Informatics for Engineering Management

EM 624 Fall 2018 – Final Project

analysis of NBA data

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Research Backgrounds:

The NBA (National Basketball Association) is widely considered to be the premier men's professional basketball league in the world. This project is trying to analyze NBA player data.

Dataset Description:

All of our data is from NBA China official website: https://www.basketball-reference.com/

Data Preparation:

I use python for doing Data Cleaning, Data analysis and Data Visualization. I used the code in the attachment to collect player information.

Methodology:

Before we load the data, we need to understand what each item means

Rk	Rank
Player	
Position	
Age	
MP	Minutes played per game
FG	Field goals per game
FGA	Field goal attempts per game
FG%	Field goal percentage
3P	3-point field goals per game
3PA	3-point field goal attempts per game
3P%	3-point field goal percentage
2P	2-point field goals per game
2PA	2-point field goal attempts per game
eFG%	Effective field goal percentage
FT	Free throws per game
FTA	Free throw attempts per game
FT%	Free throw percentage
ORB	Offensive rebounds per game
DRB	Defensive rebounds per game
TRB	Total rebounds per game
AST	Assists per game
STL	Steals per game
BLK	Blocks per game
TOV	Turnovers per game
PF	Personal fouls per game
Points	Points per game
Team	
GP	
MPG	Minutes per game
ORPM	Offensive real plus minus
DRPM	Defensive real plus minus
RPM	Real Plus minus
Wins_RPM	Winning game real plus minus
PIE	shows what % of game events did that player or team achieve
Pace	used to estimate the number of possessions a team has per game
W	
Salary_million	

Player data analysis section

Top 10 highest-paid players

	PLAYER	SALARY_MILLIONS	RPM	AGE	MPG
6	LeBron James	30.96	8.42	32	37.8
25	Mike Conley	26.54	4.47	29	33.2
67	Al Horford	26.54	1.82	30	32.3
0	Russell Westbrook	26.50	6.27	28	34.6
1	James Harden	26.50	4.81	27	36.4
10	Kevin Durant	26.50	5.74	28	33.4
64	Dirk Nowitzki	25.00	0.26	38	26.4
19	Carmelo Anthony	24.56	0.12	32	34.3
5	Damian Lillard	24.33	3.14	26	35.9
34	Dwyane Wade	23.20	-0.91	35	29.9

Lebron James was the highest-paid player of the season, and McConley got a big contract, but the star-studded salary list pales in the shade. Also on the list are Westbrook, Harden, Durant and others, Curry was not in the top 10 because his previous contract was too small.

Top 10 highest-efficiency value players

	PLAYER	RPM	SALARY_MILLIONS	AGE	MPG
6	LeBron James	8.42	30.96	32	37.8
37	Chris Paul	7.92	22.87	31	31.5
8	Stephen Curry	7.41	12.11	28	33.4
120	Draymond Green	7.14	15.33	26	32.5
7	Kawhi Leonard	7.08	17.64	25	33.4
44	Nikola Jokic	6.73	1.36	21	27.9
12	Jimmy Butler	6.62	17.55	27	37.0
66	Rudy Gobert	6.37	2.12	24	33.9
0	Russell Westbrook	6.27	26.50	28	34.6
10	Kevin Durant	5.74	26.50	28	33.4

James is the highest paid player in the league, plays without ambiguity, and ranks first in efficiency. Paul and Curry were close behind, with Warriors occupying three of the top 10 spots. It's worth noting that Denver's Jokic and Utah's Gobert, both earning modest salaries, have been among the league's top 10 most efficient players, setting the stage for their next big contracts.

