Career Trajectory Prediction for NBA players

Introduction

Background

About NBA:

- NBA (National Basketball Association)
- Prestigious Professional Basketball leagues

About Career Trajectory:

- Player Performance Statistics
- Game Records and Historical Data

Introduction

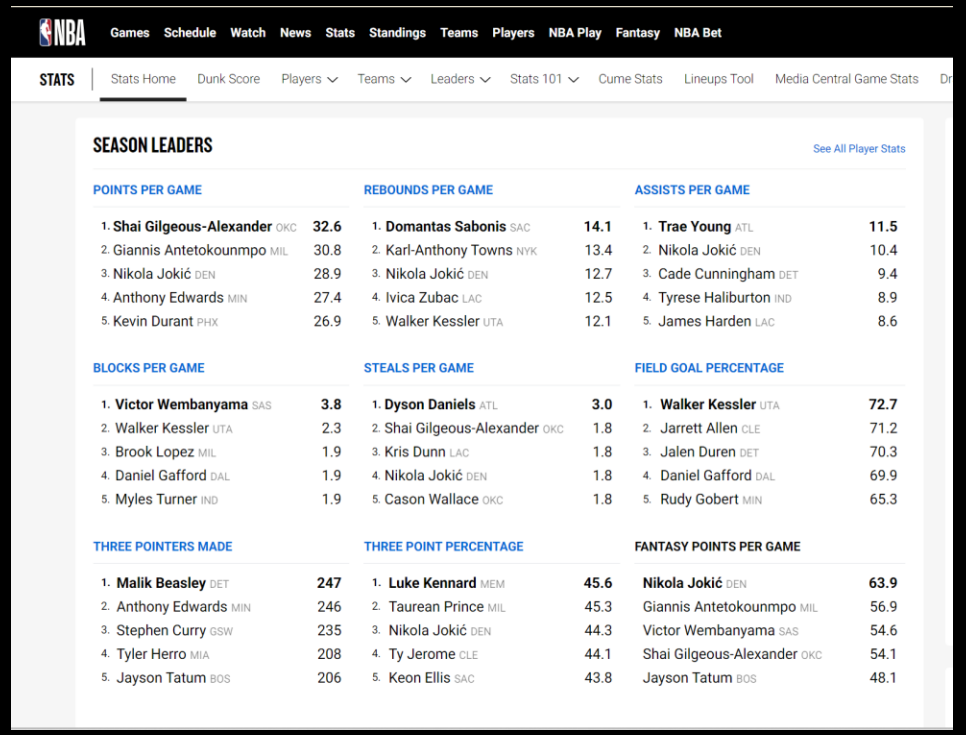
We want to predict the future career development of NBA players, which is a complex task that involves analyzing a variety of factors, both quantitative and qualitative. There are some different aspects to measure their development.

- More suitable position in a team
- Performance in subsequent games
- Expected retirement age
- Future influence in the league

Available Data

Player's performance data in contests

- Basic Statistics: Points, rebounds, assists, steals, blocks, field goal percentage, three-point percentage, free throw percentage, etc.



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SEASON LEADERS — See All Player Stats

POINTS PER GAME

1.	Shai Gilgeous-Alexander OKC	32.6
2.	Giannis Antetokounmpo MIL	30.8
3.	Nikola Jokić DEN	28.9
4.	Anthony Edwards MIN	27.4
5.	Kevin Durant PHX	26.9

REBOUNDS PER GAME

1.	Domantas Sabonis SAC	14.1
2.	Karl-Anthony Towns NYK	13.4
3.	Nikola Jokić DEN	12.7
4.	Ivica Zubac LAC	12.5
5.	Walker Kessler UTA	12.1

ASSISTS PER GAME

1.	Trae Young ATL	11.5
2.	Nikola Jokić DEN	10.4
3.	Cade Cunningham DET	9.4
4.	Tyrese Haliburton IND	8.9
5.	James Harden LAC	8.6

