CMSC 474, Game Theory

9b. Social Choice (post-election)

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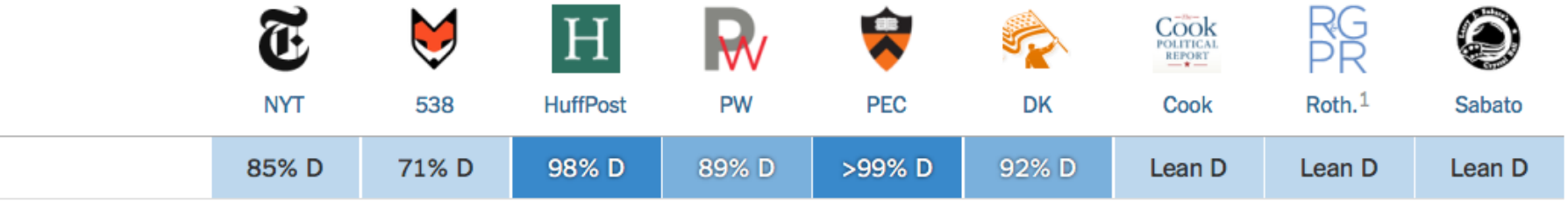
2016 Presidential Election

- Many sites did pre-election poll analysis; most predicted Clinton would win



http://www.nytimes.com/interactive/2016/upshot/presidential-polls-forecast.html?_r=0

2016 Presidential Election

- Clinton didn't win the electoral vote, but won the popular vote

	Clinton (D)	Trump (R)	D – R
Popular votes	59,923,027	59,692,974	230,053
Popular votes %	47.7	47.5	0.2
Electoral votes	232	306	–74

- Last time this happened was in 2000, Gore vs. Bush

	Gore (D)	Bush (R)	D – R
Popular votes	50,999,897	50,456,002	543,895
Popular votes %	48.4	47.9	0.5
Electoral votes	266	271	–5

Pre-election polling versus popular votes

- Post-election analysis of poll accuracy
  - http://www.electoral-vote.com/evp2016/Data/results.xlsx

- Prediction errors were bigger in red states (i.e., where Trump won) than blue states (i.e., where Clinton won)

	D – R votes	D – R predicted	prediction error
avg* over red states:	–19.2	–12.2	–6.7
avg* over blue states:	17.6	17.4	–0.4
avg* over all states:	–4.1	0.0	–4.1

* These are state-by-state averages, I didn't weight them by population

50,999,897 50,456,002 543,895

Social Choice

- Analyze what the results would be according to different social-choice algorithms
  - Simple plurality, Hare system, Condorcet winner, Borda count
- Consider two cases
  - National popular vote (NPV)
  - Electoral college, in states where the votes were close
- Need the voters' rankings for all the candidates
  - Let's speculate

Possible Rankings

- Clinton voters:
  - C > T > S > J
  - C > T > J > S
  - C > S > T > J
  - C > J > T > S
  - C > S > J > T
  - C > J > S > T
- Trump voters:
  - T > C > S > J
  - T > C > J > S
  - T > S > C > J
  - T > J > C > S
  - T > S > J > C
  - T > J > S > C
- Stein voters:
  - Let's assume all prefer C > T
    - S > C > J > T
    - S > J > C > T
- Johnson voters:
  - Let c = percentage that prefer C > T
    - J > C > T > S
    - J > C > S > T
    - J > S > C > T
  - Let t = percentage that prefer T > C
    - J > T > C > S
    - J > T > S > C
    - J > S > T > C

50,999,897 50,456,002 543,895

Hare System with NPV

$c + j = 0.9$

- National percentages

Clinton	Trump	Johnson	Stein	C – T
47.7	47.5	0.9	0.3	–0.2

- Repeatedly remove candidate with smallest number of 1st-choice votes
  - Clinton voters: C > T
  - Stein voters: C > T
  - some Johnson voters: C > T
  - some Johnson voters: T > C
  - Trump voters: T > C

- **Who would win?**

50,999,897 50,456,002 543,895

Hare System with NPV

$c + j = 0.9$

- National percentages

Clinton	Trump	Johnson	Stein	C – T
47.7	47.5	0.9	0.3	–0.2

- Repeatedly remove candidate with smallest number of 1st-choice votes
  - remove S, then remove J
    - Clinton voters: C > T
    - Stein voters: C > T
    - Johnson *c*: C > T
    - Johnson *j*: T > C
    - Trump voters: T > C
  - Clinton: $47.7 + 0.3 + c = 48 + c$
  - Trump: $47.5 + t = 47.5 + 0.9 - c = 48.4 - c$
  - Clinton wins if $c > 0.2$
    - i.e., if more than 2/9 of the Johnson voters prefer Clinton

50,999,897 50,456,002 543,895

Condorcet Winner with NPV

$c + j = 0.9$

- National percentages

Clinton	Trump	Johnson	Stein	C – T
47.7	47.5	0.9	0.3	–0.2

- Candidate preferred in one-on-one comparisons to all other candidates
  - C vs S
  - C vs J
  - T vs S
  - T vs J
  - C vs T
- **Who would win?**

50,999,897 50,456,002 543,895

Condorcet Winner with NPV

$c + j = 0.9$

- National percentages

Clinton	Trump	Johnson	Stein	C – T
47.7	47.5	0.9	0.3	–0.2

- Candidate who wins one-on-one comparisons to all other candidates
  - C vs S: let's assume C wins
  - C vs J: let's assume C wins
  - T vs S: let's assume T wins
  - T vs J: let's assume T wins

