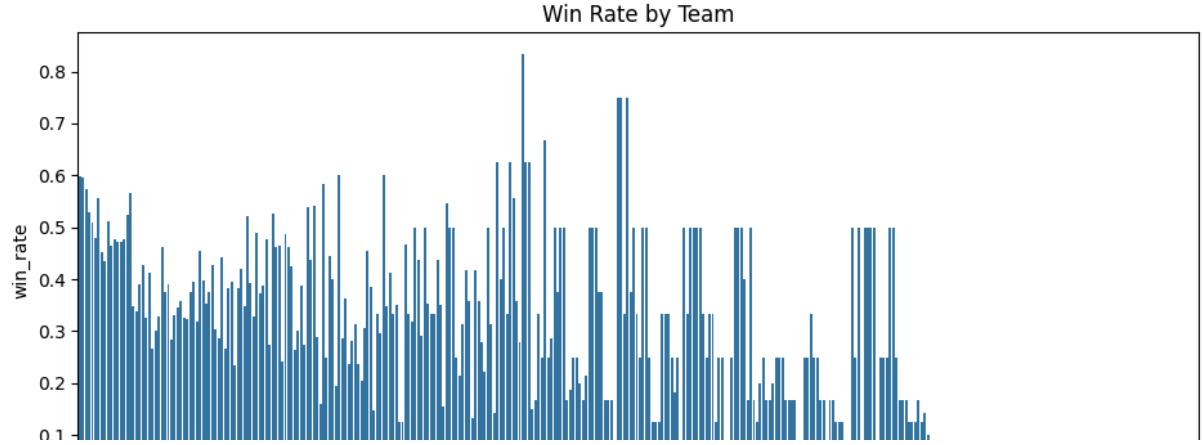
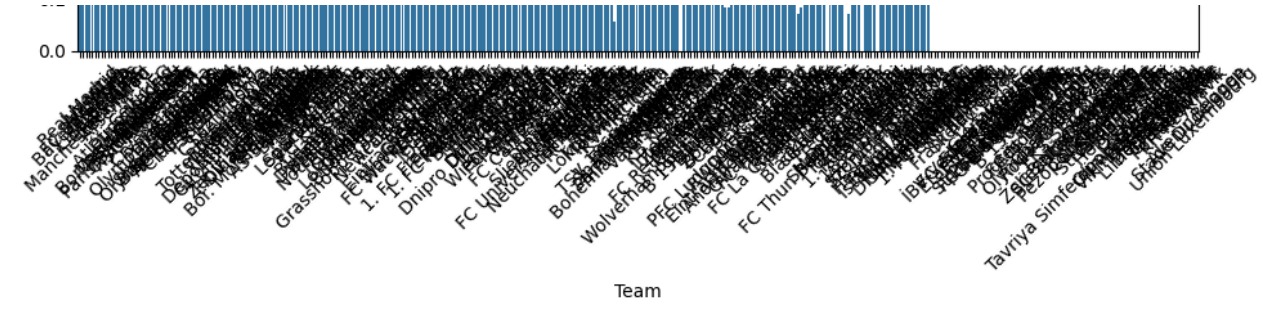
Step 1: Data Cleaning and Preparation

