

# INFORMATION VISUALIZATION PROJECT 2016

NBA teams' performance tracking system

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## Contents

The Idea Behind the Project.....	3
What is the dataset about?.....	3
Users Tasks.....	5
Proposed Dashboard.....	5
Dashboard Implementation.....	6
Dashboard Limitation.....	9
How does the solution enable users to answer the tasks? .....	12
The findings and insights.....	13
Conclusion.....	14

## The Idea Behind the Project

NBA teams' performance tracking system is a project aims to help users to track the performance of NBA teams from 2000 to 2009. With the assistance of this system, users are able to quickly become aware of win ranks of NBA teams during this 10 years' period, the overall trend and also the team players' information. The system requirements, also known as functional requirements, of the project are interactive exploration and filtering techniques.

## What is the dataset about?

The dataset used in this project is two collections of related dataset of NBA players and 33 NBA teams regular season records from 1946 to 2009. It was retrieved from [http://www.databasebasketball.com/stats\\_download.htm](http://www.databasebasketball.com/stats_download.htm). The following statistics and abbreviations are used on the player and team pages:

Abbreviation	Stand for	Abbreviation	Stand for
<b>Illkid</b>	Player identification number	<b>Blk</b>	Total Block
<b><u>Year</u></b>	<u>Year</u>	<b>To</b>	Turnover
<b><u>Firstname</u></b>	<u>First name of a player</u>	<b>Pf</b>	Total Personal foul
<b><u>Lastname</u></b>	<u>Last name of a player</u>	<b>Fga</b>	Field Goal Attempted
<b><u>Team</u></b>	<u>A team that player plays for</u>	<b>Fgm</b>	Field Goal Made
<b>Leag</b>	leag	<b>Fta</b>	Free Throw Attempted
<b>Gp</b>	Game points	<b>ftm</b>	Free Throw Made
<b>minutes</b>	minutes	<b>Tpa</b>	Total Throws Attempted
<b>pts</b>	Total points	<b>tpm</b>	Total Throws Made
<b>oreb</b>	Offensive Rebounds	<b>3pm</b>	Three Pointers Made

Abbreviation	Stand for	Abbreviation	Stand for
<b>dreb</b>	Defensive Rebounds	<b>3pa</b>	Three Pointers Attempted
<b>Reb</b>	Total Rebounds	<u>Won</u>	<u>Total games won</u>
<b>Asts</b>	Total Assist	<u>lost</u>	<u>Total games lost</u>
<b>Stl</b>	Total Steal	<b>pace</b>	Pace

The underline words are the data types we used in this project. Beside the existing data type, four new data types were fostered. Below table gives a summary of the data types.

Abbreviation	Stand for	Abbreviation	Stand for
<b>winRate</b>	A percentage of total win games divided by total games	<b>WrRank</b>	A position based on winRate.
<b>Name</b>	First name and last name of a player.	<b>EFFi</b>	Efficiency of a player or a team on a particular season

Efficiency is calculated by using this formula:  $(pts * 100) / ((fta * 0.44) + fga + to - oreb)$ . The formula is taken from <http://www.databasebasketball.com/about/aboutstats.htm> and is computed on a per season basis.

Initialize, the project had supposed to visualize all the records. However, due to time constraints and data overload, the record from 2000 – 2009 is used instead.

