Basic Information

Title – Which teams, players, and playing styles have dominated the NBA since 1980?
Name – Dominic Fernandez
Email – dcfernandez@dons.usfca.edu
Github Repo – https://github.com/dcfernandez1023/cs360-data-viz-proj
Website – https://nba-data-viz-project.web.app/

Background and Motivation

This project is motivated by my love for **coding**, **data**, and **basketball**, a sport that I have played and watched for over 15 years. When playing pick-up basketball with friends and watching NBA basketball, I often find myself making predictions, friendly bets, and analyzing how the game changes over the years. I want to create a website that will give better insights about the NBA through data visualizations that show the teams, players, and playing styles that have been most dominant in the NBA since 1980.

Project Overview (ALPHA RELEASE)

The main objective of this project is to use NBA data to easily see and look up the best teams and players from the 1980s to today and to gain deeper insights about these teams and players through the use of interactive data visualizations. This project is a web application with 3 main sections:

- Section 1 is an introduction to the project with a title, a brief 2 paragraph description of the project, and a couple of GIFs to catch the user's attention.
- Section 2 shows the best teams and players from the user-selected season from 1980 to 2021 (today). There are 3 lists that are displayed: Eastern Conference teams, Western Conference teams, and the 10 best players. If the user selects a different season, the best teams and players in the 3 lists will reflect the newly selected season. By clicking on any of the teams in the Eastern Conference or Western Conference lists, it will pop up a modal with 3 visualizations: a diverging bar chart of the team's winning and losing streaks, a bar chart or area chart (still deciding) of a toggleable statistic for that team, and a shot chart of all the shots the team has taken for that season (this is still in progress and is not in the Alpha Release). By clicking on any of the players in the 10 best players list, the same visualizations will appear except it will be specific to that individual player and the diverging bar chart will show that player's +/- stats for each game in the season instead of a winning and losing streak.
- Section 3 shows the averages of various statistics throughout the years (1980-2021) in a line chart. The user can select or deselect the stats currently being graphed.

Project Objectives

The main objective of this project is to use NBA data to visualize the best teams, players, and ways that the game has changed from the 1980s to today. Viewers will be able to learn:

- **The best teams of each season since 1980 and the statistics of those teams**. Teams will be ranked by their standing at the end of the season (i.e. 1st place, 2nd place, etc.) and the team that won the championship that season will be marked as the best team for that season.

- **The 5 best players of each season since 1980 and the statistics of those players**. Players will be ranked by the statistical categories of points, rebounds, assists, and steals, and the player that won MVP of a given season will be marked as the best player for that season.
- **The way the game has changed from 1980 vs. today**. This objective will be measured by how average statistical categories change each season. For example, the number of 3-pointers taken in the 2010-2011 season vs the 2020-2021 season.

Related Work

- **How many high school stars make it in the NBA?** "How Many High School Stars Make It In The NBA?". *The Pudding*, 2019, https://pudding.cool/2019/03/hype. Accessed 21 Mar 2022.
    - This website tells a data-driven story of the number of high school basketball stars that made the NBA and actually do well in the NBA. From their visualizations and text analysis, we see that the majority of high school stars that make it to the NBA have a "below average" career and do not stay in the NBA for very long, as it is extremely competitive. I got inspiration for the overall website design of my project from this website.
- **Buckets: NBA Shot Visualization**
- "Buckets: NBA Shot Visualization". *Buckets.Peterbeshai.Com*, 2022, https://buckets.peterbeshai.com/app/#/playerView/201935_2015. Accessed 21 Mar 2022.
    - This website is a dashboard of various visualizations that show the shot frequency, field goal percentage, and a shot chart for every player in each NBA season. The data on the charts change based on the player and season that the user selects, which inspired Section 2 of this project.
- **10 Unique Visualizations of the NBA** "10 Unique Visualizations Of The NBA". *Medium*, 2020, https://towardsdatascience.com/10-unique-visualizations-of-the-nba-b981cfdb78bf. Accessed 21 Mar 2022.
    - This website displays 10 different visualizations in regard to NBA data. Some of these visualizations provided inspiration for Section 3 of the project, which uses a line graph to compare how different statistical change categories over time.
- *Web.Stanford.Edu*, 2022,https://web.stanford.edu/class/archive/cs/cs448b/cs448b.1166/cgi-bin/wiki/images/c/c1/448b_paper_nijhawan_proulx_reyna.pdf. Accessed 21 Mar 2022.
    - This research paper analyzes the effectiveness of a visualization tool created at Stanford that allows the user to dynamically toggle various statistical categories instead of viewing such categories on the traditional large tables/spreadsheets. The research paper inspired me to implement the toggleable features in Sections 2 and 3 of this project.

