Post 2

Zhiyuan He

December 2, 2017

Creating Heatmaps in R

Introduction

Tables of data with many rows and columns of information are sometimes the best ways to describe information. Visualizing these multiple columns and rows of data onto a single bar or line graph. Heat maps are a great alternative as they replace numbers with color on the table. It can be useful to look at highs and lows or patterns. We will look at NBA data to visualize and create a heat map

Downloading the Data

```
nba <- read.csv("http://datasets.flowingdata.com/ppg2008.csv", sep=",")
```

Now if we just look at the data it is already organized by points from the most to least, but we can not really find any significant meaning

```
nba
```

```
##                  Name  G  MIN  PTS  FGM  FGA   FGP FTM  FTA   FTP X3PM
## 1        Dwyane Wade  79 38.6 30.2 10.8 22.0 0.491 7.5  9.8 0.765  1.1
## 2       LeBron James  81 37.7 28.4  9.7 19.9 0.489 7.3  9.4 0.780  1.6
## 3        Kobe Bryant  82 36.2 26.8  9.8 20.9 0.467 5.9  6.9 0.856  1.4
## 4      Dirk Nowitzki  81 37.7 25.9  9.6 20.0 0.479 6.0  6.7 0.890  0.8
## 5      Danny Granger  67 36.2 25.8  8.5 19.1 0.447 6.0  6.9 0.878  2.7
## 6       Kevin Durant  74 39.0 25.3  8.9 18.8 0.476 6.1  7.1 0.863  1.3
## 7       Kevin Martin  51 38.2 24.6  6.7 15.9 0.420 9.0 10.3 0.867  2.3
## 8       Al Jefferson  50 36.6 23.1  9.7 19.5 0.497 3.7  5.0 0.738  0.0
## 9         Chris Paul  78 38.5 22.8  8.1 16.1 0.503 5.8  6.7 0.868  0.8
## 10   Carmelo Anthony  66 34.5 22.8  8.1 18.3 0.443 5.6  7.1 0.793  1.0
## 11        Chris Bosh  77 38.1 22.7  8.0 16.4 0.487 6.5  8.0 0.817  0.2
## 12       Brandon Roy  78 37.2 22.6  8.1 16.9 0.480 5.3  6.5 0.824  1.1
## 13    Antawn Jamison  81 38.2 22.2  8.3 17.8 0.468 4.2  5.6 0.754  1.4
## 14       Tony Parker  72 34.1 22.0  8.9 17.5 0.506 3.9  5.0 0.782  0.3
## 15  Amare Stoudemire  53 36.8 21.4  7.6 14.1 0.539 6.1  7.3 0.835  0.1
## 16       Joe Johnson  79 39.5 21.4  7.8 18.0 0.437 3.8  4.6 0.826  1.9
## 17      Devin Harris  69 36.1 21.3  6.6 15.1 0.438 7.2  8.8 0.820  0.9
## 18      Michael Redd  33 36.4 21.2  7.5 16.6 0.455 4.0  4.9 0.814  2.1
## 19        David West  76 39.3 21.0  8.0 17.0 0.472 4.8  5.5 0.884  0.1
## 20  Zachary Randolph  50 35.1 20.8  8.3 17.5 0.475 3.6  4.9 0.734  0.6
## 21      Caron Butler  67 38.6 20.8  7.3 16.2 0.453 5.1  6.0 0.858  1.0
## 22      