# Analyzing methods used to measure recruiting classes of major college football programs and assign star ratings to recruits

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joint with Michael Nadrowski (2021 Ferris State graduate)

Recruiting is said to be the "lifeblood" of a college football program. It is widely believed that better recruiting classes yield greater success on the field.

This thesis is supported (somewhat) by several studies (Langelett 2003, Herda et al. 2009, Caro 2012, Maxcy 2013, Bergman and Logan 2016, Connolly 2016, Dronyk-Trosper and Stitzel 2017, Dumond et al. 2018, Mankin et al. 2021).

These studies examine the correlation between **recruiting class quality** and **team success**. To do this quantitatively, they use metrics for these two items.

# Metrics for team success

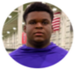
To measure **team success**, most studies use either the number of games a team wins (*WINS*), or its end-of-year Sagarin rating (*SAG*) (this is effectively ELO).

In this talk, assume that by team success, I mean Sagarin rating *SAG* (although we have similar results if one uses *WINS*).

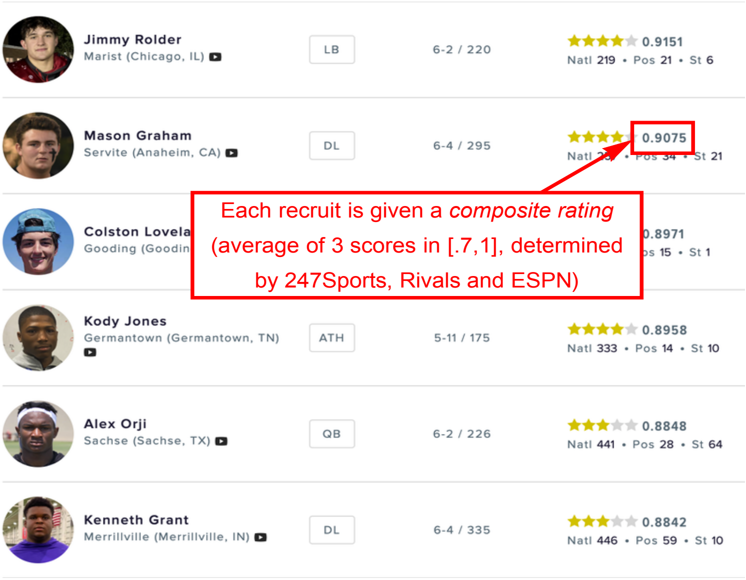
This talk is about the metrics these studies use for **recruiting class quality**.

**Our sample:** recruiting classes of major college football teams (ACC, Big 12, Big Ten, Pac-12, SEC, Notre Dame) from 2016-2019.

# Composite ratings and star classifications

| | | | | |
|---|---|---|---|---|
|  | **Jimmy Rolder** Marist (Chicago, IL) | LB | 6-2 / 220 | ★★★★☆ 0.9151 Natl 219 • Pos 21 • St 6 |
|  | **Mason Graham** Servite (Anaheim, CA) | DL | 6-4 / 295 | ★★★★☆ 0.9075 Natl 257 • Pos 34 • St 21 |
|  | **Colston Loveland** Gooding (Gooding, ID) | TE | 6-5 / 230 | ★★★★☆ 0.8971 Natl 316 • Pos 15 • St 1 |
|  | **Kody Jones** Germantown (Germantown, TN) | ATH | 5-11 / 175 | ★★★★☆ 0.8958 Natl 333 • Pos 14 • St 10 |
|  | **Alex Orji** Sachse (Sachse, TX) | QB | 6-2 / 226 | ★★★☆☆ 0.8848 Natl 441 • Pos 28 • St 64 |
|  | **Kenneth Grant** Merrillville (Merrillville, IN) | DL | 6-4 / 335 | ★★★☆☆ 0.8842 Natl 446 • Pos 59 • St 10 |

# Composite ratings and star classifications




Each recruit is given a *composite rating* (average of 3 scores in [.7,1], determined by 247Sports, Rivals and ESPN)

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Based on their composite rating,
each recruit is given 2 to 5 *stars*:

| rating | .7 – .797 | .797 – .89 | .89 – .983 | .983 – 1 |
|---|---|---|---|---|
| # stars | 2★ | 3★ | 4★ | 5★ |
| % of recruits | 3.3% | 71.7% | 22.9% | 2.1% |

