

2019 Superbowl Score Predictions: New England Patriots versus Los Angeles Rams

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2/3/2019

Final Score Prediction and Outcome

Patriots Predicted Score

30

Rams Predicted Score

28

Patriots WIN!

How the Prediction was Made

Data Investigation

First step is to check the data for irregularities and possible outliers. A table of descriptive statistics is included. Only variable used later in the linear regression are included. Table of variables are split into two categories: Standard NFL game statistics, which include measurable statistics like Passing Yards, Rushing Yards, turnovers, etc...

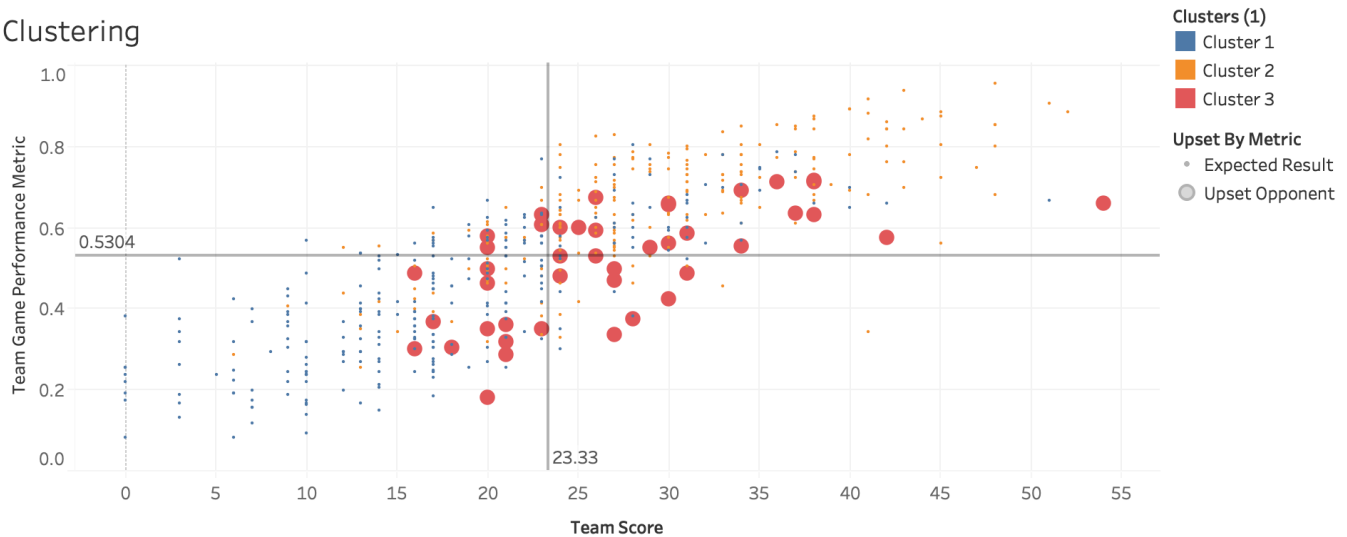
The next group of variables is comprised of engineered variables calculated from the Standard NFL game

	n	mean	sd	min	max	range
Group 1: Standard NFL Game Stats						
Team_Score	266	24.42	10.58	0.00	54.00	54.00
Team_Passing	266	242.55	83.83	20.00	462.00	442.00
Team_Rushing	266	117.41	55.14	14.00	323.00	309.00
Total_Yards	266	359.97	87.26	89.00	576.00	487.00
Team_Turnovers	266	1.25	1.15	0.00	5.00	5.00
Opponent_Score	266	22.24	9.82	0.00	51.00	51.00
Opponent_Passing	266	233.46	83.14	37.00	452.00	415.00
Opponent_Rushing	266	110.86	49.39	19.00	273.00	254.00
Opponent_Total_yards	266	344.32	89.02	119.00	576.00	457.00
Opponent_Turnovers	266	1.44	1.25	0.00	6.00	6.00
Net_yards	266	15.65	121.58	-271.00	350.00	621.00

statistics. The two groups of variables will be very similar, but the engineered variables have been tweaked slightly to improve accuracy. The engineered variables, also known as the performance metrics, are essentially a rank order percentile of all 32 teams performance. The main distinction in this new metric is that each category (e.g. Passing Yards) has been ranked against other teams' Passing Yard performance, but only for the same game number. Essentially, the calculation of performance is isolated game by game and improves the accuracy of performance per game for each of the 32 teams in the data set.

