Analyze Results

Basketball Salaries Team

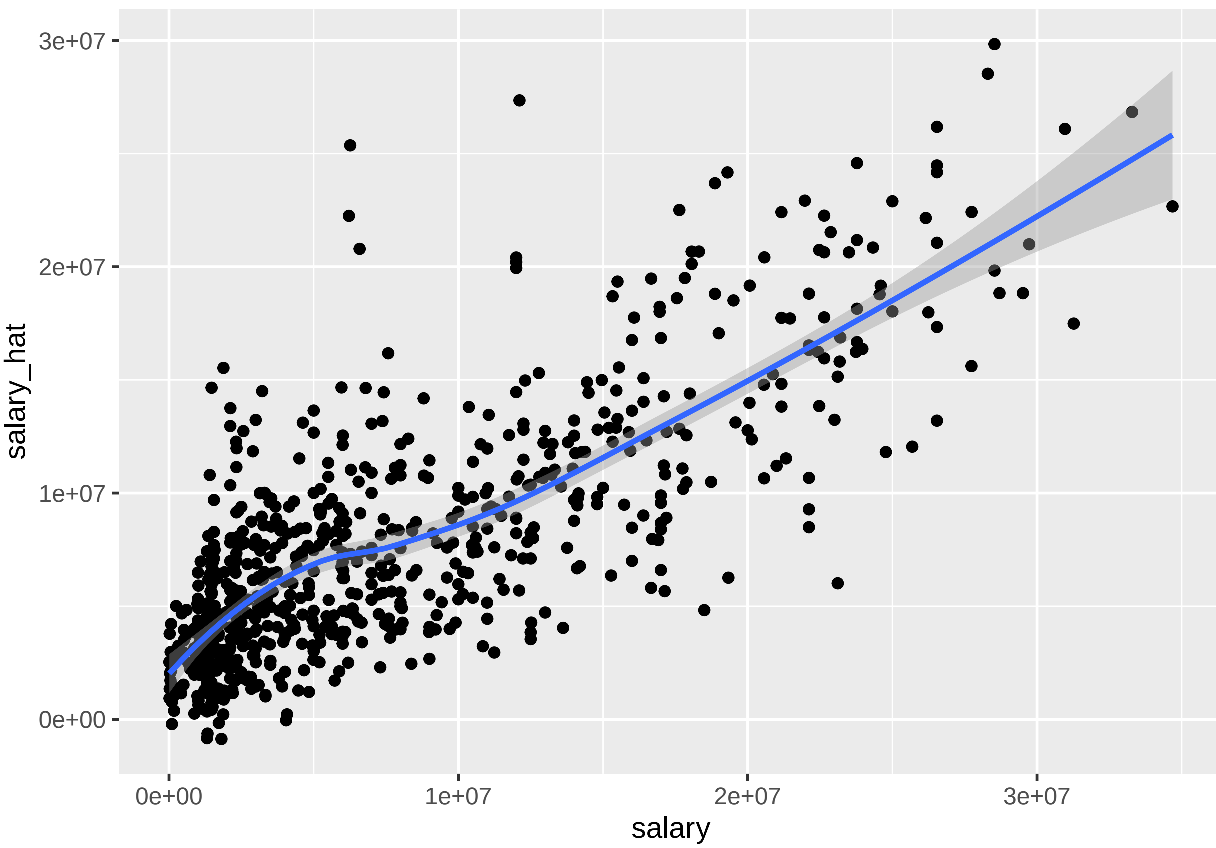
Load Results from Optimal Elasticnet Model

```
df <- read.csv('../data/predictions/elasticnet.csv')
head(df)
```

```
##             name year  salary salary_hat
## 1  aaron brooks 2016 2700000    3730156
## 2  aaron brooks 2017 2116955    3179791
## 3  aaron gordon 2016 4351320    8286105
## 4  aaron gordon 2017 5504420   10716914
## 5 adreian payne 2016 2022240    1125380
## 6    aj hammons 2017 1312611    1495870
```

Plot Salary vs Predicted Salary

```
library(ggplot2)
ggplot(df,aes(x=salary,y=salary_hat)) +
  geom_point() +
  geom_smooth()
```