Caveat: some of these assumptions are questionable

  - C vs T:
    - Clinton preferred by $47.7 + 0.3 + c = 48 + c$
    - Trump preferred by $47.5 + t = 48.4 - c$

➢ Clinton wins if $c > 0.2$

- i.e., if more than 2/9 of the Johnson voters prefer Clinton

Borda Count with NPV

$c + j = 0.9$

- National percentages

Clinton	Trump	Johnson	Stein	C – T
47.7	47.5	0.9	0.3	–0.2

- Translate preferences into weights:
  - 4 for 1st choice
  - 3 for 2nd choice
  - 2 for 3rd choice
  - 1 for 4th choice
- Compute weighted sum

- **Who would win?**

Possible Rankings

- Clinton voters:
  - Let's assume T is their last choice
    - C > S > J > T
    - C > J > S > T
- Trump voters:
  - Let's assume C is their last choice
    - T > S > J > C
    - T > J > S > C
- Stein voters:
  - Let's assume all prefer C > T
    - S > C > J > T
    - S > J > C > T
- Johnson voters:
  - Let c = percentage that prefer C > T
  - Assume their preference is
    - J > C > S > T
  - Let t = percentage that prefer T > C
  - Assume their preference is
    - J > T > S > C
- *Caveat*: some of these assumptions are questionable

Borda Count with NPV

$c + j = 0.9$

- National percentages

Clinton	Trump	Johnson	Stein	C – T
47.7	47.5	0.9	0.3	–0.2

- Translate preferences into weights:
  - total for C = 4(Clinton%) + 1(Trump%) + 3(Stein%) + 3c + t
    = 4(47.7) + 1(47.5) + 3(0.3) + 3c + (0.9 – c)
    = 240.1 + 2c
  - total for T = 4(Trump%) + 1(Clinton%) + 1(Stein%) + 3t + c
    = 4(47.5) + 1(47.7) + 1(0.3) + 3(0.9 – c) + c
    = 238.9 + 2t = 240.7 – 2c
  - C wins if $2c > 0.3$
    - i.e., if more than 1/6 of the Johnson voters prefer Clinton

Electoral College

- States where the vote was close

- Percentages

		Clinton	Trump	Johnson	Stein	C – T
Michigan	(16 EV)	47.3	47.6	3.6	1.1	–0.3
Wisconsin	(10 EV)	46.9	47.9	3.6	1.1	–1.0
Pennsylvania	(20 EV)	47.7	48.8	2.4	0.8	–1.1
Florida	(29 EV)	47.8	49.1	2.2	0.7	–1.3
New Hampshire	(4 EV)	47.5	47.4	4.2	0.9	0.1
Minnesota	(10 EV)	46.8	45.4	3.9	1.3	1.8

Hare System

- Percentages

		Clinton	Trump	Johnson	Stein	C – T
Michigan	(16 EV)	47.3	47.6	3.6	1.1	–0.3
Wisconsin	(10 EV)	46.9	47.9	3.6	1.1	–1.0
Pennsylvania	(20 EV)	47.7	48.8	2.4	0.8	–1.1
Florida	(29 EV)	47.8	49.1	2.2	0.7	–1.3
New Hampshire	(4 EV)	47.5	47.4	4.2	0.9	0.1
Minnesota	(10 EV)	46.8	45.4	3.9	1.3	1.8

- Repeatedly remove candidate with smallest number of 1st-choice votes
  - Clinton voters: C > T
  - Stein voters: C > T
  - some Johnson voters: C > T
  - some Johnson voters: T > C
  - Trump voters: T > C

Condorcet Winner

- Percentages

		Clinton	Trump	Johnson	Stein	C – T
Michigan	(16 EV)	47.3	47.6	3.6	1.1	–0.3
Wisconsin	(10 EV)	46.9	47.9	3.6	1.1	–1.0
Pennsylvania	(20 EV)	47.7	48.8	2.4	0.8	–1.1
Florida	(29 EV)	47.8	49.1	2.2	0.7	–1.3
New Hampshire	(4 EV)	47.5	47.4	4.2	0.9	0.1
Minnesota	(10 EV)	46.8	45.4	3.9	1.3	1.8

- Candidate preferred in one-on-one comparisons to all other candidates
  - C vs S, C vs J: C wins
  - T vs S, T vs J: T wins
  - C vs T:
    - Clinton preferred % = Clinton + Stein + some Johnson
    - Trump preferred % = Trump + some Johnson

Borda Count

- Percentages

		Clinton	Trump	Johnson	Stein	C – T
Michigan	(16 EV)	47.3	47.6	3.6	1.1	–0.3
Wisconsin	(10 EV)	46.9	47.9	3.6	1.1	–1.0
Pennsylvania	(20 EV)	47.7	48.8	2.4	0.8	–1.1
Florida	(29 EV)	47.8	49.1	2.2	0.7	–1.3
New Hampshire	(4 EV)	47.5	47.4	4.2	0.9	0.1
Minnesota	(10 EV)	46.8	45.4	3.9	1.3	1.8

- Candidate preferred in one-on-one comparisons to all other candidates
  - C: 4(Clinton%) + 3(Stein%) + 3(some J) + 2(some J) + 1(some J)
  - T: 4(Trump%) + 1(Stein%) + 3(some J) + 2(some J) + 1(some J)