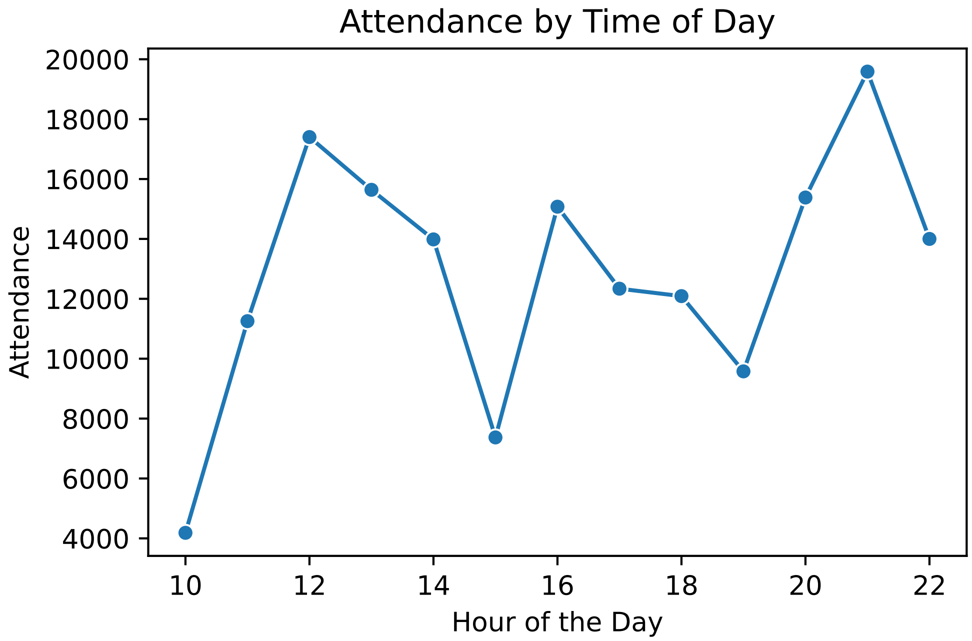
Day of the Week total Count

```
grouped_week_count = time_df.groupby('day_of_week').count().reset_index()

grouped_week_count['day_of_week'] = pd.Categorical(grouped_week_count['day_of_week'], cate
grouped_week_count.sort_values(by = 'day_of_week', inplace = True)


sns.barplot(data = grouped_week_count, x = 'day_of_week', y = 'date')
plt.xlabel('Day of the Week')
plt.ylabel('Count')
plt.title('Number of games per day of the Week')
plt.show()
```



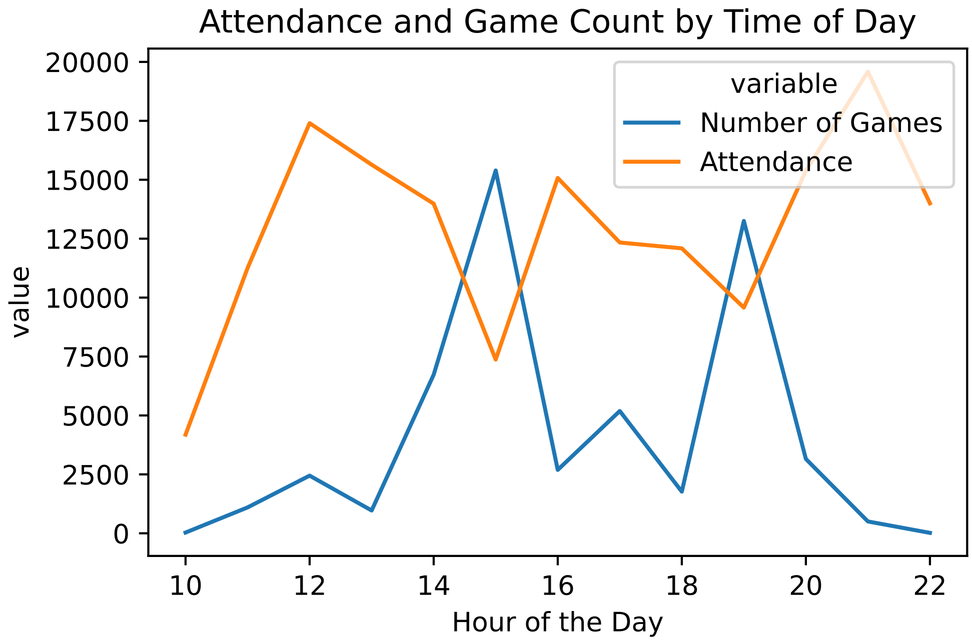
Attendance Time of Day

```
df_grouped_mean_tod= time_df.groupby(time_df['date_time'].dt.hour).mean()
df_grouped_median_tod= time_df.groupby(time_df['date_time'].dt.hour).median()


sns.lineplot(data = df_grouped_median_tod, x = 'date_time', y = 'raw_attendance', markers
plt.title('Attendance by Time of Day')
plt.xlabel('Hour of the Day')
plt.ylabel('Attendance')
plt.show()
```



