Practice2

2024-02-19

R Markdown

This is an R Markdown document. Markdown is a simple formatting syntax for authoring HTML, PDF, and MS Word documents. For more details on using R Markdown see http://rmarkdown.rstudio.com.

When you click the **Knit** button a document will be generated that includes both content as well as the output of any embedded R code chunks within the document. You can embed an R code chunk like this:

```
library(readr)
library(dplyr)
```

```
##
## Attaching package: 'dplyr'
```

```
## The following objects are masked from 'package:stats':
##
##     filter, lag
```

```
## The following objects are masked from 'package:base':
##
##     intersect, setdiff, setequal, union
```

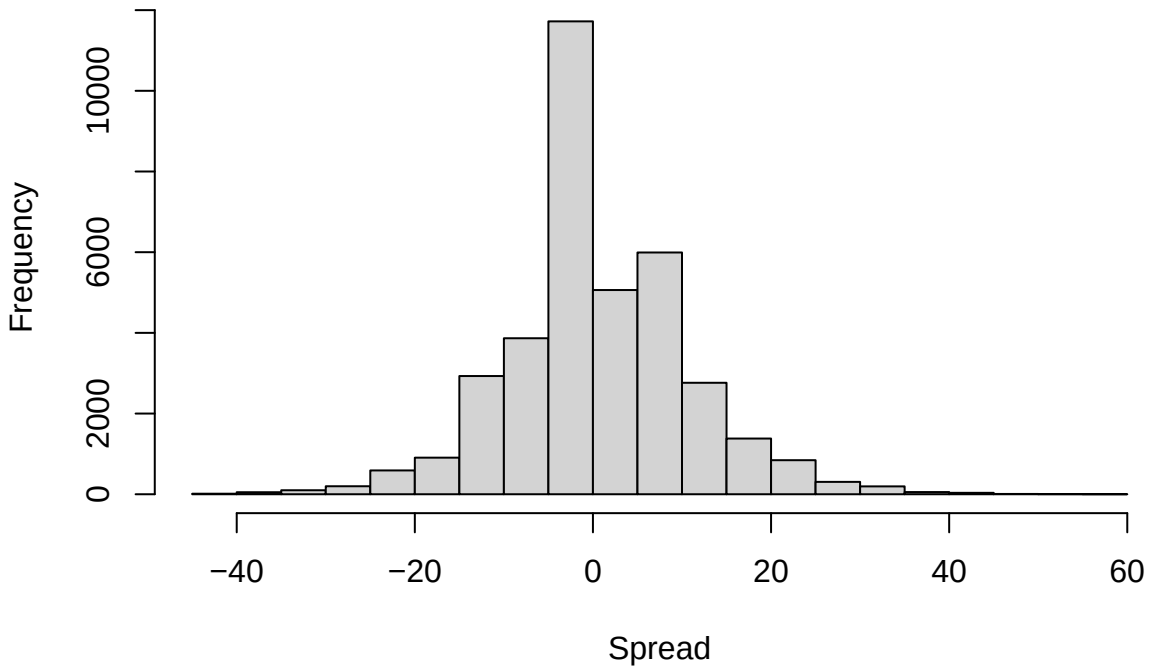
Linear Regression

```
kicking = read_csv("/Users/hannahbrown/Desktop/Sports Analytics/Practice2/kicking.csv")
```