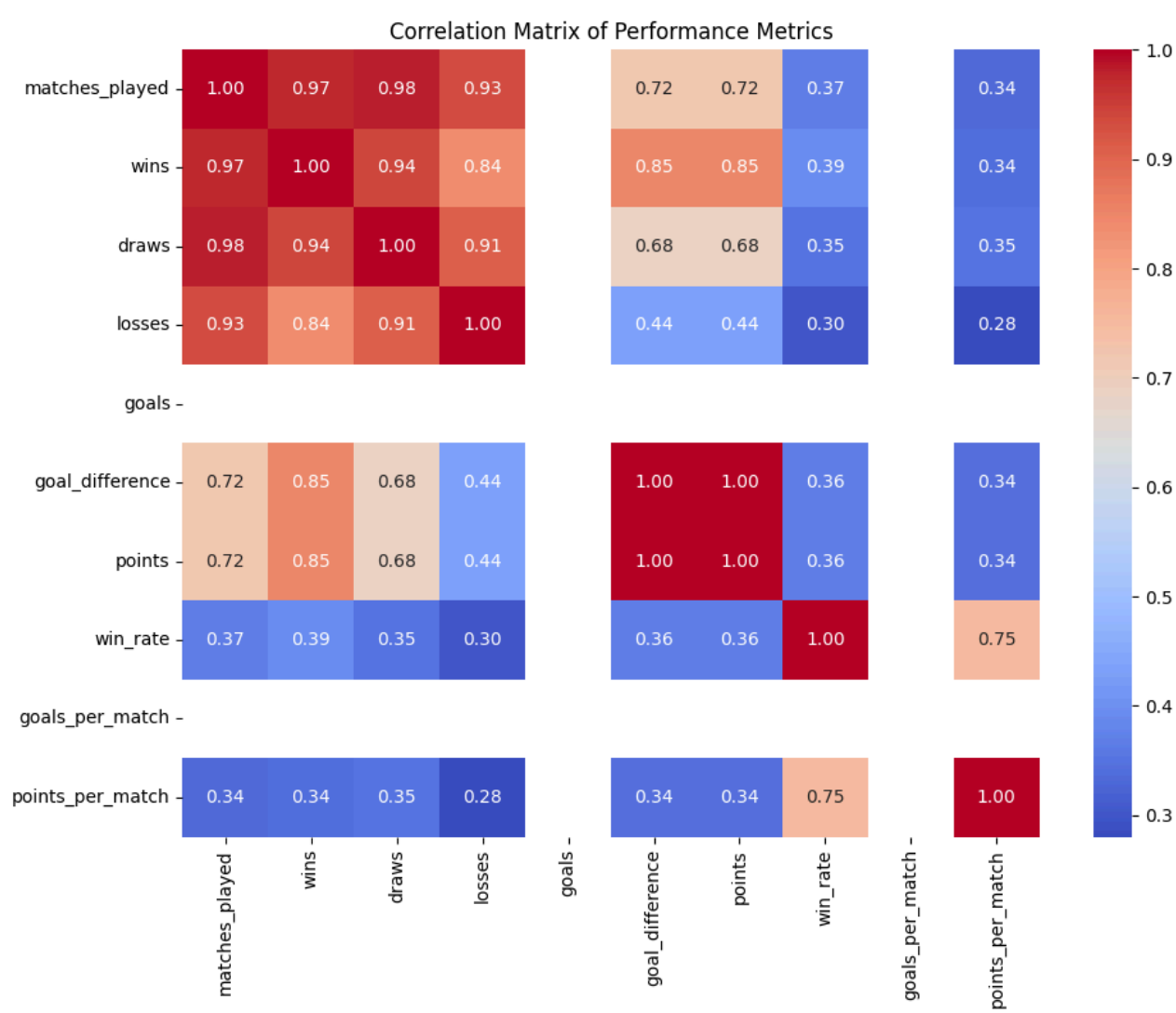
```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns

# 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))
```

```
metrics = ['win_rate', 'goals_per_match', 'points_per_match', 'goal_diff_per_match']
df_melted = pd.melt(df, id_vars=['Team'], value_vars=metrics,
                    var_name='Metric', value_name='Value')

sns.catplot(data=df_melted, x='Team', y='Value', hue='Metric', kind='bar', height=6, aspe
plt.title('Performance Metrics Across Teams')
plt.xticks(rotation=45)
plt.tight_layout()
plt.savefig('performance_comparison.png')

# Calculate win-to-loss ratio
df['win_loss_ratio'] = df['wins'] / df['losses']
print("\nWin-to-Loss Ratio:")
print(df[['Team', 'win_loss_ratio']].sort_values(by='win_loss_ratio', ascending=False))

# Display team rankings based on points per match
print("\nTeam Rankings based on Points per Match:")
print(df[['Team', 'points_per_match']].sort_values(by='points_per_match', ascending=False
```

```
DataFrame with additional metrics:
                Team  matches_played  wins  win_rate  goals_per_match  \
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:
                Team  points_per_match
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]
```