Number of Games Time of Day

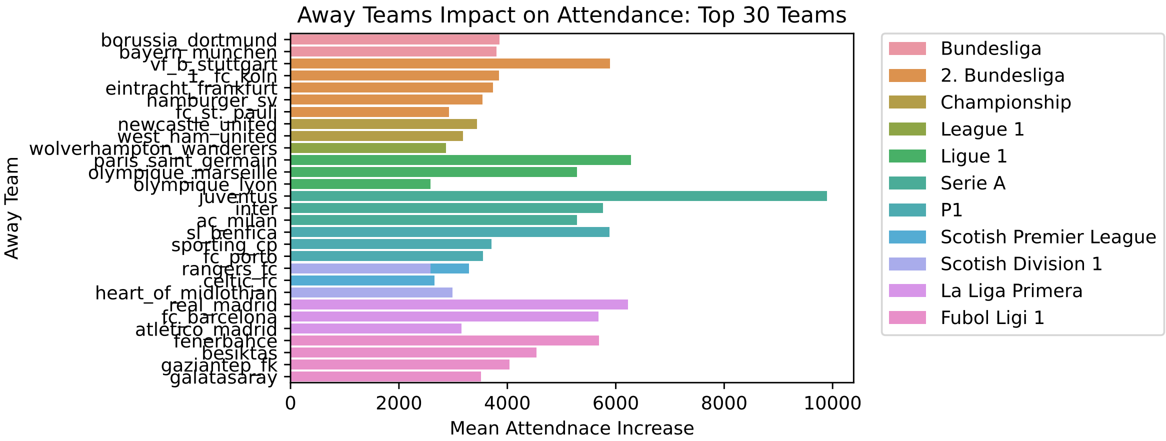
```
df_grouped_count = time_df.groupby(time_df['date_time'].dt.hour).count()
# print(df_grouped_count)
df_grouped_count = df_grouped_count['raw_attendance'].reset_index()
df_grouped_count['count'] = df_grouped_count['raw_attendance']
df_grouped_count = df_grouped_count[['date_time', 'count']]
# df_grouped_count= df_grouped_count.rename(columns = {'date':'count'})
# print(df_grouped_count)

df_count_atted = pd.merge(df_grouped_count, df_grouped_median_tod, on = 'date_time')
df_count_atted = df_count_atted.drop(columns= ['capacity_filled'])
df_count_atted.rename( columns = {'raw_attendance': 'Attendance', 'count': "Number of Game
# print(df_count_atted)
melted_count_attend = pd.melt(df_count_atted, value_vars=['Number of Games', 'Attendance']
# print(melted_count_attend)

sns.lineplot(data = melted_count_attend, x = 'date_time', y = 'value', hue = 'variable')
plt.title('Attendance and Game Count by Time of Day')
plt.xlabel('Hour of the Day')
plt.show()
```