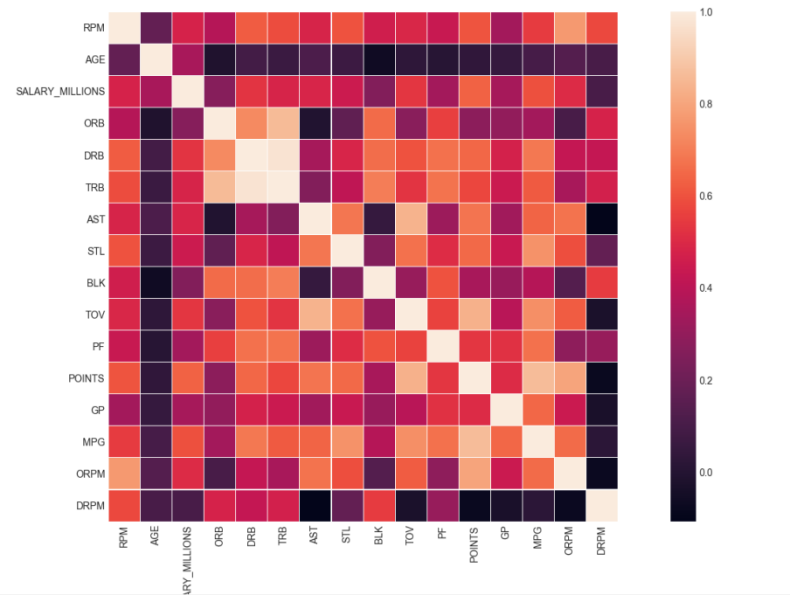
Top 10 highest-playing time player

	PLAYER	RPM	SALARY_MILLIONS	AGE	MPG
6	LeBron James	8.42	30.96	32	37.8
32	Zach LaVine	-2.97	2.24	21	37.2
14	Andrew Wiggins	-1.60	6.01	21	37.2
11	Karl-Anthony Towns	2.13	5.96	21	37.0
12	Jimmy Butler	6.62	17.55	27	37.0
17	John Wall	2.26	16.96	26	36.4
1	James Harden	4.81	26.50	27	36.4
3	Anthony Davis	4.35	22.12	23	36.1
5	Damian Lillard	3.14	24.33	26	35.9
13	Paul George	2.58	18.31	26	35.9

James rank the 1st in list again, followed by Lavine and Wiggins, with the Timberwolves making up three of the top 10.

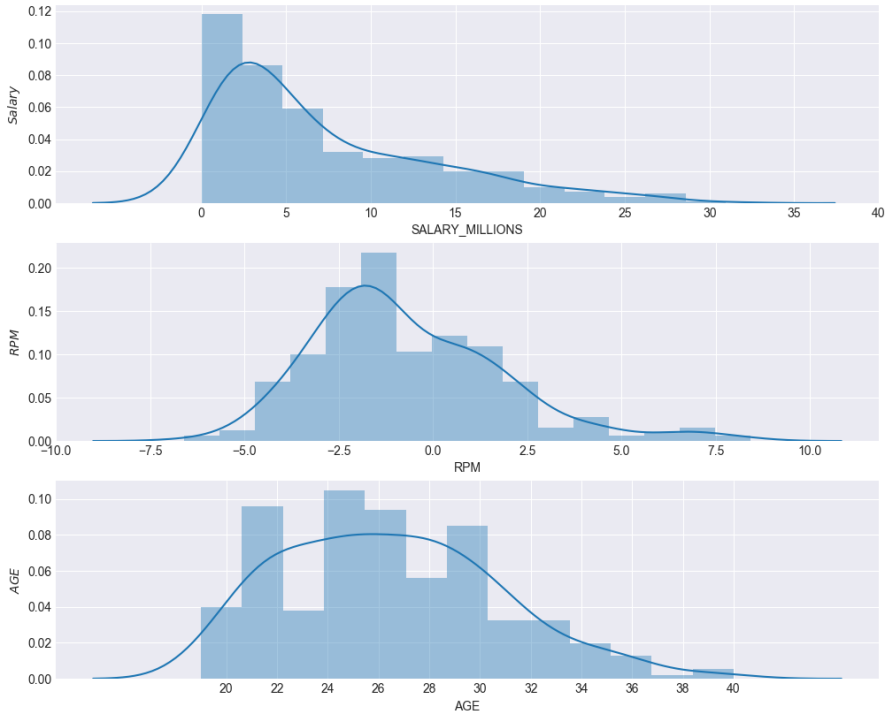
Correlation analysis of efficiency value

Among the numerous data, there is an item named "RPM", which indicates the efficiency value of players. This data reflects the contribution of players to the team's victory in the game when they are on the spot, and it can best reflect the comprehensive strength of players. Let's see how it relates to other data:



