Determining the Expected House Majority Using Pattern Analysis

Methods and Motivations

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What is Gerrymandering?

• Gerrymandering is the use of demographic knowledge of an area and accompanying voting trends in order to draw legislative districts with the intent to create partisan electoral advantage.

Contemporary Debate

• Does gerrymandering benefit one party over the other?
• How does one decide if a district has been gerrymandered?
• Does this alter the “natural” majority in the House?

Project Goals

• Simulate what a “natural” majority in the House would consist of by:
  • Removing human interaction from the redistricting process
  • Using demographic trends paired with existing election results to determine the “victorious” party in each district

Part 1: Randomized Redistricting

• Due to lack of previous academic study, a code was commissioned to randomly draw congressional districts for each state
• A unique census tract adjacency list and population list was derived from the 2010 census data for each state.
• The code uses a Monte Carlo method of randomly connecting adjacent nodes from the adjacency list, and is weighted by the population vector provided by the population list.
• In-state population variation <1%
• 100 trials on each state for statistical significance

Random Redistricting of Utah

Part 2: Linear Model

• A spreadsheet was created that consisted of all Congressional districts and accompanying election results from 2002-2014, along with demographic data from the 2000 and 2010 U.S. Census, and 2007-2011 ACS data. ACS data only existed in block format, so this was dissolved into the proper congressional districts using ArcMap.
• Elections resulting in a large margin of victory (over twenty points) were removed to preserve the accuracy of the model
• Due to the binary nature of U.S. elections, the Republican party was chosen to have its results used. Election results for other conservative parties in a district were aggregated with Republican results from the same district.
• Using the general library in R, a linear model was created using the spreadsheet. It was found that a combination of veteran status, female, black, married, business management, service occupations/natural resources, less than high school diploma, high school diploma, and advanced degree proved to be the best demographics of which to predict congressional elections

Materials

• ESRI’s ArcMap software
• Microsoft Excel
• R console
• 2000 and 2010 U.S. Census data, delineated by census tract and in shapefile format
• 2002-2014 U.S. House of Representatives election results
• 2007-2011 American Community Survey (ACS) data, delineated by congressional district
• Connection algorithm

Connectivity Issues

• Islands break connectivity and are missed by the connection algorithm. To solve this, the adjacency list was modified to connect an island with its main ferry terminal on the mainland.
• Michigan’s Upper Peninsula was connected to the mainland using the two census tracts at the Mackinaw bridge
• Virginia’s section of the Delmarva Peninsula was connected to the state by the closest geographic point

Conclusion

• Once each state has been redistricted, the outputs will be compared to the linear model to produce a winner in each district
• Using a one-sided alpha level of 0.05, the current majority in the makeup of the House will be compared to the synthesized population using a Z-score
• If the Z score is not significant, this will provide evidence suggesting that gerrymandering does not significantly effect the makeup of the House.

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