Vince Carter  80 36.8 20.8  7.4 16.8 0.437 4.2  5.1 0.817  1.9
## 23   Stephen Jackson  59 39.7 20.7  7.0 16.9 0.414 5.0  6.0 0.826  1.7
## 24        Ben Gordon  82 36.6 20.7  7.3 16.0 0.455 4.0  4.7 0.864  2.1
## 25     Dwight Howard  79 35.7 20.6  7.1 12.4 0.572 6.4 10.7 0.594  0.0
## 26       Paul Pierce  81 37.4 20.5  6.7 14.6 0.457 5.7  6.8 0.830  1.5
## 27     Al Harrington  73 34.9 20.1  7.3 16.6 0.439 3.2  4.0 0.793  2.3
## 28    Jamal Crawford  65 38.1 19.7  6.4 15.7 0.410 4.6  5.3 0.872  2.2
## 29          Yao Ming  77 33.6 19.7  7.4 13.4 0.548 4.9  5.7 0.866  0.0
## 30 Richard Jefferson  82 35.9 19.6  6.5 14.9 0.439 5.1  6.3 0.805  1.4
## 31       Jason Terry  74 33.6 19.6  7.3 15.8 0.463 2.7  3.0 0.880  2.3
## 32    Deron Williams  68 36.9 19.4  6.8 14.5 0.471 4.8  5.6 0.849  1.0
## 33        Tim Duncan  75 33.7 19.3  7.4 14.8 0.504 4.5  6.4 0.692  0.0
## 34       Monta Ellis  25 35.6 19.0  7.8 17.2 0.451 3.1  3.8 0.830  0.3
## 35          Rudy Gay  79 37.3 18.9  7.2 16.0 0.453 3.3  4.4 0.767  1.1
## 36         Pau Gasol  81 37.1 18.9  7.3 12.9 0.567 4.2  5.4 0.781  0.0
## 37    Andre Iguodala  82 39.8 18.8  6.6 14.0 0.473 4.6  6.4 0.724  1.0
## 38    Corey Maggette  51 31.1 18.6  5.7 12.4 0.461 6.7  8.1 0.824  0.5
## 39         O.J. Mayo  82 38.0 18.5  6.9 15.6 0.438 3.0  3.4 0.879  1.8
## 40      John Salmons  79 37.5 18.3  6.5 13.8 0.472 3.6  4.4 0.830  1.6
## 41  Richard Hamilton  67 34.0 18.3  7.0 15.6 0.447 3.3  3.9 0.848  1.0
## 42         Ray Allen  79 36.3 18.2  6.3 13.2 0.480 3.0  3.2 0.952  2.5
## 43 LaMarcus Aldridge  81 37.1 18.1  7.4 15.3 0.484 3.2  4.1 0.781  0.1
## 44       Josh Howard  52 31.9 18.0  6.8 15.1 0.451 3.3  4.2 0.782  1.1
## 45  Maurice Williams  81 35.0 17.8  6.5 13.9 0.467 2.6  2.8 0.912  2.3
## 46  Shaquille O'neal  75 30.1 17.8  6.8 11.2 0.609 4.1  6.9 0.595  0.0
## 47     Rashard Lewis  79 36.2 17.7  6.1 13.8 0.439 2.8  3.4 0.836  2.8
## 48  Chauncey Billups  79 35.3 17.7  5.2 12.4 0.418 5.3  5.8 0.913  2.1
## 49     Allen Iverson  57 36.7 17.5  6.1 14.6 0.417 4.8  6.1 0.781  0.5
## 50     Nate Robinson  74 29.9 17.2  6.1 13.9 0.437 3.4  4.0 0.841  1.7
##    X3PA  X3PP ORB DRB  TRB  AST STL BLK  TO  PF
## 1   3.5 0.317 1.1 3.9  5.0  7.5 2.2 1.3 3.4 2.3
## 2   4.7 0.344 1.3 6.3  7.6  7.2 1.7 1.1 3.0 1.7
## 3   4.1 0.351 1.1 4.1  5.2  4.9 1.5 0.5 2.6 2.3
## 4   2.1 0.359 1.1 7.3  8.4  2.4 0.8 0.8 1.9 2.2
## 5   6.7 0.404 0.7 4.4  5.1  2.7 1.0 1.4 2.5 3.1
## 6   3.1 0.422 1.0 5.5  6.5  2.8 1.3 0.7 3.0 1.8
## 7   5.4 0.415 0.6 3.0  3.6  2.7 1.2 0.2 2.9 2.3
```

