Koy Kunkel_SC

From: applications.administrator@capitol.local
Sent: Saturday, March 13, 2021 8:47 AM
To: Senate Redistricting
Subject: INETMAIL: Redistricting Public Input
Attachments: slides_for_SSCR_Public_210313.pdf

Date: 2021-03-13
First Name: Andrea
Last Name: Barreiro
Title: N/A
Organization: self
Address: [redacted]
City: Dallas
State: TX
Zipcode: [redacted]
Phone: [redacted]

Affirm public info: I agree

Regarding: Senate

Message:
My name is Andrea Barreiro, I am an Associate Professor of Mathematics at SMU, and I am a resident of SD 16 and a constituent of Nathan Johnson. I am speaking on behalf of a group of colleagues at SMU and Collin College seeking to use our technical expertise to inform the redistricting process.

Partisan gerrymandering is not a good practice. It tells some voters that their votes don't matter, and it breaks the promise of "one person, one vote". But how can we know a map is gerrymandered? How can we distinguish an intentional gerrymander from a partisan advantage that might result from political geography: say, for the tendency for urban areas to lean more Democratic, and rural areas to lean more Republican?

Fortunately, math has an answer. In the past decade, mathematicians have learned how to apply Markov Chain Monte Carlo methods to generate ensembles of maps that give us a baseline for what to expect of a fair, unbiased map. We can then compare a plan to this baseline, to see if it is typical, or if it is an extreme outlier in some way.

To demonstrate this method, we performed an analysis of the current State Senate map. We generated 50,000 maps that were population balanced and compact, and evaluated them on 5 metrics used to assess partisan asymmetry. We found that on 4 out of 5 metrics, the current plan is a significant outlier.

For one example: we computed the percentage of the statewide vote that each party would need, to win a majority. For the current plan, Republicans need only 45.7% of the vote; Democrats would need 54.2%: that's nearly a 10% difference! In contrast, the average difference was less than 1%. The observed value was very rare among the ensemble: only 1 out of 200 plans had a difference that was as large. I have uploaded slides to illustrate these results, and a full report is forthcoming.

Finally, ensemble sampling and outlier analysis of redistricting plans is reliable and replicable. The basic computations can be done in a matter of hours on a standard laptop. It has already been used in a number of court cases, notably the "Mathematicians' Brief" before the Supreme Court in Rucho vs. Common Cause in 2019.

In Rucho, the majority stated that while “distasteful,” partisan gerrymandering was not up to the federal courts to resolve. Instead, Justice Roberts wrote, it was up to the legislatures. That means that it’s up to you. Thank you for your time and attention.

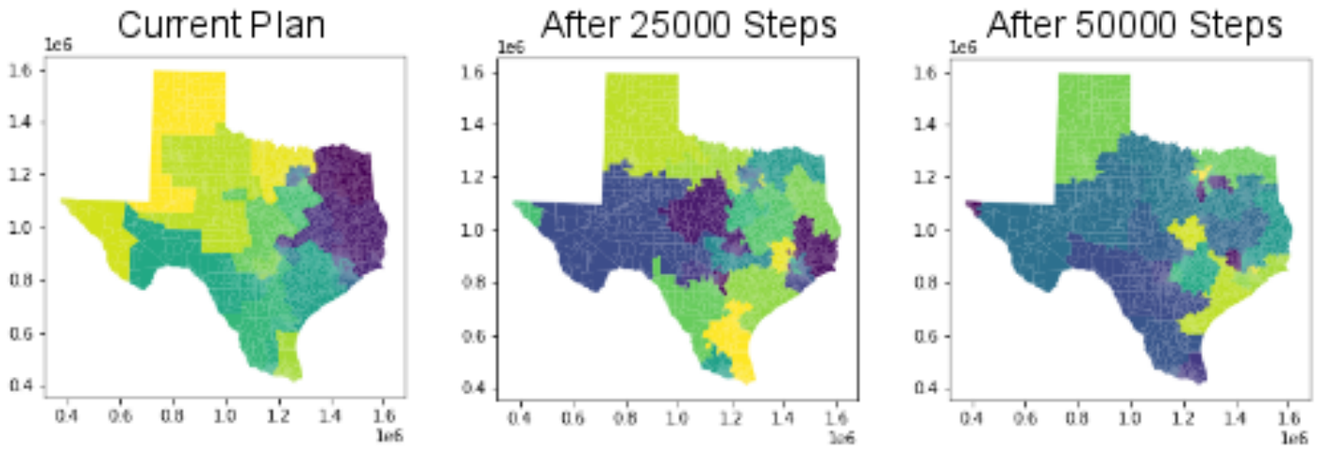
[redacted]

