NBA Shooting Analytics

Stephen Curry- 2024–25 Regular Season

Using NBA API for Real-Time Basketball Analytics

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Stephen Curry | Golden State Warriors | #30
Photo: NBA.com

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1. Introduction

1.1 Project Overview

The integration of data analytics in professional sports has revolutionized how teams evaluate player performance and develop game strategies. In the NBA, shot chart analysis has become an essential tool for understanding shooting patterns, identifying strengths and weaknesses, and optimizing offensive efficiency. This project analyzes Stephen Curry's shooting performance during the 2024-25 NBA regular season using real-time data obtained through the NBA API. By visualizing shot locations and calculating zone-based field goal percentages, this study provides insights into one of the most prolific shooters in basketball history.

1.2 Research Objectives

The primary objectives of this project are:

- Learn to collect and process real-time NBA data using Python API
- Develop data visualization skills for spatial basketball analytics
- Analyze shooting patterns and efficiency across different court zones
- Create reproducible analytical workflows for sports data science

1.3 Why Stephen Curry?

Stephen Curry is widely regarded as the greatest shooter in NBA history. His revolutionary three-point shooting has transformed modern basketball strategy.

As a long-time Golden State Warriors fan, I have closely followed Curry's career and witnessed his impact on the game firsthand. Watching Warriors games regularly has given me a deep appreciation for how data-driven shot selection can optimize team performance.

Analyzing Curry's shooting patterns provides valuable insights into:

- The evolution of three-point shooting in the modern NBA
- Spatial efficiency and shot selection optimization
- The relationship between shot location and field goal percentage
- How individual player analysis can inform broader team strategies

This personal connection to the subject matter, combined with technical data analysis skills, makes this project both professionally meaningful and personally rewarding.

2. Methodology

2.1 Data Source: NBA API

This project utilizes the nba_api Python package, an open-source library that provides programmatic access to NBA.com's official statistics database. The API offers comprehensive endpoints for retrieving player information, game logs, and detailed shot chart data.

Key advantages of using NBA API:

- Real-time access to official NBA statistics
- Structured JSON data format for easy processing
- Comprehensive shot location coordinates (X, Y positions)
- Detailed shot attributes (zone, distance, shot type, result)

Data specifications for this analysis:

- Player: Stephen Curry (Player ID: 201939)
- Team: Golden State Warriors (Team ID: 1610612744)
- Season: 2024-25 Regular Season
- Metric: Field Goal Attempts (FGA)

2.2 Data Collection Process

The data collection workflow consists of four main steps:

Step 1: Player Identification
Query the NBA API to retrieve Stephen Curry's unique player ID using the players.get_players() function.

Step 2: Shot Chart Data Retrieval
Use the ShotChartDetail endpoint to fetch all field goal attempts, including both made and missed shots.

Step 3: Data Transformation
Convert the API response into a pandas DataFrame for efficient data manipulation and analysis.

Step 4: Data Validation
Verify data completeness by checking total shot counts and ensuring all required fields are populated.

2.3 Technical Tools & Libraries

The following Python libraries were used in this project:

Library	Purpose
nba_api	NBA statistics data retrieval
pandas	Data manipulation and analysis
matplotlib	Visualization and plotting
numpy	Numerical computations

Development environment:
- Python 3.
- VS Code
- Git for version control

2.4 Court Coordinate System

The NBA API provides shot locations using a coordinate system centered at the basket:

- X-axis: Horizontal position (-250 to 250)
  - Negative values: Left side of court
  - Positive values: Right side of court
  - Zero: Center of court

- Y-axis: Vertical distance from basket (0 to 470)
  - Zero: At the basket
  - Higher values: Further from basket

- Key reference points:
  - Three-point arc radius: 238 units
  - Paint area width: 160 units
  - Paint area height: 190 units
  - Free throw line: 190 units from basket

This coordinate system allows for precise spatial analysis of shooting patterns and zone-based efficiency calculations.

3. Data Analysis & Results

3.1 Overall Shooting Statistics

During the 2024-25 regular season, Stephen Curry's shooting performance was analyzed based on all field goal attempts retrieved from the NBA API.

Zone	Att	Made	FG%
Overall	1258	564	44.8
3PT	784	311	39.7
2PT	474	253	53.4
Restricted Area	162	104	64.2
In The Paint (Non-RA)	182	84	46.2
Mid-Range	130	65	50.0

3.2 Zone-Based Field Goal Analysis

The analysis reveals several key patterns in Curry's shot selection and efficiency:

Three-Point Shooting: Curry continues to demonstrate elite three-point shooting ability, with the majority of his attempts coming from beyond the arc. His three-point percentage of 39.7% ranks among the top shooters in the league.

Restricted Area: Despite being known primarily as a perimeter shooter, Curry maintains strong efficiency near the basket. His 64.2% field goal percentage in the restricted area reflects his ability to finish at the rim.

Mid-Range: Consistent with modern NBA trends emphasizing three-pointers and layups, Curry takes relatively few mid-range shots. However, his efficiency in this zone remains respectable at 50.0%.