	n	mean	sd	min	max	range
Net_Score	266	2.18	14.20	-37.00	44.00	81.00
Net_Turnovers	266	0.20	1.78	-5.00	5.00	10.00
Group 2: Engineered Performance Metrics						
Score_Percentile	266	0.54	0.30	0.03	1.00	0.97
Pass_percentile	266	0.54	0.29	0.03	1.00	0.97
rush_percentile	266	0.52	0.30	0.03	1.00	0.97
TotalYards_Percentile	266	0.54	0.28	0.03	1.00	0.97
TO_percentile	266	0.63	0.30	0.00	0.97	0.97
OppScore_Percentile	266	0.47	0.28	0.03	1.00	0.97
OppPass_Percentile	266	0.50	0.29	0.03	1.00	0.97
OppRush_Percentile	266	0.50	0.28	0.03	1.00	0.97
OppTotYd_Percentile	266	0.49	0.29	0.03	1.00	0.97
OppTO_Percentile	266	0.58	0.32	0.00	0.97	0.97
team_game_performance_metric	266	0.55	0.19	0.09	0.96	0.86
opp_game_performance_metric	266	0.51	0.18	0.08	0.94	0.86
favored_by_metric	266	0.57	0.50	0.00	1.00	1.00
upset_by_metric	266	0.09	0.29	0.00	1.00	1.00

Clustering



Rolling Average (3 Game)

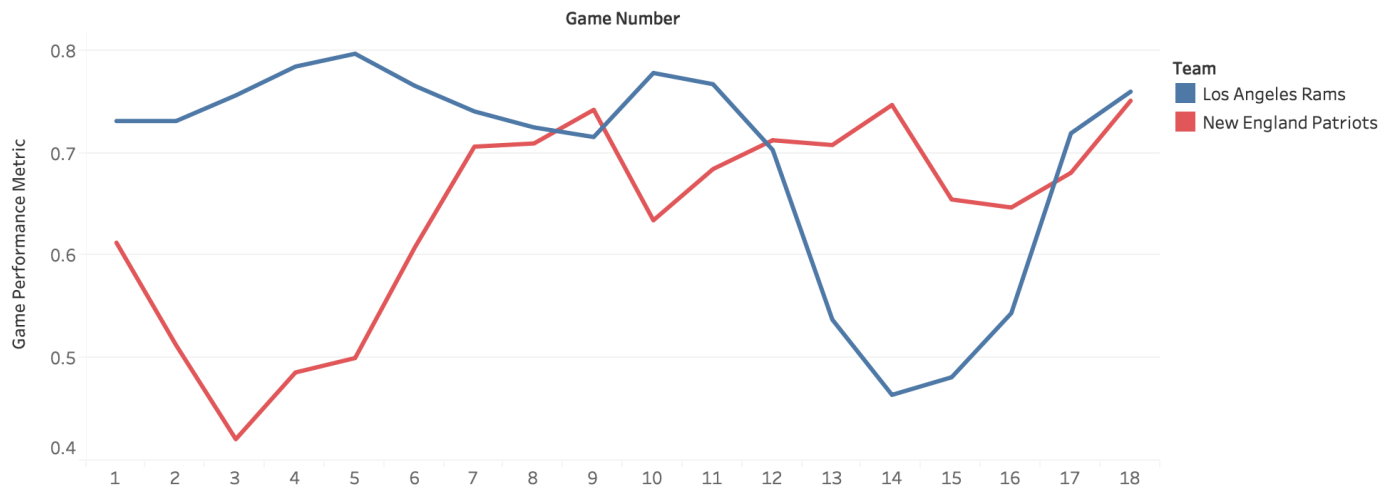


Figure 1 (top) shows a clustering of Team Score vs. Team Game Performance Metric. Color indicates the separation of games by clustering methods (3). Larger dots indicate a team was considered to pull off an upset. A majority of upset victories occur when the team has both better than average Team Score and better than average Team Performance Metric.

