# Step 1: Data Cleaning and Preparation

```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
# Recreating the dataset from the information provided
df = pd.read csv('https://raw.githubusercontent.com/JadenDsouza/UEFA Champions League Dat
# Make sure all numerical columns are properly typed as numbers
numeric_columns = ['#', 'matches_played', 'wins', 'draws', 'losses', 'goals', 'goal_diffe
for col in numeric columns:
    df[col] = pd.to_numeric(df[col], errors='coerce')
# Check for any remaining string values that should be numbers
for col in numeric_columns:
    if df[col].dtype == 'object':
        print(f"Column {col} contains non-numeric values")
        # You can inspect the problematic values
        print(df[df[col].apply(lambda x: not isinstance(x, (int, float)))][col])
# Now calculate additional metrics
df['win_rate'] = df['wins'] / df['matches_played']
df['goals_per_match'] = df['goals'] / df['matches_played']
df['points_per_match'] = df['points'] / df['matches_played']
df['goal_diff_per_match'] = df['goal_difference'] / df['matches_played']
print("\nDataFrame with additional metrics:")
print(df[['Team', 'matches_played', 'wins', 'win_rate', 'goals_per_match', 'points_per_ma
# Visualize the team performance
plt.figure(figsize=(10, 6))
sns.barplot(x='Team', y='win rate', data=df)
plt.title('Win Rate by Team')
plt.xticks(rotation=45)
plt.tight layout()
plt.savefig('win_rate_chart.png')
# Let's do a quick correlation analysis
plt.figure(figsize=(10, 8))
corr_matrix = df[['matches_played', 'wins', 'draws', 'losses',
                  'goals', 'goal_difference', 'points',
                  'win_rate', 'goals_per_match', 'points_per_match']].corr()
sns.heatmap(corr_matrix, annot=True, cmap='coolwarm', fmt='.2f')
plt.title('Correlation Matrix of Performance Metrics')
plt.tight layout()
plt.savefig('correlation_matrix.png')
# Performance comparison across multiple metrics
plt.figure(figsize=(12, 20))
```



DataFrame with additional metrics:

	Team	matches_played	wins	win_rate	<pre>goals_per_match</pre>	\
0	Real Madrid	486	291	0.598765	NaN	
1	Bayern Munich	388	231	0.595361	NaN	
2	FC Barcelona	341	196	0.574780	NaN	
3	Manchester United	289	153	0.529412	NaN	
4	Juventus	297	151	0.508418	NaN	

points\_per\_match
0 1.096708
1 1.100515
2 0.935484
3 0.775087
4 0.575758

## Win-to-Loss Ratio:

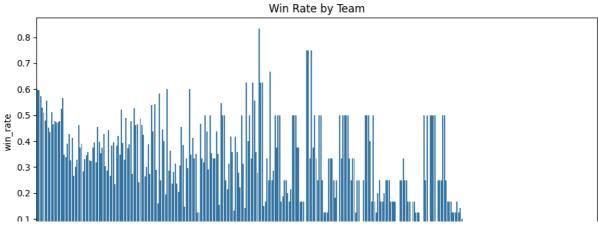
	Team	win_loss_ratio
206	Zbrojovka Brno	inf
140	FC Ararat	5.00
147	AFC DWS	4.00
98	1. FC Köln	3.50
74	Spartak Trnava	3.25
	• • •	• • •
318	Pezoporikos Larnaca	0.00
319	Tavriya Simferopol (1958-2014)	0.00
320	Ilves Tampere	0.00
353	Avenir Beggen	0.00
270	Flamurtari Vlorë	NaN

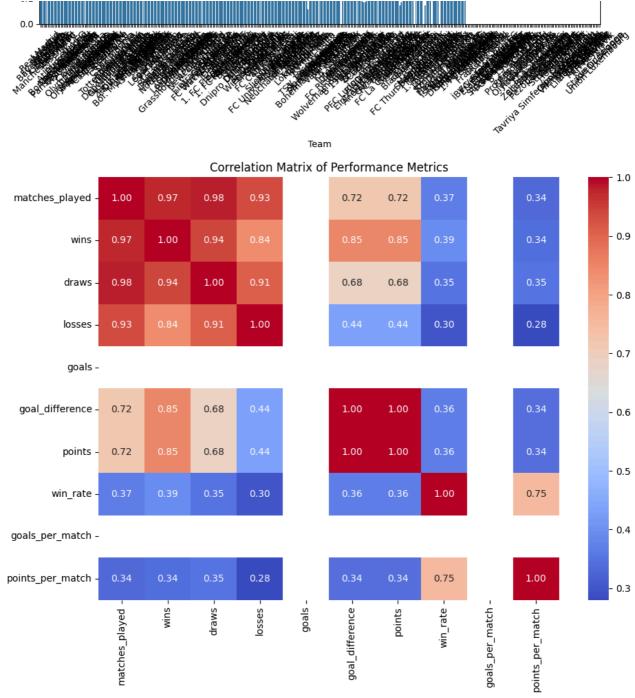
## [354 rows x 2 columns]

