NFL Combine as a Predictor for Draft Position

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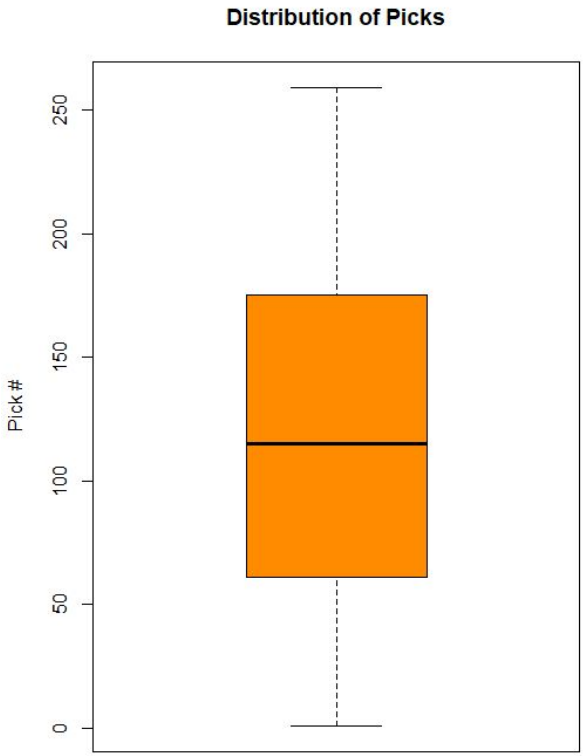
Research Question + Background

- NFL Combine is a series of skill evaluations based on performance measurables
- The players are innately separated by their positional group, but there may be clusters of athletes within those groups
- Can we accurately predict where a player will go in the draft based on their combine metrics as opposed to purely college statistics?

Data

- Players drafted from 2000 - 2020
- Participated in every combine drill
  - 40 yard dash
  - Vertical
  - Bench
  - Broad Jump
  - 3 cone drill
  - Shuttle drill
- 2162 Players



Pos	count
C	74
CB	256
DE	207
DL	27
DT	180
EDGE	15
FB	45
ILB	87
LB	19
LS	1
OG	147
OL	24
OLB	184
OT	225
QB	3
RB	163
S	168
TE	152
WR	185

Methodology

- Classification
  - Using Machine Learning, we can classify the players into subgroups based on position, physical measurements, and combine results
- Predictive Modeling
  - Here we can use regression analysis to identify the drills and measurables most significant in predicting draft location
  - Initial OLS Regression Analysis shows Height, Weight, 40 yard dash, 3 cone drill and Broad jump to be significant variables

Data Cleaning

- Position Reclassification
  - All defensive linemen were grouped together (OG, OT, C, OL)
  - All offensive linemen were grouped together (DE, EDGE, DT, DL)
  - All linebackers were grouped together (ILB, OLB, LB)
  - QB, LS, and FB were removed due to low frequency
- Classified 3 levels of draft pick
  - 1st rounder (pick 1-32)
  - 2nd-3rd rounder (pick 33-96)
  - Late rounder (pick 97+)

Pos	count
CB	256
DL	429
LB	290
OL	470
RB	163
S	168
TE	152
WR	185

Predicting Position from Combine Performance

- Naive Bayes model
  - Training dataset: Years 2000 - 2014
  - Testing dataset: Years 2015-2020
  - Do prior years' combine results predict future team selection preference?
- Confusion Matrix results
  - Overall Accuracy: 57.85%
  - Far stronger than no-information rate
  - Still large 95% CI
  - Strong confusion between DL and OL, WR and CB, WR and S

Confusion Matrix and Statistics

pred1	CB	DL	LB	OL	RB	S	TE	WR
CB	47	0	0	0	3	6	0	31
DL	0	50	2	19	0	0	3	0
LB	0	12	56	0	4	0	10	2
OL	0	41	0	100	0	0	0	0
RB	1	0	4	0	20	2	1	1
S	14	0	1	0	13	23	0	35
TE	0	31	3	0	0	0	30	0
WR	6	0	0	0	2	0	0	13

Overall Statistics

Accuracy : 0.5785
95% CI : (0.5374, 0.6188)
No Information Rate : 0.2287
P-Value [Acc > NIR] : < 2.2e-16