# Measuring recruiting class quality

247SPORTS NCAAF FB REC NCAAB BK REC COMMUNITY PODCASTS ...

| Rank | Team | Total | 5-stars | 4-stars | 3-stars | Avg | Points |
|---|---|---|---|---|---|---|---|
| 1 (1) | Texas A&M | 29 Commits | 7 | 19 | 3 | 94.77 | 330.51 |
| 2 (2) | Alabama | 25 Commits | 3 | 19 | 3 | 95.19 | 322.15 |
| 3 (3) | Georgia | 29 Commits | 5 | 15 | 9 | 92.79 | 316.77 |
| 4 (4) | Ohio State | 21 Commits | 2 | 17 | 2 | 94.05 | 300.51 |
| 5 (5) | Texas | 28 Commits | 2 | 19 | 6 | 91.02 | 288.71 |
| 6 (6) | Penn State | 25 Commits | 3 | 13 | 9 | 90.82 | 277.80 |
| 7 (7) | Notre Dame | 21 Commits | 1 | 16 | 4 | 91.74 | 272.89 |

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Counts of recruits in each star category

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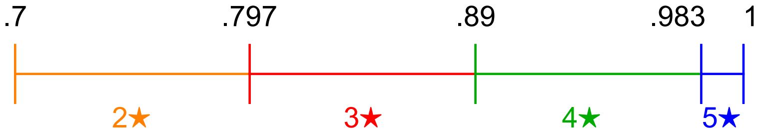
PTS = weighted sum of individual recruit ratings

# Different thresholds for star-like classifications

Recall how 247Sports partitions players into star classifications:




**Questions**

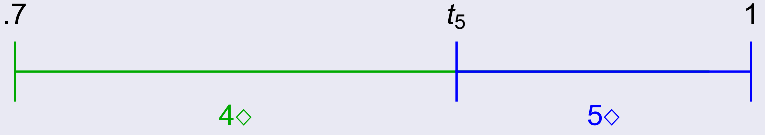
Where did these thresholds come from?

Would different thresholds provide a classification of recruits more strongly correlated with team success?

# Different thresholds for star-like classifications

## Our two-subset model

We divide recruits into two types: 5♢ and 4♢, based on a variable threshold $t_5$:




The goal is to determine $t_5$ so that the counts of 5♢ and 4♢ players in each class is most strongly correlated with $SAG$.

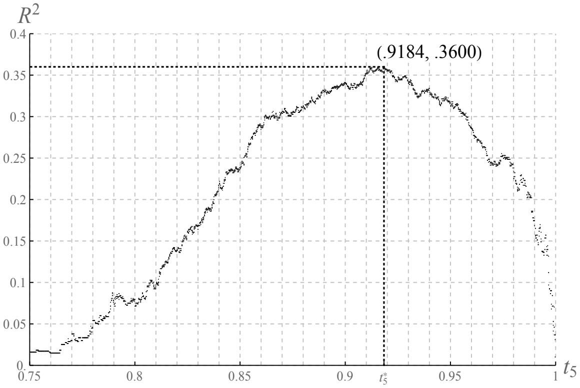
To do this, we perform a linear regression

$$SAG = \beta_0 + \beta_5\,\#(5\diamondsuit \text{ recruits}) + \beta_4\,\#(4\diamondsuit \text{ recruits})$$

and compute the correlation coefficient $R$ as a function of $t_5$.

# Our optimal two-subset model

Our optimal value of $t_5$ is $t_5^* = .9184$:



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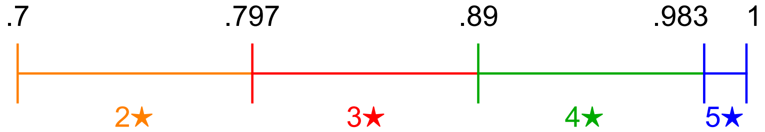
Our optimal two-subset model:


247Sports star classifications:



# Our optimal two-subset model

Using the optimal threshold $t_5^* = .9184$ to split players into 5$\diamondsuit$ and 4$\diamondsuit$ types, we found:

| | 5$\diamondsuit$ | 4$\diamondsuit$ |
|---|---|---|
| % of recruits | 14.1% | 85.9% |
| change in *SAG* per recruit | 1.718*** | −0.348*** |
| additional wins per recruit | 0.249*** | −0.113*** |

*** $p < .001$

- These regression coefficients have stronger significance than analogous coefficients coming from traditional star ratings.
- The $R^2$-value between counts from our model and *SAG*, $R^2 = .3600$, is 9.2% higher than the $R^2$-value coming from traditional star ratings.