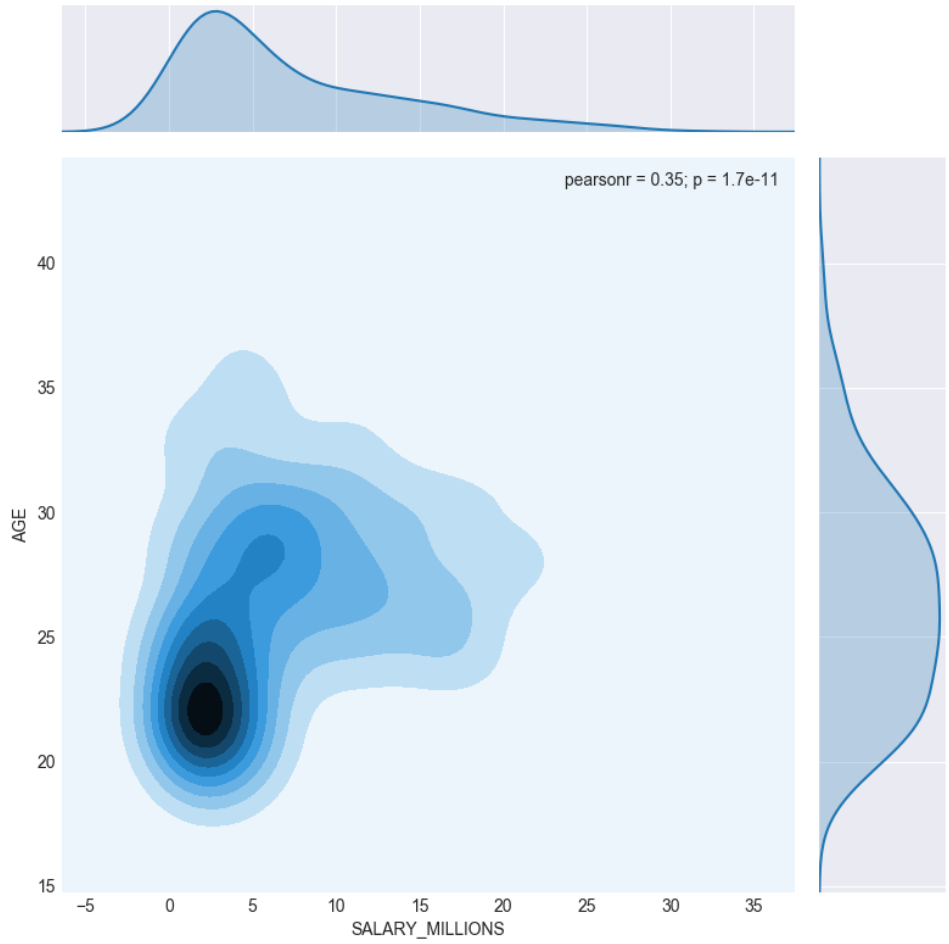
It can be seen from the heatmap of the correlation analysis that the RPM value has the weakest correlation with age, and it has the strongest correlation with the game technical data such as "attack efficiency value", "average score per game" and "average steals per game".

Seaborn method analyzes a single attribute



It can be seen that the age and efficiency values are more in line with the normal distribution, while the salary of players is more like a skewed distribution, with a smaller proportion of high-paid players.