```
## Rows: 37022 Columns: 13
## -- Column specification --------------------------------------------------------
## Delimiter: ","
## chr (7): home_team, away_team, possession_team, nonpossession_team, play_typ...
## dbl (6): game_id, yardline, home_score_pre, visiting_score_pre, scored, quarter
##
## i Use `spec()` to retrieve the full column specification for this data.
## i Specify the column types or set `show_col_types = FALSE` to quiet this message.
```

```
# creating a new variable called spread calculated from home_score_pre - visiting_score_pre
kicking <- mutate(kicking, spread = home_score_pre - visiting_score_pre)
```

```
# create a histogram of the spread variable
hist(kicking$spread, main="Histogram of Spread Variable", xlab="Spread")
```




```
# fit a linear regression model to predict spread based off home team, away team, the quarter, and the
lmspread = lm(spread~home_team + away_team + quarter + yardline, data=kicking)
```

```
# Coefficients and P-values from individual t-tests on Coefficients from previous linear regression
summary(lmspread)$coefficients
```

```
##                                  Estimate  Std. Error       t value
## (Intercept)                -0.1467707015 0.446146051  -0.328974561
## home_teamAtlanta Falcons    3.3153462600 0.418943412   7.913589671
## home_teamBaltimore Ravens   4.0513259582 0.427511372   9.476533771
## home_teamBuffalo Bills      0.8216035348 0.428402678   1.917830062
## home_teamCarolina Panthers  1.2007129117 0.425762993   2.820143907
## home_teamChicago Bears      1.0826154804 0.425079772   2.546852501
## home_teamCincinnati Bengals 1.8368493157 0.423636348   4.335910558
## home_teamCleveland Browns  -0.2039829380 0.433347034  -0.470714975
## home_teamDallas Cowboys     1.3575577486 0.416763595   3.257380838
## home_teamDenver Broncos     1.4676812283 0.423020446   3.469527870
## home_teamDetroit Lions     -0.3575447194 0.420544265  -0.850195209
## home_teamGreen Bay Packers  4.3057994426 0.418123979  10.297901245
## home_teamHouston Texans     0.0006363789 0.423248944   0.001503557
## home_teamIndianapolis Colts 2.5555807527 0.422350999   6.050845762
## home_teamJacksonville Jaguars -0.4104981651 0.433119942 -0.947770180
## home_teamKansas City Chiefs 2.4408586996 0.425006089   5.743114658
## home_teamLas Vegas Raiders -1.2760912000 0.417803330  -3.054286812
## home_teamLos Angeles Chargers 3.7028944616 0.421987131  8.774899024
## home_teamLos Angeles Rams  -0.1648383984 0.416613947  -0.395662218
## home_teamMiami Dolphins    -0.6364412297 0.427933506  -1.487243277
## home_teamMinnesota Vikings  2.0470688048 0.423979731   4.828223279
## home_teamNew England Patriots 5.0514722100 0.422082020 11.967987190
## home_teamNew Orleans Saints 1.9504290512 0.409288643   4.765412093
```

```
## home_teamNew York Giants           0.4793384456 0.419892806   1.141573369
## home_teamNew York Jets             1.2181191803 0.427560545   2.848998103
## home_teamPhiladelphia Eagles       2.8806211019 0.423071117   6.808834233
## home_teamPittsburgh Steelers       3.7922070029 0.429214304   8.835229781
## home_teamSan Francisco 49ers       0.1441967748 0.421867129   0.341806140
## home_teamSeattle Seahawks          2.6658106557 0.421604609   6.323011184
## home_teamTampa Bay Buccaneers     -0.5848700987 0.424051308  -1.379243709
## home_teamTennessee Titans         -0.3386457041 0.423119143  -0.800355432
## home_teamWashington Football Team -0.6695593945 0.426092823  -1.571393271
## away_teamAtlanta Falcons          -1.1647513002 0.423289806  -2.751663955
## away_teamBaltimore Ravens         -1.9594019685 0.429071037  -4.566614378
## away_teamBuffalo Bills            -0.5424944856 0.429030205  -1.264466882
## away_teamCarolina Panthers        -2.2780757491 0.421691642  -5.402231212
## away_teamChicago Bears            -0.5756351379 0.426871847  -1.348496375
## away_teamCincinnati Bengals       -1.3435553853 0.428860254  -3.132851254
## away_teamCleveland Browns          0.4930226658 0.428852098   1.149633331
## away_teamDallas