BLOCKS PER GAME

1.	Victor Wembanyama SAS	3.8
2.	Walker Kessler UTA	2.3
3.	Brook Lopez MIL	1.9
4.	Daniel Gafford DAL	1.9
5.	Myles Turner IND	1.9

STEALS PER GAME

1.	Dyson Daniels ATL	3.0
2.	Shai Gilgeous-Alexander OKC	1.8
3.	Kris Dunn LAC	1.8
4.	Nikola Jokić DEN	1.8
5.	Cason Wallace OKC	1.8

FIELD GOAL PERCENTAGE

1.	Walker Kessler UTA	72.7
2.	Jarrett Allen CLE	71.2
3.	Jalen Duren DET	70.3
4.	Daniel Gafford DAL	69.9
5.	Rudy Gobert MIN	65.3

THREE POINTERS MADE

1.	Malik Beasley DET	247
2.	Anthony Edwards MIN	246
3.	Stephen Curry GSW	235
4.	Tyler Herro MIA	208
5.	Jayson Tatum BOS	206

THREE POINT PERCENTAGE

1.	Luke Kennard MEM	45.6
2.	Taurean Prince MIL	45.3
3.	Nikola Jokić DEN	44.3
4.	Ty Jerome CLE	44.1
5.	Keon Ellis SAC	43.8

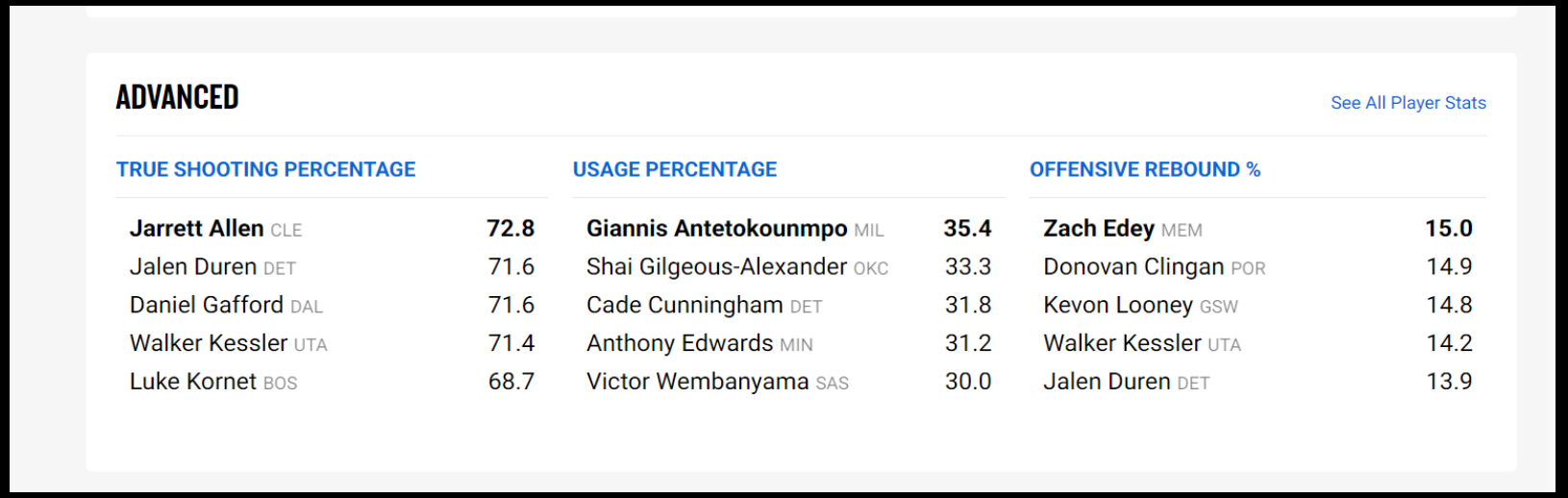
FANTASY POINTS PER GAME

Nikola Jokić DEN		63.9
Giannis Antetokounmpo MIL		56.9
Victor Wembanyama SAS		54.6
Shai Gilgeous-Alexander OKC		54.1
Jayson Tatum BOS		48.1

Available Data

Player's performance data in contests

- Advanced Statistics: True Shooting Percentage (TS%), Player Efficiency Rating (PER), Win Shares, Box Plus-Minus (BPM), Value Over Replacement Player (VORP), etc.