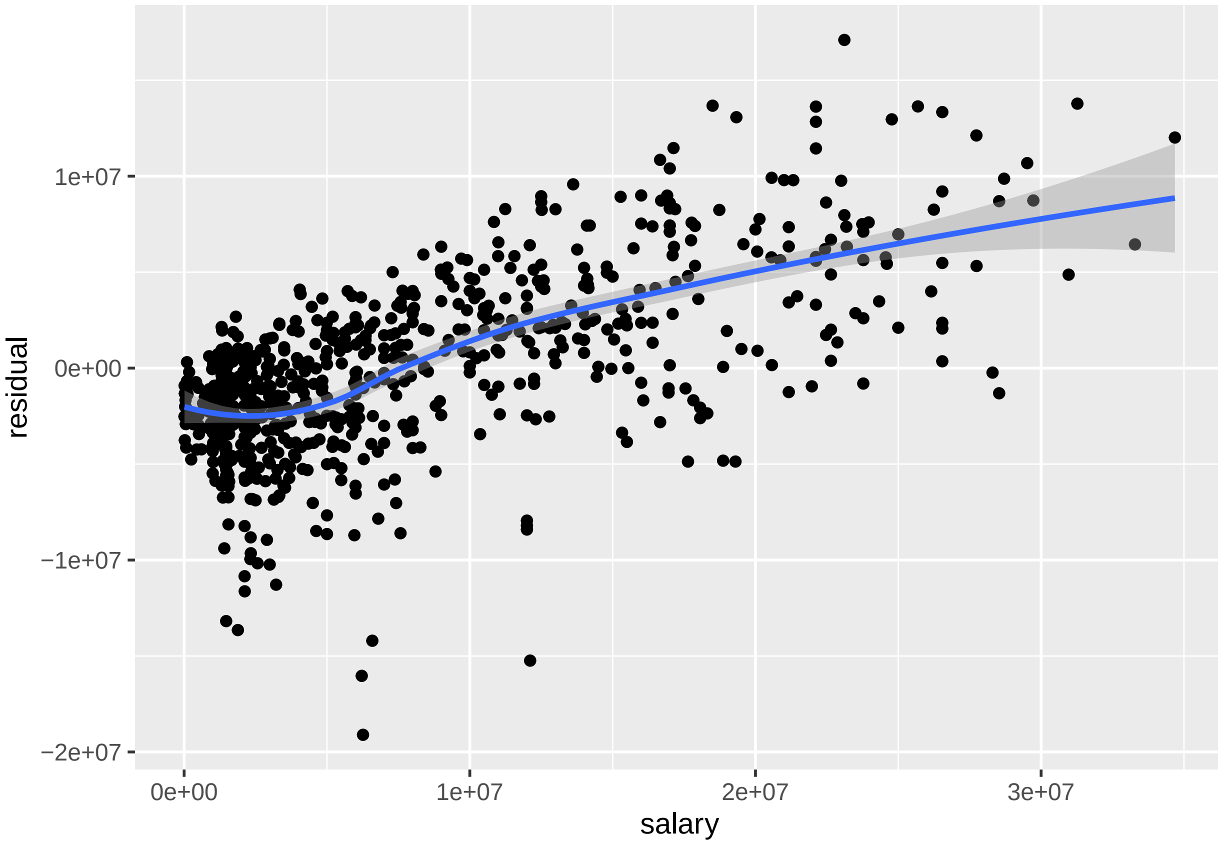



```
ggsave("../figures/enet_salary_vs_prediction_scatter.png", width=10, height=7)
```

Plot Salary vs Redisual Prediction

Appears to be a positive linear trend between the salary and residuals.
Thus, the optimal elasticnet model tends to underestimate players with higher salaries.

```
library(ggplot2)
residual <- df$salary - df$salary_hat
ggplot(df, aes(x=salary,y=residual)) +
  geom_point() +
  geom_smooth()
```




```
ggsave("../figures/enet_salary_vs_residual_scatter.png", width=10, height=7)
```