Cowboys           -1.5231639107 0.426206379  -3.573770800
## away_teamDenver Broncos           -1.5893336075 0.423750488  -3.750635465
## away_teamDetroit Lions             0.6539494557 0.424836720   1.539295980
## away_teamGreen Bay Packers        -2.4271612962 0.418539325  -5.799123651
## away_teamHouston Texans            0.4460923450 0.426210569   1.046647777
## away_teamIndianapolis Colts       -1.3622538714 0.419650791  -3.246160618
## away_teamJacksonville Jaguars      1.6752676623 0.428354856   3.910934212
## away_teamKansas City Chiefs       -1.3353029051 0.424224331  -3.147633950
## away_teamLas Vegas Raiders         1.1625368643 0.426057680   2.728590325
## away_teamLos Angeles Chargers     -1.9475226654 0.422776943  -4.606501606
## away_teamLos Angeles Rams          0.0778199119 0.422255685   0.184295711
## away_teamMiami Dolphins           -0.1941760010 0.428693573  -0.452948244
## away_teamMinnesota Vikings        -1.2238643035 0.424194975  -2.885145688
## away_teamNew England Patriots     -5.2192020353 0.423025385 -12.337798672
## away_teamNew Orleans Saints       -2.2923913372 0.416223996  -5.507590526
## away_teamNew York Giants          -1.0420390637 0.422322386  -2.467401915
## away_teamNew York Jets             0.5284080878 0.431151370   1.225574414
## away_teamPhiladelphia Eagles      -1.1033823417 0.419372508  -2.631031651
## away_teamPittsburgh Steelers      -2.8379081652 0.433015443  -6.553826687
## away_teamSan Francisco 49ers       0.4026791998 0.420889105   0.956734673
## away_teamSeattle Seahawks         -0.7541441894 0.422021300  -1.786981343
## away_teamTampa Bay Buccaneers      0.0576870778 0.419161616   0.137624905
## away_teamTennessee Titans          0.2323420249 0.427462231   0.543538137
## away_teamWashington Football Team -0.2630409005 0.426414252  -0.616867047
## quarter                            0.4311610285 0.047523908   9.072507837
## yardline                          -0.0143358468 0.005033714  -2.847966238
##                                       Pr(>|t|)
## (Intercept)                       7.421768e-01
## home_teamAtlanta Falcons          2.571834e-15
## home_teamBaltimore Ravens         2.783177e-21
## home_teamBuffalo Bills            5.514046e-02
## home_teamCarolina Panthers        4.802833e-03
## home_teamChicago Bears            1.087406e-02
## home_teamCincinnati Bengals       1.455515e-05
## home_teamCleveland Browns         6.378471e-01
## home_teamDallas Cowboys           1.125494e-03
## home_teamDenver Broncos           5.219834e-04
## home_teamDetroit Lions            3.952222e-01
```

```
## home_teamGreen Bay Packers        7.796176e-25
## home_teamHouston Texans           9.988003e-01
## home_teamIndianapolis Colts       1.455059e-09
## home_teamJacksonville Jaguars     3.432528e-01
## home_teamKansas City Chiefs       9.369693e-09
## home_teamLas Vegas Raiders        2.257609e-03
## home_teamLos Angeles Chargers     1.784196e-18
## home_teamLos Angeles Rams         6.923566e-01
## home_teamMiami Dolphins           1.369593e-01
## home_teamMinnesota Vikings        1.383208e-06
## home_teamNew England Patriots     6.037601e-33
## home_teamNew Orleans Saints       1.892020e-06
## home_teamNew York Giants          2.536390e-01
## home_teamNew York Jets            4.388199e-03
## home_teamPhiladelphia Eagles      9.993343e-12
## home_teamPittsburgh Steelers      1.043125e-18
## home_teamSan Francisco 49ers      7.324988e-01
## home_teamSeattle Seahawks         2.595157e-10
## home_teamTampa Bay Buccaneers     1.678282e-01
## home_teamTennessee Titans         4.235102e-01
## home_teamWashington Football Team 1.161001e-01
## away_teamAtlanta Falcons          5.932296e-03
## away_teamBaltimore Ravens         4.973033e-06
## away_teamBuffalo Bills            2.060707e-01
## away_teamCarolina Panthers        6.623338e-08
## away_teamChicago Bears            1.775073e-01
## away_teamCincinnati Bengals       1.732558e-03
## away_teamCleveland Browns         2.503026e-01
## away_teamDallas Cowboys           3.523363e-04
## away_teamDenver