## Team Rankings based on Points per Match:

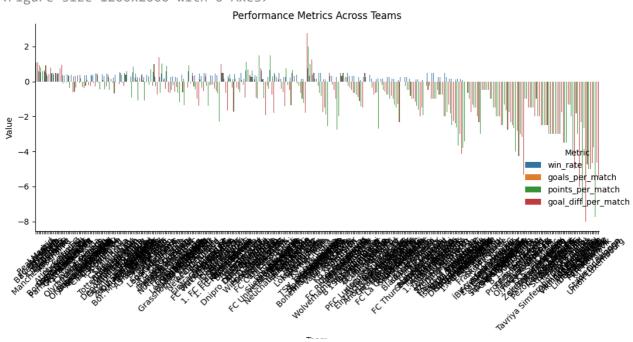
i Caiii	Mankings basea on	TOTILES PET MACCIT
	Team	<pre>points_per_match</pre>
170	Ipswich Town	2.750
171	TSV 1860 München	2.000
140	FC Ararat	1.500
147	AFC DWS	1.500
77	Stade Reims	1.375
353	Avenir Beggen	-5.500
341	AEL Limassol	-6.000
343	KPV Kokkola	-7.000
351	Stade Dudelange	-7.750
345	EPA Larnaca	-8.000

## [354 rows x 2 columns]





<Figure size 1200x2000 with 0 Axes>



## Step 2: Exploratory Data Analysis

```
# Analyzing relationships between variables
plt.figure(figsize=(15, 10))
# Plot 1: Wins vs Matches Played
plt.subplot(2, 2, 1)
plt.scatter(df['matches_played'], df['wins'], alpha=0.7)
for i, txt in enumerate(df['Team']):
    plt.annotate(txt, (df['matches_played'][i], df['wins'][i]), fontsize=9)
plt.xlabel('Matches Played')
plt.ylabel('Wins')
plt.title('Wins vs Matches Played')
# Plot 2: Goal Difference Distribution
plt.subplot(2, 2, 2)
plt.bar(df['Team'], df['goal_difference'])
plt.xticks(rotation=45, ha='right')
plt.ylabel('Goal Difference')
plt.title('Goal Difference by Team')
# Plot 3: Win Rate Analysis
plt.subplot(2, 2, 3)
plt.bar(df['Team'], df['win_rate'])
plt.xticks(rotation=45, ha='right')
plt.ylabel('Win Rate')
plt.title('Win Rate by Team')
# Plot 4: Goals per Match
plt.subplot(2, 2, 4)
plt.bar(df['Team'], df['goals_per_match'])
plt.xticks(rotation=45, ha='right')
plt.ylabel('Goals per Match')
plt.title('Goals per Match by Team')
plt.tight_layout()
plt.savefig('team performance analysis.png')
# Correlation analysis
correlation = df[['matches played', 'wins', 'draws', 'losses', 'goals', 'goal difference'
print("\nCorrelation Matrix:")
print(correlation)
```