Grouping Positions to Predict Pick # Using OLS: Skill

- Grouped together WRs and RBs
- Skill positions often have strong emphasis on speed, quickness
- Preferences demonstrated by OLS results
  - 40-yard dash, 3-cone drill, and Broad Jump or measurements to be significant at 5% level o better
  - These drills demonstrate speed, quickness, and pure athleticism

```
Call:
lm(formula = pick ~ Ht_in + Wt + `40yd` + Vertical + Bench +
    `3Cone` + `Broad Jump` + Shuttle, data = skillpos)

Residuals:
     Min       1Q   Median       3Q      Max
-132.807  -51.903   -5.218   50.398  161.330

Coefficients:
             Estimate Std. Error t value Pr(>|t|)
(Intercept) -545.0177   273.2349  -1.995  0.04688 *
Ht_in          2.9306     1.9865   1.475  0.14107
Wt            -0.6893     0.3544  -1.945  0.05261 .
`40yd`       156.6871    43.8169   3.576  0.00040 ***
Vertical       1.2440     1.5622   0.796  0.42640
Bench         -1.1520     0.8831  -1.305  0.19294
`3Cone`       48.4541    22.0577   2.197  0.02872 *
`Broad Jump`  -2.2089     0.8134  -2.715  0.00696 **
Shuttle      -46.1817    29.2003  -1.582  0.11468
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 66.37 on 339 degrees of freedom
Multiple R-squared:  0.1107,    Adjusted R-squared:  0.08975
F-statistic: 5.277 on 8 and 339 DF,  p-value: 3.024e-06
```

Grouping Positions to Predict Pick # Using OLS: DBs

- Grouped together CBs and S's
- Also typically have emphasis on speed and quickness
- Preferences demonstrated by OLS results
  - Only 40-yard dash and 3-cone drill significant at 5% level or better

```
Call:
lm(formula = pick ~ Ht_in + Wt + `40yd` + Vertical + Bench +
    `3Cone` + `Broad Jump` + Shuttle, data = db)

Residuals:
     Min       1Q   Median       3Q      Max
-124.810  -47.043   -5.361   45.351  168.184

Coefficients:
             Estimate Std. Error t value Pr(>|t|)
(Intercept) -893.46515  234.88929  -3.804 0.000164 ***
Ht_in         -2.26545    2.31504  -0.979 0.328359
Wt            -0.24317    0.36783  -0.661 0.508929
`40yd`       201.35665   36.29944   5.547 5.18e-08 ***
Vertical      -0.65157    1.38541  -0.470 0.638382
Bench         -0.05786    0.76356  -0.076 0.939638
`3Cone`       57.99134   16.78359   3.455 0.000606 ***
`Broad Jump`  -0.81665    0.72223  -1.131 0.258817
Shuttle        8.67488   23.89305   0.363 0.716736
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 60.81 on 415 degrees of freedom
Multiple R-squared:  0.1539,    Adjusted R-squared:  0.1376
F-statistic: 9.435 on 8 and 415 DF,  p-value: 5.286e-12
```

Grouping Positions to Predict Pick # Using OLS: Linemen

- Grouped together OL and DL
- Typically have emphasis on weight and strength for these positions
- Results show mix of results
  - 40-yard dash, Weight, 3-cone drill, and broad jump all significant at 5% level
  - Preference shown toward heavier yet more athletic linemen
  - Bench not significant at 5% level - typically seen as pure measurement of strength

```
Call:
lm(formula = pick ~ Ht_in + Wt + `40yd` + Vertical + Bench + 
    `3Cone` + `Broad Jump` + Shuttle, data = linemen)

Residuals:
     Min       1Q   Median       3Q      Max 
-140.159  -52.428   -8.118   52.511  176.488 

Coefficients:
             Estimate Std. Error t value Pr(>|t|)    
(Intercept)  184.8343   161.3382   1.146  0.25226    
Ht_in         -1.9744     1.5452  -1.278  0.20166    
Wt            -1.5478     0.1806  -8.568  < 2e-16 ***
`40yd`       102.5460    17.4962   5.861 6.48e-09 ***
Vertical       0.3931     0.9519   0.413  0.67971    
Bench         -0.7347     0.4824  -1.523  0.12810    
`3Cone`       23.6626    11.4789   2.061  0.03955 *  
`Broad Jump`  -1.4736     0.4998  -2.949  0.00327 ** 
Shuttle        1.9819    17.3438   0.114  0.90905    
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 66.91 on 890 degrees of freedom
Multiple R-squared:  0.1351,    Adjusted R-squared:  0.1273 
F-statistic: 17.37 on 8 and 890 DF,  p-value: < 2.2e-16
```