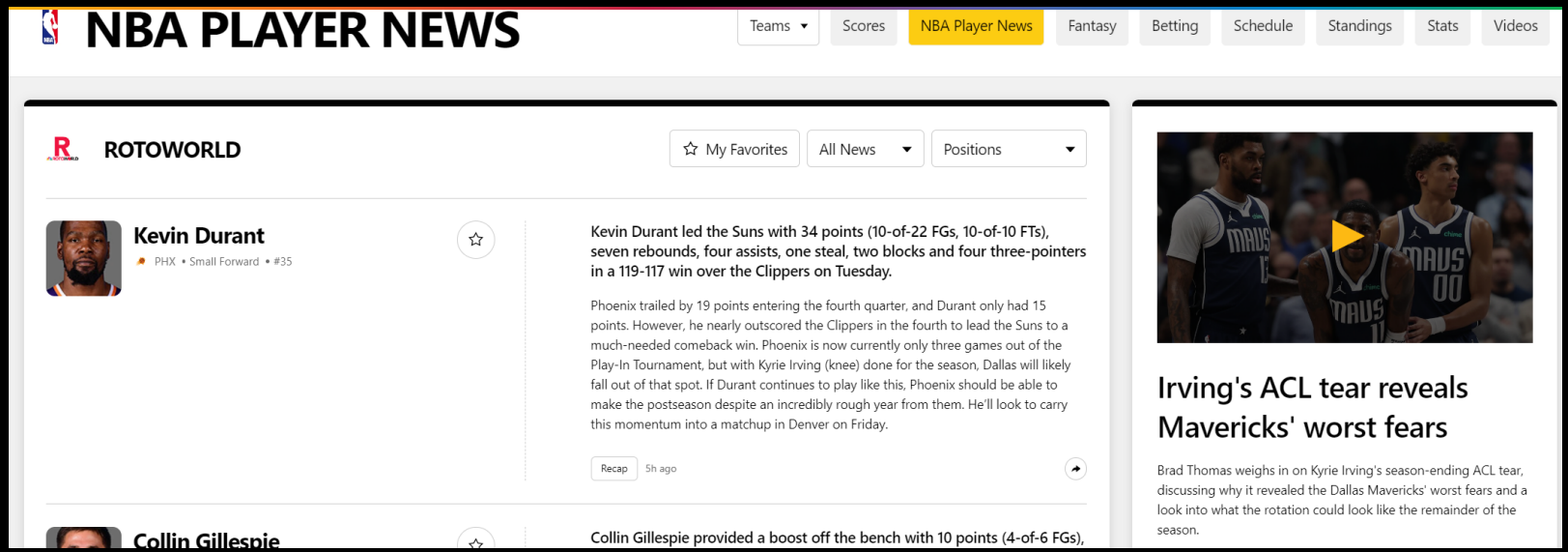
ADVANCED — See All Player Stats

TRUE SHOOTING PERCENTAGE		USAGE PERCENTAGE		OFFENSIVE REBOUND %	
Jarrett Allen CLE	**72.8**	**Giannis Antetokounmpo** MIL	**35.4**	**Zach Edey** MEM	**15.0**
Jalen Duren DET	71.6	Shai Gilgeous-Alexander OKC	33.3	Donovan Clingan POR	14.9
Daniel Gafford DAL	71.6	Cade Cunningham DET	31.8	Kevon Looney GSW	14.8
Walker Kessler UTA	71.4	Anthony Edwards MIN	31.2	Walker Kessler UTA	14.2
Luke Kornet BOS	68.7	Victor Wembanyama SAS	30.0	Jalen Duren DET	13.9

