More About My NCAAF Power Rankings

Objective:

Every week there are countless arguments over what each team should be ranked. Everyone has their own opinion, including coaches and press, who's votes construct the AP and Coaches poll. Throughout the season a team's ranking in these polls gives them no competitive advantage and plays no role in determining their schedule. However, the problem arises, when the regular season games are over, and it is time to decide which teams make it to the College Football Playoff and get a chance to play for a national championship. Unlike the NFL, NBA, and MLB, where playoff participants are completely decided by specific credentials such as (division winner, record, head-to-head wins, etc..) college football playoff spots are completely up to the opinions of the College Football Playoff committee. The committee members could be influenced by preference or pressured to boost the ranking of teams with a high market value. Even if this is not the case, in today's age it is unacceptable to have a committee of 13 people decide which teams go to the CFB playoff. Imagine if Vegas set spreads by asking a few people which team they thought was going to win and by how much. While CFB playoff spots do not have clear prerequisites, analytics needs to be used to rank the teams and decide CFB playoff spots. The objective of these rankings is to rank teams purely based on their performance in the present season and order them by a function of their average spread, strength of schedule and ability to win games.

Deriving the rankings:

I am going to explain how each metric on tylerhoylman.com is computed, but first it is important to point out that only Division 1 FBS teams are considered in these rankings, and games against non-FBS opponents are not considered. It would be next to impossible to compile sufficient data to credibly quantify the rating of all non-FBS teams. Therefore, I was left with two options. Treat all non-FBS opponents as equal, which is not the case, or remove them from the analysis. I decided to remove them. For this reason, many teams' win percentage may be slightly off if they have played a non-FBS team.

It is important to also point out that this ranking system is heavily optimized to rank teams and NOT predict point spreads. While it may seem that these two metrics go hand in hand, I do not believe this is the case. To predict point spreads (Y) most efficiently, 100s of variables (X's) need to be considered. Roster talent, program success over prior seasons, and injured players are just a few examples of variables that need to be considered to predict point spreads. I think a major problem with current ranking systems is that they weigh in these variables when they are simply not needed. I do not believe a team's ranking should be skewed by how they played the previous season, what recruiting grade they got or any other external factor. While these external factors surely help accurately predict point spreads and rank teams towards the beginning of the season, I think they serve as bias in the long haul and should not be considered in analysis. The beauty in partialing out all other variables is that my rankings can be derived purely from point spreads.

Adj +/-:

"Adj +/-" is the foundation of these rankings. To find the adjusted plus minus we will be creating a system of equations with 130 variables and 130 unknowns. To do this we need to define two arrays. The first array will define the coefficients for our system of equations and will have dimensions of 130 x 130. One axis will house a row for each team and the other will have a column for each potential opponent. If two teams have played one another, their corresponding entity = 1 and if they have not it = 0. The second array will house our solutions and thus be 130 x 1 (one rating for each team). The initial values in the second array will be teams average point spread throughout the season. To help illustrate how this works I am going to solve a 4x4 matrix with fictional data from a 2-game season consisting of 4 teams.

The first step is to create the 4x1 matrix that houses each team's average spread. The code for these rankings treats any margin of victory over 28 points and any margin of defeat over 28 points as a 28 and -28 margin respectively. This is done to eliminate a "style points" bias from teams running up the score. For example

Location	Team	Points	Spread
Away	Texas Tech	10	-28
Home	Alabama	56	28

This game counts as a spread of -28 for Texas Tech and 28 for Alabama

The other immediate adjustment made to spreads is for home field advantage. I have coded the home team to lose 2.5 points from the spread. The away spread is just the inverse of the home team. Neutral sites spreads are unaffected. These are the three remaining games in my fictional season. Notice how home and away location effects the spread.

Location	Team	Points	Spread
Away	Baylor	17	-20.5
Home	Texas Tech	35	20.5

Location	Team	Points	Spread
Away	Alabama	35	7.5
Home	Oregon	30	-7.5

Location	Team	Points	Spread
Neutral	Oregon	24	3
Neutral	Baylor	21	-3

Now that we have all our data and game spreads, we can create our arrays and systems of equations. This is the 4x4 matrix with the team coefficients.

	Texas Tech	Alabama	Oregon	Baylor
Texas Tech	0	1	0	1
Alabama	1	0	1	0
Oregon	0	1	0	1
Baylor	1	0	1	0

The formula for the 4x1 matrix is

r_team = (spread1 + spread2 + spread3 … + spreadn) / n

The resulting 4x1 matrix for this fictional season is

Texas Tech	(-28+ 20.5) / 2 = -7.5
Alabama	(28 + 7.5) / 2 = 17.75
Oregon	(-7.5 + 3) / 2 = -2.25
Baylor	(-20.5 -3) / 2 = -11.75

Now that we have the opponents +/- we solve the system of equations and append the results divided by games played to our original matrix.

r_team = r_team + (r_opp1 + r_opp2 + r_opp3 … + r_oppn) / n

Texas Tech	-7.5 + (17.75 - 11.75) / 2 = -4.5
Alabama	17.75 + (-7.5 - 2.25) / 2 = 12.875
Oregon	-2.25 + (17.75 - 11.75) / 2 = .75
Baylor	-11.75 (-7.5 - 2.25) / 2 = -16.625

With more teams we would need to re-solve the matrix until the systems of equations solutions are all equal. In this hypothetical scenario we have already reached this point. However, when operating with 130 teams several more iterations are necessary. If we multiply the matrixes again, we see that every value in the solution array is equal to 3.75 and therefore we are finished.