```
## 8   0.1 0.000 3.4 7.5 11.0  1.6 0.8 1.7 1.8 2.8
## 9   2.3 0.364 0.9 4.7  5.5 11.0 2.8 0.1 3.0 2.7
## 10  2.6 0.371 1.6 5.2  6.8  3.4 1.1 0.4 3.0 3.0
## 11  0.6 0.245 2.8 7.2 10.0  2.5 0.9 1.0 2.3 2.5
## 12  2.8 0.377 1.3 3.4  4.7  5.1 1.1 0.3 1.9 1.6
## 13  3.9 0.351 2.4 6.5  8.9  1.9 1.2 0.3 1.5 2.7
## 14  0.9 0.292 0.4 2.7  3.1  6.9 0.9 0.1 2.6 1.5
## 15  0.1 0.429 2.2 5.9  8.1  2.0 0.9 1.1 2.8 3.1
## 16  5.2 0.360 0.8 3.6  4.4  5.8 1.1 0.2 2.5 2.2
## 17  3.2 0.291 0.4 2.9  3.3  6.9 1.7 0.2 3.1 2.4
## 18  5.8 0.366 0.7 2.5  3.2  2.7 1.1 0.1 1.6 1.4
## 19  0.3 0.240 2.1 6.4  8.5  2.3 0.6 0.9 2.1 2.7
## 20  1.9 0.330 3.1 6.9 10.1  2.1 0.9 0.3 2.3 2.7
## 21  3.1 0.310 1.8 4.4  6.2  4.3 1.6 0.3 3.1 2.5
## 22  4.9 0.385 0.9 4.2  5.1  4.7 1.0 0.5 2.1 2.9
## 23  5.2 0.338 1.2 3.9  5.1  6.5 1.5 0.5 3.9 2.6
## 24  5.1 0.410 0.6 2.8  3.5  3.4 0.9 0.3 2.4 2.2
## 25  0.0 0.000 4.3 9.6 13.8  1.4 1.0 2.9 3.0 3.4
## 26  3.8 0.391 0.7 5.0  5.6  3.6 1.0 0.3 2.8 2.7
## 27  6.4 0.364 1.4 4.9  6.2  1.4 1.2 0.3 2.2 3.1
## 28  6.1 0.360 0.4 2.6  3.0  4.4 0.9 0.2 2.3 1.4
## 29  0.0 1.000 2.6 7.2  9.9  1.8 0.4 1.9 3.0 3.3
## 30  3.6 0.397 0.7 3.9  4.6  2.4 0.8 0.2 2.0 3.1
## 31  6.2 0.366 0.5 1.9  2.4  3.4 1.3 0.3 1.6 1.9
## 32  3.3 0.310 0.4 2.5  2.9 10.7 1.1 0.3 3.4 2.0
## 33  0.0 0.000 2.7 8.0 10.7  3.5 0.5 1.7 2.2 2.3
## 34  1.0 0.308 0.6 3.8  4.3  3.7 1.6 0.3 2.7 2.7
## 35  3.1 0.351 1.4 4.2  5.5  1.7 1.2 0.7 2.6 2.8
## 36  0.0 0.500 3.2 6.4  9.6  3.5 0.6 1.0 1.9 2.1
## 37  3.2 0.307 1.1 4.6  5.7  5.3 1.6 0.4 2.7 1.9
## 38  1.9 0.253 1.0 4.6  5.5  1.8 0.9 0.2 2.4 3.8
## 39  4.6 0.384 0.7 3.1  3.8  3.2 1.1 0.2 2.8 2.5
## 40  3.8 0.417 0.7 3.5  4.2  3.2 1.1 0.3 2.1 2.3
## 41  2.8 0.368 0.7 2.4  3.1  4.4 0.6 0.1 2.0 2.6
## 42  6.2 0.409 0.8 2.7  3.5  2.8 0.9 0.2 1.7 2.0
## 43  0.3 0.250 2.9 4.6  7.5  1.9 1.0 1.0 1.5 2.6
## 44  3.2 0.345 1.1 3.9  5.1  1.6 1.1 0.6 1.7 2.6
## 45  5.2 0.436 0.6 2.9  3.4  4.1 0.9 0.1 2.2 2.7
## 46  0.0 0.000 2.5 5.9  8.4  1.7 0.7 1.4 2.2 3.4
## 47  7.0 0.397 1.2 4.6  5.7  2.6 1.0 0.6 2.0 2.5
## 48  5.0 0.408 0.4 2.6  3.0  6.4 1.2 0.2 2.2 2.0
## 49  1.7 0.283 0.5 2.5  3.0  5.0 1.5 0.1 2.6 1.5
## 50  5.2 0.325 1.3 2.6  3.9  4.1 1.3 0.1 1.9 2.8
```