Away Teams Impact Best Teams

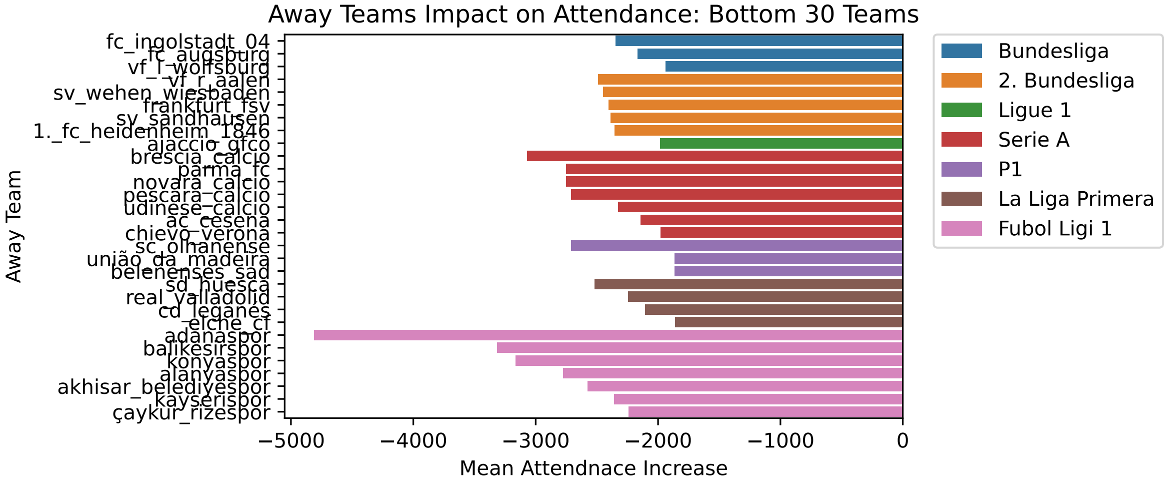
```
impact_data = total_data_set[total_data_set.division != 'SC2']
impact_data = impact_data[['home_team', 'away_team', 'date_time', 'division', 'raw_attenda
impact_data['year']= impact_data['date_time'].dt.year
impact_data = impact_data.dropna()

average_team_attendance = impact_data.groupby(['year', 'home_team']).mean().reset_index().
standard_dev_attendance = impact_data.groupby(['year', 'home_team']).std().reset_index().r


# print(average_team_attendance)
# print(standard_dev_attendance)
avg_df = pd.merge(impact_data,average_team_attendance, on = ['year','home_team'])
avg_df = pd.merge(avg_df, standard_dev_attendance, on = ['year', 'home_team'])
# print(avg_df)
# print(avg_df.isna().sum())
avg_df['away_team_impact'] = avg_df['raw_attendance'] - avg_df['avg_raw_attendance']
```

```
avg_df['attendance_zscore'] = (avg_df['raw_attendance']- avg_df['avg_raw_attendance'])/avg

# print(avg_df.sort_values('attendance_zscore'))
# avg_df.to_csv('src/Teams_impact/avg_df.csv')
away_team_impact = avg_df.groupby(['away_team', 'division']).mean().reset_index()
away_team_impact = away_team_impact[['away_team', 'attendance_zscore', 'away_team_impact',

away_top_30 = away_team_impact.sort_values('away_team_impact', ascending = False).head(30)

div_dict = {'D1':'Bundesliga', 'D2': '2. Bundesliga', 'E0':'Premier League', 'E1':'Champio
            'E2':'League 1', 'E3':'Leauge 2','SP1':'La Liga Primera', 'SP2':'La Liga Segun
              'B1':'Jupiler League', 'F1':'Ligue 1','F2':'Ligue 2','I1':'Serie A','I2':'Se
              'SC0':'Scotish Premier League', 'SC1':'Scotish Division 1', 'T1':'Fubol Ligi
away_top_30 = away_top_30.replace({'division':div_dict})
# div_avg = div_avg.replace({'division':div_dict})
# print(away_top_30)


sns.barplot(data = away_top_30, x = 'away_team_impact', y = 'away_team', hue = 'division',
plt.title('Away Teams Impact on Attendance: Top 30 Teams')
plt.xlabel('Mean Attendnace Increase')
plt.ylabel('Away Team')
plt.legend(bbox_to_anchor=(1.05, 1), loc='upper left', borderaxespad=0)
plt.show()
```