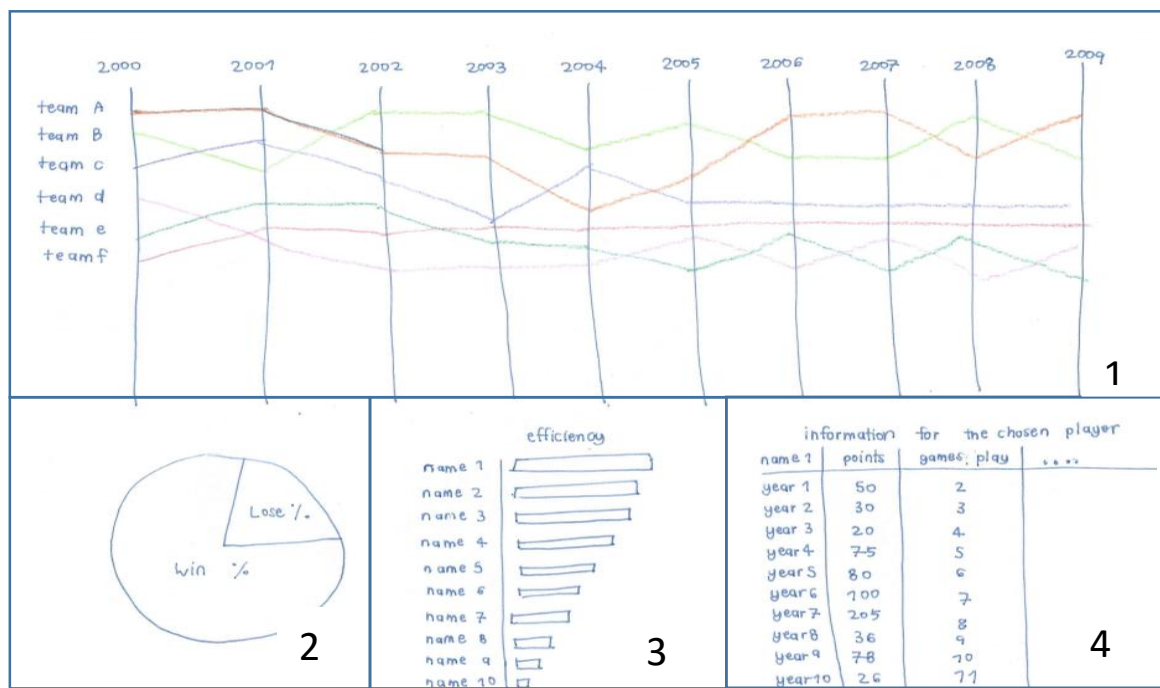
## Users Tasks

Talking about user tasks, a question the come in to our mind was what every user would want to be fully aware of through the observation. The following is the list that we believe that users expect to able to accomplish after using our work:

- Be able to know how proficiently NBA teams and NBA player has carried out.
- Be able to compare the win rank of NBA teams from 2000 to 2009.
- Be informed the number of winning games and losing games of a particular team in a particular season
- Be able to compare the efficiency of the best team, the worst team and a chosen team.

## Proposed Dashboard

With reference to user tasks, here is our proposed dashboard.



The detail of the dashboard is outlined in the below table.

Number	Chart type	Information
1	Parallel coordinates	Performance of NBA teams
2	Pie chart	The number of winning and losing games
3	Bar chart	Top 10 players based on their efficiency
4	table	Top 10 players in details

## Dashboard Implementation

The solution proposed in previous was built only to a certain extent. There are some parts of the proposal that were not implemented and some parts that were fostered in the final system.

As a result of consideration, an extra table was added so that the users are given the information about the exact rank of the teams in each season. A bar chart was put in to show the trend of the teams' efficiency instead of players' efficiency. The players' information is shown in a scatter plot and cover their name, the number of game their played, efficiency and points they made.

The way this project was implemented can be divided in to 2 perspectives: lay out of the dashboard and technical.

- Layout view perspective

The NBA team records are outputted as graphs and table in such a way that the important aspects are addressing splitting both the vertical and horizontal space so that the information can be easily read by the user.

Here is the dashboard:



In order to make the win rank table display size to be fit with monitor screen fully, the win rank table presents only up to 20 records at a time.

Different color is used in parallel coordinate and pie chart to distinct a team from other team and winning game from losing game, respectively. This is to establish identity of different NBA teams and to make out the difference between game results. Different brightness of a color is also used for the same purpose in the scatter plot and bar chart.

The bar chart has the arrangement of team efficiencies in relation to each other according to their efficiencies. Besides the best team, the worst team and the interesting team's efficiency, the average efficiency of that season was added to tell how good the team actually was.

- Technical perspective

The project mainly relies on building a web page using html, CSS, JavaScript, jQuery d3.js, and SVG. Also, we referred a parallel coordinate d3 library from <https://syntagmatic.github.io/parallel-coordinates/> to implement the teams' performance graph. In addition, an extra .css file from Bootstrap is used for a better layout.

The main user actions here are analyzing the existing information. With reference to our project, users will be able to discover new information. They can also identify their target team trends, compare it with other team and get a summary of all possible teams' performance.

