Combating Gerrymandering with Social Choice: the Design of Multi-member Districts

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Redistricting

Basics Following the census, voters are partitioned into contiguous equal-population districts, each of which elect a representative independently.

Objectives Draw districts which lead to globally representative outcomes (e.g. proportional) while preserving local representation (e.g. compactness).

Challenges Intentional and natural gerrymandering

1. Intentional: partisan manipulation to influence electoral outcomes
2. Natural: spatial distribution of voters make it impossible to draw representative maps.

Most Democratic

Most Republican

This bill requires (1) that ranked choice voting ...be used for all elections for Members of the House of Representatives, (2) that states entitled to six or more Representatives elect all Representatives on an at-large basis—Fair Representation Act, H.R. 4000, 2019.

Social Choice

Suppose we are electing N people.

Winner takes all: Each voter votes for N candidates. Top N vote-getters are elected.

STV: Candidates are not elected “independently.” Each voter submits a ranking, and candidates are selected sequentially.

Thiele rules: Parameterize decreasing marginal returns for individual voters in approval voting.

Our Work

Study the joint design space of districts and social choice rules.

Research Questions How do multiple multi-member districts (MMDs) affect the distribution of possible outcomes, under either adversarial gerrymanders or neutral redistricting? What is the role of the social choice function used? How big is “big enough”? How do MMDs affect intra-party measures, such as geographic and political diversity of winners?

Contributions Methodologically, we provide a scalable methodology to algorithmically study partisan gerrymandering and fair redistricting under MMDs, and in particular under STV.

Empirically, we show that 2- or 3-member districts with STV are enough to both inhibit partisan gerrymandering and eliminate natural gerrymanders, without sacrificing local representation.

Methods

Challenge: Need to generate maximally fair and unfair maps at scale for a wide range of states, voting rules, and district numbers. Very hard optimization and simulation problems.


1. Hierarchically generate districts in a tree structure
2. Calculate expected outcomes for districts in the leaf nodes using historical data.
3. Use a dynamic program (or an IP) to aggregate into maps

Results

Most Republican

Most Democratic

Figure 3. How the partisan lean and proportionality gap vary at the state level with voting method and the number of districts. Shows natural gerrymandering is virtually eliminated by using STV.

Design Recommendations

1. Two and three member districts are effective in most states in mitigating both intentional and natural gerrymandering.
2. MMDs with winner take all or using a mix of SMDs and MMDs do not help, and can enable worse gerrymandering.
3. Larger districts are needed in smaller and more partisan states.
4. H.R. 4000 is effective in promoting fair maps, while still allowing flexibility in MMD size.

Open Questions

1. How does the design of MMDs and voting rules interact with third parties?
2. What is the right way to think about the VRA in the context of MMDs?
3. What are the effects at the city level, where most candidates are in the same party?
4. Are there more data-driven or realistic but still tractable assumptions on voting behavior?

References