Predicting First Round Picks Using Logistic Regression

- Logistic Model predicting probability of first round pick
  - “Is_first” dummy variable indicating first round pick
- Results show preference toward bigger, faster, quicker athletes
  - 40-yard dash, Weight, 3-cone, and Broad Jump all significant at 5% level.

```
Call:
glm(formula = is_first ~ Ht_in + Wt + `40yd` + Vertical + Bench +
    `3Cone` + `Broad Jump` + Shuttle, family = binomial(link = logit),
    data = combinedatafinal)

Deviance Residuals:
    Min       1Q   Median       3Q      Max
-1.2554  -0.5398  -0.3968  -0.2812   2.8499

Coefficients:
             Estimate Std. Error z value Pr(>|z|)
(Intercept)  8.316867   4.865403   1.709  0.08738 .
Ht_in        0.003541   0.043467   0.081  0.93508
Wt           0.044873   0.005451   8.232  < 2e-16 ***
`40yd`      -4.018174   0.647655  -6.204  5.5e-10 ***
Vertical     0.013092   0.029630   0.442  0.65861
Bench       -0.008708   0.015379  -0.566  0.57122
`3Cone`     -1.232948   0.388817  -3.171  0.00152 **
`Broad Jump` 0.037344   0.015758   2.370  0.01780 *
Shuttle      0.337842   0.545594   0.619  0.53577
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

(Dispersion parameter for binomial family taken to be 1)

    Null deviance: 1564.3  on 2112  degrees of freedom
Residual deviance: 1404.6  on 2104  degrees of freedom
AIC: 1422.6

Number of Fisher Scoring iterations: 5
```

Predicting Draft Round for the Wide Receiver Position

- Naive Bayes model
  - Create a new variable with three factors (Round 1, Round 2-3, Round 4-7)
  - Split the data into a 70% training and 30% testing based on the round group
  - Do combine statistics accurately predict where a player will be drafted?
- Confusion Matrix results
  - Overall Accuracy: 58.43%
  - Model never predicted a first round receiver since the test sample for 1st round was so small (7 players)
  - Looking at a continual scale of pick number rather than round could resolve this issue

```
Cross-Validated (3 fold, repeated 10 times) Confusion Matrix

(entries are percentual average cell counts across resamples)

          Reference
Prediction    1    2    3
         1  0.0  0.0  0.0
         2  1.6  5.0  4.9
         3  6.5 28.5 53.5

 Accuracy (average) : 0.5843
```

Predicting Draft Round for the Running Back Position

- Naive Bayes model
  - Create a new variable with three factors (Round 1, Round 2-3, Round 4-7)
  - Split the data into a 70% training and 30% testing based on the round group
  - Do combine statistics accurately predict where a player will be drafted?
- Confusion Matrix results
  - Overall Accuracy: 62.94%
  - Once again very few predictions in the first round, but since Running Backs drafted early shared more similar traits than the Wide Receiver model it was not zero
  - The Running Back model was also better at predicting players in the second and third groups than the Receiver model.

```
Cross-Validated (3 fold, repeated 10 times) Confusion Matrix

(entries are percentual average cell counts across resamples)

          Reference
Prediction    1    2    3
         1  0.2  0.7  1.5
         2  2.0 13.8 10.2
         3  5.2 17.4 49.0

 Accuracy (average) : 0.6294
```

Limitations and Future Research

- There was significant selection bias when we subsetted our original data, since we only wanted to look at players who competed in every drill. This disproportionately removed positions where it is not common to do every drill at the combine, and thus included more linebackers and lineman.
- The combine data can also not be completely trusted if we are assuming that players are all giving 100% effort. Some athletes have more to gain than others based on current draft positioning and may work harder because of that and vice versa.

Conclusion

- While it is difficult to purely use combine data to predict where a player will get drafted, there are notable takeaways:
  - Speed was always a preferred factor, as the 40-yard dash was always significant
  - Agility/Athleticism is also favorable, as the 3-cone drill was significant many times
- It is easier to predict running back placement than wide receiver based on combine data
- It is possible but difficult to predict position based on combine data, since there are skill types that are similar to each other on offense and defense