COLLEGE FOOTBALL PLAYOFF (CFP)

Objectively modelling the committee's selections

John A. Trono
Saint Michael's College
Colchester, Vermont (USA)

Determining (National) Champions

- Most sports rely on competition to determine which team is crowned the best that year: Wimbledon, the Masters, the World Cup, *March Madness*, etc.
- The National Collegiate Athletic Association (NCAA) championship in (American) football (until 1998) had no such mechanism.
- Recently ranging between 120 and 130 teams, across many different conferences, most regular season games are intra-conference contests, and the inter-conference matches are typically scheduled many years in advance.
- Therefore, direct competition between the best teams is typically nonexistent.
- The AP and Coaches' polls have previously ***determined*** the NC.

NCAA Football Champions

- Typically, both polls have agreed regarding which was the best team.
- Both polls have included postseason bowl games since 1973.
- Sometimes even the consensus National Champion (NC) was controversial.
- Roughly once per decade, the polls disagreed, creating split-NCs.
- In the 1970s and 1980s, several times each decade, reasonable arguments could be made for teams other than the #1 team (in the polls) to have been the NC.

More NCAA NC History

- Bowl games increased from 14 in 1980 to 18 in ’90, to 25 in ‘00 and ~40 now.
- #1 versus #2 occurred in 1982, ‘86 and ‘87 (even with bowl affiliations).
- Split-NCs occurred in 1978, ‘90, ‘91 and ‘97 (with two 12-0 teams in 1994).
- The Bowl Championship Series (BCS) began in 1998 (after serious discussion began about doing something in 1992).
- Controversy about top two teams playing for the NC for half of the BCS’ 16 years.
- CFP started in 2014, with the top four teams to play two semifinals – with the two winners meeting in the CFP Championship game.

CFP Committee Criterion

- For purposes of any four team playoff, the process will inevitably need to select the four best teams from among several with legitimate claims to participate.
- When comparing teams with similar records (and pedigree):
  - *Winning conference championships*
  - *Strength of schedule*
  - *Head-to-head competition (if it occurred)*
  - *Comparative outcomes of common opponents (without incenting margin of victory)*
  - *Other relevant factors such as key injuries that may have affected a team's performance during the season or likely will affect its postseason performance*

Criteria Behind Ranking Strategy

- Attempt to partition teams into groups of similar performance.
- Group size should decrease as teams in that group have collectively performed better than the teams in the prior group.
- Defeating any team in a certain group will accrue an identical reward.
- Rewards should increase for wins over more successful teams.
- Losses will incur a negative reward (inversely proportional to the reward for a win).
- Margin of Victory (MOV) will be ignored (for now).

Model Formation

- Victory Reward value
  - *This should increase as wins are earned over teams in more exclusive groups.*
- Group-size strategy
  - *Groups decrease in size, and teams in these more restrictive groups increase in performance.*
    - Some teams may play more games in a season than other teams
      - *The largest group holds weakest teams, so victory reward of zero is assigned to defeating a team in this group, which also mitigates # of contests/team.*

Victory Reward Values

- Linear – 0, 1, 2, 3, 4, 5, …
- Quadratic – 0, 1, 3, 6, 10, 15, …
- Exponential – 0, 1, 2, 4, 8, 16, …
- Fibonacci-based – 0, 2, 3, 5, 8, 13, …

Group-Size Strategies

- Exponential (E): 50%, 25%, 12.5%, 6.25% and 6.25%
- Motivated by Zipf's Law
  - *N: 1/4, 1/5, 1/6, 1/7,1/8 and ~1/9*
  - *W: 1/3, 1/4, 1/5, and (exactly) 1/20*
  - *O: 1/3, 1/5 1/7, 1/9, 1/11, 1/13 and ~1/23*
- Percentage separation
  - *F (reduced by 10%): 40, 30, 20 and 10*
  - *V (Roman #5) starts and end with 5%, then 10%: 35, 30, 20, 10 and 5%.*
- Two equal halves (H): 50% (25 & 25), 50% (25%, 20, 15, 10, 5%)
- Golden Ratio (G): 37.5%, 26.25% and then reduce by 61.8% until ~4%

Monte Carlo Approach

- The initial ordering of teams into groups directly impacts the total # of points/team.
  - *The overall, final ranking is quite sensitive to the initial ordering.*
- To avoid any bias that any initial ordering algorithm may cause, one million random orderings are used, with the average point total per season being used to rank all the teams.
  - *Several iterations are required before teams converge into stable groupings.*
- Each team's average, season long point total converged to within 0.02 with two different sets - of one million random orderings - in 2014.

Early Results

- 9 of 32 models chose the same four teams as the CFP committee in 2014:
  - *NL, WF, WL, WE, VF, FF, FL, HF, and HL.*
- Each of the models had the #1 and #4 teams correct, and the #2 and #3 were switched, but that would not have impacted the participants in that year's semifinal contests.
- In 2015, 10 models (NQ,NE,WF,WL,WQ,VL,OL,FF,FL and EL) matched the committee.
  - *However, none of the models' rankings produced either semifinal matchup.*
- Perhaps MOV should be considered?
- WF, WL, FF and FL matched all 8 of the committee's selections from 2014 to 2015.