# Models with more than two subsets

One could repeat our methodology with more than two subsets:


In this "three-subset model", the goal is to determine $(t_4, t_5)$ so that the counts of players of each type are most strongly correlated with $SAG$.

# Models with more than two subsets

However, it turns out that with more subsets:

- .9184 is always one of the thresholds;
- the statistical significance of the regression coefficients $\beta_j$ drops off dramatically;
- the correlation between counts from these models and $SAG$ is only very slightly greater than the correlation coming from the two-subset model.

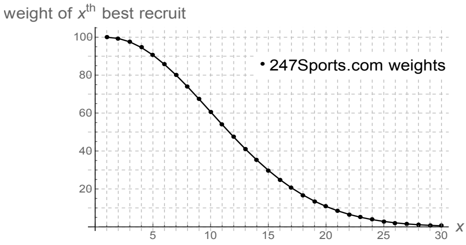
# Different weighted totals

Here is how 247Sports produces its weighted sum $PTS_{247}$:
first, let $P_1$, $P_2$, $P_3$, ... be the composite ratings of recruits in a class, arranged from highest to lowest. Then,

$$PTS_{247} = \sum_x w_{247}(x) \cdot (P_x - .7)$$

where

$$w_{247}(x) = 100 \exp\left(\frac{-(x-1)^2}{2 \cdot 9^2}\right).$$



**Question**

Would different weighting provide a metric more strongly correlated with team success than $PTS_{247}$?

**Remark:** If you allow $w(x)$ to be *any* function and try to optimize the correlation between a weighted sum and $SAG$, this leads to negative weights (which makes no sense) and/or regression coefficients without any statistical significance.

So we choose weighting functions $w(x)$ taken from parametrized families, and look for parameters within those families that maximize the correlation between $SAG$ and our version of $PTS$.

## Our variable Gaussian weighting model

Define

$$w(m, b, x) = 100 \exp\left(\frac{-(x-m)^2}{2b^2}\right)$$

and

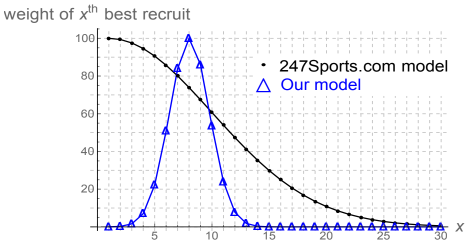
$$PTS(m, b) = \sum_x w(m, b, x)(P_x - .7).$$

The goal is to determine values of $m$ and $b$ which maximize the correlation between $PTS(m, b)$ and $SAG$.

To do this, we perform a linear regression between $PTS(m, b)$ and $SAG$, defining $R(m, b)$ to be the correlation coefficient. Using a computer algebra system, we numerically estimate values $m^*$ and $b^*$ which maximize $R(m, b)$.

# Our variable Gaussian weighting model

We found that optimal parameters $m^* = 8.038$, $b^* = 1.752$. These parameters correspond to the following weight function:




Our value of $R^2$ (.3607) is 6.5% greater than the $R^2$ coming from $PTS_{247}$.

We found that each increase in $PTS(m^*, b^*)$ increases a team's Sagarin rating by .425 and increases their number of wins by .0986; both of these regression coefficients are significant at the .001 level.

# Conclusions

- Dividing players into two groups (5$\diamondsuit$ and 4$\diamondsuit$) is useful for predicting team success, but dividing players into more than two groups is of limited additional value.
- Fewer players should be categorized as "blue chip" than are currently.
- There is positive correlation between Gaussian weighted sums of individual player ratings and team success.
- The weighted sums currently used by 247Sports take an unnecessary amount of information into account: sums constructed with a smaller spread parameter produce a weighted total more correlated with team success. In particular, the exact ratings of players rated below .85 are largely irrelevant (this is 37% of the recruits studied).

# Conclusions

If interested:

D. McClendon and M. Nadrowski. An analysis of methods used to measure recruiting classes of major college football programs and assign star ratings to recruits. *Mathematics and Sports* **3** (2021), 1-20.

Available at http://mcclendonmath.com/papers.html