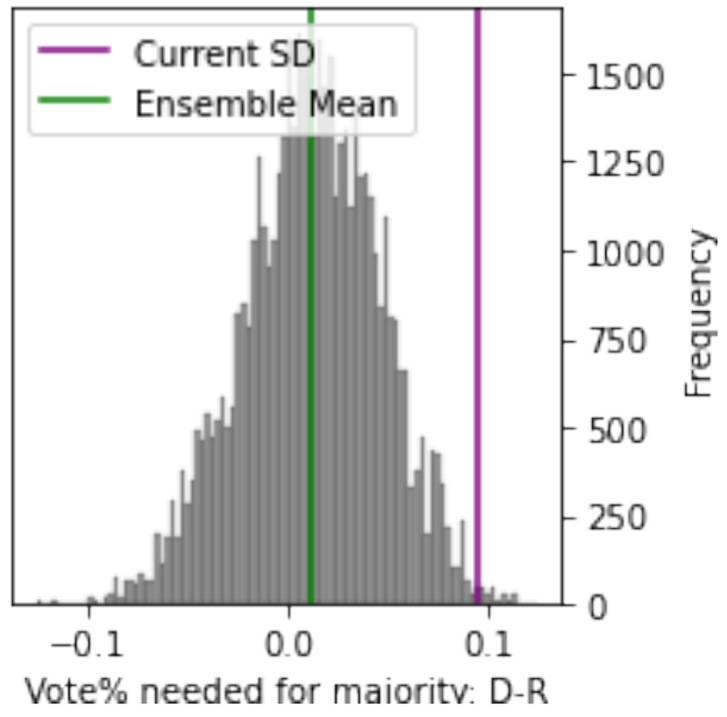
What is ensemble sampling?

- Generate large number of sample plans
- Assess each plan on measures of partisan asymmetry
- Create a histogram to illustrate the distribution of outcomes.
- Compare with the actual plan (or a proposed plan)
- ***If the outcome for the proposed plan is an outlier, this is evidence of deliberate gerrymandering***