Away Team Impact Worst Teams

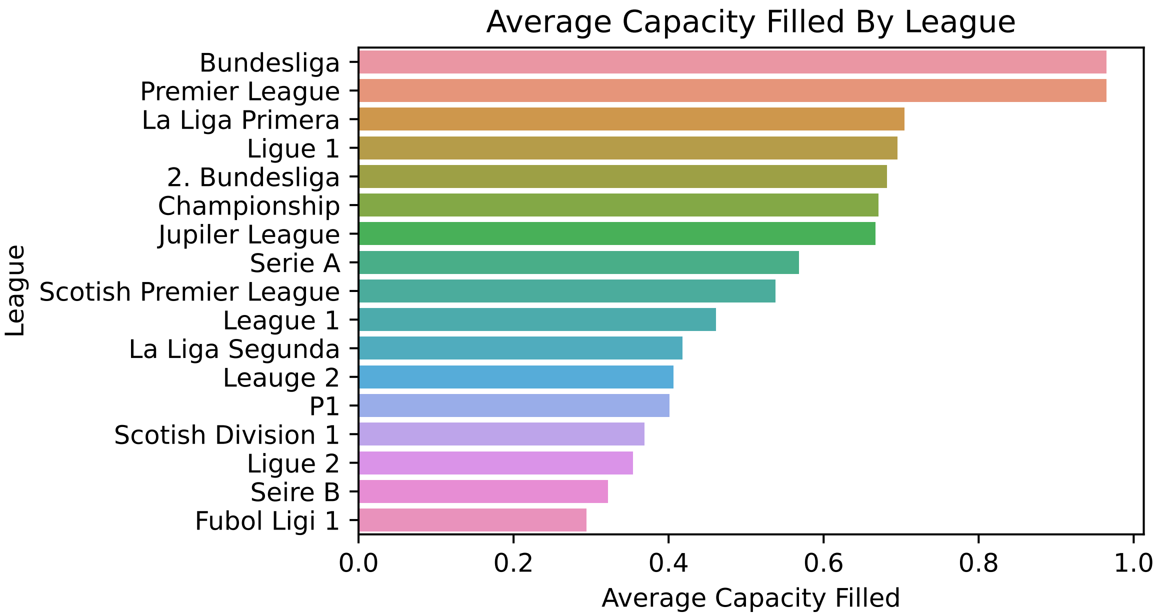
```
away_bottom_30 = away_team_impact.sort_values('away_team_impact', ascending = True).head(3
away_bottom_30 = away_bottom_30.replace({'division':div_dict})
sns.barplot(data = away_bottom_30, x = 'away_team_impact', y = 'away_team', hue = 'divisio
plt.title('Away Teams Impact on Attendance: Bottom 30 Teams')
plt.xlabel('Mean Attendnace Increase')
plt.legend(bbox_to_anchor=(1.05, 1), loc='upper left', borderaxespad=0)
plt.ylabel('Away Team')

plt.show()
```



Division Capacity

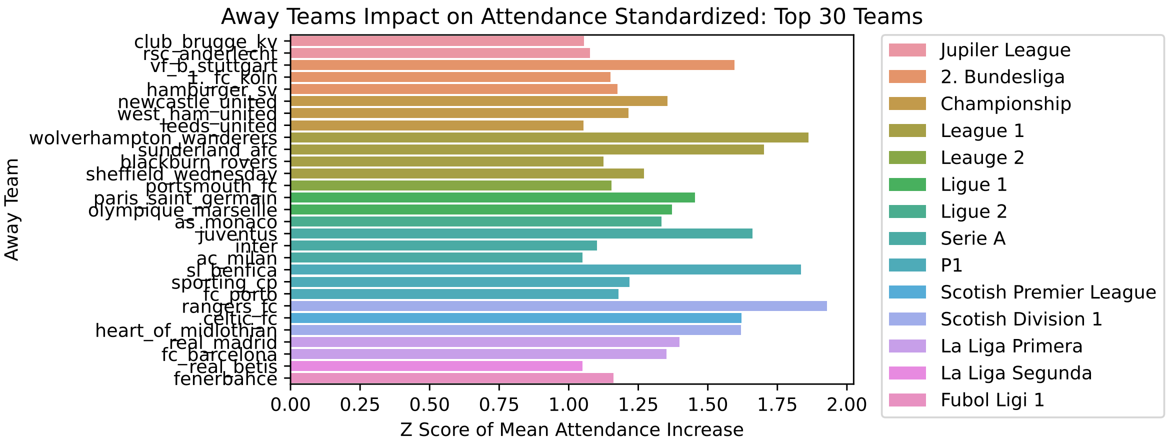
```
div_dict = {'D1':'Bundesliga', 'D2': '2. Bundesliga', 'E0':'Premier League', 'E1':'Champio
            'E2':'League 1', 'E3':'Leauge 2','SP1':'La Liga Primera', 'SP2':'La Liga Segun
              'B1':'Jupiler League', 'F1':'Ligue 1','F2':'Ligue 2','I1':'Serie A','I2':'Se
              'SC0':'Scotish Premier League', 'SC1':'Scotish Division 1', 'T1':'Fubol Ligi

div_avg = impact_data.groupby('division').median().reset_index().sort_values('capacity_fil
div_avg = div_avg.replace({'division':div_dict})
# print(div_avg['division'])

# away_team_impact.to_csv('src/Teams_impact/away_team_impact.csv')
```

```
division_fig = sns.barplot(data = div_avg, y='division', x= 'capacity_filled')
# plt.bar(div_avg['division'], div_avg['capacity_filled'],  align = 'center')
plt.title('Average Capacity Filled By League')
plt.xlabel('Average Capacity Filled')
plt.ylabel('League')
# sns.set_palette(sns.color_palette("rocket"))

plt.show()
```