- **NBA 3D Data Visualization: 1950–2020** "NBA 3D Data Visualization: 1950–2020". *NBA 3D Data Visualization: 1950–2020*, 2022, https://nba3d.peterbeshai.com/. Accessed 21 Mar 2022.
    - This website shows 3D bar charts of the NBA's all-time leaders in various statistical categories, which can be toggled by the user. The user can also apply various filters that increase or decrease the detail of the visualizations. I did not get any direct ideas from this website that I am incorporating in this project, but this website is super cool 😎.

Data

- 💾 Source: https://www.nba.com/stats/
- ⚡ API: https://github.com/swar/nba_api

Data Processing

The data will be collected via the python API mentioned in the *Data* section. This JSON data will simply be transformed to CSV format using python. There will be one or more CSV files for each objective listed in the *Project Objectives* section.

Must-Have Features

- Section 1 - Title & Introduction
    - Title and introduction should be eye catching and visually pleasing
- Section 2 - Best Teams & Players
    - Data under each list category (Western Conference, Eastern Conference, Players) should change every 5 seconds, starting from 1980 and ending at 2022
    - User should be able to pause the current state of the time progression (i.e. stop at a specific season
    - Users should be able to manually select a season and the data will be rendered for the selected season. For example, if the user selects the season 2010-2011, then the time progression should pause and the data shown will be the best teams and players from the 2010-2011 season
    - Users should be able to drill-down on a specific player or team in any of the lists and a modal should pop up showing three different visualizations:
        - Diverging bar chart representing the +/- of the player/team
        - Bar chart that displays the amount of a statistic that a player/team had in each game of the selected season. X-axis = game in the season(earliest → latest); Y-axis = amount of selected statistic. These statistics should also be toggeable by the user. For example, the user can first select "Points" as the variable being visualized, and the bar chart will display the data for "Points". If the user selects "Rebounds", then the variable being visualized will switch to "Rebounds".
        - Shot chart (scatterplot) that displays the locations of all the shots that the player/team has taken. The color red will be used to indicate if a shot is a miss, and the color green will be used to indicate that a shot is a make.

        - Users should be able to close the pop-up modal when they are done visualizing the data and continue where they left off with viewing the lists of the best teams and players.
- Section 3 - How the game has changed over time
    - Line chart with toggleable variables. X-axis = season (1980-91 → 2021-2022); Y-axis = amount of statistic
    - Line chart will have initial data that compares 3-point field goals (FGs) and 2-point FGs (as this is one of the statistics that has changed drastically over the years, as more and more players shoot 3-pointers today than before)
    - User will be able to remove the variables currently being graphed
    - User will be able to select more variables to be graphed

Optional Features

- Make visualizations responsive to mobile devices (may not have the time to perfect this, but will try to do so)
- GIFs on the introduction page
- Toggleable speed for the time progression on Page 2

Implemented Features (ALPHA RELEASE)

The features that have been currently implemented from the project proposal are:

- Section 1:
    - Title + introduction paragraph + GIFs
- Section 2:
    - List of best teams and players
    - Selectable list items that pop up a modal with visualizations
    - Diverging bar chart of team's winning and losing streaks
    - Bar chart/area chart (still deciding) of a statistic (points for now)
    - User can close the modal
- Section 3:
    - Static visualization of two statistics (3-point Makes and Turnovers)

Upcoming Immediate Milestones (ALPHA RELEASE)

The next milestones/features that will be implemented next are:

- The shot chart in the pop up modal in Section 2.
- The ability to select a different variable for the bar chart/area chart in the pop up modal in Section 2.
- The time progression for the Section 2 best teams and players lists.
- The ability to select and deselect variables for the change over time line chart in Section 3.