Underrated Players in 2016

An underrated player is any player who should be making 50% more
$\hat{salary} - salary > \frac{1}{2}salary$
Players who our model classifies as underrated tend to get higher salaries the next year

```
# get underrated players in 2016
df_underrated_2016 <- df[
  ((df$salary_hat-df$salary) > (df$salary/2)) &
  df$year==2016,]
# link with 2017 stats
df_underrated_2017 <- df[(df$name%in%df_underrated_2016$name)&(df$year==2017),]
df_underrated <- merge(df_underrated_2016,df_underrated_2017,all.x=F,all.y=F,by='name')
names(df_underrated) <- c('name','2016','salary_2016','salary_hat_2016','2017','salary_2017','salary_hat_2017')
df_underrated <- df_underrated[,c('name','salary_2016','salary_hat_2016','salary_2017','salary_hat_2017')]
df_underrated
```

```
##                      name salary_2016 salary_hat_2016 salary_2017
## 1            aaron gordon     4351320       8286104.8     5504420
## 2        anderson varejao     1984005       4735387.9     1913345
## 3          andre roberson     2183072       5797383.2     9259259
## 4          andrew wiggins     6006600      12541957.7     7574322
## 5            bobby portis     1453680       3117239.5     1516320
## 6        bojan bogdanovic     3730653       6499120.2    10500000
```

```
## 7               cj mccollum    3219579      14503449.7    23962573
## 8                  cj miles    4583450       7388745.7     7936509
## 9              clint capela    1296240       5114481.5     2334520
## 10          darren collison    5229454       9055869.1    10000000
## 11               david west    1551659       9693036.1     2328652
## 12             delon wright    1577280       2366257.0     1645200
## 13          dennis schroder    2708582       6860532.1    15500000
## 14             devin booker    2223600       5362632.1     2319360
## 15             dion waiters    2898000       6151961.4    11000000
## 16           doug mcdermott    2483040       5660426.2     3294994
## 17            elfrid payton    2613600       7793728.1     3332340
## 18          emmanuel mudiay    3241800       6205590.9     3381480
## 19           frank kaminsky    2730000       5289751.4     2847600
## 20              gary harris    1655880       6225110.1     2550055
## 21              george hill    8000000      12163220.1    20000000
## 22    giannis antetokounmpo    2995421      13231011.4    22471910
## 23             gorgui dieng    2348783       7738226.0    14112360
## 24            isaiah canaan    1015696       4916526.2      200000
## 25           isaiah thomas    6587132      20791520.6     6261395
## 26                ish smith    6000000       9098922.9     6000000
## 27            jabari parker    5374320       8449932.1     6782392
## 28              jae crowder    6286408      11028598.6     6796117
## 29            jahlil okafor    4788840       7670507.3     4995120
## 30             jarell eddie     175000        380587.1       17224
## 31             jarrett jack    1551659       7700472.4     2328652
## 32              jason terry    1551659       4657437.1     2328652
## 33             javale mcgee    1403611       4245730.8     2116955
## 34              jeff teague    8800000      14185938.8    19000000
## 35              jeff withey    1015696       2839837.5     1577320
## 36             jerami grant     980431       5104947.7     1524305
## 37                 jj barea    4096950       8211377.8     3903900
## 38                jj redick    7377500      13180799.4    23000000
## 39        joffrey lauvergne    1709720       4661511.9     1524305
## 40         jonathon simmons     874636       2956668.4     6300000
## 41             josh huestis    1191480       3969558.7     1471382
## 42          josh richardson     874636       2145132.8     1471382
## 43            julius randle    3267120       8574670.6     4149242
## 44           justin holiday    1015696       2963229.5     4615385
## 45          justise winslow    2593440       5179143.0     2705040
## 46             jusuf nurkic    1921320       3065890.6     2947305
## 47       karl anthony towns    5960160      14666696.1     6216840
## 48             kelly olynyk    3094014       6291168.4    10607169
## 49             kemba walker   12000000      20410535.3    12000000
## 50 kentavious caldwell pope    3678319       9404962.4    17745894
## 51       kristaps porzingis    4317720       9630442.9     4503600
## 52            kyle anderson    1192080       3360877.2     2151704
## 53              kyle korver    5239437      10183482.6     7000000
## 54               kyle lowry   12000000      20204144.3    28703704
## 55             lou williams    7000000      10902031.6     7000000
## 56            marcus morris    4625000      13111574.3     5000000
## 57             marcus smart    3578880       5644722.3     4538020
## 58        marreese speights    1403611       3666717.4     