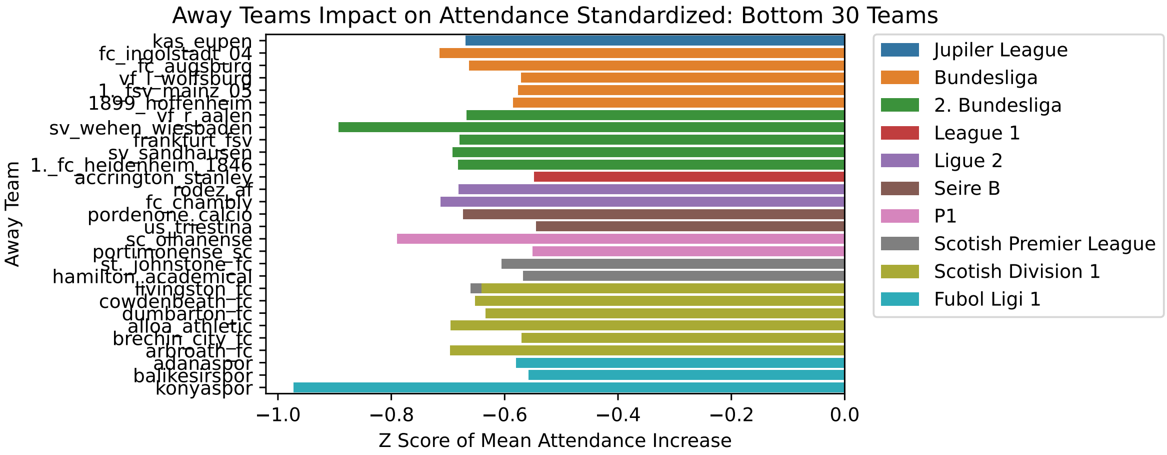
Standardized Best Away Teams Impact

```
away_top_30_std = away_team_impact.sort_values('attendance_zscore', ascending = False).hea
away_top_30_std = away_top_30_std.replace({'division':div_dict})
sns.barplot(data = away_top_30_std, x = 'attendance_zscore', y = 'away_team', hue = 'divis
plt.title('Away Teams Impact on Attendance Standardized: Top 30 Teams')
plt.xlabel('Z Score of Mean Attendance Increase')
plt.legend(bbox_to_anchor=(1.05, 1), loc='upper left', borderaxespad=0)
plt.ylabel('Away Team')

plt.show()
```



Standardized Worst Away Teams Impact

```
away_bottom_30_std = away_team_impact.sort_values('attendance_zscore', ascending = True).h
away_bottom_30_std = away_bottom_30_std.replace({'division':div_dict})
sns.barplot(data = away_bottom_30_std, x = 'attendance_zscore', y = 'away_team', hue = 'di
plt.title('Away Teams Impact on Attendance Standardized: Bottom 30 Teams')
plt.xlabel('Z Score of Mean Attendance Increase')
plt.legend(bbox_to_anchor=(1.05, 1), loc='upper left', borderaxespad=0)
plt.ylabel('Away Team')

plt.show()
```



```
# import ipywidgets as widgets
# leagues_impact_away_team = away_team_impact
# # .sort_values('division').replace({'division':div_dict})
# divisions_list = list(set(leagues_impact_away_team.division.values.tolist()))
# # print(divisions_list)
# # print(sorted(divisions_list))

# divisions_list = [div_dict.get(item,item) for item in divisions_list]
# # print(divisions_list)


# # dd = widgets.Dropdown(
# #   options = divisions_list,
# #   value = divisions_list[0],
# #   description = 'Select a Division'
# # )
# def draw_plot(divisions_list):

#   df = away_team_impact[away_team_impact['division']==divisions_list]

#   p = sns.barplot(data = df,
#                      x = 'attendance_zscore', y = 'away_team', dodge = False)
# division = widgets.Dropdown(options = divisions_list, description = 'Division:')

# gui = widgets.interactive(draw_plot, divisions_list = divisions_list)
# # display(x)
# gui
```

Setbacks

- Data Scraping and Processing took significantly longer than expected
- Once Scraping and Processing was complete. The questions refereing to a teams position in the league affect on attendance were unattainable
  - The position would be columsn that need to be created and with missing data and not a consitent schedule of leagues start date
- Calendar Mat plot have been a struggle to get to function properly.

Future Work

- Calendar Plots

- Betting Data Analysis
- Model for Team Attendance