Regression Analysis

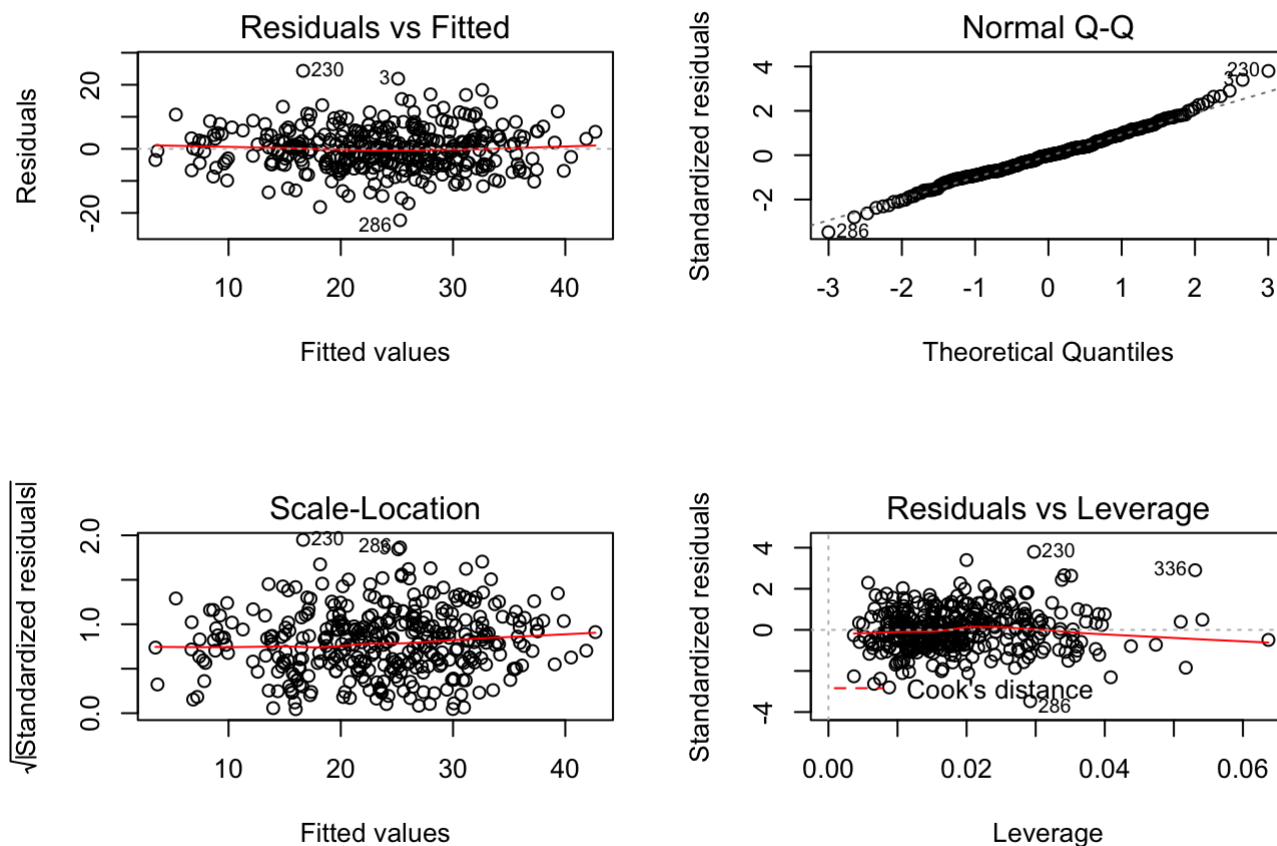
Linear Regression: Team Score

First Linear Model:

This linear regression model was constructed using standard NFL game stats (Team / Opponent Passing Yards, Team / Opponent Rushing Yards and Team / Opponent Turnovers).