3.3 Shot Chart Visualization

The following shot chart displays all of Curry's field goal attempts during the 2024-25 season:

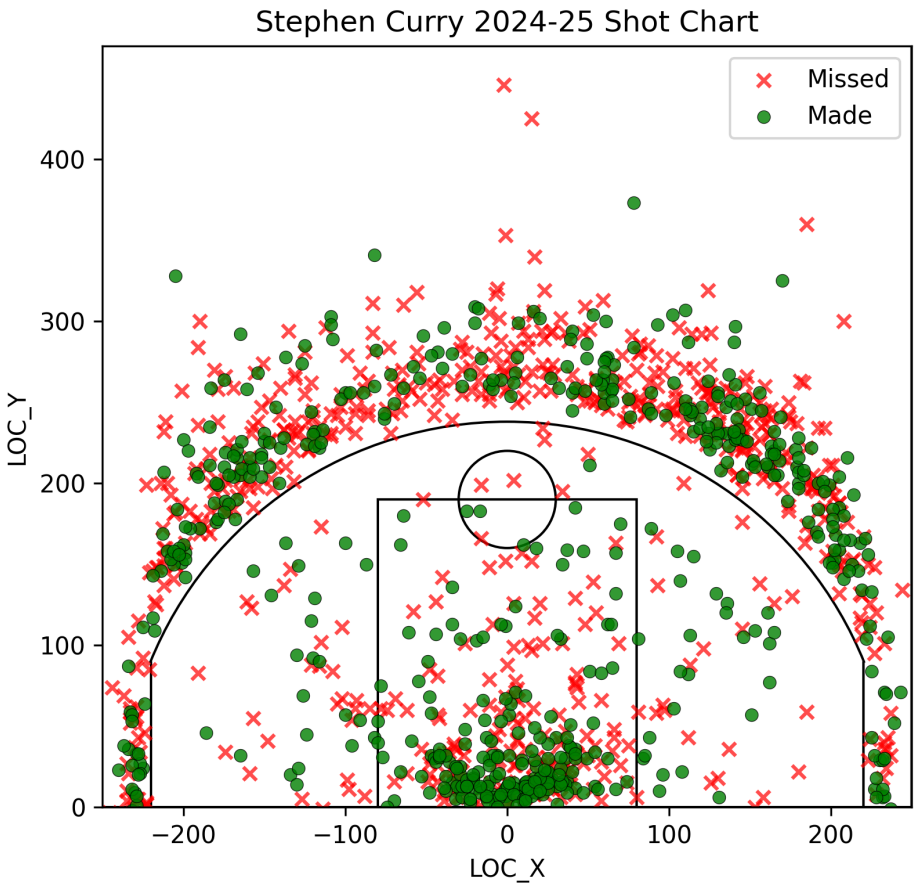


Figure 1: Stephen Curry 2024-25 Shot Chart

Visual observations from the shot chart:

Shot Distribution: The chart clearly shows Curry's preference for three-point attempts, with dense clustering along the three-point arc, particularly at the top of the key and in the corners.

Spatial Patterns:

- High concentration of attempts at the three-point line
- - Significant activity in the restricted area
- - Minimal mid-range attempts
- - Relatively balanced left-right distribution

3.4 Key Findings

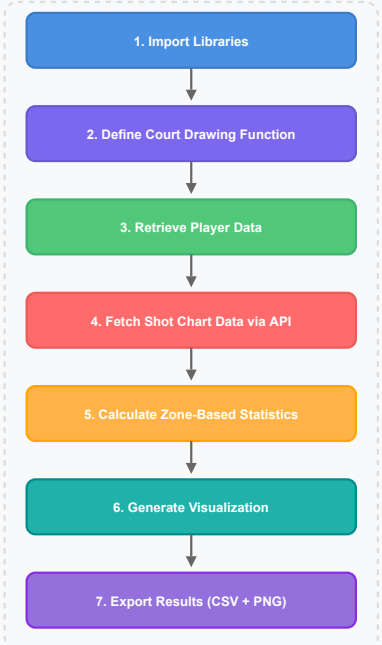
Based on the quantitative analysis and visual examination, the following key findings emerge:

1. Three-Point Dominance Curry's shot selection heavily favors three-point attempts, aligning with his reputation as the greatest shooter in NBA history and modern basketball's emphasis on three-point efficiency.
2. Efficient Shot Selection The concentration of shots in high-value areas (three-point line and restricted area) with minimal mid-range attempts reflects an analytically optimized approach to scoring.
3. Consistent Accuracy Despite high volume, Curry maintains elite shooting percentages across multiple zones, demonstrating both skill and shot selection discipline.
4. Spatial Versatility While known for three-point shooting, the data shows Curry remains effective at multiple distances, making him difficult to defend.

