RPM with Neural Networks

Lancer Analytics – Saint Francis High School
Mountain View, CA

Real Plus-Minus (RPM)

1. Replaces traditional +/-
2. The predicted points advantage a player contributes per 100 possessions
3. Uses information from both offensive and defensive sides of the game
4. 21 NBA MVPs have been successfully predicted out of last 25 NBA seasons

Example

Plus/minus: 13.2
RPM: 3.90

VS.

Stats provided from ESPN (2015)

Plus/minus: 12.9
RPM: 11.37

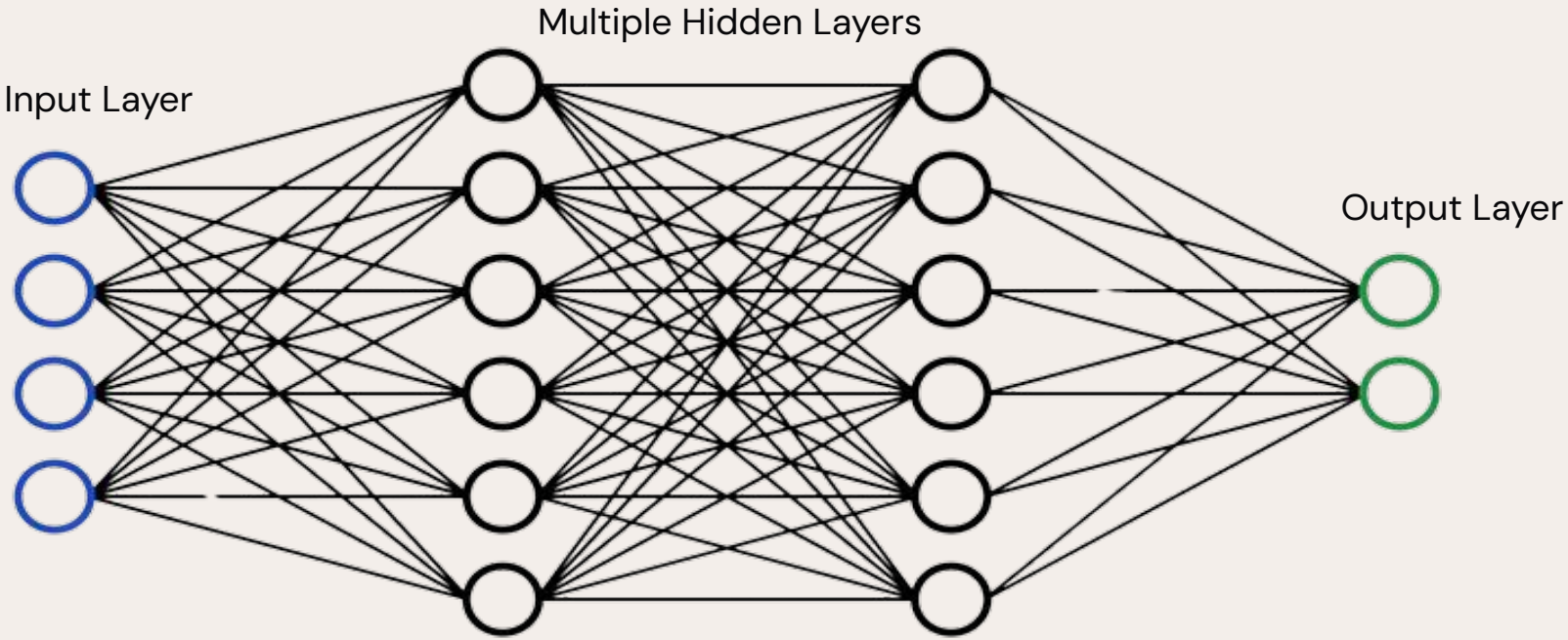
Present State

1. ESPN's formula for RPM has not been publicly disclosed
2. Analytics teams outside of the NBA cannot figure out their own player's RPM and are left with no way to holistically evaluate a player