2116955
## 59            mason plumlee    2328530      11146506.1    14041096
## 60          michael beasley    1403611       3405414.8     2116955
## 61  michael carter williams    3183526       6173725.7     2700000
## 62             myles turner    2463840       5056516.9     2569920
## 63             nerlens noel    4384490       7195523.2     4187599
## 64             nikola jokic    1358500       8103074.3     1471382
## 65            norman powell     874636       4010833.8     1471382
## 66              omri casspi    3000000       7961592.4     2106470
## 67              paul pierce    3500000       7156731.7     1096080
## 68                pj tucker    5300000       8229036.4     7590035
## 69         rakeem christmas    1052342       2307327.7      172552
## 70                raul neto     937800       3826166.3     1471382
```

```
## 71           raymond felton     1551659       8284117.5     2328652
## 72        richard jefferson     2500000       5181166.1     2500000
## 73         robert covington     1015696       5909399.1    16698103
## 74              rodney hood     1406520      10797855.3     2386864
## 75  rondae hollis jefferson     1395600       3762800.2     1471382
## 76              rudy gobert     2121288      13751283.4    21974719
## 77              salah mejri      874636       3144578.7     1471382
## 78          sean kilpatrick      980431       2674652.0     1524305
## 79         shabazz muhammad     3046299       5431883.5     1577230
## 80             shelvin mack     2433334       5141093.6     6000000
## 81        spencer dinwiddie      726672       2228495.3     1524305
## 82            stephen curry    12112359      27352365.8    34682550
## 83             steven adams     3140517       9991738.3    22471910
## 84           thabo sefolosha     3850000       8346980.1     5250000
## 85                tj warren     2128920       3544866.5     3152931
## 86               tony snell     2368327       4040666.9     9821429
## 87               trey lyles     2340600       4433565.8     2441400
## 88           victor oladipo     6552960      10501995.5    21000000
## 89              will barton     3533333       9762814.1     3533333
## 90      willie cauley stein     3551160       6444626.7     3704160
## 91              zach lavine     2240880       7998179.6     3202217
## 92            zaza pachulia     2898000      11845725.8     3477600
##    salary_hat_2017
## 1       10716913.8
## 2        6498688.3
## 3        7794637.6
## 4       16177279.2
## 5        3768595.2
## 6        9833913.3
## 7       16369999.9
## 8        8358124.9
## 9       11980005.9
## 10       9178202.9
## 11       7339153.9
## 12       2316848.3
## 13      13273554.7
## 14      12270237.2
## 15       9295510.5
## 16       7698529.4
## 17       9961869.6
## 18       5591950.2
## 19       8737618.0
## 20       8312533.9
## 21      12772197.7
## 22      20743921.8
## 23       9455761.2
## 24       1084718.8
## 25      25366136.3
## 26       8098892.2
## 27      11137029.8
## 28      14641353.1
## 29       7476043.5
## 30        929282.4
## 31       2286364.1
## 32       5654844.9
## 33       7816633.1
## 34      17062262.2
## 35       2426601.6
## 36       4262138.2
## 37       8552614.0
## 38      13236926.3
## 39       3461134.7
## 40       5580168.4
## 41       4321017.6
```

```
## 42       6007926.0
## 43       9402205.1
## 44       4629632.2
## 45       4692807.8
## 46       7703827.9
## 47      22250990.1
## 48       8031695.6
## 49      19945218.8
## 50      11085004.6
## 51      11529715.6
## 52       2583328.5
## 53      10005116.9
## 54      18835023.8
## 55      13064185.7
## 56      12671675.4
## 57       8428998.6
## 58       5709406.8
## 59      11760572.6
## 60       5214431.1
## 61       3785920.9
## 62      12737848.8
## 63       5498705.6
## 64      14653690.1
## 65       6108513.1
## 66       4054661.7
## 67       6973136.0
## 68       6380338.6
## 69       2543977.9
## 70        426385.8
## 71       5224175.0
## 72       7727971.5
## 73       7968749.0
## 74       9208872.2
## 75       7063077.4
## 76      22923156.7
## 77       3345920.2
## 78       6978799.8
## 79       5013230.7
## 80       3683850.5
## 81       3483574.5
## 82      22668263.3
## 83      13844144.6
## 84       9186163.8
## 85       7458134.3
## 86       7810897.8
## 87       3516974.4
## 88      11202922.6
## 89       8520207.9
## 90       8870964.3
## 91       8957523.8
## 92       9598059.8
```

```r
# calculate percent increase factor
sal_factor_2016 = .25
p_increase <- 100*mean(
  (df_underrated$salary_2017-df_underrated$salary_2016) > sal_factor_2016*df_underrated$salary_2016)
sprintf(
  'Percent of underrated players in 2016 whose salary increased by more than 25%% for 2017: %.1f%%',p_increase)
```

```
## [1] "Percent of underrated players in 2016 whose salary increased by more than 25% for 2017: 62.0%"
```