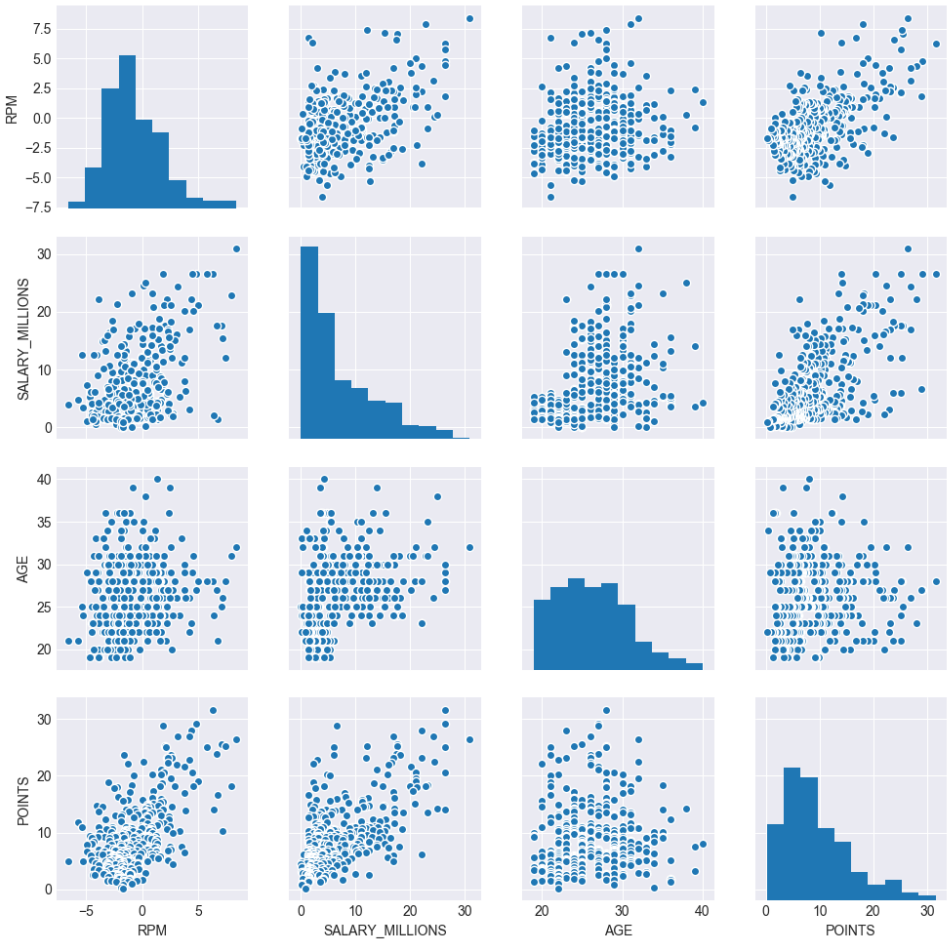
Seaborn method analyzes two attributes



The figure above shows the relationship between players' salary and age. We can generally feel the concentrated characteristics of age and salary.

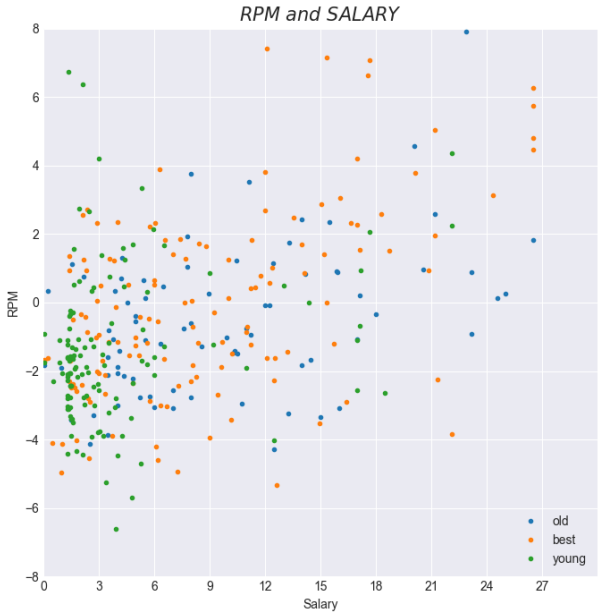
Seaborn method analyzes multivariate attributes

Let's first use the distplot plot in seaborn to see the distribution of player salary, efficiency value and age



The figure above shows the pin-wise correlation between the four variables of player salary, efficiency value, age and average score. The diagonals show the distribution diagram of players themselves, and we can see the correlation degree of different features from the trend of scatter. On the whole, the correlation of all dimensions is not very strong. Positive and negative values have a weak positive correlation with salary and field average score, while age has a weak correlation with other variables.