Data cleaning

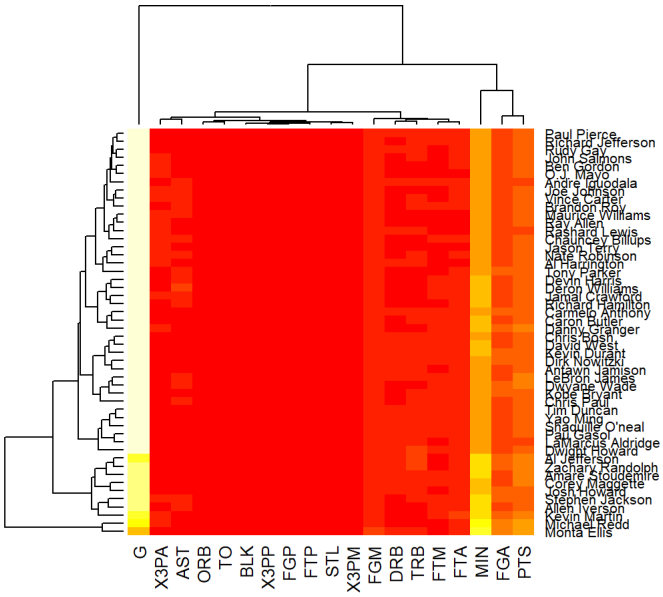
We want to change the row names to player names instead of numbers to easily look at the data later and we also dont need the first column anymore as it is just the player names. In order to create a heat map you need the data to be in a data matix instead of the data frame that it was loaded in.

```
row.names(nba) <- nba$Name #changing row names

nba <- nba[,2:20] #removing the name column

nba_matrix <- data.matrix(nba) #Turning it into a data matrix

nba <- nba[order(nba$PTS),]
```

Creating the basic heat map

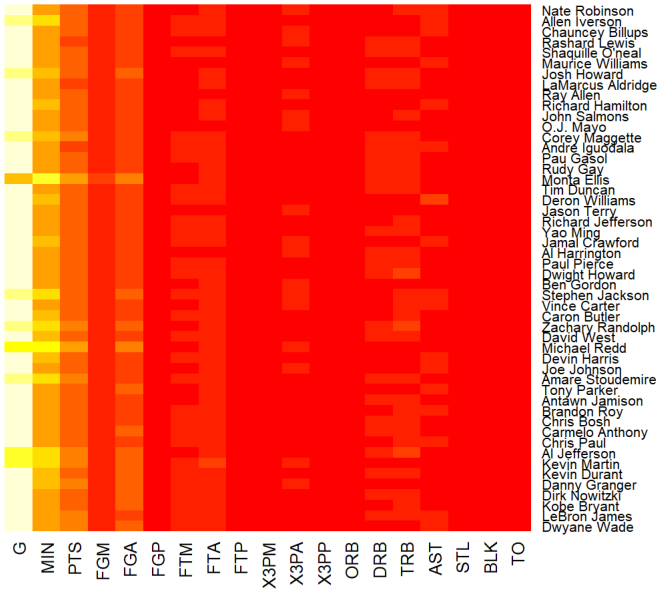
To create the heat map we will call the heat map function

```
heatmap(nba_matrix)
```



Without any paramaters we see that the heatmap created is very messy and confusing to read espicially the brackets on the X and Y axis. Let's start by removing them