Overrated Players in 2016

An overrated player is any player who should be making 50% more
$salary - \hat{salary} > \frac{1}{2}salary$
Hard for players who have high salaries to get a salary cut despite lacking stats

```
df_overrated_216 <- df[
  ((df$salary-df$salary_hat) > (df$salary/2)) &
  df$year==2016,]
# link with 2017 stats
df_overrated_2017 <- df[(df$name%in%df_overrated_216$name)&(df$year==2017),]
df_overrated <- merge(df_overrated_216,df_overrated_2017,all.x=F,all.y=F,by='name')
names(df_overrated) <- c('name','2016','salary_2016','salary_hat_2016','2017','salary_2017','salary_hat_2017')
df_overrated <- df_overrated[,c('name','salary_2016','salary_hat_2016','salary_2017','salary_hat_2017')]
df_overrated
```

```
##                     name salary_2016 salary_hat_2016 salary_2017
## 1           allen crabbe    18500000       4826359.9    19332500
## 2          austin rivers    11000000       4444805.5    11825000
## 3           bradley beal    22116750       8490691.4    23775506
## 4       chandler parsons    22116750      10671332.6    23112004
## 5           cole aldrich     7643979       3609821.7     7300000
## 6        demarre carroll    14200000       6769843.2    14800000
## 7          dwight powell     8375000       2455833.5     9003125
## 8        harrison barnes    22116750       9281186.3    23112004
## 9           iman shumpert     9700000       3994809.8    10337079
## 10            joakim noah    17000000       8393785.7    17765000
## 11            john henson    12517606       4276013.1    11422536
## 12             jon leuer    10991957       5157916.2    10497319
## 13           kevon looney     1182840        451297.3     1471382
## 14          kj mcdaniels     3333333       1013608.2      100000
## 15          kyle singler     4837500       1211564.5     4666500
## 16          mario hezonja     3909840       1454530.1     4078320
## 17      maurice harkless     8988764       3857698.1    10162922
## 18        meyers leonard     9213484       3971522.2     9904495
## 19 michael kidd gilchrist    13000000       4720726.3    13000000
## 20            mike conley    26540100      13199859.9    28530608
## 21         miles plumlee    12500000       3849374.0    12500000
## 22        nemanja bjelica     3800000       1814264.4     3949999
## 23        pat connaughton      874636        255027.1     1471382
## 24         rashad vaughn     1811040       -866999.7     1889040
## 25            sam dekker     1720560       -160575.3     1794600
## 26          solomon hill    11241218       2953446.4    12236535
## 27           tarik black     6191000       2502750.3     3290000
## 28        timofey mozgov    16000000       7002922.3    15280000
## 29         trevor booker     9250000       4605976.8     9125000
## 30          troy daniels     3332940       1080160.7     3408520
## 31          tyler zeller     8000000       3979985.2     1709538
##    salary_hat_2017
## 1        6259010.6
## 2        7250777.4
## 3       16673157.2
## 4        6012393.7
## 5        2297919.6
## 6        9827352.9
## 7        4086057.0
## 8       15143129.4
## 9        6458411.9
## 10      10186031.6
## 11       6202557.1
## 12       8525008.0
## 13        465991.2
## 14        768466.9
## 15       2169666.7
```

```
## 16        219604.2
## 17       6521070.7
## 18       4274749.9
## 19      10893707.4
## 20      19832043.2
## 21       3544135.9
## 22       3426925.7
## 23        601458.5
## 24        875860.4
## 25       4256985.8
## 26       7109339.3
## 27       3436066.5
## 28       6354677.0
## 29       8216626.0
## 30       4127478.8
## 31       3084342.7
```

```r
# calculate percent decrease factor
sal_factor_2016 = .0
p_decrease<- 100*mean(
  (df_overrated$salary_2016-df_overrated$salary_2017) > sal_factor_2016*df_overrated$salary_2016)
sprintf(
  'Percent of overrated players in 2016 whose salary decreased by more than 25%% for 2017: %.1f%%',p_decrease)
```

```
## [1] "Percent of overrated players in 2016 whose salary decreased by more than 25% for 2017: 29.0%"
```