Broncos           1.766630e-04
## away_teamDetroit Lions            1.237408e-01
## away_teamGreen Bay Packers        6.721818e-09
## away_teamHouston Texans           2.952691e-01
## away_teamIndianapolis Colts       1.170796e-03
## away_teamJacksonville Jaguars     9.210827e-05
## away_teamKansas City Chiefs       1.647318e-03
## away_teamLas Vegas Raiders        6.363651e-03
## away_teamLos Angeles Chargers     4.108997e-06
## away_teamLos Angeles Rams         8.537825e-01
## away_teamMiami Dolphins           6.505887e-01
## away_teamMinnesota Vikings        3.914646e-03
## away_teamNew England Patriots     6.668133e-35
## away_teamNew Orleans Saints       3.662590e-08
## away_teamNew York Giants          1.361436e-02
## away_teamNew York Jets            2.203669e-01
## away_teamPhiladelphia Eagles      8.516234e-03
## away_teamPittsburgh Steelers      5.683650e-11
## away_teamSan Francisco 49ers      3.387076e-01
## away_teamSeattle Seahawks         7.394891e-02
## away_teamTampa Bay Buccaneers     8.905376e-01
## away_teamTennessee Titans         5.867627e-01
## away_teamWashington Football Team 5.373263e-01
## quarter                           1.220363e-19
## yardline                          4.402449e-03
```

```r
# R-squared from previous linear regression
summary(lmspread)$r.squared
```

```
## [1] 0.04939167
```

```r
# Adjusted R squared from previous linear regression
summary(lmspread)$adj.r.squared
```

```
## [1] 0.04770315
```

```r
# Create a new model using all data that adds the interaction between the home team and the away team t
lmspread_interaction <- lm(spread ~ home_team + away_team + quarter + yardline + home_team*away_team, da
```

```r
# R-squared from new model with interaction term
summary(lmspread_interaction)$r.squared
```

```
## [1] 0.1831133
```

```r
# Adjusted R-squared from new model with interaction term
summary(lmspread_interaction)$adj.r.squared
```

```
## [1] 0.1600044
```

```r
# Randomly split the data into 80% training data and 20% testing data
set.seed(12345)
rows <- sample(nrow(kicking))
kicking_shuffled = kicking[rows,]

# 80% in training data set
kicking_train = kicking_shuffled[1:29618,]

# 20% in testing set
kicking_test = kicking_shuffled[29618:37022,]
```

```r
# Refit both models on the training data
kicking_train_mod1 = lm(spread ~ home_team + away_team + quarter + yardline, data = kicking_train)

kicking_train_mod2 = lm(spread ~ home_team + away_team + quarter + yardline + home_team*away_team, data
```

```r
# Predict spread on the testing data
fitSpread=predict(kicking_train_mod1, newdata = kicking_test)

fitSpread_interaction=predict(kicking_train_mod2, newdata = kicking_test)
```

```
## Warning in predict.lm(kicking_train_mod2, newdata = kicking_test): prediction
## from rank-deficient fit; attr(*, "non-estim") has doubtful cases
```

```r
# calculating the residuals of both models
spreadresid1=kicking_test$spread - fitSpread

spreadresid2=kicking_test$spread - fitSpread_interaction
```

```r
#install.packages("Metrics")
library(Metrics)

# removing NA values from actual and predicted values
fitSpread = na.omit(fitSpread)
kicking_test = na.omit(kicking_test)
```

```r
# calculating RMSE of model without interaction
RMSE1 = rmse(kicking_test$spread, fitSpread)
RMSE1
```

```
## [1] 9.863403
```

```r
# calculating MAD of model without interaction
MAD1 = mean(fitSpread)
MAD1
```

```
## [1] 1.243602
```

```r
# removing NA values from predictions
fitSpread_interaction = na.omit(fitSpread_interaction)

# calculating RMSE of model with interaction
RMSE2 = rmse(kicking_test$spread, fitSpread_interaction)
RMSE2
```

```
## [1] 9.433283
```

```r
# calculating MAD of model without interaction
MAD2 = mean(fitSpread_interaction)
MAD2
```

```
## [1] 1.199163
```

```r
#install.packages("knitr")
library(knitr)

# putting all values for RMSE and MAD into a table
mytable = data.frame(Model = c("Without Interaction", "With Interaction"),
                     RMSE = c("9.863403", "9.863403"),
                     MAD = c("1.243602", 1.199163))