Our study

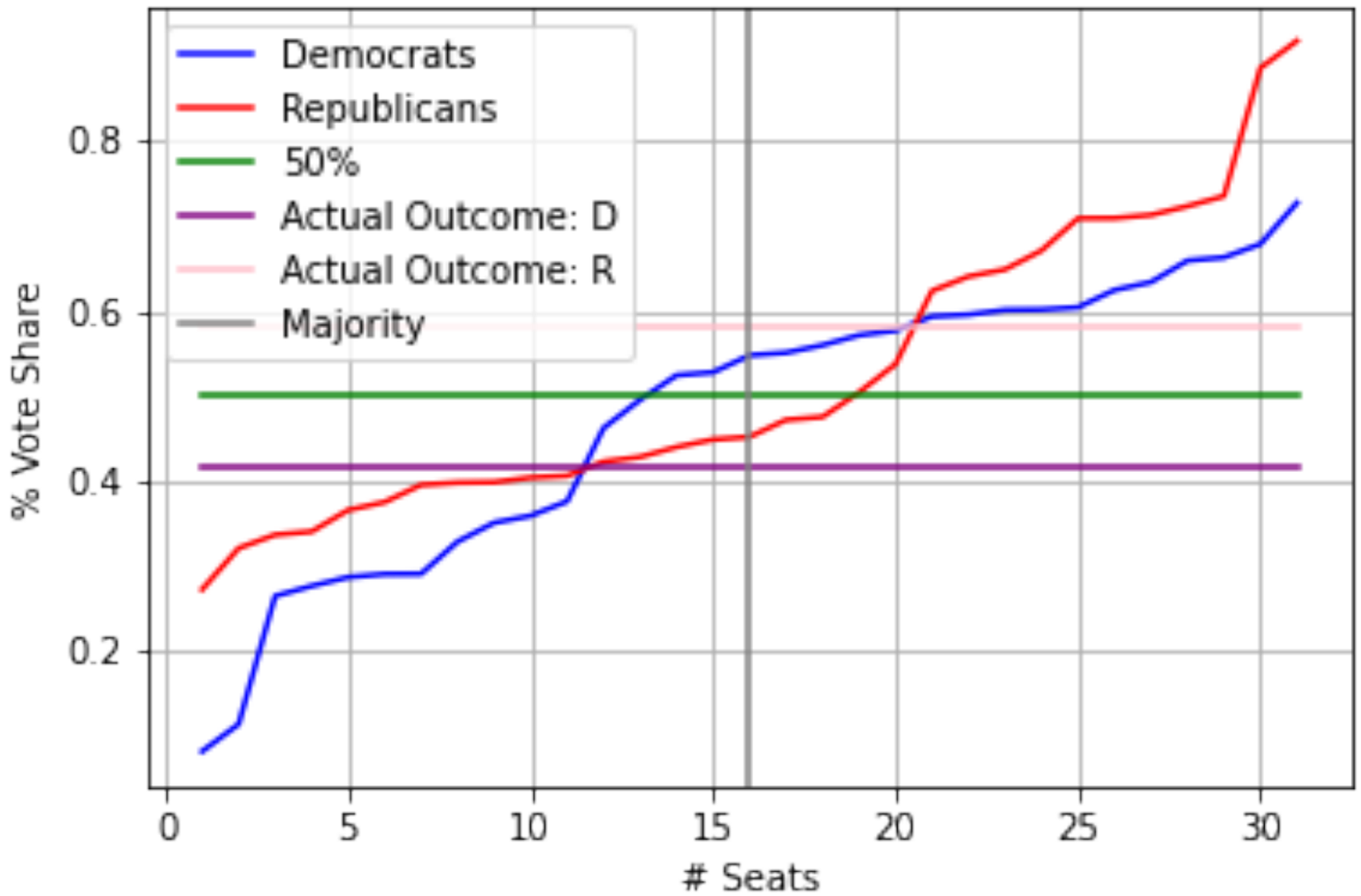
- We generated 50,000 plans starting from the current TX State Senate district plan
- We used open source software, GerryChain, developed by the MGGG Redistricting Lab at Tufts University
- For vote data, we focused on 2012 US Senate election, because it was a statewide race with no incumbent.
- We used precinct-level election geodata from MGGG