Our first linear model is significant at a 95% confidence level with $p\text{-value} < 0.05$. The model performs moderately well, with an $R\text{-sq}$ value of 0.58. Model applied to both training and testing set. A summary of the predicted values from the testing set are as follows: 5.8722804, 16.54316, 22.7435863, 22.4122178, 27.1866602, 41.2806583

```
##
## Call:
## lm(formula = Team_Score ~ Team_Passing + Team_Rushing + Team_Turnovers +
##      Opponent_Passing + Opponent_Rushing + Opponent_Turnovers,
##      data = nfl_train[, 3:ncol(nfl_train)])
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -22.2795  -4.4540   0.0131   3.9736  24.3581
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)   -4.171919   2.207318  -1.890   0.0595 .
## Team_Passing    0.068186   0.004270  15.969 < 2e-16 ***
## Team_Rushing    0.085421   0.007068  12.085 < 2e-16 ***
## Team_Turnovers  -1.771832   0.303217  -5.843 1.13e-08 ***
## Opponent_Passing  0.008998   0.004347   2.070   0.0392 *
## Opponent_Rushing -0.007994   0.007160  -1.117   0.2649
## Opponent_Turnovers 1.954274   0.285382   6.848 3.18e-11 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 6.51 on 366 degrees of freedom
## Multiple R-squared:  0.581, Adjusted R-squared:  0.5741
## F-statistic: 84.59 on 6 and 366 DF, p-value: < 2.2e-16
```



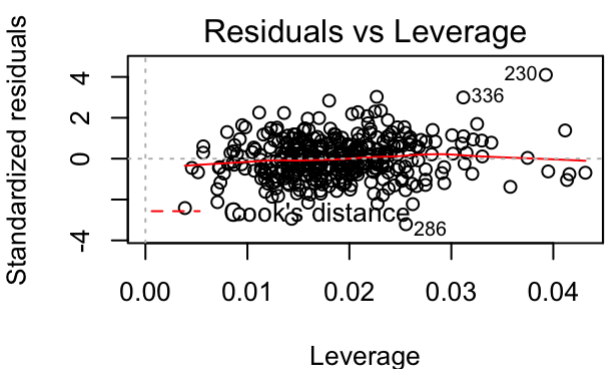
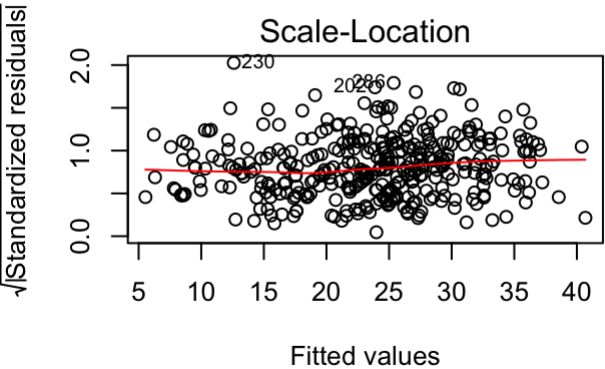
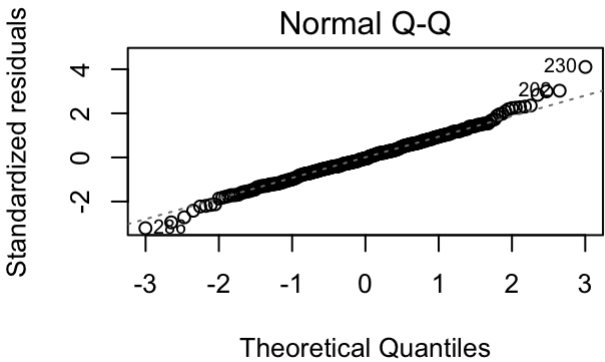
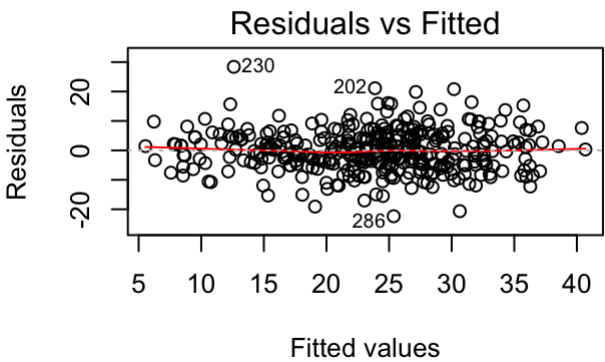
##	Min.	1st Qu.	Median	Mean	3rd Qu.	Max.
##	5.872	16.543	22.744	22.412	27.187	41.281

