Interactive NBA Visualizer

Forest Yang
Massachusetts Institute of
Technology
Cambridge, MA, United States
foresty@mit.edu

Akshaj Kadaveru
Massachusetts Institute of
Technology
Cambridge, MA, United States
akshajk@mit.edu

Liam Conboy
Massachusetts Institute of
Technology
Cambridge, MA, United States
lconboy@mit.edu

ABSTRACT

We created a basketball game visualization tool that allows users to 'replay' the whole game and see shots in real time on the basketball court as well as watch player's game statistics go up over the course of the game. View our visualization here.

1 INTRODUCTION

All basketball fans know that when you want to see the results of a game, you look up the **box score**. Box scores allow a viewer to see, in a table, the points, assists, rebounds, field goals made/missed, and three-pointers made/missed, as well as a variety of other statistics for each player in the game (Figure 1).

The problem with box scores is that it clearly does not tell the full picture of a basketball game. The thrill of seeing a buzzer-beating shot in the last second, the excitement about seeing the specific placement of each shot, and the thrill of seeing players going on shooting streaks just does not exist in this tabular format.

We seek to make up for these shortcomings by providing a **basketball game visualization tool** that allows users to **'replay' the whole game** and **see shots in real time on the basketball court** as well as **watch player's game statistics go up over the course of the game**. Our tool allows users to more-powerfully analyze basketball games than would be possible by box scores alone.

2 RELATED WORK

The idea of visualizing shots on a court has been done before; these type of charts are called 'shot charts'. Typically such charts will take a specific player and plot all of their shots over the course of a season, showing a cool and insightful distribution of shot locations.

ESPN has the only 'single-game' shot visualizer we could find, which is visible under the shot chart section at [2]. The difference is that this shot chart visualizer only shows a static view of the shots at the conclusion of the game. Our visualizer's main innovation on this design is to allow fans to watch the game progress over time, and see the shots appear on the court when they happen. In addition to this, we show images of the player when they make the shot, as well as provide a live-updating box score on the side.

2.1 Methods

We decided to use Basketball Reference as our information source. Specifically, they provide a shot chart and a 'play by play' listing for each NBA game. The shot chart provides us the x,y coordinates for each shot, and the play-by-play listing gives us information about each shot as well as every assist, rebound, and free-throw. We needed both these information sources in order to have the box-score part of our visualization sync up with the shot chart part

Figure 1: Example Box Score

STARTERS	MIN	FG	3PT	FT	OREB	DREB	REB	AST	STL	BLK	TO	PF
A. Davis PF	43	15-28	0-5	1-2	2	6	8	2	2	2	1	1
L. James SF	43	13-23	4-9	9-11	0	12	12	16	4	1	4	5
D. Green SF	34	5-9	3-6	1-2	0	1	1	1	1	0	1	2
J. McGee C	12	1-1	0-0	0-0	1	1	2	0	0	1	0	3
A. Bradley PG	39	5-12	1-3	0-0	1	4	5	2	2	0	1	3
BENCH	MIN	FG	3PT	FT	OREB	DREB	REB	AST	STL	BLK	TO	PF
K. Kuzma SF	19	3-8	0-4	3-4	1	2	3	1	0	0	1	0
D. Howard C	27	1-1	0-0	2-2	1	7	8	0	2	3	1	4
Q. Cook PG	4	0-0	0-0	0-0	0	0	0	0	0	0	0	0
K. Caldwell-Pope SG	21	1-5	0-1	0-0	0	0	0	1	0	1	1	2
A. Caruso G	16	3-5	1-2	0-0	0	2	2	0	0	0	1	1
T. Daniels G	9	0-4	0-2	0-0	0	0	0	1	0	0	0	0
J. Dudley SF	DNP-COACH'S DECISION											
TEAM		47-96	9-32	16-21	6	35	41	24	11	7	11	21
		49.0%	28.1%	76.2%								

(otherwise, since free throws aren't a part of the shot chart, the scores would be off by the number of made free throws).

We started by using this scraper (1), but had to edit the scraper code significantly to suit our needs.