#### Correlation Matrix:

matches_played         wins         draws         losses         goals           wins         0.974861         0.981159         0.933849         NaN           wins         0.981159         0.943131         1.000000         0.911338         NaN           losses         0.933849         0.836572         0.911338         NaN           losses         0.933849         0.836572         0.911338         NaN           goals         NaN         NaN         NaN         NaN         NaN           goal_difference         0.719490         0.850304         0.683847         0.437281         NaN           win_rate         0.369980         0.393172         0.349130         0.300980         NaN           win_rate         0.369980         0.393172         0.349130         0.300980         NaN           wins         0.8583040         0.850304         0.369980         NaN         NaN           wins         0.8583040         0.850304         0.369980         NaN           wins         0.683847         0.683847         0.34721         NaN           losses         0.437281         0.437281         0.30980         NaN           losses         0.437281		ix:					
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# Step 3: Performance Metrics Analysis

```
df['goal diff per match'] = df['goal difference'] / df['matches played']
# Define metrics for radar chart
metrics = ['Win Rate', 'Goals/Match', 'Points/Match', 'Goal Difference/Match']
# Set up the angles for the radar chart
angles = np.linspace(0, 2*np.pi, len(metrics), endpoint=False).tolist()
angles += angles[:1] # Close the loop
# Function to create radar chart
def create radar chart(ax, angles, stats, team name):
   # Plot data
    ax.plot(angles, stats, linewidth=1, linestyle='solid')
   # Fill area
    ax.fill(angles, stats, alpha=0.1)
   # Add labels
    ax.set_yticklabels([])
   ax.set xticks(angles[:-1]) # Don't show the last angle (which is just a duplicate)
    ax.set_xticklabels(metrics)
    ax.set_title(team_name, size=11, y=1.1)
    return ax
# Create a figure for the radar charts
fig, axs = plt.subplots(1, len(df), figsize=(20, 4), subplot kw=dict(polar=True))
# Handle the case when there's only one team (axs would not be an array)
if len(df) == 1:
    axs = [axs]
# Find max values for normalization
max stats = [
```

```
df['win_rate'].max(),
   df['goals per match'].max(),
   df['points_per_match'].max(),
   df['goal_diff_per_match'].max()
# Plot each team's radar chart
for i, (idx, row) in enumerate(df.iterrows()):
   team stats = [
       row['win_rate'],
       row['goals_per_match'],
        row['points_per_match'],
        row['goal_diff_per_match']
    # Normalize stats (0-1 scale)
    team_stats = [s/m for s, m in zip(team_stats, max_stats)]
    # Add first stat again to close the loop
    stats = team_stats + [team_stats[0]]
    # Create the radar chart
    create_radar_chart(axs[i], angles, stats, row['Team'])
plt.tight_layout()
# Save figure
plt.savefig('team_radar_charts.png')
# Display the plot (if in interactive environment)
plt.show()
# Calculate efficiency metrics
print("\nEfficiency Metrics:")
efficiency_df = df[['Team', 'win_rate', 'goals_per_match', 'points_per_match', 'goal_diff
print(efficiency_df.sort_values(by='points_per_match', ascending=False))
```



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### Efficiency Metrics:

	Team	win_rate	<pre>goals_per_match</pre>	points_per_match	\
170	Ipswich Town	0.750000	NaN	2.750	
171	TSV 1860 München	0.750000	NaN	2.000	
140	FC Ararat	0.833333	NaN	1.500	
147	AFC DWS	0.666667	NaN	1.500	
77	Stade Reims	0.583333	NaN	1.375	
353	Avenir Beggen	0.000000	NaN	-5.500	
341	AEL Limassol	0.000000	NaN	-6.000	
343	KPV Kokkola	0.000000	NaN	-7.000	
351	Stade Dudelange	0.000000	NaN	-7.750	
345	EPA Larnaca	0.000000	NaN	-8.000	

	<pre>goal_diff_per_match</pre>
170	2.750
171	2.000
140	1.500
147	1.500
77	1.375
	0 0 0
353	-5.500
341	-6.000
343	-7.000
351	-7.750
345	-8.000

[354 rows x 5 columns]

# **Step 4: Statistical Tests and Deeper Analysis**

```
from scipy import stats
# Let's analyze the relationship between matches played and success metrics
print("\nRegression Analysis: Impact of Experience (Matches Played) on Performance")
# Matches played vs. Win Rate
slope, intercept, r_value, p_value, std_err = stats.linregress(df['matches_played'], df['w.
print(f"Matches played vs. Win Rate: r² = {r_value**2:.3f}, p-value = {p_value:.3f}")
# Matches played vs. Goals per Match
slope, intercept, r_value, p_value, std_err = stats.linregress(df['matches_played'], df['go')
print(f"Matches played vs. Goals per Match: r² = {r_value**2:.3f}, p-value = {p_value:.3f}
# Comparisons between teams
print("\nTeam Performance Comparison:")
```

team matrice - df[['Team' | Lin mate' | Team' | Lin mate' | Team' | Lin material | Lin material