Predicting Season Outcomes for the NBA

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Outline

- Motivation
- Methods and Results
- Conclusion

Motivation

Prediction of game and season outcomes is interesting for

- Entertainment (betting)
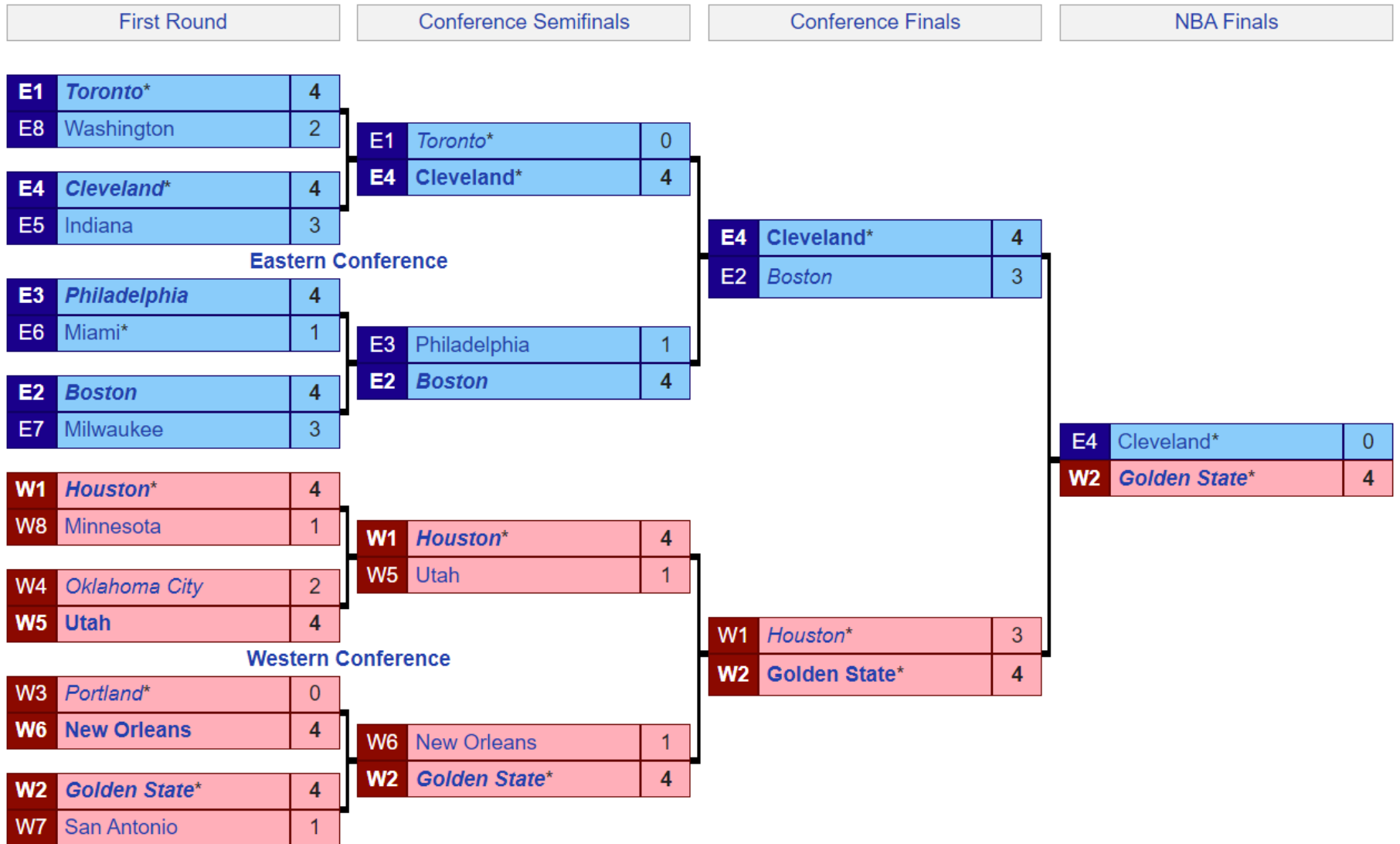- Creating a competitive team and implementing winning strategies

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Method

- Result: prediction scores for the different teams of reaching different stages in the playoffs

First Round	Conference Semifinals	Conference Finals	NBA Finals

Eastern Conference

	Team	Score
E1	*Toronto**	4
E8	Washington	2

	Team	Score
E4	*Cleveland**	4
E5	Indiana	3

	Team	Score
E1	*Toronto**	0
E4	Cleveland*	4

	Team	Score
E3	*Philadelphia*	4
E6	Miami*	1

	Team	Score
E2	*Boston*	4
E7	Milwaukee	3

	Team	Score
E3	Philadelphia	1
E2	*Boston*	4

	Team	Score
E4	Cleveland*	4
E2	*Boston*	3

Western Conference

	Team	Score
W1	*Houston**	4
W8	Minnesota	1

	Team	Score
W4	*Oklahoma City*	2
W5	Utah	4

	Team	Score
W1	*Houston**	4
W5	Utah	1

	Team	Score
W3	*Portland**	0
W6	New Orleans	4

	Team	Score
W2	*Golden State**	4
W7	San Antonio	1

	Team	Score
W6	New Orleans	1
W2	*Golden State**	4

	Team	Score
W1	Houston*	3
W2	Golden State*	4

NBA Finals

	Team	Score
E4	Cleveland*	0
W2	*Golden State**	4

From Wikipedia

Method

Season outcome prediction by

- Game outcome prediction

- Simulate season 10,000 times

Data

- https://www.basketball-reference.com/
- https://projects.fivethirtyeight.com/complete-history-of-the-nba (for ELO data)