kable(mytable)
```

Model	RMSE	MAD
Without Interaction	9.863403	1.243602
With Interaction	9.863403	1.199163

```r
print(mytable)
```

```
##                 Model     RMSE      MAD
## 1 Without Interaction 9.863403 1.243602
## 2    With Interaction 9.863403 1.199163
```

Logistic Regression

```r
# Subset data for only the field goals
FGdata = subset(kicking, play_type == "Field Goal")

# Remove any observations where kicker name is listed only once in data set
kickerobs <- table(FGdata$kicker_name) # making a list of kicker names and number of occurrences

multobs = names(kickerobs[kickerobs>1]) # finding only the kicker names which appear multiple times in
```

```r
# creating a cleaned data set that only includes observations where kicker name is featured more than o
FGdata_cleaned = subset(FGdata, kicker_name %in% multobs)
```

```r
# fit a logistic regression model, using all data, to predict the probability of success given the yard
logitmod <- glm(scored ~ yardline + quarter + kicker_name + spread, data = FGdata_cleaned, family = bin

# show a table that contains output from logistic regression that at a minimum contains coefficients an
summary(logitmod)
```

```
##
## Call:
## glm(formula = scored ~ yardline + quarter + kicker_name + spread,
##     family = binomial, data = FGdata_cleaned)
##
## Coefficients:
##                              Estimate Std. Error z value Pr(>|z|)
## (Intercept)                 1.986e+00  1.836e+00   1.082   0.2795
## yardline                   -1.133e-01  2.912e-03 -38.912   <2e-16 ***
## quarter                     2.024e-02  2.194e-02   0.922   0.3564
## kicker_nameA. Rosas         1.949e+00  2.055e+00   0.949   0.3428
## kicker_nameA. Seibert       1.197e+00  2.001e+00   0.598   0.5497
## kicker_nameA.Elling        -1.050e+00  2.329e+00  -0.451   0.6521
## kicker_nameA.Franks         1.985e+00  1.903e+00   1.043   0.2969
## kicker_nameA.Henery         1.928e+00  1.859e+00   1.037   0.2998
## kicker_nameA.Pettrey       -8.489e-01  2.139e+00  -0.397   0.6915
## kicker_nameA.Rosas          2.082e+00  1.868e+00   1.114   0.2652
## kicker_nameA.Seibert        2.328e+00  1.919e+00   1.213   0.2252
## kicker_nameA.Vinatieri      2.513e+00  1.841e+00   1.365   0.1724
## kicker_nameB. McManus       2.922e+00  1.901e+00   1.537   0.1242
## kicker_nameB.Cundiff        1.658e+00  1.845e+00   0.899   0.3687
## kicker_nameB.Gramatica      1.574e+01  1.385e+03   0.011   0.9909
## kicker_nameB.Maher          1.926e+00  1.866e+00   1.032   0.3019
## kicker_nameB.McManus        2.235e+00  1.848e+00   1.209   0.2266
## kicker_nameB.Walsh          2.451e+00  1.848e+00   1.326   0.1848
## kicker_nameC. Boswell       1.699e+01  5.281e+02   0.032   0.9743
## kicker_nameC. McLaughlin    2.681e+00  2.247e+00   1.193   0.2327
## kicker_nameC. Parkey        2.201e+00  1.943e+00   1.133   0.2574
## kicker_nameC. Santos        3.116e+00  1.985e+00   1.570   0.1165
## kicker_nameC.Barth          2.368e+00  1.847e+00   1.282   0.1999
## kicker_nameC.Boswell        2.617e+00  1.856e+00   1.410   0.1585
## kicker_nameC.Catanzaro      2.246e+00  1.852e+00   1.213   0.2252
## kicker_nameC.Hentrich       1.992e+00  2.346e+00   0.849   0.3958
## kicker_nameC.McLaughlin     2.121e+00  1.925e+00   1.102   0.2705
## kicker_nameC.Parkey         2.113e+00  1.854e+00   1.140   0.2544
## kicker_nameC.Santos         2.035e+00  1.851e+00   1.100   0.2715
## kicker_nameC.Stitser        1.686e+00  2.158e+00   0.781   0.4345
## kicker_nameC.Sturgis        2.141e+00  1.850e+00   1.157   0.2471
## kicker_nameD. Bailey        1.555e+00  1.945e+00   0.800   0.4240
## kicker_nameD. Carlson       2.923e+00  1.990e+00   1.469   0.1419
## kicker_nameD. Hopkins       2.137e+00  1.897e+00   1.126   0.2601
## kicker_nameD.Akers          2.102e+00  1.842e+00   1.141   0.2538
## kicker_nameD.Bailey         2.722e+00  1.846e+00   1.474   0.1404
## kicker_nameD.Brien          1.648e+00  1.892e+00   0.871   0.3839
## kicker_nameD.Brooks        -1.771e+01  1.668e+03  -0.011   0.9915
```