Available Data

Player's Injury Data

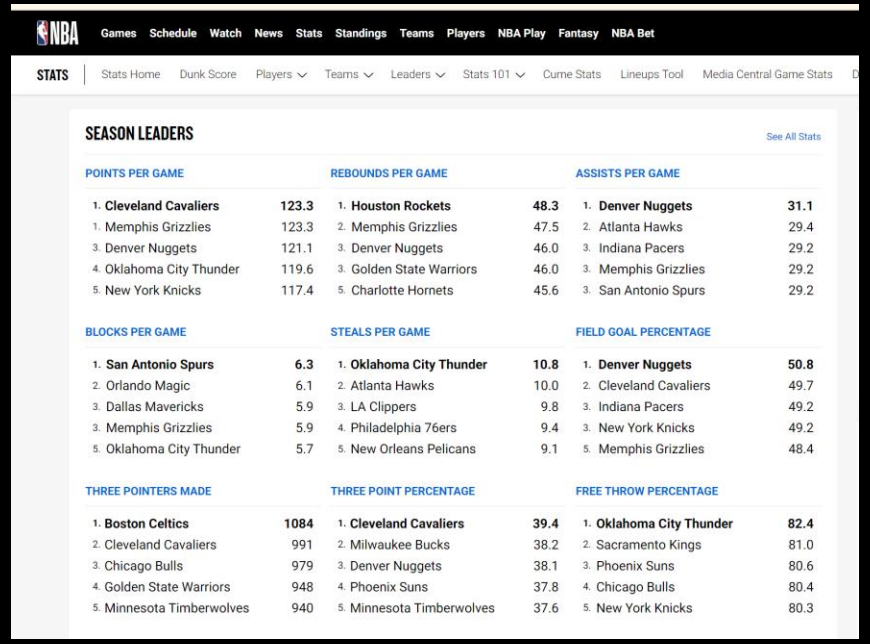
- Injury History: Past injuries, recovery times, and games missed.
- Injury Risk: Playing style, workload, and medical history.



Available Data

Team and Contextual Data

- Team Performance: Win-loss records, offensive and defensive ratings, and playoff success.
- Role and Usage: Player usage rate, time on court, and role within the team.



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SEASON LEADERS — See All Stats

POINTS PER GAME

1.	**Cleveland Cavaliers**	**123.3**
1.	Memphis Grizzlies	123.3
3.	Denver Nuggets	121.1
4.	Oklahoma City Thunder	119.6
5.	New York Knicks	117.4

REBOUNDS PER GAME

1.	**Houston Rockets**	**48.3**
2.	Memphis Grizzlies	47.5
3.	Denver Nuggets	46.0
3.	Golden State Warriors	46.0
5.	Charlotte Hornets	45.6

ASSISTS PER GAME

1.	**Denver Nuggets**	**31.1**
2.	Atlanta Hawks	29.4
3.	Indiana Pacers	29.2
3.	Memphis Grizzlies	29.2
3.	San Antonio Spurs	29.2

BLOCKS PER GAME

1.	**San Antonio Spurs**	**6.3**
2.	Orlando Magic	6.1
3.	Dallas Mavericks	5.9
3.	Memphis Grizzlies	5.9
5.	Oklahoma City Thunder	5.7

STEALS PER GAME

1.	**Oklahoma City Thunder**	**10.8**
2.	Atlanta Hawks	10.0
3.	LA Clippers	9.8
4.	Philadelphia 76ers	9.4
5.	New Orleans Pelicans	9.1

FIELD GOAL PERCENTAGE

1.	**Denver Nuggets**	**50.8**
2.	Cleveland Cavaliers	49.7
3.	Indiana Pacers	49.2
3.	New York Knicks	49.2
5.	Memphis Grizzlies	48.4

THREE POINTERS MADE

1.	**Boston Celtics**	**1084**
2.	Cleveland Cavaliers	991
3.	Chicago Bulls	979
4.	Golden State Warriors	948
5.	Minnesota Timberwolves	940