- 10 NBA seasons: 2008-2009 to 2017-2018

Data – box score per game

Home team
Season stage
Games played in Regular Season
Wins in League Record
Losses in League Record
Games played in current play-offs round
Wins in current play-offs round
Losses in current play-offs round
Won Last game
Won Last Home game
Won Last Away game
Wins in previous 3, 8 and 15 games
Wins in previous 3, 8 and 15 home games
Wins in previous 3, 8 and 15 away games
Back-to-back game

Data – team performance in previous season

Previous season furthest stage
Previous season regular season record
Previous season offensive rating
Previous season defensive rating
Offense Four Factors: eFG%, TOV%, ORB%, FT/FGA
Defense Four Factors: eFG%, TOV%, DRB%, FT/FGA

Data – player performance in previous season

Staying players weighted mean eWS48

Signed players weighted mean eWS48

Leaving players weighted mean eWS48

Data – player salaries

Total Salary

Total Salary / Salary Cap Ratio

Top-1 player salary ratio

Top-2 players salary ratio

Top-3 players salary ratio

Top-5 players salary ratio

Data – draft picks

Previous season draft picks in positions 1 to 3

Previous season draft picks in positions 4 to 10

Previous season draft picks in positions 11 to 20

Previous season draft picks in positions 21 to end of 1st round

Previous season draft picks in 2nd round

Previous 3 seasons draft picks in positions 1 to 3

Previous 3 seasons draft picks in positions 4 to 10

Previous 3 seasons draft picks in positions 11 to 20

Previous 3 seasons draft picks in positions 21 to end of 1st round

Previous 3 seasons draft picks in 2nd round

Previous 5 seasons draft picks in positions 1 to 3

Previous 5 seasons draft picks in positions 4 to 10

Previous 5 seasons draft picks in positions 11 to 20

Previous 5 seasons draft picks in positions 21 to end of 1st round

Previous 5 seasons draft picks in 2nd round

Game outcome prediction

- 4 algorithms

  Logistic Regression

  Linear Support Vector Machines

  Multilayer Perceptron

  Random Forest

- Hyperparameter tuning
- Feature selection

Game outcome prediction

Accuracy of best version of

Logistic Regression: 68.58%

Linear Support Vector Machines: 68.18%

Multilayer Perceptron: 68.85%

Random Forest: 69.88%

RF top 50 features

- **Staying player performance**
- *Home team*
- Wins and losses current and previous season
- Wins, home wins, away wins last 15 games
- Total salary of a team, the percentage over the salary cap, the salary of the top-2 and top-3 players.
- Team performance previous year
- Leaving/Signed player performance

Season simulation

- 10 seasons

- Game outcome model trained on previous seasons

- Use actual schedule for regular season

- Update current season features after every simulated game

- No use of data of future seasons

- 10,000 simulations

Season simulation

Table 2: Predictions for the 2017-2018 season.

	Team	1st Round (Model)	Conf. Semifinals (Model)	Conf. Finals (Model)	NBA Finals (Model)	NBA Champion (Model)	Reality (furthest stage)	ELO season start	ELO season end
1	GSW	88.4	73.1	47.9	28.9	20.8	NBA champion	1752	1745
2	CLE	86.5	58.0	37.8	22.3	16.1	NBA finals	1650	1577
3	HOU	83.5	51.6	34.1	20.9	14.6	Conf. finals	1574	1704
4	TOR	85.5	56.1	36.9	20.8	10.4	Conf. semifinals	1532	1600
5	SAS	86.3	64.5	35.7	17.4	8.6	1st round	1617	1551
6	BOS	81.6	50.5	29.8	12.2	7.3	Conf. finals	1532	1580
7	NOP	79.8	57.0	29.8	9.6	4.1	Conf. semifinals	1488	1585
8	UTA	67.5	46.1	19.8	7.3	2.5	Conf. semifinals	1580	1663
9	OKC	65.9	30.8	15.6	6.0	2.2	1st round	1518	1611
10	POR	58.9	30.6	13.1	5.6	1.5	1st round	1531	1579
11	PHI	79.2	33.1	14.0	5.7	1.4	Conf. semifinals	1380	1641
12	WAS	59.0	26.1	12.4	4.8	1.2	1st round	1566	1499
13	MIA	86.6	37.5	13.5	4.4	1.2	1st round	1553	1497
14	IND	54.0	21.7	8.0	3.1	1.0	1st round	1503	1572
15	MIN	60.6	18.9	6.8	2.3	1.0	1st round	1474	1548

Season simulation

Our/ELO(/odds)

Season	1st Round	Conf. Semifinal	Conf. Final	NBA Final	NBA Champion
2008-2009	13/12	6/3	3/1	1/1	0/0/0.5*
2009-2010	13/13	6/4	3/2	1/1	1/1/1
2010-2011	12/10	3/2	1/0	0/0	0/0/0
2011-2012	13/11	5/5	3/2	1/1	1/0/1
2012-2013	14/12	5/6	3/2	2/2	1/0/1
2013-2014	12/11	5/5	4/3	2/2	0/0/0
2014-2015	12/11	4/4	0/1	0/0	0/0/0
2015-2016	12/12	5/4	2/2	1/1	0/0/0
2016-2017	13/13	5/3	3/3	2/1	1/0/1
2017-2018	15/13	7/4	2/2	2/2	1/1/1
Total	129/118	51/40	24/18	12/11	5/2/5.5
out of	160	80	40	20	10

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Conclusions

- Game outcome prediction that reached a mean accuracy of 69.88%

- Season outcome prediction equally successful in picking a Champion as the odds makers and outperforming ELO for all playoff rounds