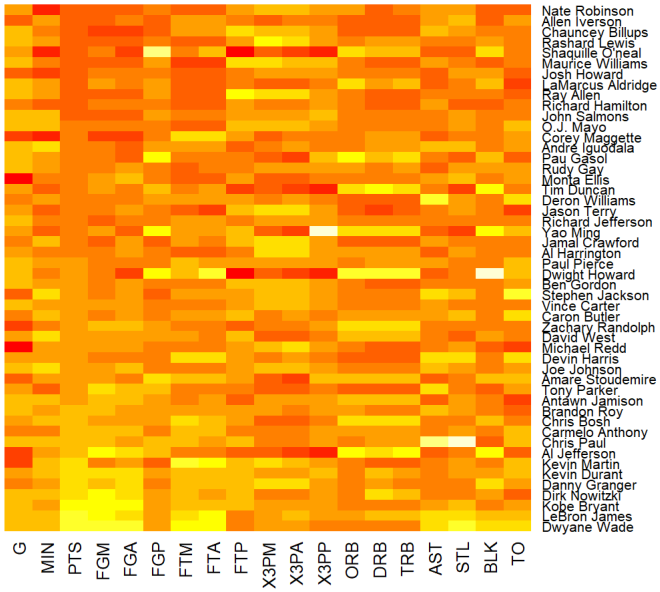
```
heatmap(nba_matrix, Rowv=NA, Colv=NA)
```



Now the heat map looks a little

better but the scale seems to be off as the whole heat map is a blob of red. that is because the default scale is by rows. For our case it would make more sense for the scale to be by the column as the category of the stat is the same

```
heatmap(nba_matrix, Rowv=NA, Colv=NA, scale="column")
```

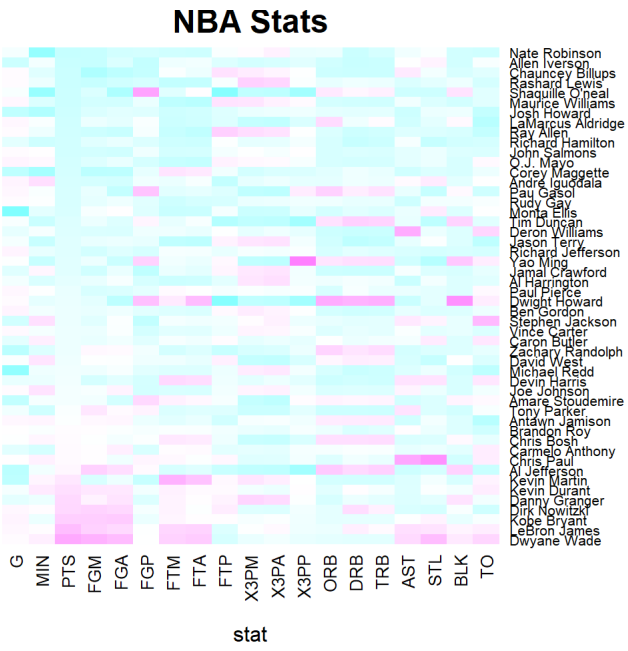


We can tell that the lighter the color the more of that stat a player has. But what if we wanted a dark color to represent the more that a player has we can change that by changing the color

```
heatmap(nba_matrix, Rowv=NA, Colv=NA, col = cm.colors(256), scale="column")
```

As with all graphs we should add a title and an axis to make it easier for the reader to understand and with heat map you can do this as well

```
heatmap(nba_matrix, Rowv=NA, Colv=NA, scale="column",xlab="stat", main="NBA Stats", col = cm.colors(256))
```



Using superheat package

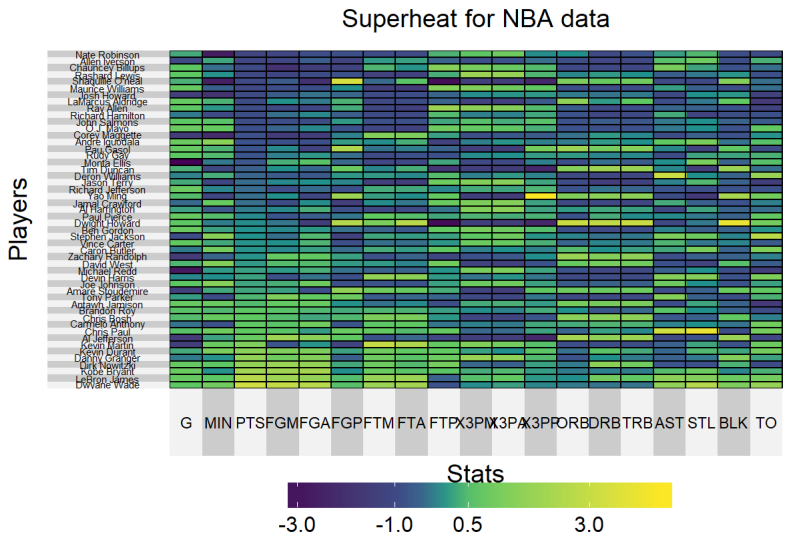
A better and more advance heat using the package super heat

```
#downloading and using these packages
#install.packages("superheat")
library(superheat)
```

```
## Warning: package 'superheat' was built under R version 3.4.3
```