```
## kicker_nameD.Buehler       1.748e+00  1.890e+00   0.925   0.3549
## kicker_nameD.Carlson       1.759e+00  1.871e+00   0.940   0.3473
## kicker_nameD.Carpenter     2.424e+00  1.844e+00   1.315   0.1886
## kicker_nameD.Defense      -1.623e+01  1.675e+02  -0.097   0.9228
## kicker_nameD.Hopkins       2.446e+00  1.853e+00   1.320   0.1868
## kicker_nameD.Rayner        1.540e+00  1.855e+00   0.830   0.4064
## kicker_nameE.Pineiro       1.687e+00  1.913e+00   0.882   0.3779
## kicker_nameG. Gano         4.250e+00  2.106e+00   2.018   0.0436 *
## kicker_nameG. Zuerlein     2.658e+00  1.898e+00   1.400   0.1614
## kicker_nameG.Anderson      2.559e+00  1.988e+00   1.288   0.1978
## kicker_nameG.Gano          2.436e+00  1.845e+00   1.321   0.1866
## kicker_nameG.Hartley       1.842e+00  1.856e+00   0.992   0.3210
## kicker_nameG.Joseph        2.273e+00  1.951e+00   1.165   0.2441
## kicker_nameG.Tavecchio     2.348e+00  1.925e+00   1.220   0.2226
## kicker_nameG.Zuerlein      2.509e+00  1.845e+00   1.360   0.1739
## kicker_nameH. Butker       2.952e+00  1.999e+00   1.477   0.1397
## kicker_nameH.Butker        2.821e+00  1.867e+00   1.511   0.1309
## kicker_nameJ. Brown       -4.933e-01  2.317e+00  -0.213   0.8314
## kicker_nameJ. Elliott      2.068e+00  1.976e+00   1.047   0.2952
## kicker_nameJ. Lambo        1.790e+01  9.777e+02   0.018   0.9854
## kicker_nameJ. Myers        1.747e+01  4.996e+02   0.035   0.9721
## kicker_nameJ. Sanders      3.312e+00  1.937e+00   1.709   0.0874 .
## kicker_nameJ. Slye         1.767e+00  1.909e+00   0.926   0.3547
## kicker_nameJ. Tucker       3.065e+00  1.948e+00   1.573   0.1157
## kicker_nameJ.Brown         2.541e+00  1.843e+00   1.379   0.1679
## kicker_nameJ.Carney        2.143e+00  1.854e+00   1.156   0.2476
## kicker_nameJ.Chandler      1.117e+00  2.109e+00   0.530   0.5963
## kicker_nameJ.Cortez        1.046e+00  1.935e+00   0.541   0.5888
## kicker_nameJ.Elam          2.127e+00  1.849e+00   1.150   0.2501
## kicker_nameJ.Elliott       2.344e+00  1.861e+00   1.259   0.2080
## kicker_nameJ.Feely         2.262e+00  1.844e+00   1.227   0.2197
## kicker_nameJ.Hall          1.701e+00  1.889e+00   0.900   0.3679
## kicker_nameJ.Hanson        2.510e+00  1.846e+00   1.360   0.1737
## kicker_nameJ.Kasay         2.425e+00  1.846e+00   1.314   0.1889
## kicker_nameJ.Lambo         2.758e+00  1.858e+00   1.485   0.1376
## kicker_nameJ.Medlock       8.775e-01  1.973e+00   0.445   0.6565
## kicker_nameJ.Myers         2.605e+00  1.853e+00   1.406   0.1597
## kicker_nameJ.Nedney        2.507e+00  1.854e+00   1.352   0.1763
## kicker_nameJ.Potter        1.416e+00  2.259e+00   0.627   0.5309
## kicker_nameJ.Reed          1.916e+00  1.847e+00   1.038   0.2994
## kicker_nameJ.Sanders       2.130e+00  1.877e+00   1.135   0.2563
## kicker_nameJ.Scobee        2.146e+00  1.842e+00   1.165   0.2440
## kicker_nameJ.Slye          2.656e+00  1.905e+00   1.394   0.1633
## kicker_nameJ.Taylor        1.749e+00  2.189e+00   0.799   0.4244
## kicker_nameJ.Tucker        3.360e+00  1.850e+00   1.817   0.0693 .
## kicker_nameJ.Wilkins       2.135e+00  1.852e+00   1.153   0.2491
## kicker_nameK. Fairbairn    2.638e+00  1.943e+00   1.358   0.1745
## kicker_nameK. Forbath      3.836e-01  2.375e+00   0.161   0.8717
## kicker_nameK.Brindza       5.886e-01  1.958e+00   0.301   0.7637
## kicker_nameK.Brown         1.898e+00  1.847e+00   1.028   0.3041
## kicker_nameK.Fairbairn     2.337e+00  1.860e+00   1.256   0.2090
## kicker_nameK.Forbath       2.769e+00  1.857e+00   1.491   0.1359
## kicker_nameL.Tynes         1.860e+00  1.845e+00   1.008   0.3133
## kicker_nameM. Badgley      1.564e+00  1.886e+00   0.829   0.4071
```