Seats-Votes Curve

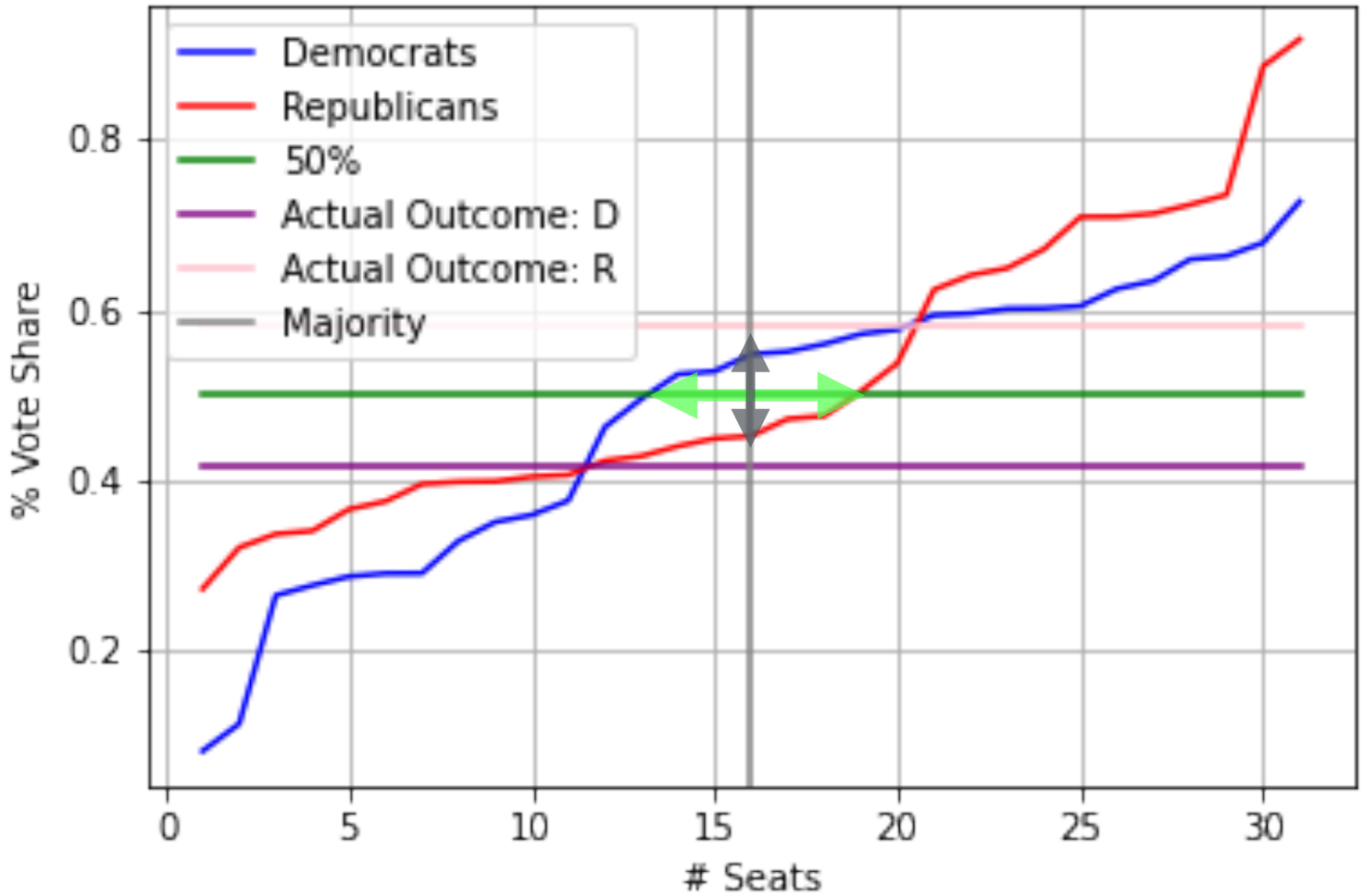
- Number of seats each party would win, if it received a certain percentage of votes, assuming a uniform shift in observed vote percentages.
- To compute:
  - Let x_A^k be the percentage of votes earned in district k by party A, and x_A is the overall percentage earned by party A (statewide)
  - Reorder districts so that $x_A^1 < x_A^2 < \ldots < x_A^{n_D}$
  - Compute the minimum proportion of votes needed for party A to win the kth seat: that is, $y_A^k = x_A - x_A^k + 0.5$

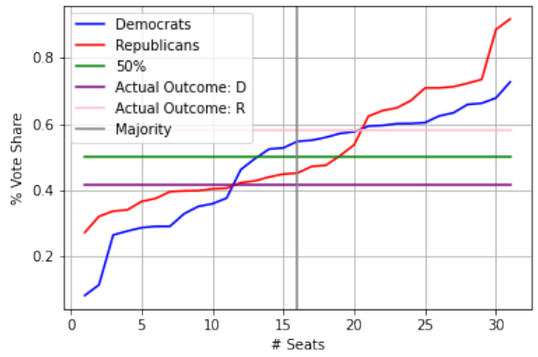


What can we learn from the Seats-Votes Curve?