THREE POINT PERCENTAGE

1.	**Cleveland Cavaliers**	**39.4**
2.	Milwaukee Bucks	38.2
3.	Denver Nuggets	38.1
4.	Phoenix Suns	37.8
5.	Minnesota Timberwolves	37.6

FREE THROW PERCENTAGE

1.	**Oklahoma City Thunder**	**82.4**
2.	Sacramento Kings	81.0
3.	Phoenix Suns	80.6
4.	Chicago Bulls	80.4
5.	New York Knicks	80.3

Methodology

- Objective:
  - Predict NBA players' career trajectories based on historical performance data
- Approach:
  - Combine **time-series forecasting**, **regression models**, and **clustering** techniques to analyze career progression.
- Key Components:
  - Data Collection & Preprocessing
  - Feature Engineering
  - Predictive Modeling
  - Model Evaluation & Interpretation

Data Collection & Preprocessing

- Data Sources: Kaggle NBA database
  - 30 teams
  - 4800+ players
  - 65,000+ games (every game since the inaugural 1946-47 NBA season)

MIN: Minutes	**FT%:** Free Throw Percentage
PTS: Points	**OR:** Offensive Rebounds
FGM-A: Field Goals Made-Attempted	**DR:** Defensive Rebounds
FG%: Field Goal Percentage	**REB:** Rebounds
3PM-A: 3-Point Field Goals Made-Attempted	**AST:** Assists
3P%: 3-Point Field Goal Percentage	**BLK:** Blocks
FTM-A: Free Throws Made-Attempted	**STL:** Steals

- Data Preprocessing: Data Cleaning, Data Integration, Data Transformation

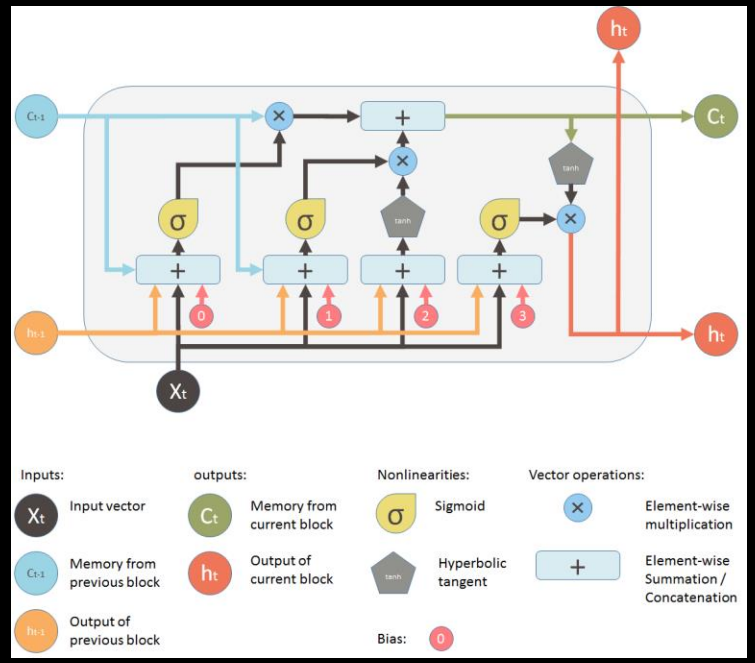
Feature Engineering

- Core Features for Prediction:
  - Player Performance: FG% (Field goal percentage), 3P% (3-point shooting percentage), FT% (Free throw percentage), TRB, AST, PTS, GmSc

- Creating New Features:
  - Recent Trends: 5-game rolling averages, Exponentially Weighted Averages (EWA)
  - Career Trends: Cumulative statistics over seasons (e.g., Career PTS, Career GmSc)