```
## kicker_nameM. Crosby       1.735e+01  5.762e+02   0.030   0.9760
## kicker_nameM. Gay          2.113e+00  2.005e+00   1.054   0.2919
## kicker_nameM. Nugent       1.913e+00  2.136e+00   0.895   0.3706
## kicker_nameM. Prater       2.295e+00  1.916e+00   1.197   0.2311
## kicker_nameM. Wright       1.715e+01  1.150e+03   0.015   0.9881
## kicker_nameM.Andersen      2.151e+00  1.876e+00   1.147   0.2516
## kicker_nameM.Badgley       2.524e+00  1.922e+00   1.313   0.1891
## kicker_nameM.Bryant        2.565e+00  1.842e+00   1.393   0.1637
## kicker_nameM.Crosby        2.212e+00  1.841e+00   1.202   0.2295
## kicker_nameM.Gay           2.156e+00  1.891e+00   1.140   0.2544
## kicker_nameM.Gramatica     1.377e+00  1.873e+00   0.735   0.4622
## kicker_nameM.Koenen        5.525e-01  1.982e+00   0.279   0.7804
## kicker_nameM.McCrane       1.423e+00  1.955e+00   0.728   0.4668
## kicker_nameM.Nugent        1.989e+00  1.842e+00   1.080   0.2801
## kicker_nameM.Prater        2.471e+00  1.842e+00   1.342   0.1796
## kicker_nameM.Stover        2.278e+00  1.852e+00   1.230   0.2187
## kicker_nameM.Vanderjagt    1.893e+00  1.871e+00   1.012   0.3117
## kicker_nameN. Folk         3.765e+00  2.106e+00   1.787   0.0739 .
## kicker_nameN.Folk          2.120e+00  1.842e+00   1.151   0.2498
## kicker_nameN.Freese       -1.199e-01  2.025e+00  -0.059   0.9528
## kicker_nameN.Kaeding       2.367e+00  1.849e+00   1.280   0.2005
## kicker_nameN.Novak         2.156e+00  1.846e+00   1.168   0.2427
## kicker_nameN.Nullified    -1.686e+01  1.828e+02  -0.092   0.9265
## kicker_nameN.Rackers       2.348e+00  1.845e+00   1.272   0.2032
## kicker_nameN.Rose          2.692e+00  2.147e+00   1.254   0.2098
## kicker_nameO.Kimrin        5.376e-01  1.975e+00   0.272   0.7854
## kicker_nameO.Mare          1.822e+00  1.845e+00   0.987   0.3234
## kicker_nameO.Offense      -1.883e+00  1.851e+00  -1.018   0.3088
## kicker_nameP.Dawson        2.427e+00  1.841e+00   1.318   0.1875
## kicker_nameP.Edinger       1.644e+00  1.867e+00   0.880   0.3787
## kicker_nameP.Murray        2.586e+00  1.886e+00   1.371   0.1703
## kicker_nameR. Blankenship  2.155e+00  1.905e+00   1.131   0.2581
## kicker_nameR. Bullock      2.234e+00  1.912e+00   1.169   0.2426
## kicker_nameR. Gould        2.049e+00  1.931e+00   1.061   0.2888
## kicker_nameR. Succop       2.404e+00  1.943e+00   1.237   0.2159
## kicker_nameR.Aguayo        1.166e+00  1.886e+00   0.618   0.5364
## kicker_nameR.Bironas       2.515e+00  1.845e+00   1.363   0.1728
## kicker_nameR.Bullock       2.440e+00  1.850e+00   1.319   0.1872
## kicker_nameR.Gould         2.631e+00  1.842e+00   1.428   0.1532
## kicker_nameR.Lindell       2.052e+00  1.844e+00   1.113   0.2658
## kicker_nameR.Longwell      2.492e+00  1.849e+00   1.348   0.1777
## kicker_nameR.Schmitt       1.662e+01  1.682e+03   0.010   0.9921
## kicker_nameR.Succop        2.256e+00  1.843e+00   1.224   0.2210
## kicker_nameS. Castillo     1.167e+00  1.935e+00   0.603   0.5464
## kicker_nameS. Ficken       2.324e+00  2.016e+00   1.153   0.2490
## kicker_nameS. Gostkowski   1.775e+00  1.891e+00   0.939   0.3479
## kicker_nameS. Hauschka    -1.704e+01  1.510e+03  -0.011   0.9910
## kicker_nameS. Sloman       1.524e+00  2.019e+00   0.755   0.4505
## kicker_nameS.Andrus        3.514e-01  2.140e+00   0.164   0.8696
## kicker_nameS.Christie      2.005e+00  1.928e+00   1.040   0.2985
## kicker_nameS.Ficken        1.500e+00  1.882e+00   0.797   0.4254
## kicker_nameS.Gostkowski    2.386e+00  1.842e+00   1.296   0.1951
## kicker_nameS.Graham        2.310e+00  1.845e+00   1.252   0.2107
## kicker_nameS.Hauschka      2.642e+00  1.845e+00   1.432   0.1521
```