Below are the functions that the system offers:

Visualization	technique	output
Parallel Coordinates	Filter technique	NBA teams' performance can be filtered to extract only those records that fulfill a specified criterion.  The other charts and table will take out the related records and update accordingly.
Team win rank table	Interactive exploration	User selection will trigger filter action in the other visualizations. When their move their pointer over a team win rank of a particular season in win rank table, the other charts and table will take out the related records and update accordingly.
	Highlight	User selection is highlighted corresponding visual elements

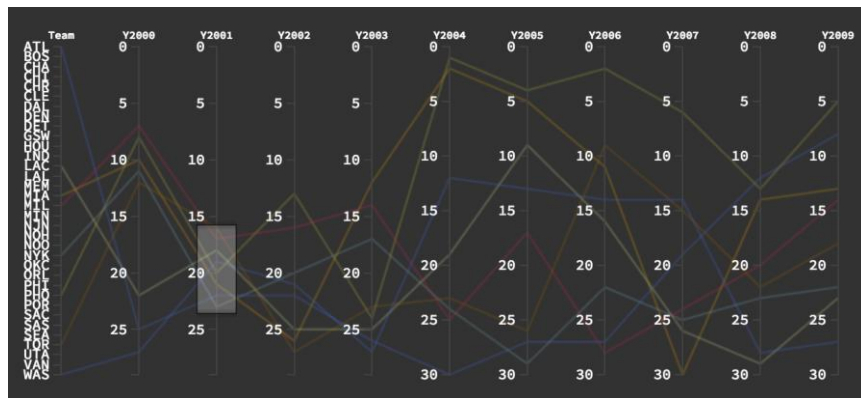


Visualization	technique	output
Players' information scatter plot	Highlight	Information related to user selection in Team win rank table has a darken color.
	tooltips	A small box with information corresponding visual elements is appeared near the item
Bar chart	Order	The chart is arranged according to their values, from high to low.

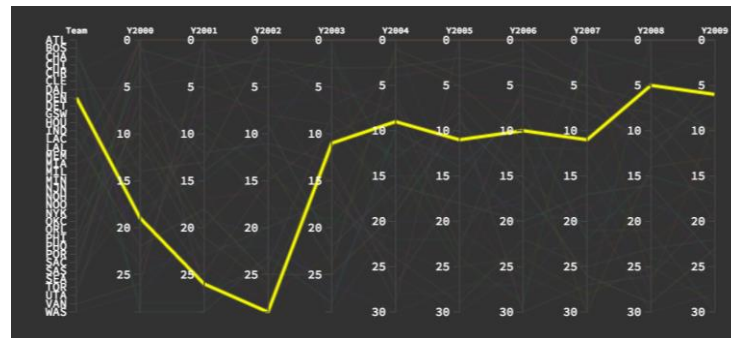
## Dashboard Limitation

Due to time constraints, the following are the limitation of the project:

- Limitation of the parallel coordinate of NBA teams' performance



- Users can add only one specified criterion at each y-axis, year, at a time. If they try to add more specified criterion, the first criterion will be automatically cancelled.



- A NBA team performance line is highlighted if and only there is a mouse hover on the team rank in win rank table. Therefore, it is not possible to compare overall trends of the teams' performance.
- Limitation of the table of win rank