- Number of seats won at 50% vote share
  - Democrats: 13
  - Republicans: 18
  - ***Difference: -5***

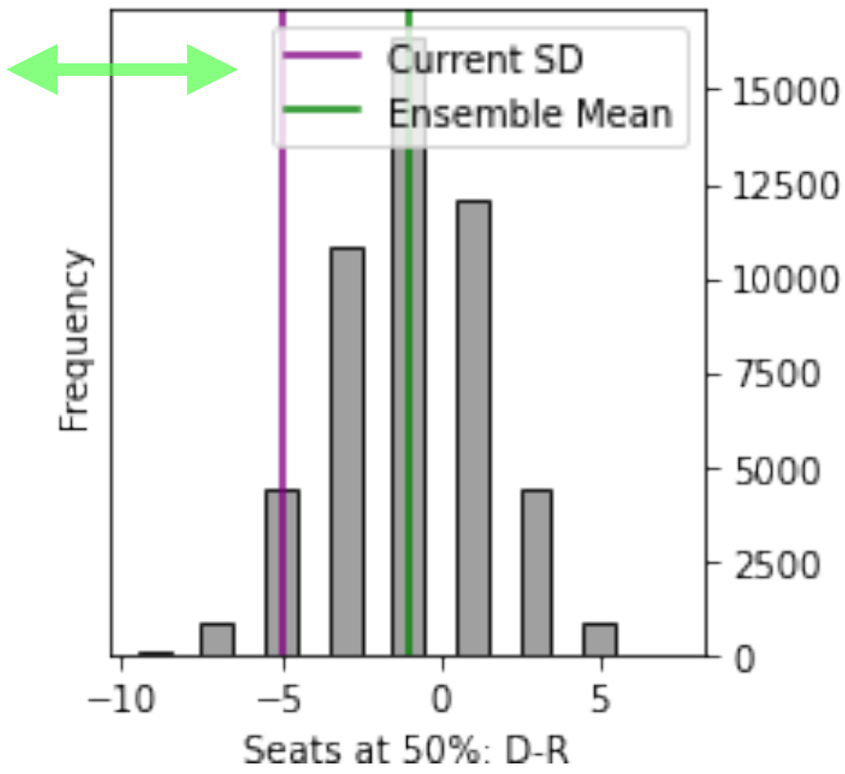
- Vote share needed for majority (16 seats)
  - Democrats: 54.2%
  - Republicans: 45.7%
  - ***Difference: 9.6%***





Is this outcome representative of an ensemble of plans?
No!