```
## kicker_nameS.Janikowski    2.345e+00  1.840e+00   1.274   0.2026
## kicker_nameS.Suisham       2.087e+00  1.844e+00   1.132   0.2578
## kicker_nameT. Bass         2.164e+00  1.905e+00   1.136   0.2560
## kicker_nameT. Vizcaino     1.703e+01  1.334e+03   0.013   0.9898
## kicker_nameT.Coons         3.502e+00  2.101e+00   1.667   0.0955 .
## kicker_nameT.France        1.633e+01  8.525e+02   0.019   0.9847
## kicker_nameT.Long          1.961e+00  2.010e+00   0.976   0.3292
## kicker_nameT.Mehlhaff      9.124e-01  2.212e+00   0.412   0.6800
## kicker_nameT.Peterson      2.384e+00  1.902e+00   1.254   0.2099
## kicker_nameW. Lutz         1.942e+00  1.912e+00   1.016   0.3098
## kicker_nameW.Lutz          2.847e+00  1.859e+00   1.532   0.1256
## kicker_nameY. Koo          3.453e+00  1.984e+00   1.740   0.0818 .
## kicker_nameY.Koo           1.950e+00  1.903e+00   1.024   0.3056
## kicker_nameZ. Gonzalez     1.898e+00  1.907e+00   0.995   0.3196
## kicker_nameZ.Gonzalez      2.033e+00  1.867e+00   1.089   0.2762
## kicker_nameZ.Hocker        1.153e+00  1.950e+00   0.592   0.5542
## spread                    -7.353e-04  2.602e-03  -0.283   0.7775
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## (Dispersion parameter for binomial family taken to be 1)
##
##     Null deviance: 15279  on 16587  degrees of freedom
## Residual deviance: 11445  on 16425  degrees of freedom
## AIC: 11771
##
## Number of Fisher Scoring iterations: 15
```

```
# print out a contingency table that shows the number of true positives, true negatives, false positive
predictions <- predict(logitmod, data = FGdata_cleaned, family = binomial)

combined <- data.frame(FGdata_cleaned$scored, predictions)
```

```
# count the number of true positives
truepos <- combined %>%
  filter(FGdata_cleaned.scored == 1 & predictions >= 1) %>%
  nrow()
print(truepos)
```

```
## [1] 11788
```

```
# count the number of false positives
falsepos <- combined %>%
  filter(FGdata_cleaned.scored == 0 & predictions >= 1) %>%
  nrow()
print(falsepos)
```

```
## [1] 1276
```

```
# count the number of false negatives
falseneg <- combined %>%
  filter(FGdata_cleaned.scored == 1 & predictions < 1) %>%
  nrow()
print(falseneg)
```

```
## [1] 1931
```

```r
# count the number of true negatives
trueneg <- combined %>%
  filter(FGdata_cleaned.scored == 0 & predictions < 1) %>%
  nrow()
print(trueneg)
```

```
## [1] 1593
```

```r
# create contingency table

contingency = data.frame("Contingency Table" = c("Field Goal Successful", "Field Goal Unsuccessful"),
                         Model_Predicted_Success = c("11788", "1276"),
                         Model_Predicted_Failure = c("1931", "1593"))
kable(contingency)
```

Contingency.Table	Model_Predicted_Success	Model_Predicted_Failure
Field Goal Successful	11788	1931
Field Goal Unsuccessful	1276	1593

Evaluate the Logistic Regression Using Leave-One-Out Cross Validation

```r
# create an empty column in the data to save your predictions
FGdata_cleaned[,"empty"] = NA
head(FGdata_cleaned)
```

```
## # A tibble: 6 x 15
##   game_id home_team       away_team possession_team nonpossession_team play_type
##     <dbl> <chr>           <chr>     <chr>           <chr>               <chr>
## 1   26909 New England Pa~ Indianap~ Indianapolis C~ New England Patri~ Field Go~
## 2   26909 New England Pa~ Indianap~ Indianapolis C~ New England Patri~ Field Go~
## 3   26909 New England Pa~ Indianap~ New England Pa~ Indianapolis Colts Field Go~
## 4   26909 New England Pa~ Indianap~ New England Pa~ Indianapolis Colts Field Go~
## 5   26910 Buffalo Bills   Jacksonv~ Buffalo Bills   Jacksonville Jagu~ Field Go~
## 6   26910 Buffalo Bills   Jacksonv~ Buffalo Bills   Jacksonville Jagu~ Field Go~
## # i 9 more variables: yardline <dbl>, home_score_pre <dbl>,
## #   visiting_score_pre <dbl>, description <chr>, scored <dbl>,
## #   kicker_name <chr>, quarter <dbl>, spread <dbl>, empty <lgl>
```

```r
# fit the model to the entire dataset except the first row
remove = FGdata_cleaned[-1,]
nofirstrow <- glm(scored ~ yardline + quarter + kicker_name + spread, data = remove, family = binomial)
head(remove)
```

```
## # A tibble: 6 x 15
##   game_id home_team       away_team possession_team nonpossession_team play_type
##     <dbl> <chr>           <chr>     <chr>           <chr>               <chr>
## 1   26909 New England Pa~ Indianap~ Indianapolis C~ New England Patri~ Field Go~
## 2   26909 New England Pa~ Indianap~ New England Pa~ Indianapolis Colts Field Go~
## 3   26909 New England Pa~ Indianap~ New England Pa~ Indianapolis Colts Field Go~
## 4   26910 Buffalo Bills   Jacksonv~ Buffalo Bills   Jacksonville Jagu~ Field Go~
## 5   26910 Buffalo Bills   Jacksonv~ Buffalo Bills   Jacksonville Jagu~ Field Go~
## 6   26910 Buffalo Bills   Jacksonv~ Jacksonville J~ Buffalo Bills      Field Go~
## # i 9 more variables: yardline <dbl>, home_score_pre <dbl>,
## #   visiting_score_pre <dbl>, description <chr>, scored <dbl>,
## #   kicker_name <chr>, quarter <dbl>, spread <dbl>, empty <lgl>
```