Target State

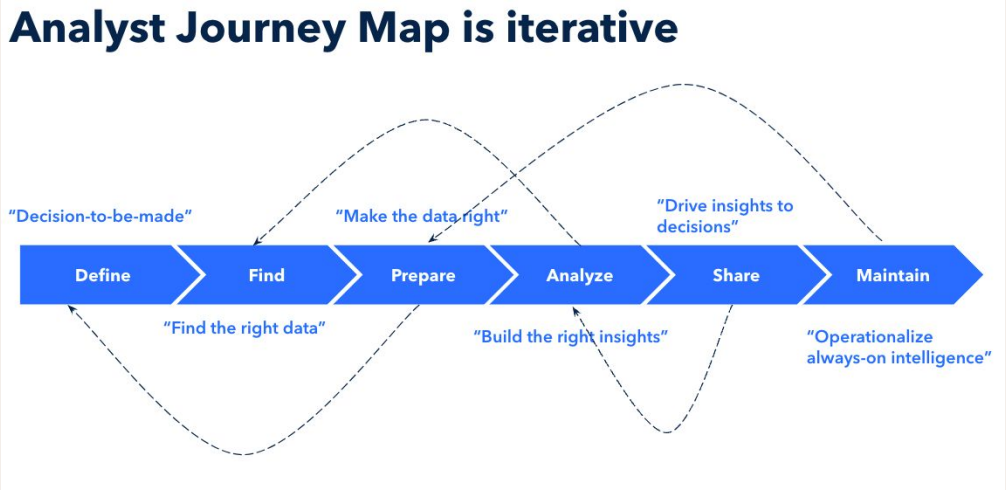
Empower high school and club programs with the ability to better evaluate player performance.

Neural Network



Methodology

1. Data collection
2. Cleaning Data/Pre-Processing
3. Train/Test Split of Data
4. Train Neural Network on data
5. Test Neural Network accuracy



What are our inputs?

- Basic Box statistics
  - P/A/R/S/B
  - FG/3P/FT%
- Advanced statistics
  - Win Shares
  - Def Rating
- Strength of player's team