Roadblocks (ALPHA RELEASE)

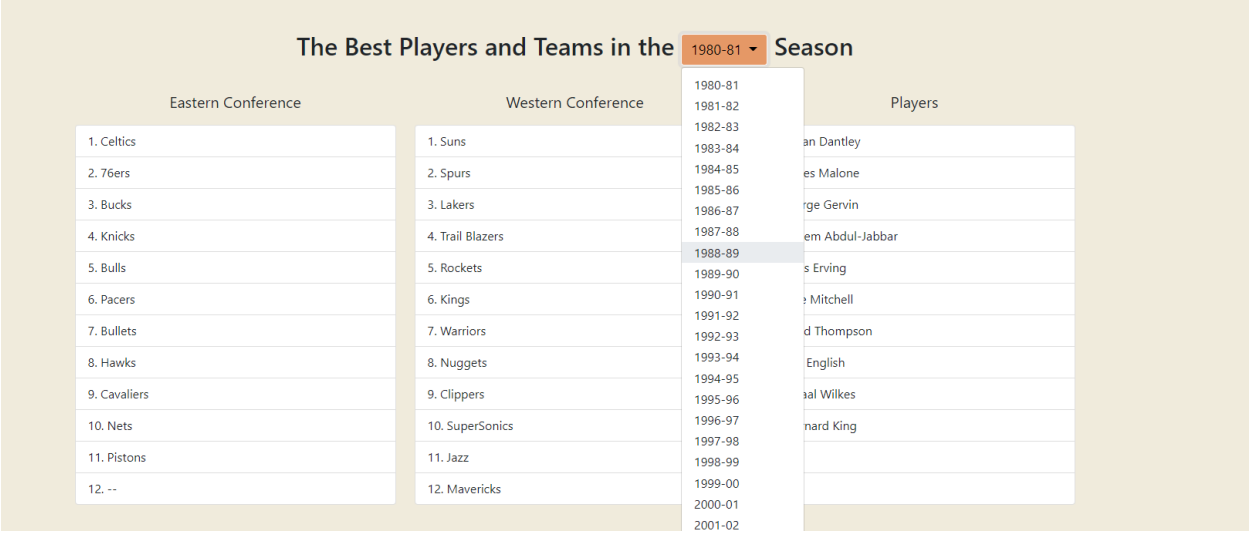
- Choosing between a bar chart and area chart for the pop-up modal in Section 2. The bar chart was the initial choice in the project proposal, but after playing around with the area chart it looks much more visually pleasing.
- Graphing a multi-series line chart for variables with great differences in values in Section 3. For example, the variable 3-point Makes has values that range from 1 to 13, but the variable Points has values that range from 70 - 100+. When these two values are on the graph together, the user cannot see the trends/changes for the 3-point Makes variable because the y-axis goes from 0 to 140 (since the Points variable is also being graphed), but the 3-Point Makes variable only spans from 1 to 13.