Predictive Modeling

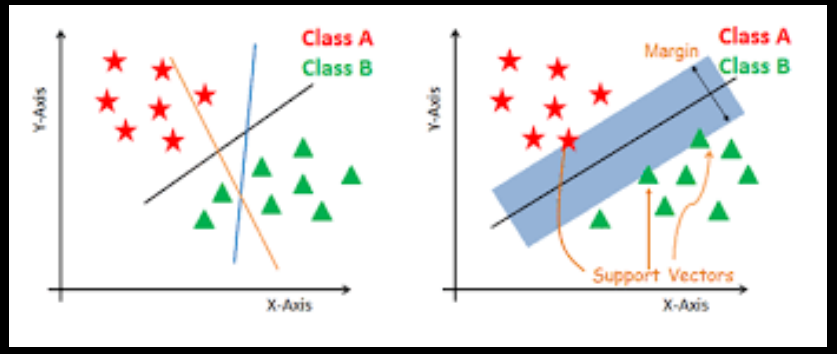
- Time-Series Forecasting (Predicting Future Performance)
  - LSTM (Long Short-Term Memory Networks): Capture career trends by analyzing player performance over multiple seasons and predicting future trajectories.



Predictive Modeling

- Regression Models (Predicting Long-Term Performance)
  - XGBoost: Use performance metrics (e.g., FG%, 3P%, PTS) and historical features (e.g., WAR/82, career averages) to predict long-term performance.

- Clustering & Classification (Career Stage Identification)
  - SVM (Support Vector Machine): Classify players into “emerging stars,” “consistent performers,” or “declining veterans”.



Model Evaluation & Interpretation

- Evaluation Metrics:
  - For Time-Series Models: RMSE (Root Mean Squared Error), MAE (Mean Absolute Error)
  - For Regression Models: R^2, MSE (Mean Squared Error)
  - For Classification Models: Accuracy, F1-Score to evaluate career stage classification

- Visualizing Career Trajectories:
  - Player Performance Trends: Plot the career trajectory of key players (e.g., average points per game, Game Score, FG%)
  - Comparative Analysis: Compare young players to past legends by analyzing the progression curves for players with similar stats or backgrounds

Expected Results

1.Career Longevity Prediction:

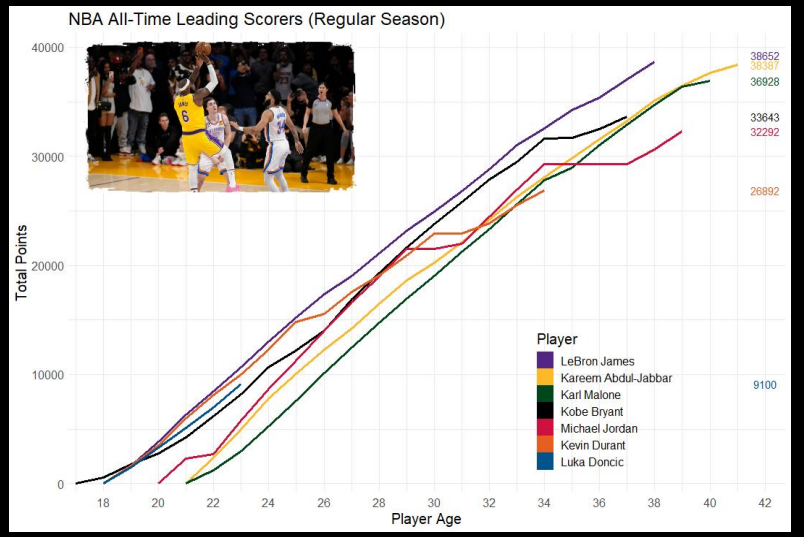
- statistical estimates of how long a player will remain based on factors like injury history, and performance metrics.

2. Role Transition Probabilities:

- Likelihood of players shifting roles (e.g., star → role player, rookie → bench) based on early-career stats.

3. Career Trajectory Summary

- Plot describing players' performance over the age axis



Weekly Plans

Week 6-7	Week 8-9	Week 10-11	Week 12-13
Data Gathering and Processing	Exploratory Analysis & Feature Engineering	Model Development & Training	Model Refinement & Final Reporting