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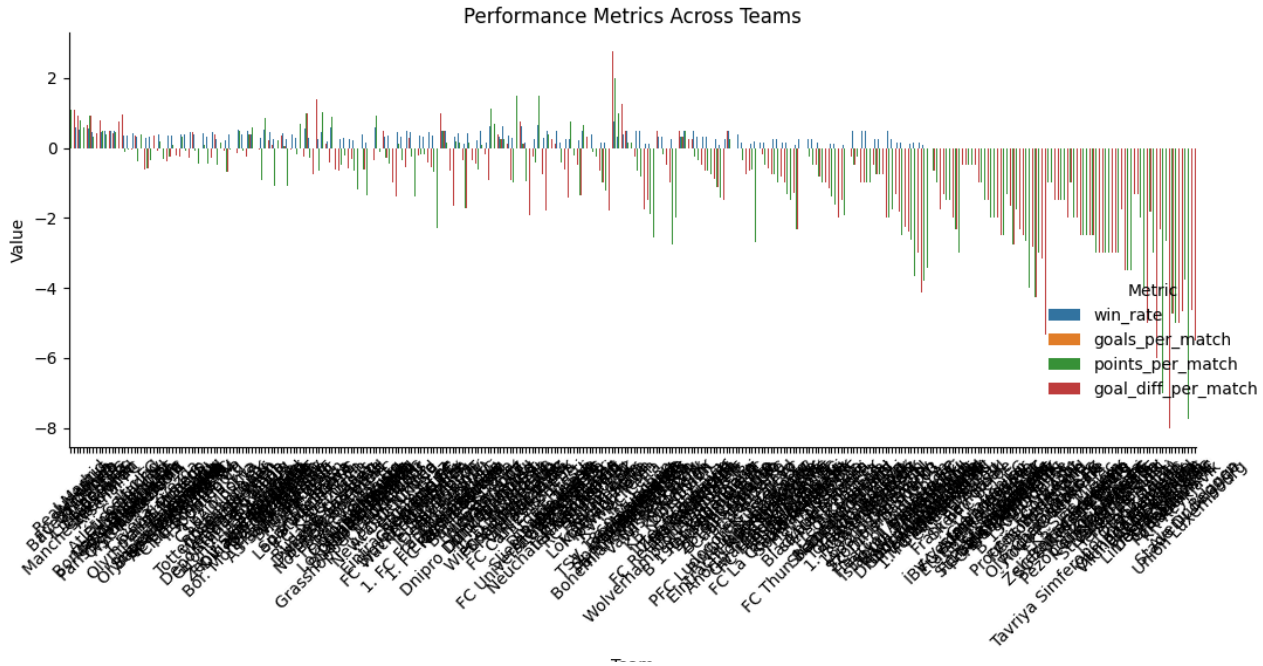
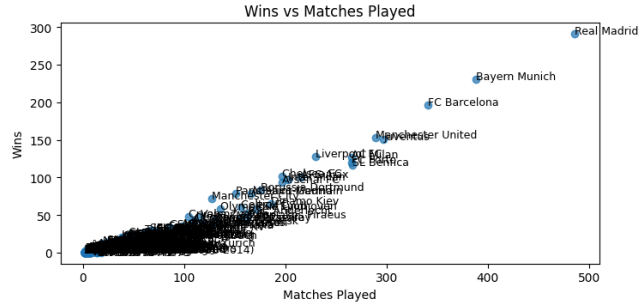