Seats at 50%

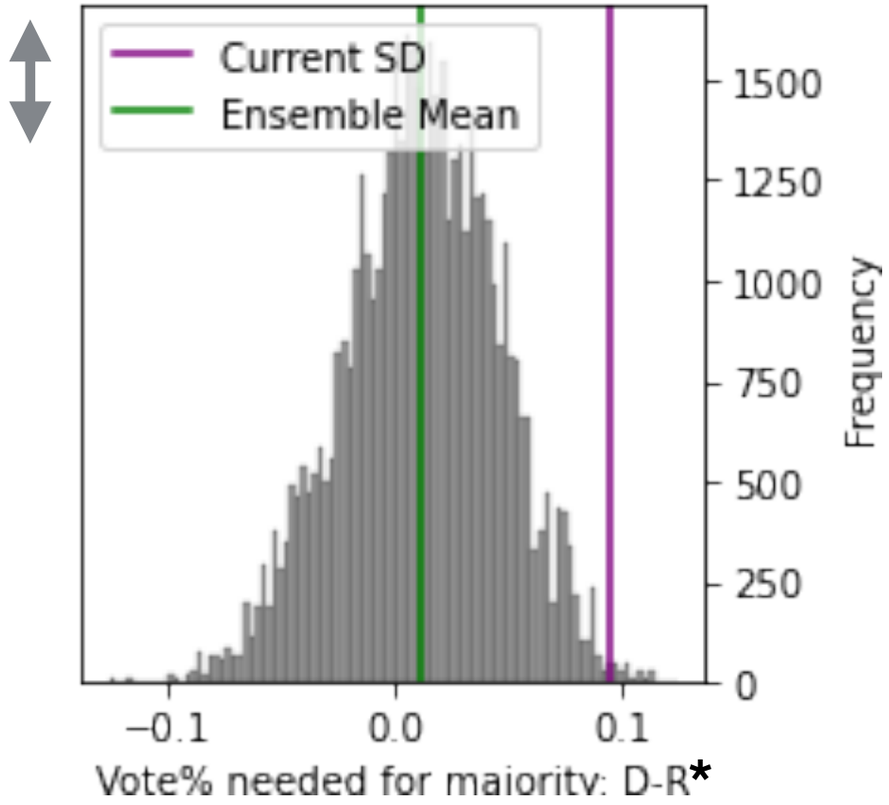


Average: -0.95

Actual plan: -5

1 in 10 plans show this level of disparity

Votes for 16



Average: 1.2%

Actual plan: 9.6%

Only 1 in 200 plans show this level of disparity

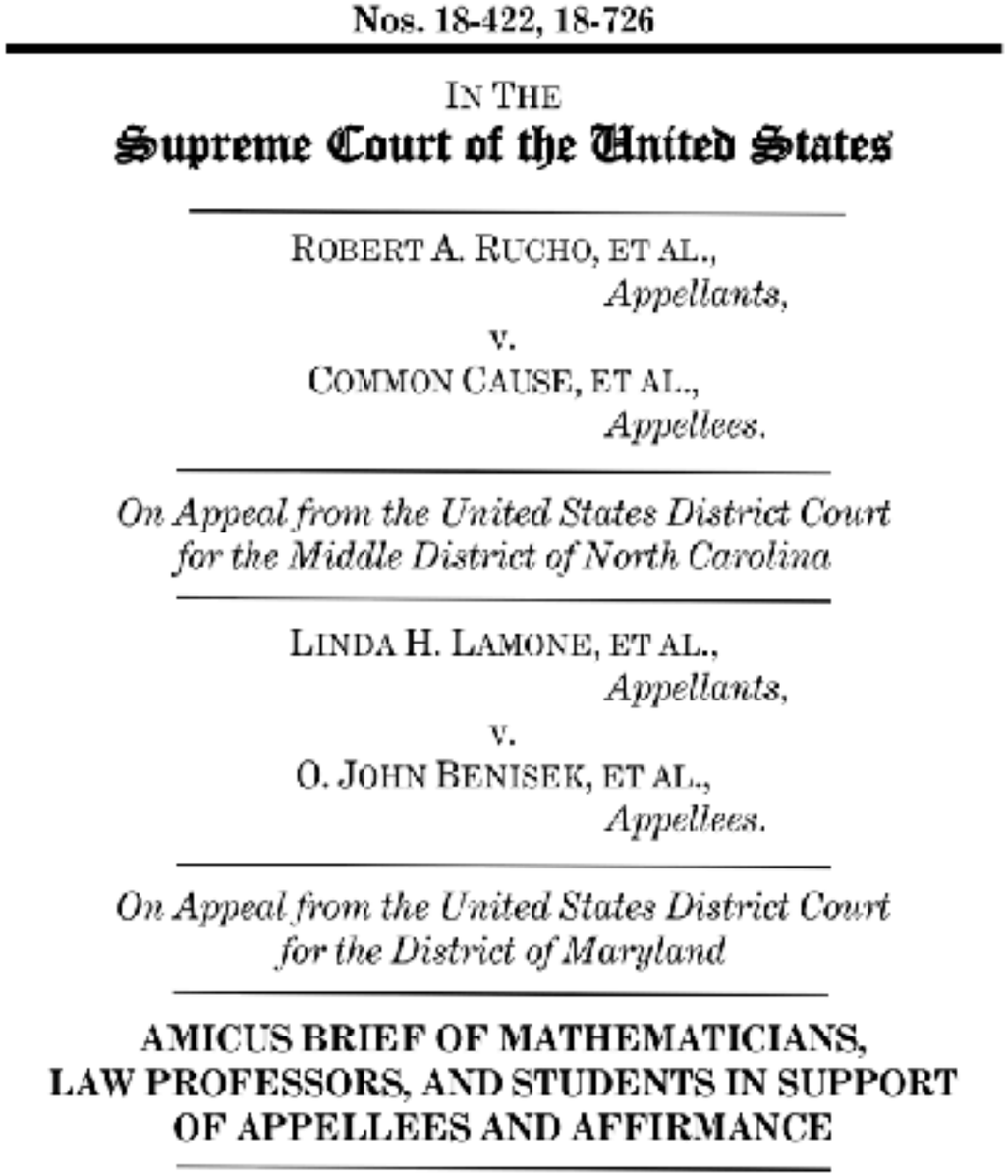
*Vote% Diff expressed as fraction of 1; i.e. 0.1=10%