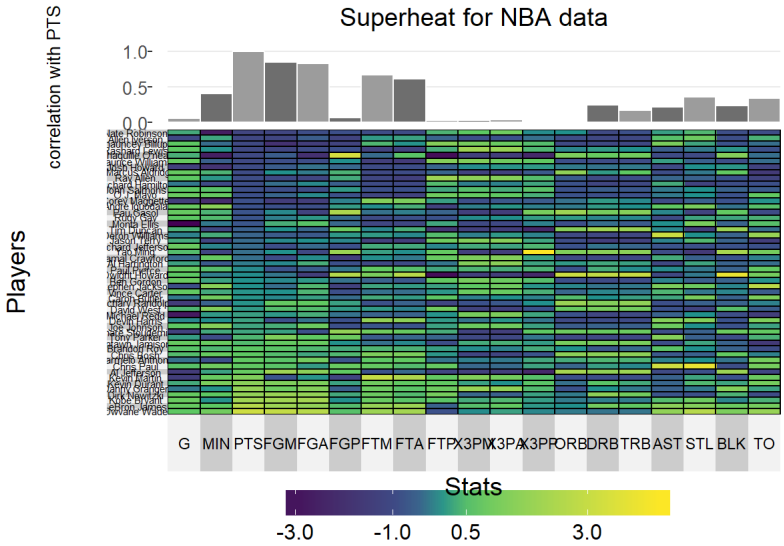
Lets use super heat to model the same heat map as before but with relative scaling

```
superheat(nba_matrix, #using the data
          scale=TRUE, #setting the scale for the colors
          left.label.text.size = 2,
          bottom.label.text.size = 3,
          title = "Superheat for NBA data",
          row.title = "Players",
          column.title = "Stats"
)
```



Now this looks similar to our old heat map and you can see that it is organized by points. Let's suppose that we think that the there is some correlation either with games or any other statistic. We can easily look at the correlation using heat map package at the same time as the heatmap itself

```
superheat(nba_matrix, #using the data
          scale=TRUE, #setting the scale for the colors
          left.label.text.size = 2,
          bottom.label.text.size = 3,
          yt = cor(nba_matrix)[, "PTS"],
          yt.plot.type = "bar",
          yt.axis.name = "correlation with PTS",
          title = "Superheat for NBA data",
          row.title = "Players",
          column.title = "Stats"
)
```



We can see that Field goals made and Field goals attempted has the highest correlation with points per game compared to the other statistics.

Conclusion

Heatmaps allow a way for users to look at a table visually to notice trends and patterns. With the help of the superheat package we are able to create a very good heatmap with even the ability to add correlation by the columns. If I was trying to find a stat that is most closely correlated with points per game I could see that using the super heat heat map from the colors that the field goals made colors matches very similarly with the points per game hinting a correlation. Then looking at the correlation plotted right above the heat map I am able to confirm that Field goals made is the closest correlation with points per game.

References

https://rlbarter.github.io/superheat/index.html http://flowingdata.com/2010/01/21/how-to-make-a-heatmap-a-quick-and-easy-solution/
https://www.r-graph-gallery.com/215-the-heatmap-function/
https://github.com/rlbarter/superheat
https://www.r-graph-gallery.com/heatmap/
https://stat.ethz.ch/R-manual/R-devel/library/stats/html/heatmap.html
https://github.com/adam-p/markdown-here/wiki/Markdown-Cheatsheet#links