

MIT IAP 2019

Computational Methods in Political Redistricting

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1 Introduction

Hi Everyone,

You are receiving this email because you expressed an interest in attending the MIT IAP on Computational Approaches for Computational Redistricting. I wanted to outline the goals for the class and some of the material that we will be covering.

Our main goal is to explore MCMC approaches for generating districting plans using the GerryChain software. In order to situate these problems in the proper social and mathematical contexts we will also discuss some related material about redistricting as many of these issues are not well understood, even by politically engaged individuals. An overview of these topics is below.

Understanding how the political redistricting process varies across the states

Modeling the redistricting process as a mathematical problem first requires us to understand the underlying political issues. One surprise is the extent to which the rules for redistricting vary by state and the extent to which small choices of rules can change the political outcomes. In recent years, there has been increasing attention on ballot initiatives setting up independent redistricting commissions but setting up useful rules for these bodies is a complex task that we will investigate using MCMC ensembles.

Understanding how these get formalized as mathematical problems

Learning the official legal constraints is one thing but turning them in to mathematical properties that we can measure is an entirely separate problem. Even seemingly simple rules such as connectedness turn out to lead to interesting mathematical variants of the partitioning problem and the more complex rules lead to even more exciting problems. Additionally, the fact that we have to build our districting plans out of discrete sub-units means that there are issues related to the level of resolution that must be addressed.

Understanding the related data challenges

The state of electoral data is shockingly bad in some states. Even determining the locations of precinct boundaries for a given election can be an onerous task, to say nothing of the effort required to associate the aggregate voting data with the correct underlying units. In order to generate realistic ensembles we need access to good data so we will spend some time investigating how to work with geospatial data.

Understanding how to apply MCMC and outlier analysis to proposed plans

Once we have generated ensembles of plans the next step is to compare their properties to those of plans currently in use. Several different types of analysis have been used in court cases and expert reports and we will consider the pros and cons of these methods. We will

also discuss the features that make outlier analysis with MCMC our preferred approach and look at several specific examples.

2 Schedule

The plan is to have four meetings: Jan 8, 10, 22, 29. The official website lists them at 8am but my guess is that most people would prefer later in the day? In order not to contradict the official material on the IAP website, my plan will be prepared to give a version of the introductory lecture each week at 8 and then hold more in-depth discussions from 12-1 on each of those days. The plan will be to cover:

- 1/8 Introduction and geospatial data
- 1/10 MCMC and GerryChain
- 1/22 Other partitioning methods
- 1/29 Specific state level analyses

Throughout, we will make use of the software (github.com/mggg) and data (github.com/mggg-states) prepared by the Metric Geometry and Gerrymandering Group.

Please feel free to email me for any additional information that would be helpful.

3 Background Material

Still a work in progress!