Ensemble sampling is reliable and replicable

- It has been used to develop plans in other states and as evidence in court cases
  - "Mathematicians' Brief" in Rucho vs. Common Cause, 2019 **(Left)**
  - League of Women Voters of Mich. v. Benson, 2019 (MI)
  - Ohio A. Philip Randolph Institute v. Householder, 2019 (OH)
  - League of Women Voters v. Commonwealth, 2018 (PA)
  - Common Cause v. Lewis, 2019 (NC)

Ensemble sampling is fast

- Computations for this report took < 3 hours on a 2013 MacBook Pro



Nos. 18-422, 18-726

IN THE
Supreme Court of the United States

ROBERT A. RUCHO, ET AL.,
Appellants,
v.
COMMON CAUSE, ET AL.,
Appellees.

On Appeal from the United States District Court for the Middle District of North Carolina

LINDA H. LAMONE, ET AL.,
Appellants,
v.
O. JOHN BENISEK, ET AL.,
Appellees.

On Appeal from the United States District Court for the District of Maryland

AMICUS BRIEF OF MATHEMATICIANS, LAW PROFESSORS, AND STUDENTS IN SUPPORT OF APPELLEES AND AFFIRMANCE

References

- Used in our study
  - Software from MGGG (GerryChain): https://gerrychain.readthedocs.io/en/latest/
  - Precinct-level election geodata from MGGG: https://github.com/mggg-states
- Legal cases: see previous slide
- Expert Reports
  - M. Duchin, *Outlier analysis for Pennsylvania congressional redistricting*, available at https://mggg.org/uploads/md-report.pdf
  - J. Mattingly, *Expert Report on the North Carolina State Legislature*, available at https:// sites.duke.edu/quantifyinggerrymandering/files/2019/09/Report.pdf
  - All expert reports prepared by MGGG: https://mggg.org/reports
- Academic centers
  - MGGG Redistricting Lab (Tufts): https://mggg.org
  - Quantifying Gerrymandering (Duke): https://sites.duke.edu/quantifyinggerrymandering/

Contact

Andrea K. Barreiro
Associate Professor of Mathematics
Southern Methodist University
[redacted]
http://faculty.smu.edu/abarreiro

A full report is in preparation: contact A. Barreiro for a copy