Texas Tech	-4.5 + (12.875 - 16.625) / 2 =
Alabama	12.875 + (-4.5 + .75) / 2 =
Oregon	.75 + (12.875 - 16.625) / 2 =
Baylor	-16.625 + (-4.5 + .75) / 2 =

The last step is to calculate the mean +/- and subtract it from each of our team ratings. In this case the mean is -1.875 so I add 1.875 to each team.

Texas Tech	-4.5 + 1.875 = -2.625
Alabama	12.875 + 1.875 = 14.75
Oregon	.75 + 1.875 = 2.625
Baylor	-16.625 + 1.875 = -14.75

This step is important because it allows us to see how each team is expected to perform against an average team on a neutral field. Standardizing the results around zero also helps us compare a team's rating from a previous week. In this case, since there are only four teams, the results are perfectly symmetrical around zero.

Since +/- is the most important value in the power ratings I wanted to work out the equations rather than just labeling it as black box.

Adj win %:

Adjusted win percentage is in place so that recent games are weighted more heavily than older ones. Just as in win %, to find Adj win %, we sum up total wins divided by games played. The only difference is that losses are usually not equal to zero. A more recent loss is < 0 and a loss early in the season is > 0. Therefore, a team is not punished as much for a week one loss as a loss in the previous week. This is a way to consider how a team is trending. To illustrate how adjusted win percentage is found we will be analyzing Tennessee's schedule through the first 7 weeks of 2021 and calculating their adjusted win loss percentage.

This Is Tennessee's win loss results by week

	Result	Win %
Week 1	W	1
Week 2	L	0
Week 3	non FBS	
Week 4	L	0
Week 5	W	1
Week 6	W	1
Week 7	L	0
Total	3-3	0.5

We can find Tennessee's "Adj win %" using this formula

(((1 + Last_week) / 50) - (((1 + Last_week)/25) / (Last_week – 1) * (week_i -1)))

For week 2

(((1 + 7) / 50) - (((1 + 7)/25) / (7-1) * (3 – 1))) =
.16 – (.32/6) * 1 = .107

For week 4

(((1 + 7) / 50) - (((1 + 7)/25) / (7-1) * (3 – 1))) =
.16 – (.32/6) * 3 = 0

For week 7

(((1 + 7) / 50) - (((1 + 7)/25) / (7-1) * (3 – 1))) =
.16 – (.32/6) * 6 = .16

	Result	Win %	Adj Win %
Week 1	W	1	1
Week 2	L	0	0.107
Week 3	non FBS		
Week 4	L	0	0
Week 5	W	1	1
Week 6	W	1	1
Week 7	L	0	-0.16
Total	3-3	0.5	0.49

By looking at the results we can see that Tennessee is not penalized as much for losses in the beginning of the season. Their loss in week 4 is worth 0 because it is in the exact middle of the season. Their "Adj win %" is slightly lower than their standard Win % because their losses are slightly skewed towards the end of the season. If their first loss had been in week 1 instead of week 2 then their win losses would be evenly distributed and thus result in a .5 win % (same as actual).

Rating:

Now we can calculate our final metric. Rating is calculated as a function of "Adj +/-" and "Adj win %". This is the formula

$$(''Adj + / - '' + 100) * (^2\sqrt{''}AdjWin\%'')$$

Adding 100 to "Adj +/-" makes all values positive, and after testing data from other seasons, seems to provide a good balance of quantifying a teams win % and margin of victory. We can see how Adj win % effects ratings by sampling from part of the top 10 of week 8

		Rating	Win %	Adj win %		Adj +/-
4	Michigan State	116.08	100	100	[redacted]	16.1
5	Wake Forest	115.67	100	100	[redacted]	15.7
6	Alabama	114.52	83	82	[redacted]	20.5
7	Penn State	112.44	80	78	[redacted]	19.7
8	Oklahoma State	112.26	100	100	[redacted]	12.3
9	Ohio State	111.46	83	85	[redacted]	16.0

If these teams were ranked purely off "Adj +/-" the ranks would be

4 Alabama, 5 Penn State, 6 Michigan State, 7 Ohio State, 8 Wake Forest, 9 Oklahoma State
Alabama and Ohio state each have one loss and the same amount of games played, but because Ohio State lost much earlier in the season, their "Adj win %" is higher and their rating is penalized less.

There is one last problem we need to address. With this formula all teams without a win will inherently recieve a rating of zero. The solution to this problem is to manipulate zero win teams "Adj win %" using this formula

= .4/total_games

Using this formula the "Adj win %" for no win teams are as followed

Record	Adj Win %
0-1	0.4
0-2	0.2
0-3	0.13
0-4	0.1
0-5	0.08
0-6	0.07

2022 Updates

There are two minor functional differences to the 2022 Rankings.

First,
Additional rating points are rewarded for each victory a team has over another top 25 team.
Top 5 = +3 points
Top 10 = +2 points
Top 25 = +1 point

Second,
If a is school is ranked directly below a school they have beat but has not beat them, the positions are flipped.

The following metrics have no correlation to how teams are ranked.

Offense:

Offense is simply points scored over games played. The teams are then ranked in descending order by PPG. I know that there is a better way to rank offenses, since this system does not consider the strength of defenses faced. I would love to improve the code that derives offensive rank and if you have any suggestions, please email me thoylman@uga.edu.

Defense:

Defense is simply points allowed over games played. The teams are then ranked in ascending order by points allowed per game. As with Offense I am looking to improve upon the code to derive defensive rank.

Win %:

Win percentage is simply wins over total games.

+/- :

+/- is a team's average margin of victory.

SOS:

Strength of schedule is computed for each team by calculating the average "Adj +/-" of their opponents. The teams are then ranked in descending order of their SOS value.

Spreads:

Spreads are calculated using the difference in two teams "Adj +/-" and location of the game. Home teams are given a +2.5 boost to the spread and the inverse is true for away teams.