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S
1	Name	G	MP	PER	TS%	3PAr	FTr	ORB%	DRB%	TRB%	AST%	STL%	BLK%	TOV%	USG%	OWS	DWS	WS	WS/48
2	Precious Achiu	55	1140	15.2	0.554	0.267	0.307	9.3	24.4	16.3	6.3	1.3	2.6	11.4	19.4	0.8	1.4	2.2	0.093
3	Steven Adams	42	1133	17.5	0.564	0.004	0.49	20.1	25.3	22.7	11.2	1.5	3.7	19.8	14.6	1.3	2.1	3.4	0.144
4	Bam Adebayo	75	2598	20.1	0.592	0.011	0.361	8	23.6	15.5	15.9	1.7	2.4	12.7	25.2	3.6	3.8	7.4	0.137
5	Ochai Agbaji	59	1209	9.5	0.561	0.591	0.179	3.9	6.9	5.4	7.5	0.6	1	9	15.8	0.9	0.4	1.3	0.053
6	Santi Aldama	77	1682	13.9	0.591	0.507	0.274	5.4	18	11.7	7.6	1.3	2.6	9.3	16	2.1	2.4	4.6	0.13
7	Nickeil Alexanc	59	884	11.6	0.565	0.539	0.203	1.9	10.5	6.3	16.7	1.7	2	14.6	17.9	0.3	0.8	1.1	0.062
8	Grayson Allen	72	1972	12.3	0.612	0.657	0.226	3.4	9	6.3	10.9	1.5	0.6	10.5	14.6	2.8	2.2	5.1	0.123
9	Jarrett Allen	68	2220	19.9	0.67	0.016	0.353	11.7	23.6	17.7	7.5	1.2	3.5	11.4	16.4	5.5	4	9.5	0.205
10	Jose Alvarado	61	1310	11.8	0.525	0.505	0.164	2.4	9.8	6.1	19.9	2.5	0.7	13.4	19.8	0.1	1.7	1.8	0.066
11	Kyle Anderson	69	1957	14.8	0.583	0.212	0.275	3.8	16.9	10.5	22.6	1.9	2.8	15.7	14.4	2.5	2.6	5.1	0.125
12	Giannis Anteto	63	2024	29	0.605	0.134	0.604	7.3	30	19.1	33.2	1.2	2.1	13.2	38.8	4.9	3.7	8.6	0.204
13	Thanasis Antet	37	206	6.7	0.458	0.174	0.478	7.9	14.1	11.1	9.3	0.7	1.2	17.7	13.8	-0.1	0.2	0.1	0.022
14	Cole Anthony	60	1552	16	0.57	0.338	0.279	3.4	17.6	10.5	22.9	1.2	1.9	11.7	21.5	2.1	1.7	3.7	0.116
15	OG Anunoby	67	2386	14.6	0.586	0.415	0.189	4.2	12.1	7.9	8	2.7	2	12.1	19.5	1.8	2.9	4.7	0.094
16	Ryan Arcidiaco	20	172	2.7	0.351	0.622	0	0	10	5	16.9	1.4	0	15.9	11.1	-0.2	0.1	-0.2	-0.043
17	Deni Avdija	76	2020	11.2	0.535	0.401	0.285	4.2	21.9	13.4	13.9	1.6	1.2	15.9	16.7	0	2.3	2.3	0.054
18	Deandre Ayton	67	2035	19.9	0.617	0.027	0.225	9.2	27.5	18.1	9.2	0.9	2.3	11	22.9	3.3	3	6.2	0.147
19	Udoka Azubuik	36	359	16.1	0.774	0	0.278	9.5	26.1	17.9	4.3	0.8	3.5	18.2	11.5	0.6	0.4	1	0.134
20	Marvin Bagley	42	990	17.2	0.587	0.173	0.283	10.2	20.2	15.1	5.9	0.9	2.7	9.7	20.4	1.3	0.7	2	0.095
21	Patrick Baldwir	31	226	11.3	0.546	0.771	0.055	0.5	18.6	9.7	6.9	1.3	1.6	9	22.8	-0.1	0.3	0.1	0.029
22	LaMelo Ball	36	1268	17.9	0.541	0.531	0.169	3.5	16.2	9.7	38.7	1.7	0.8	14.3	30	0.6	1.2	1.8	0.068
23	Mo Bamba	49	769	15.7	0.602	0.515	0.257	8.5	24.2	16.4	8.7	0.8	5.3	10.1	16.6	1.1	1.1	2.2	0.139
24	Paolo Banchero	72	2430	14.9	0.529	0.254	0.476	3.9	19.3	11.6	17.2	1.2	1.5	12.8	27.5	-0.3	2.6	2.4	0.047
25	Desmond Bane	58	1841	19.1	0.606	0.433	0.218	2.5	14.3	8.4	20.8	1.4	1.1	10.9	26.1	3.5	2.3	5.8	0.151
26	Dalano Banton	31	279	14.9	0.505	0.392	0.185	4.2	14.9	9.1	19.3	2.3	4.5	11.4	24.2	0	0.4	0.4	0.064
27	Dominick Barlo	28	408	12.4	0.567	0.047	0.291	11.9	15.6	13.7	7.6	1.2	3.8	13.4	11.3	0.5	0.2	0.7	0.082
28	Harrison Barne	82	2662	14.1	0.632	0.446	0.522	3.8	11.9	7.9	6.3	1	0.3	8.1	17.1	5.1	1.4	6.5	0.118
29	Scottie Barnes	77	2678	15.5	0.524	0.22	0.242	7.1	15.2	10.8	20	1.5	2.2	12	20.3	2.3	2.7	5	0.09
30	RJ Barrett	73	2475	12.9	0.531	0.332	0.333	2.7	13.7	8.2	12.4	0.6	0.6	10.8	26.2	0.5	1.8	2.2	0.043
31	Will Barton	56	993	10	0.493	0.495	0.129	1.7	13.5	7.7	15.4	1.4	1.1	11.1	18.9	-0.4	0.8	0.4	0.021
32	Charles Bassey	35	508	18.8	0.658	0.059	0.274	15.5	26.4	20.7	12.9	1.5	5.4	21.3	15.6	0.7	0.6	1.3	0.122
33	Keita Bates-Di	67	1452	14.9	0.609	0.305	0.323	4.7	14.3	9.3	9.8	1.5	1.1	9.5	16.7	2.1	0.6	2.7	0.089
34	Nicolas Batum	78	1709	11	0.594	0.832	0.126	4.1	15.4	9.8	9.4	1.5	2.3	11.1	11.5	1.7	1.9	3.6	0.101
35	Darius Bazley	43	616	13.1	0.524	0.29	0.383	5.8	18.5	12.1	8.3	1.7	5.1	11.2	16.4	0.1			