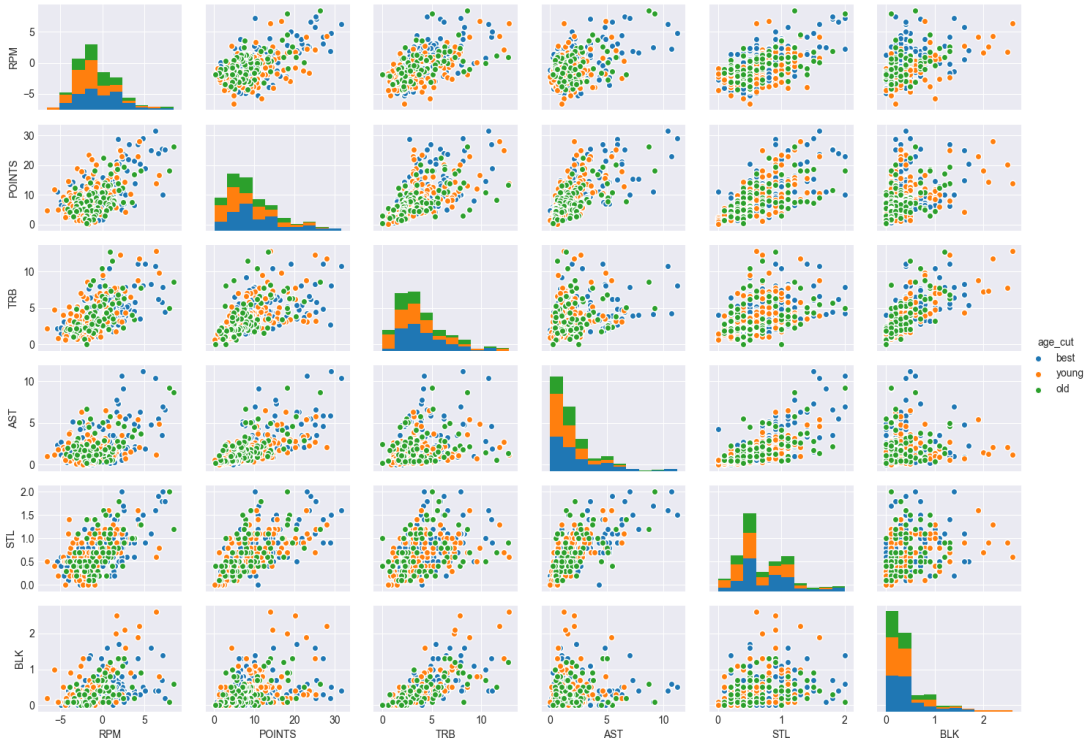
Then I divided the players into three generations according to their ages. Now that we have obtained the label of three generations of senior, middle and young players, let's take a look at the relationship between RPM (positive and negative) of players of different ages and salary before:



The x of the graph is player salary, and the y is efficiency value. It can be observed that:

- The vast majority of young players are paid less and the data is very concentrated. There are two outliers.
- The data of best age players and old players are relatively divergent, and the positive correlation between best age players' salary and efficiency value is stronger.
- Older players are older and less active, and slightly more "high-paid, low-efficiency" players.

Then I Use the method of the previous to see the distribution of the three generations of technology statistics:



Team data analysis

Team salary ranking

Group the data into teams, rank the average salary in descending order, and take a look at the top ten richest teams in the league:

	TEAM	SALARY_MILLIONS	RPM	PLAYER
9	CLE	17.095000	2.566667	6
18	GS	12.701429	3.478571	7
43	POR	9.730000	-1.260000	10
48	WSH	9.628889	-0.506667	9
39	ORL	9.490000	-2.066667	9
44	SA	9.347273	0.901818	11
26	MEM	8.705000	-0.854167	12
35	NY	8.612727	-1.182727	11
11	DAL	8.480000	-1.037143	7
24	LAC	8.266000	0.319000	10

- The cavaliers and warriors, who are both in the top two on this list for their high salaries, have been star-studded enough to fight their way through the playoffs to the division finals.
- The blazers, who finished third with 10 players on the list, are a dynamic addition. The health of the team's salary structure is crucial to the development of the team.

Age structure of the team

I ranked the players on the list in descending order according to the age group of the team. If the number of players on the list is the same, the players on the list will be ranked in descending order according to the efficiency value.

	TEAM	age_cut	SALARY_MILLIONS	RPM	PLAYER
14	CHA	young	3.835000	-0.362500	8
9	BOS	best	7.034286	0.647143	7
105	TOR	young	4.158571	-0.555714	7
11	BOS	young	2.337143	-1.821429	7
67	MIN	best	5.560000	0.828333	6
32	DEN	young	2.181667	-0.206667	6
36	DET	best	7.638333	-0.386667	6
30	DEN	best	8.336667	-0.586667	6
63	MIL	best	9.708333	-0.625000	6
70	NO	best	6.720000	-0.738333	6
69	MIN	young	3.766667	-1.578333	6
96	POR	young	7.038333	-1.850000	6
39	GS	best	14.400000	4.712000	5
98	SA	old	13.216000	1.040000	5
15	CHI	best	8.150000	0.318000	5

- The Hornets, at the top of the table, have eight young players but low efficiency.
- Boston Celtics is gorgeous, the best age players and young players a total of 14, who have high efficiency value.
- The young Timberwolves have six best age players and the old spurs have five older players

Conclusion

With the progress of science and technology, we can better record and analyze the data of basketball games, which enables us to better understand basketball and players, combining our professional knowledge and interests, and better enjoy the infinite charm of basketball games.