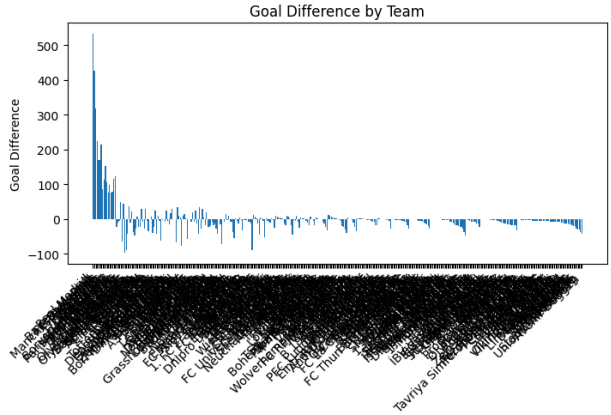
team

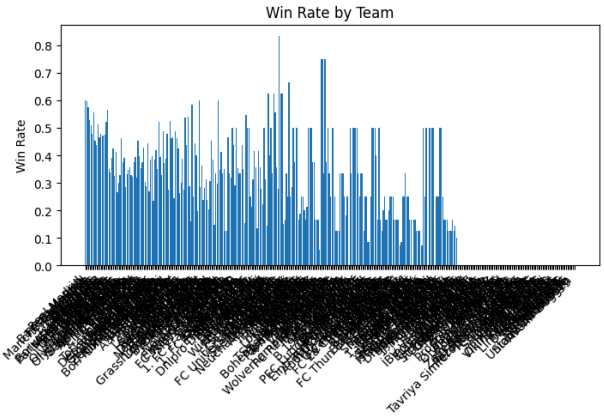
Step 2: Exploratory Data Analysis

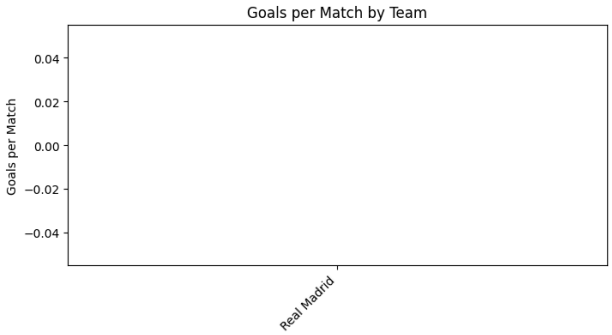
```
# Analyzing relationships between variables
plt.figure(figsize=(15, 10))

# 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  \
matches_played        1.000000  0.974861  0.981159  0.933849    NaN
wins                  0.974861  1.000000  0.943131  0.836572    NaN
draws                 0.981159  0.943131  1.000000  0.911338    NaN
losses                0.933849  0.836572  0.911338  1.000000    NaN
goals                      NaN       NaN       NaN       NaN    NaN
goal_difference       0.719490  0.850304  0.683847  0.437281    NaN
points                0.719490  0.850304  0.683847  0.437281    NaN
win_rate              0.369980  0.393172  0.349130  0.300980    NaN
goals_per_match            NaN       NaN       NaN       NaN    NaN

                goal_difference    points  win_rate  goals_per_match
matches_played         0.719490  0.719490  0.369980              NaN
wins                   0.850304  0.850304  0.393172              NaN
draws                  0.683847  0.683847  0.349130              NaN
losses                 0.437281  0.437281  0.300980              NaN
goals                       NaN       NaN       NaN              NaN
goal_difference        1.000000  1.000000  0.364875              NaN
points                 1.000000  1.000000  0.364875              NaN
win_rate               0.364875  0.364875  1.000000              NaN
goals_per_match             NaN       NaN       NaN              NaN
```









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))
```

```
<ipython-input-6-26164808fbba>:56: UserWarning: Tight layout not applied. tight_layou
  plt.tight_layout()
```

```
Efficiency Metrics:
                Team  win_rate  goals_per_match  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

     goal_diff_per_match
170                2.750
171                2.000
140                1.500
147                1.500
77                 1.375
..                   ...
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['g
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_metrics = df[['Team', 'win_rate', 'goals_per_match', 'points_per_match']]
```