Second Linear Regression Model:

This linear regression model was constructed using engineered performance metrics (Team / Opponent Passing Performance, Team / Opponent Rushing Performance, Team / Opponent Turnover Performance)

Our second linear model is also significant at a 95% confidence level with p-value < 0.05. The second model performs slightly worse with an R-sq value of 0.51. This model was also applied to both the training and testing set. A summary of the predicted values from the testing set are as follows: 7.9654012, 17.1713334, 22.7200335, 22.1966684, 27.2658032, 37.3162411

```
##
## Call:
## lm(formula = Team_Score ~ Pass_percentile + rush_percentile +
##      TO_percentile + OppPass_Percentile + OppRush_Percentile +
##      OppTO_Percentile, data = nfl_train[, 3:ncol(nfl_train)])
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -22.3672  -4.3253  -0.3576   4.4332  28.3996
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)      6.655      2.080   3.199  0.00150 **
## Pass_percentile  17.360      1.317  13.180 < 2e-16 ***
## rush_percentile  14.602      1.404  10.400 < 2e-16 ***
## TO_percentile     5.640      1.262   4.467 1.06e-05 ***
## OppPass_Percentile  3.666      1.338   2.739  0.00646 **
## OppRush_Percentile -1.871      1.394  -1.342  0.18048
## OppTO_Percentile  -7.007      1.228  -5.704 2.42e-08 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 7.062 on 366 degrees of freedom
## Multiple R-squared:  0.507, Adjusted R-squared:  0.4989
## F-statistic: 62.73 on 6 and 366 DF, p-value: < 2.2e-16
```



##	Min.	1st Qu.	Median	Mean	3rd Qu.	Max.
##	7.965	17.171	22.720	22.197	27.266	37.316

“What-if” Scenarios

Score Conclusion

Game Day Scenarios

	Rams	Patriots
Group 1: Standard NFL Game Stats		
Offensive Yards: High Defensive Yards: low	38.41	37.64
Offensive Yards: High Defensive Yards: High	35.56	35.92
Offensive Yards: Low Defensive Yards: Low	19.52	22.35
Offensive Yards: Low Defensive Yards: High	16.68	20.63

	Rams	Patriots
Standard NFL Game Stats Model Scenarios Average	27.54	29.13
Model 1 RMSE	6.91	NA
Group 2: Engineered Performance Metrics		
Offense Performance: High Defense Performance: High	32.07	33.31
Offense Performance: High Defense Performance: Low	36.63	36.00
Offense Performance: Low Defense Performance: High	20.72	25.59
Offense Performance: Low Defense Performance: Low	25.28	28.27
Performance Metric Model Scenarios Average	28.67	30.79
Model 2 RMSE	7.57	NA
Overall Scenario Average	28.11	29.96
Overall RMSE	7.24	NA

Conclusion

I used two different linear models, both employing similar statistics that are either directly related or calculated from basic NFL game stats like Passing Yards or Rush Yards. I used both a training and testing set for both models to produce predicted values. From there, I ran separate scenarios for potential game outcomes. There were four separate scenarios for both the Los Angeles Rams and the New England Patriots:

- Good offensive day and good defensive day
- Good offensive day and bad defensive day
- Bad offensive day and good defensive day
- Bad offensive day and bad defensive day

A “good” day was calculated by taking the 75% quantile value of either the Rams or Patriots 2018 season statistics for each given category. A “Bad” day was similarly calculated by taking the 25% quantile value for the 2018 season. Once the values were determined, each corresponding value was entered into the multiple regression equation and solved for a predicted score. Values of β_i are the coefficients of the model and values of X_i are the values of the observation for each factor in the model. Y is the expected output of the model, i.e. the expected score for the given evidence.

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6$$

With two models, four scenarios for each team, the average of all eight predicted outcomes was taken and compared between teams. That is the prediction of final score, Patriots: 29.96 to Rams: 28.11 with a RSME of 7.24 points.

This method of calculating scores should be considered to be extremely conservative in nature. By taking the average values of relative “good” and “bad” game scenarios is not taking into account any extraordinary performances by either team.

DISCLAIMER: This is a preliminary report and in no way should be relied on for monetary gain. Secondary analysis recommended.