Using Mathematical Modeling to Create Non-Gerrymandered Congressional Voting Maps

Pandit, Jayanth (School: Texas Academy of Mathematics and Science)
Rebello, Ethan (School: Texas Academy of Mathematics and Science)
Li, Zachary (School: Texas Academy of Mathematics and Science)

Gerrymandering is one of the biggest problems in American democracy. Political parties have, in the past few decades, used redistricting as a method of maintaining political control. Often, they create safe districts and expand their reach far beyond the will of the voters. A mathematical solution to political gerrymandering could help create a more vibrant and fair democracy. Without any settled solution to political gerrymandering, our democracy continues to be unrepresentative. In this project, we create three algorithms - Ideal Partition, Circular Engulfment, and LRPG - that use mathematical methods to create non-gerrymandered congressional maps. All three of our algorithms create congressional maps with substantially less gerrymandering than the current maps for the U.S. House of Representatives. Each method has some benefits in terms of speed, complexity, and variability in results. Ideal Partition is notable for creating districts that align with city lines and divide large cities well, but it has a large time complexity, and will occasionally fall into an infinite loop before the districts are all formed. Circular Engulfment is much quicker at generating results, but it has issues with the continuity of resultant districts and is better suited for modeling than for true district generation. LRPG is the fastest of the three and has a low variability in results but may not always create accurate districts. Regardless, our work showcases that a mathematical model for non-gerrymandering congressional maps is possible and could significantly improve the quality of democracy.

Awards Won:

Fourth Award of $500

National Geographic Society: Excellence in Geography and Geospatial Science Award