Project Schedule

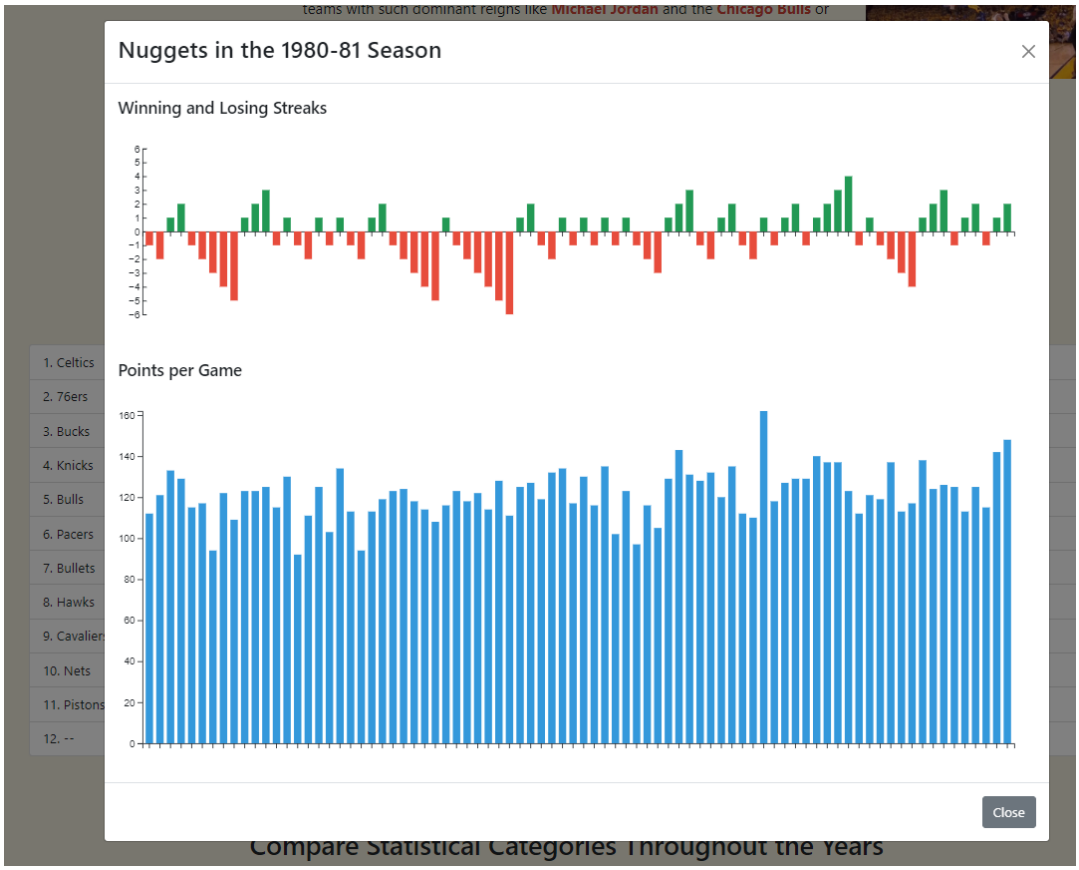
Deadline	Task	Status
3/11/22	Project Proposal Rough Draft	✅ Done
3/23/22	Project Proposal Final Draft	✅ Done
3/26/22	Process data (convert JSON from python APIs to CSV)	✅ Done
3/28/22	HTML Skeleton for website. Pages 1-3 of the Visualization Design should have the base HTML and basic JS functionality (no visualizations yet, just skeleton to hold the visualizations)	✅ Done
3/29/22	Set up CI/CD pipeline to auto deploy to cloud server (Firebase) using Github Actions	🚧 In progress
4/6/22	Alpha Release. Should include: - Section 1: title and introduction page complete - Section 2: time progression of best teams and players; pause functionality; pop-up modal with visualizations - Section 3: line chart with default data (2-point and 3-point FGs)	

	Note: Do not do the toggleable features yet in the Alpha Release	
4/10/22	Implement toggleable features for Section 2	
4/15/22	Implement toggleable features for Section 3	
4/18/22	Implement Optional Features	
4/20/22	Beta Release. Should include everything in the Alpha version, but with the toggleable features and the Optional Features (if they are doable/reasonable to implement)	
4/24/22	Presentation rough draft (slides + speaker notes)	
4/25/22	Presentation rehearsal 1	
4/27/22	Presentation revised draft	
4/29/22	Presentation rehearsal 2	
5/3/22	Presentation final draft	
5/5/22 - 5/8/22	Presentation final rehearsal(s)	
5/9/22	Final project presentation	
5/11/22	Project report outline	
5/16/22	Project report draft	
5/19/22	Project report, slides, demo video, code & data, user manual	