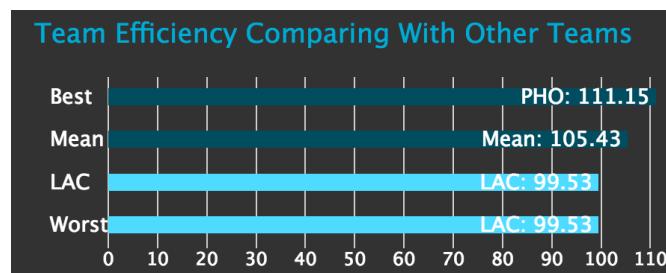
Winning Rate Rank Table

Team	Y2000	Y2001	Y2002	Y2003	Y2004	Y2005	Y2006	Y2007	Y2008	Y2009
BOS	20	9	14	20	11	24	29	1	3	11
CHA	14	13	0	0	0	0	0	0	0	0
CHR	0	0	0	0	28	28	23	23	19	15
DAL	5	4	1	7	4	3	1	10	9	4
DEN	19	26	29	11	9	11	10	11	5	6
DET	21	7	7	6	5	1	4	2	17	25
HOU	15	25	15	10	7	23	5	7	8	16
IND	18	15	10	1	15	15	19	20	18	21
LAC	22	18	25	25	19	9	16	26	29	23
LAL	2	2	5	4	21	10	13	3	2	3
MEM	0	27	24	8	13	8	30	27	26	19
MIA	10	21	26	12	2	5	11	30	14	13
MIL	7	17	16	14	25	17	28	24	20	14
MIN	13	6	4	2	14	25	24	28	25	29
NOH	0	0	12	15	29	0	0	4	10	20
NOO	0	0	0	0	0	19	18	0	0	0
NYK	11	23	20	17	24	29	22	25	23	22
OKC	0	0	0	0	0	0	0	0	27	9
ORL	17	11	17	29	20	20	17	9	4	2
PHI	3	14	9	22	16	18	20	17	16	24

Note: 0 = no data found, since some teams moved to another city and changed their names.

- It displays a maximum of 20 rows for tabular at a time base on alphabetical order.
- Since the table only displays 20 records, it might be possible the teams that users want to compare the win rank never appears at the same time.
- Limitation of a pie chart of the number of winning games and losing games
  - Users interaction is not allowed here.

- Limitation of a scatter plot of players' efficiency and total points
  - Despite the fact that users can see the scatters between players from interesting team and players from whole league, scatters for players between two arbitrary teams is not allowed here. In other words, it is impossible to outstanding team players more than one team.
- Limitation of the bar chart of teams' efficiency



- Users can view up to 3 teams' efficiency at a time and 2 out of 3 teams are fixed.
  - Users interaction is not allowed here.
- The overall dashboard is limited to present
  - The number of winning games and losing games of a particular team
  - The comparison of the efficiency point of the best team, the worst team and a particular team
  - The efficiency and the total point that the players made in a particular season at a time.
- There is actually a relation existing between teams' efficiency and player's efficiency. The team efficiency is the average of team player's efficiency. However, the relation does not show through the dashboard.

## How does the solution enable users to answer the tasks?

To display the changes of data continuously over time, line charts are the best. It clearly shows how well teams perform over the 10 years' period and the overall trends the teams' performance.

To present the win ranks of NBA teams, a table is needed. Even though users will take longer time to understand clearly ranks of the teams, the table presents precise information to users.

Taking the same result into consideration, players' efficiency and total points that players made were revealed in a scatter plot instead. The scatter plot shows all possible relations between the number of plays with player efficient. More information about a player is shown in a small box when a mouse icon is over circle in the scatter plot.

A pie chart is in the dashboard to allow users to be perceived the number of winning games and losing games. We picked this as being the best of alternatives because it visualizes the record in proportional to the quantity it presents.

Teams' efficiency is readily seen in a bar chart. The chart covers the efficiency of the best team, the worst team and an interested team and the average efficiency of the same season. Despite the fact that bar charts are the best chart to track changes of data over time, a bar chart is an alternative. The bar chart shows comparisons among team efficiency and amount of stuff is also measured here.

## The findings and insights

A correlation between two variables means that there is a connection between the variables. In this project, the finding and insights can be divided into two different sections which are:

- There is a relation existing between
  - Win ranks and numbers of winning games and losing games  
  
When team A has a better rank than team B, it means that team A had won more games than Team B.
- There is no relation between
  - win ranks and teams' efficient points  
When team A has a better rank than team B, it does not mean that team A has a higher efficient point than team B.
  - points players make and players' efficient points  
When player A makes higher score than player B, it does not mean that player A have a higher efficient point than player B.
  - number of games players plays and players' efficient points  
  
When player A plays more games than player B, it does not mean that player A have a higher efficient point than player B.
- The relation between win rank and players' efficiency and number of games their played is not so outstanding. However, the players in the team that has a better rank is apparently have a higher number of game plays compared to the team with the worse rank.

## Conclusion

The science of designing and building information visualization is still young and quite exempt from rules. The guidelines that exist today to steer information visualization designers and developers can only attest for what has been done before and proven to work, reason why many organizations simply make their own set of rules, though often based on industry benchmarks. Despite all the non-specific rules, there is one thing our team agree on: building an information visualization system requires careful effort in the planning and design stages and that the bigger the system the more planning it requires, though not necessarily at one time.

Our aim of this project is to allow users to quickly and easily realize how well NBA teams perform from 2000 to 2009. All the solutions presented here are established from careful study and analysis. With the assistance of the data visualization, the team presents in this document NBA teams' performance tracking system.