Different techniques we used in the visualization include:

- Animating the entrance of shots onto the court
- Showing a message at the top for each shot when it occurs
- Indicating team by color
- Indicating made or missed shot by filled or outlined circle
- Showing all of an individual's players shots (and grey-ing out the other shots) when hovering over a player on the side
- Ordering and animating the list of players on the side by number of points scored
- Allowing the user to select games by inputting player names
- Allowing users to specify the speed of the game

3 RESULTS

From showing our visualization to basketball fans, a common sentiment was that we provide insight into what changed throughout the game. For example, Figure 2 shows that at halftime, the Lakers were losing and had only made 2 of 11 three-point shots (evidenced by the sheer number of open circles outside the three point line). However, looking at Figure 3 shows that the Lakers made significantly more threes in the second half which ended up winning them the game.
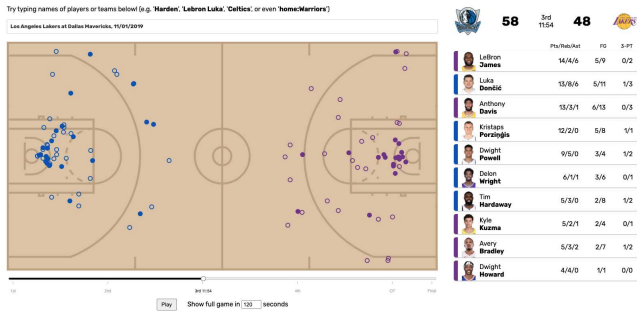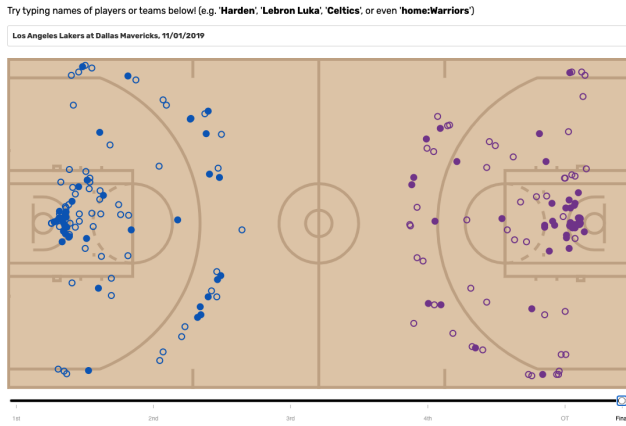
Figure 2: Lakers vs Mavericks 11/1/19, Halftime

Figure 3: Lakers vs Mavericks 11/1/19, Completed Game

4 DISCUSSION

Our visualization lies in the broader context of "ways to learn what happened in a NBA game." As such, we have to compare our visualization to the two main ways people consume basketball information: watching the full game (or highlights) on youtube, and simply reading the box score.

The power of our visualization over these other methods is that we pack in both time and location information into the box score, and still provide a great visual overview that can be consumed or played through in as little as 30 seconds.

While both our visualization and watching a full NBA game (or highlights) present a large amount of information to the viewer, our visualization allows users to focus on what they care about. They can see the shots of just Lebron James, or hover over specifically Steph Curry's three point shots, if they like, as opposed to a highlight video where they are limited to whatever the author put in the video. The interactivity provided by our visualization allows the user to easily dive-deep into the data to see important information clearly and concisely.

Box Scores also allow users to focus on the information they care about. However, while a box score reader can see how many shots Steph Curry took in a game, they cannot see exactly where on the court or when in the game they were scored. Box scores eliminate concrete points of reference to the basketball game – like

the shot-map on the basketball court – in an attempt to be more concise, but at the expense of creating distance between the viewer and the game that makes the data harder to contextualize. Our visualization opts to display player data along with things like the shot-map, game-clock, and live scoreboard as concrete reference points to the original basketball game. This helps the viewer contextualize the data, which makes the data easier to understand.

5 FUTURE WORK

We think the most exciting next step would be to incorporate video clips for each shot. The NBA official website provides an API to fetch video clips of specific shots in games, and including these clips would introduce a whole new excitement factor into our visualization. An idea we have is that clicking on a shot could show a video of it, and we could track data on the 'excitement' of a shot (perhaps through an upvote feature) and show that visually on the court through some encoding channel.

Another exciting extension would be to include more data from the last 20 years. This would allow users to search 'Lebron James', and in the dropdown, see his highest scoring games from the last 20 years (sorted by points scored). Seeing shot charts of these historical games is always very joyful for fans.

There are many potential avenues for future work to extend and refine this visualization, and we hope for it to provide a useful service to fans of the NBA!

6 CITATIONS

[1] Basketball Reference Scraper:
https://github.com/vishaalagartha/basketball_reference_scraper/
[2] ESPN Shot Chart:
https://www.espn.com/nba/game/_/gameId/401160716