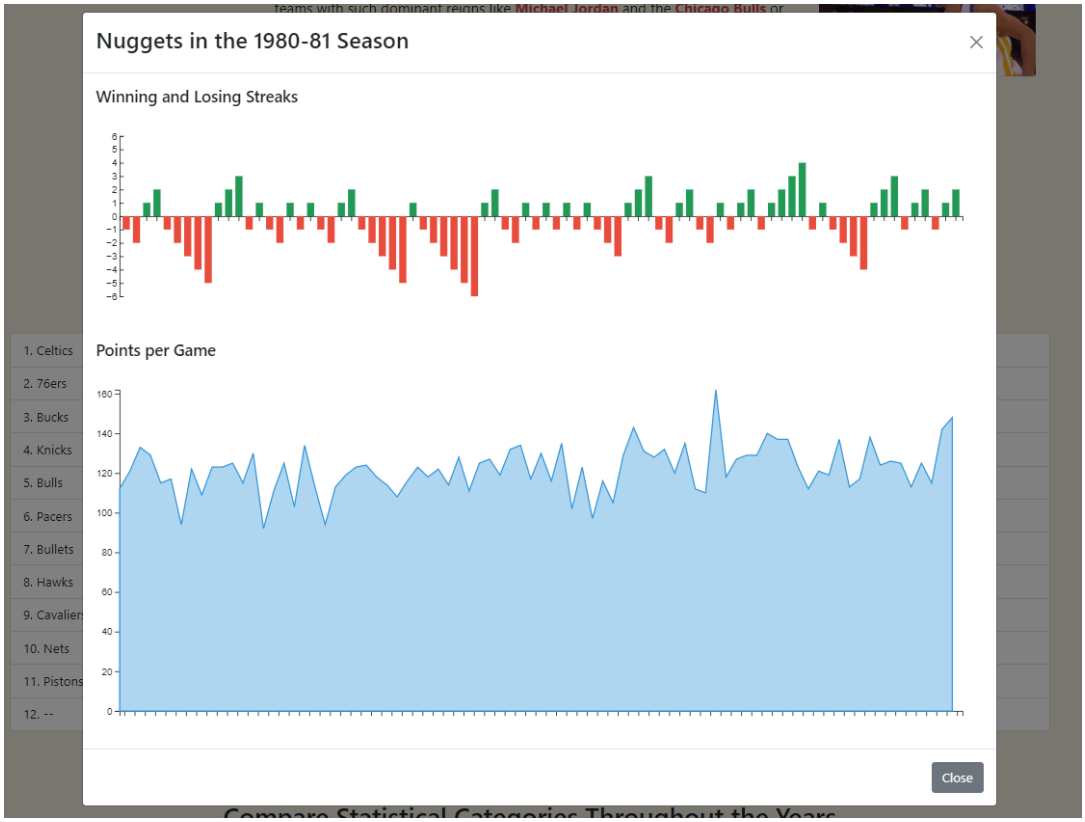
Static Visualizations (all of these can be found on the web page) (ALPHA RELEASE)



Lists of the best teams and players in the selected season.
Link: https://nba-data-viz-project.web.app/

