# The three eras of the NBA regular seasons: Historical trend and success factors
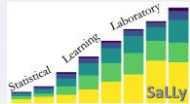
*João Vítor Rocha da Silva[1], Paulo Canas Rodrigues[1]*
[1] Department of Statistics, Federal University of Bahia, Salvador, Brazil

**Abbreviated abstract:** The NBA (National Basketball Association) is going through a transition process in its way of practice, planning and comprehension of the game. In this work, we are interested in characterizing NBA's gameplay over time in order to identify trends and success factors. In particular, this study aims: (i) to identify which factors were crucial for teams' regular season success in the past and understand the factors that are more relevant to succeed in the present day; and (ii) to group seasons and regular season winning teams into clusters of common characteristics and gameplay behavior.

**References:**
– Kubatko *et al*, Journal Of Quantitative Analysis in Sports 3 (3) (2007)
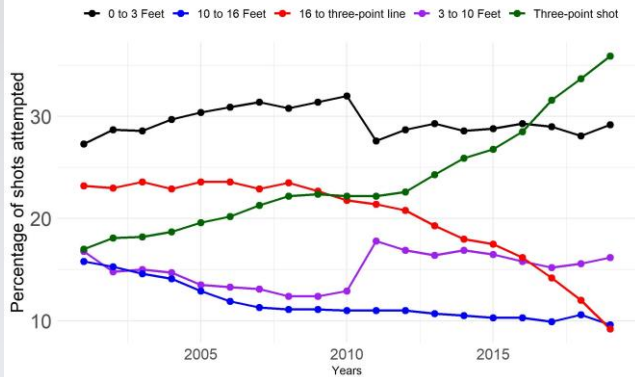– Ibáñez et al, European Journal of Sport Science 8 (6), 369-372 (2008)

rochajoaovitor1@yahoo.com, paulocanas@gmail.com, https://www.paulocanas.org/my-lab-sally - 1

# Problem, Data, Previous Works

Since the introduction of the three-point line the NBA has been gradually changing its gameplay style, moving from close to the basket to the three-point line.



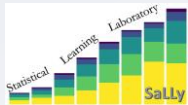Percentage of shots attempted by distance

Regarding to previous works, Kubatko *et al* (2007) determined that in order to win games a team must control:

- Field Goal Percentage
- Offensive Rebounds
- Turnovers
- Free-throws

Ibáñez *et al* (2008) determined that season-long success is most related to assists and defensive abilities (blocks and steals).

However, as the NBA gameplay style evolve throughout the years:
- Factors that were relevant for a team success in the past, are the same for today?
- Is it possible to identify Eras in the NBA by their style and strategies?
- Have teams that had the most wins in the regular season changed their strategies?
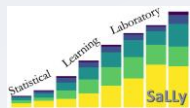
rochajoaovitor1@yahoo.com, paulocanas@gmail.com,
https://www.paulocanas.org/my-lab-sally - 2