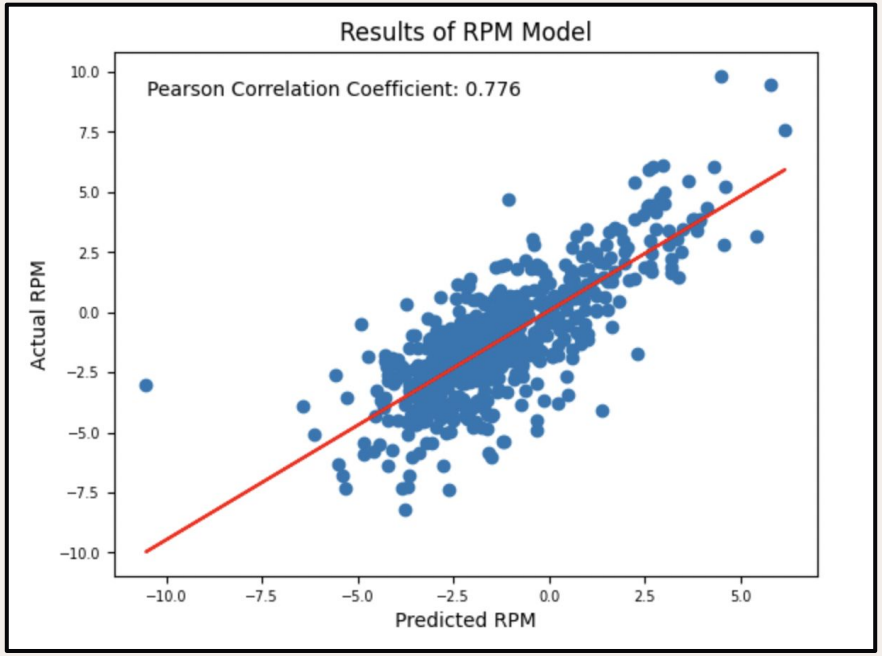
Advanced Statistics

Model Performance

1. After initial iteration we changed inputs:
   a. to include OREB, Minutes, & Usage
   b. to not include +/- and TOV%,
2. Accuracy– 0.6022 (MSE) fully accurate to ESPN RPM

$$\mathrm{MSE} = \frac{1}{N}\sum_{i=1}^{N}(y_i - \hat{y}_i)^2$$

Within 0.01 of actual	60.2%
Within 0.6	31.4%



Practical Applications

1. Player Evaluation
2. Lineup Optimization
3. Player Development
4. Game Strategy
5. Scouting Opponent
6. In-Game Adjustments/ Injury Impact

Caveats

Data Collection

Some advanced statistics such as offensive and defensive rating may not be available for all schools

Time

The lack of previous data over the years may hinder the model in creating accurate measures of RPM

Scalability

The transition from the NBA to high school can produce errors since play style/ability of players are different

Future Steps

- Recalculate with a structured database of high school basketball statistics to train the model.
- Data collection websites for high school teams in the future should improve to include more parameters applicable to our model.
    - Hudl - Box Score Statistics, etc.

Thanks for Listening!
Any Questions?

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