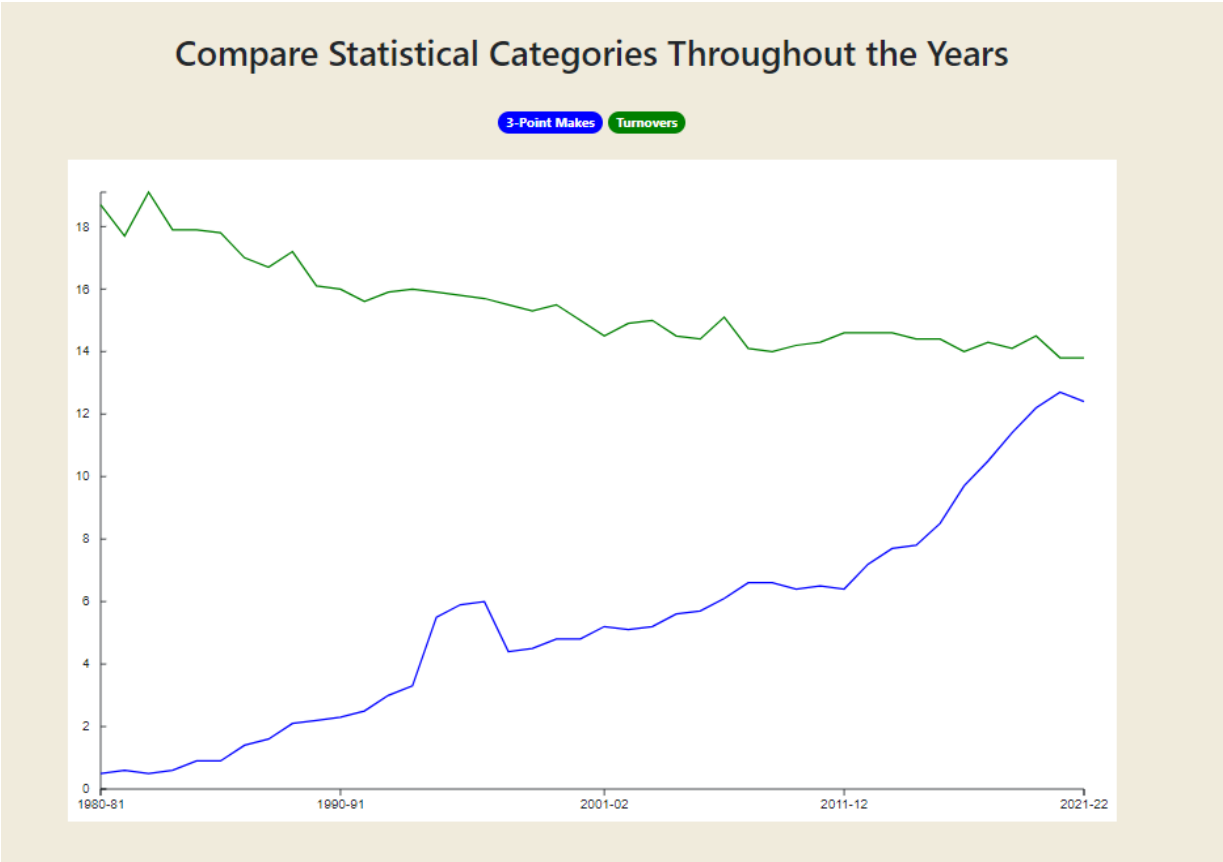


Visualization pop-up modal with a diverging bar chart showing a win/loss streak and a bar chart showing points per each game in the selected season (1980-81 in this case).
Link: https://nba-data-viz-project.web.app/



Visualization pop-up modal with a diverging bar chart showing a win/loss streak and an area chart showing points per each game in the selected season (1980-81 in this case). Deciding between area chart and bar chart still.

Link: https://nba-data-viz-project.web.app/



Line chart showing a comparison between 3-point Makes and Turnovers from 1980 to today. Users will be able to select, deselect, filter, and brush each line/variable in a future release.
Link: https://nba-data-viz-project.web.app/

Visualization Design

Section 1 - Title & Introduction

Which teams, players, and playing styles have dominated the NBA since 1980?

A data analysis of the NBA's best since the Golden Era

Introduction Paragraph

Some text will go here to introduce the background, motivation, and give a brief summary of what the visualizations below will be showing.

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The year of the season

Section 2 - Best Teams & Players

Main webpage

Section 2 - Best Teams & Players with Pop-up Modal

Pause

Speed

Main webpage becomes backdrop to the modal

Section 2 - Best Teams & Players with Pop-up Modal

The Best Players and Teams in the 1980-1991 Season

Player 1 in the 1980-1991 Season

+ / -

(Diverging bar chart of player's +/- impact on each game of the season)

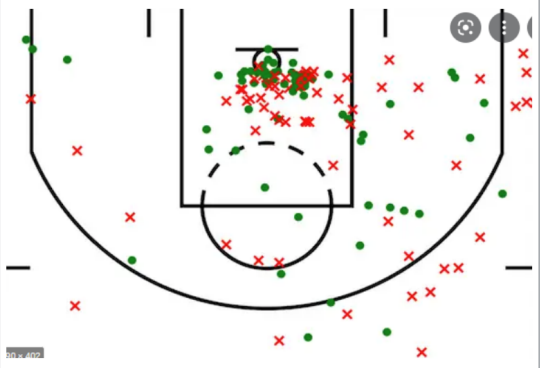
Points

(Bar chart of player's selected stat in each game of the season. User can toggle the selected stat)

Dropdown that user can select to display a different statistic in the bar chart. Options are points, 3-point makes, steals, rebounds, turnovers, assists, and blocks

Shot Chart

(Scatterplot of the location of all shots the player has taken on the court during the season. Color is used to show make or miss)



Section 3 - How the game has changed over time

Compare Statistical Categories throughout the Years