Margin of Victory (MOV)

- Running up the score against weaker competition should not be rewarded.
- Such runaway scores should be compressed.
- The two most popular scoring events in football are worth:
  - *3 points (Field Goals)*
  - *6 points(Touchdowns, which are usually followed by successful PATs → 7 pts)*

MOV Formula

MOV	$\log_2(MOV+1)+1$
0	1
1	2
3	3
7	4
15	5
31	6
63	7

Performance from 2014-16

- The victory reward value is multiplied by the result when applying the MOV formula.
- When using MOV in 2014, 9 models (WF,WL,WE,VF,FF,FL,FE,HE and GF) matched the committee, with WE matching the top four exactly, and HE had #2 ←→#3.
- In 2015, there were 13 models (NF,NL,NQ,NE,WL,VL,VQ,OL,FL,FE,HQ,EL and GL); EL matched the top four exactly, with NL and EL switching the order of #2 and #3.
- WL, FL and FE were the only three models including MOV that matched all eight.
- Five models ignoring MOV matched the top five in 2016: NL and WL exactly – VL, HL and GL inconsequentially reversed the middle two (of the four) chosen teams.
- Those same 5 models when using MOV - along with WF and VF, making 7 total – all created different pairings.
- WL matched all 12 teams – both with and without MOV from 2014 through 2016.

No Perfection in 2017

- Mid-major conference champion Western Michigan went undefeated in 2016.
  - *#15 in committee's final vote; ranked from #9 to #13 by 64 models.*
- Mid-major champ Central Florida (UCF) went undefeated in 2017: #12 in CFP poll.
- 26 no-MOV models had UCF as #2-#4; 10 MOV models ranked them as #4, 18 as 5.
- UCF went undefeated in 2018, ranked #8 by committee ('17 Bowl win over Auburn).
  - *12 MOV models → #5; 8 no-MOV models as well.*
  - *In 2017, UCF had Power rating of 120.461 (#13) and 115.694 (#17) in '18*
  - *In 2017, UCF's no-MOV Power rating was 101.045 (#5); 100.845 (#8) in'18*
- 12 models correctly chose three out of the four committee selections, when ignoring MOV, and 26 models did likewise when including MOV.

2018 Results

- Georgia lost only to #1 Alabama (by 7 points in the SEC championship game), and to LSU (9-3), on the road, in a very competitive conference, and were ranked either #2, #3, or #4 by all 64 models.
- 29 models had the other top 3, when ignoring MOV, and all MOV models (but NE) did as well.
- Overall, 14 of the 24 models without MOV that matched the committee's top four used the Linear (L) victory reward strategy; six used F, and two each for Q and E.
- With MOV, 14 of the 29 were L, 7 used F, 5 with E and 3 used Q.
- Linear had 3 of the 4 perfect matches (E the 4th).
- For inconsequential switched orderings: 9 of 15 used L, F had 4, and E the other 2.

Top Four Success Across All 32 Models

	9	10	11	12	13	14	15	16	17	18
Zero	1	2	2	4	4	4	6	5	3	1
MOV	0	0	0	2	3	6	7	6	7	1

All 64 Models

- 15.15625 correctly matched teams when including MOV
- 13.9375 teams without MOV
- WL is the model with 18 in both rows, whereas WF and VL are the only two models that matched 17 correctly – both with and without MOV.
- HL is the only other model to match 17, excluding MOV, and the five other models with 17 correct, where MOV is included, are NL, VF, FL, FE, and GL.
- Six teams were correctly chosen to be in the top four by all 64 models: (ranked #1 by the CFP committee) Alabama in 2014; (#3) Michigan State in 2015; (#3) Ohio State in 2016; (#2) Georgia in 2017; (#1) Alabama and (#2) Clemson in 2018.
- One more team was always ranked #1-#4 by the models that exclude MOV (#1 Clemson in 2015), and three more appeared in the top four of all models including MOV (#2 Oregon, in 2014, #1 Alabama, in 2016, and #1 Clemson, in 2017).
- Overall, there were seven teams that matched the committee's top four in all 32 models that ignore MOV, and nine teams in the 32 MOV-based models.

WL Model Results (no MOV): 10 of 20

- 2014
  - *Alabama (12-1) 23.03*
  - *Florida St (13-0) 21.16 (#3)*
  - *Oregon (12-1) 16.10 (#2)*
  - *Ohio St (12-1) 14.64*
  - *Mississippi (9-3) 13.28 (#9)*

2015

- *Alabama (12-1) 21.02 (#2)*
- *Michigan St (12-1) 19.64 (#3)*
- *Oklahoma (11-1) 16.59 (#4)*
- *Clemson (13-0) 15.88 (#1)*
- *Ohio St (11-1) 13.93 (#7)*

- 2016
  - *Alab. (13-0) 25.76*
  - *Clem. (12-1) 18.01*
  - *Oh. St (11-1) 16.50*
  - *Wash. (12-1) 15.07*
  - *Penn St (11-2) 12.25*

2017

- *Clem. (12.1) 19.99*
- *Okla. (12-1) 17.51*
- *Geo. (12-1) 16.29*
- *UCF (12-0) 14.96 (#12)*
- *USC (11-2) 14.17 (#8)*

2018

- *Clem. (13-0) 26.45 (#2)*
- *Alab. (13-0) 24.93 (#1)*
- *N. D. (12-0) 20.16*
- *Geo. (11-2) 19.95 (#5)*
- *Oh.St (12-1) 11.27 (#6)*

Spearman Correlation Coefficients (25)

TOP 4	No MOV	SCC	Top 4	MOV	SCC
15	NL	0.7659	16	HL	0.7854
17	HL	0.7412	17	NL	0.7669
17	WF	0.7132	18	WL	0.7091
18	WL	0.7091	17	FL	0.7058
17	VL	0.6824	17	FE	0.7048

Summary

- Paper - http://academics.smcvt.edu/jtrono/Papers/CFP_Five_Years.PDF
- WL has chosen 18 out of 20 of the committee's top four (from 2014-2018)
- Strong Spearman Correlation Coefficients for the top 4 and top 25 (no-MOV)
- Thank you for your attention!
- Any questions? (JTrono@smcvt.edu)