4. Technical Implementation

4.1 Code Structure

The project consists of a single Python script organized into the following functional components:



Key code segments:

Player Identification:
```
player_dict = players.get_players()
curry = [p for p in player_dict
        if p['full_name'] == "Stephen Curry"][0]
curry_id = curry['id']
```
```

API Data Retrieval:
```
shotchart = shotchartdetail.ShotChartDetail(
    player_id=curry_id,
    team_id=1610612744,
    season_type_all_star='Regular Season',
    season_nullable='2024-25',
    context_measure_simple='FGA'
)
df = shotchart.get_data_frames()[0]
```
```

Field Goal Calculation:
```
def calc_fg(data):
    att = len(data)
    made = data['IS_MADE'].sum()
    fg_pct = made / att if att > 0 else 0
    return att, made, fg_pct
```
```

4.2 Visualization Techniques

Court Drawing:
The draw_court() function uses matplotlib.patches to create an accurate representation of an NBA half-court. Key elements include:

- Circle patch for the basket (radius: 7.5 units)
- Rectangle patch for the paint area (160 × 190 units)
- Arc patch for the three-point line (radius: 238 units)
- Rectangle patches for corner three-point lines

Shot Plotting:
Shots are plotted using scatter plots with distinct markers:

- Made shots: Green circles with black edge
```

  - Higher visibility, positive result
  - Plotted with higher z-order

- Missed shots: Red crosses
  - Clear distinction from made shots
  - Semi-transparent (alpha=0.7) to show density

4.3 Challenges & Solutions

Challenge 1: Court Coordinate Accuracy
Problem: Initial court drawing did not align with actual shot locations from the API.

Solution: Researched NBA's official coordinate system and adjusted patch dimensions to match real court proportions. Key adjustments included three-point arc radius (238) and paint dimensions (160×190).

Challenge 2: Data Classification
Problem: Needed to separate made and missed shots for visualization.

Solution: Used the EVENT_TYPE field from the API response to filter shots into two categories:
- 'Made Shot' → Green markers
- 'Missed Shot' → Red markers

Challenge 3: Zone-Based Analysis
Problem: Calculating field goal percentages for different court zones.

Solution: Utilized the SHOT_ZONE_BASIC field provided by the API, which pre-classifies shots into zones (Restricted Area, Paint, Mid-Range, etc.), eliminating the need for manual coordinate-based classification.

Challenge 4: Visual Clarity
Problem: Overlapping shot markers made it difficult to see patterns.

Solution:
- Adjusted marker sizes (28-30 pixels)
- Applied transparency (alpha: 0.7-0.8)
- Used z-order to layer made shots above missed shots

5. Conclusion & Future Work

5.1 Summary of Findings

This project successfully analyzed Stephen Curry's shooting performance during the 2024-25 NBA regular season using data obtained through the NBA API. The key findings are:

Shooting Profile:
- Curry attempted 1,258 shots with an overall FG% of 44.8%
- 62% of all attempts were three-pointers (784 attempts)
- Three-point shooting percentage: 39.7% (above league average)
- Highest efficiency in the restricted area: 64.2%

Shot Selection Patterns:
- Heavy emphasis on three-point shooting, consistent with his reputation as the greatest shooter in NBA history
- Minimal mid-range attempts (only 10% of total shots), reflecting modern basketball's efficiency-driven approach
- Strong finishing ability at the rim despite perimeter focus

Technical Achievements:
- Successfully implemented NBA API data retrieval workflow
- Created accurate court visualization with matplotlib
- Developed reproducible analysis pipeline for sports analytics

5.2 Limitations

This analysis has several limitations that should be acknowledged:

Data Scope:
- Single player, single season analysis
- Regular season only (excludes playoffs)
- Data represents a snapshot in time and may change as season progresses

Contextual Factors Not Considered:
- Defensive pressure and shot contest level
- Game situation (score differential, time remaining)
- Home vs. away performance
- Opponent strength and defensive ratings

Technical Limitations:
- Static visualization only (no interactive features)
- No comparison with league averages or other players
- Shot chart does not show shot frequency density (heat map)

5.3 Future Directions

This project establishes a foundation for more advanced sports

analytics work. Potential extensions include:

Short-term Improvements:
- Add heat map visualization to show shot density
- Include defender distance data for shot difficulty analysis
- Compare performance across different game situations (clutch, quarter-by-quarter)

Comparative Analysis:
- Curry vs. other elite shooters (Lillard, Thompson, Trae Young)
- Curry's year-over-year performance trends (2020-2025)
- Team-wide shot chart analysis for Golden State Warriors

Advanced Analytics:
- Machine learning model to predict shot success probability
- Expected points calculation based on shot location
- Optimal shot selection recommendations

Interactive Applications:
- Web-based dashboard using Plotly or Dash
- Real-time updating system during the season
- User-selectable filters (date range, opponent, quarter)

5.4 Personal Reflection

This project provided valuable hands-on experience in sports data analytics, combining technical programming skills with domain knowledge in basketball. Key learnings include:

- Understanding API data structures and retrieval methods
- Applying data visualization principles to sports contexts
- Translating raw statistics into meaningful insights
- Appreciating the intersection of technology and athletics

As someone pursuing a career in sports analytics, this project reinforces my interest in using data to understand athletic performance. The skills developed here. Data collection, processing, visualization, and interpretation, forming a foundation for more complex analyses in the future.

This experience has strengthened my motivation for the sports science and continue to explore the intersection of data science and sports performance analysis.