# Methods

Game-related statistics of the NBA's regular seasons, from 1979-80 to 2018-19, were obtained from basketball-reference.com:
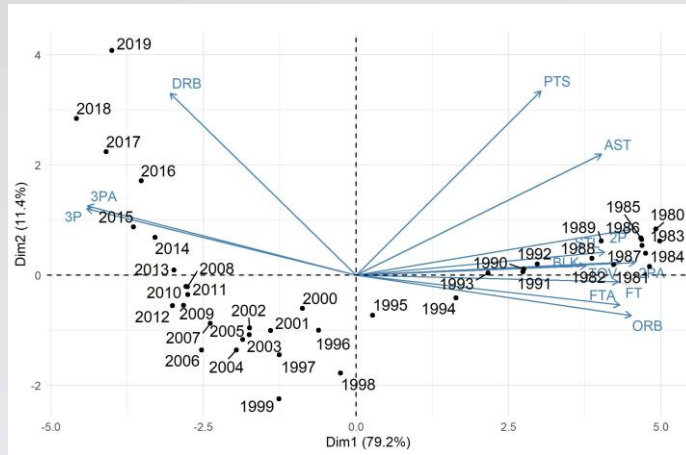
| Conference | Season | Tm | G | W | L | W/L% | MP | FG | FGA | 2P | 2PA | 3P | 3PA | FT | FTA | ORB | DRB | TRB | AST | STL | BLK | TOV | PF | PTS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| E | 2019 | Atlanta Hawks | 82 | 29 | 53 | 0.354 | 242.1 | 41.4 | 91.8 | 28.4 | 54.8 | 13.0 | 37.0 | 17.6 | 23.4 | 11.6 | 34.5 | 46.1 | 25.8 | 8.2 | 5.1 | 17.0 | 23.6 | 113.3 |
| E | 2019 | Boston Celtics* | 82 | 49 | 33 | 0.598 | 241.2 | 42.1 | 90.5 | 29.5 | 56.0 | 12.6 | 34.5 | 15.6 | 19.5 | 9.8 | 34.7 | 44.5 | 26.3 | 8.6 | 5.3 | 12.8 | 20.4 | 112.4 |
| E | 2019 | Brooklyn Nets* | 82 | 42 | 40 | 0.512 | 243.7 | 40.3 | 89.7 | 27.5 | 53.6 | 12.8 | 36.2 | 19.0 | 25.5 | 11.0 | 35.6 | 46.6 | 23.8 | 6.6 | 4.1 | 15.1 | 21.5 | 112.2 |
| E | 2019 | Charlotte Hornets | 82 | 39 | 43 | 0.476 | 241.8 | 40.2 | 89.8 | 28.3 | 55.8 | 11.9 | 33.9 | 18.4 | 23.1 | 9.9 | 33.9 | 43.8 | 23.2 | 7.2 | 4.9 | 12.2 | 18.9 | 110.7 |
| E | 2019 | Chicago Bulls | 82 | 22 | 60 | 0.268 | 242.7 | 39.8 | 87.9 | 30.7 | 62.0 | 9.1 | 25.9 | 16.2 | 20.7 | 8.8 | 34.1 | 42.9 | 21.9 | 7.4 | 4.3 | 14.1 | 20.3 | 104.9 |
| E | 2019 | Cleveland Cavaliers | 82 | 19 | 63 | 0.232 | 240.9 | 38.9 | 87.6 | 28.6 | 58.5 | 10.3 | 29.1 | 16.4 | 20.7 | 10.7 | 31.9 | 42.7 | 20.7 | 6.5 | 2.4 | 13.5 | 20.0 | 104.5 |

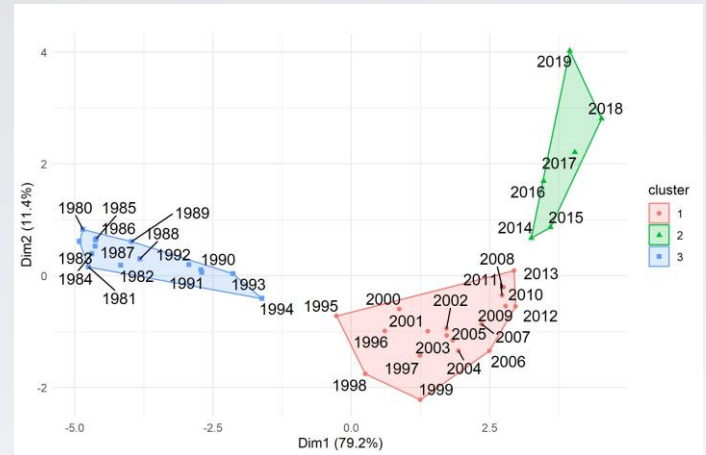And were analyzed using statistical learning methods such as:

1. Principal Component Analysis, used for dimensionality reduction of the original data into a set of non correlated principal components that explain the most part of the variability of the data, and allow data visualization.
2. Cluster Analysis (K-Means), used to group seasons and identify the Eras of the NBA regular season.
3. Multiple Linear Regression, used to explore the effects of each variable in the number of wins of each regular season.

rochajoaovitor1@yahoo.com, paulocanas@gmail.com,
https://www.paulocanas.org/my-lab-sally - 3

# Results and Conclusions





Two big groups can be identified based on PCA, one on the right and one on the left. Seasons from 1980 to 1994 are grouped with large influence of offensive rebounds, turnovers, blocks, free throws and two-point shots. Seasons from 2014 to 2019 are grouped by defensive rebounds and three-point shots.

Three Eras of the NBA were identified based on K-means clustering: Classic Era of the NBA, from 1980 to 1994; Transitional Era of the NBA, from 1995 to 2013; and Modern Era of the NBA from 2014 to 2019.

rochajoaovitor1@yahoo.com, paulocanas@gmail.com,
https://www.paulocanas.org/my-lab-sally - 4