Project Background - Part 1

Congressional District
Generation System

Reading

- Reading - all class members
  - https://www.brennancenter.org/publication/extreme-maps
References

- Public Mapping Project – Nice links to state-level details
- Data
  - [https://electionlab.mit.edu/data](https://electionlab.mit.edu/data)
  - [https://projects.iq.harvard.edu/eda/home](https://projects.iq.harvard.edu/eda/home)
- Measure references (reading by selected members of each team)
  - [chicagounbound.uchicago.edu/cgi/viewcontent.cgi?article=1946&context=public_law_and_legal_theory](https://chicagounbound.uchicago.edu/cgi/viewcontent.cgi?article=1946&context=public_law_and_legal_theory)
- GUI references (review by GUI people, and maybe others)

Project Teams

- Send an e-mail with your improved team name
- For now the team names (and team members) are:

<table>
<thead>
<tr>
<th>Group</th>
<th>Group Members</th>
</tr>
</thead>
<tbody>
<tr>
<td>Astros</td>
<td>Ishan Sethi, Kevin Tran, Aakash Kattelu, and MD Hoasain</td>
</tr>
<tr>
<td>Blue Jays</td>
<td>Edward Jiang, Sean Yip, Nick Perrillo, and Zhouqi Gong</td>
</tr>
<tr>
<td>Cubs</td>
<td>Omar Zaraci, Chaundry Khan, Ravjot Sachdev, and Daniel Eliasinski</td>
</tr>
<tr>
<td>Dodgers</td>
<td>Aditya Sheth, Christopher Giannarita, David Le, and Randy Paquette</td>
</tr>
<tr>
<td>Expos</td>
<td>Alexander Chin, Fredierica Chen, David Xie, and Jeffery Wong</td>
</tr>
</tbody>
</table>
What are the Goals of the Redistricting System?

- Display existing districts (congressional, state, and precinct) and generated districts in a Web interface
- Allow for new district boundaries to be defined by an impartial algorithm
- Combine algorithmic approaches to the generation of new voting districts
- Provide a batch district generation system
- Visually display the new district boundaries so that a comparison can be made with existing district boundaries
- Design with an expandable structure that will accommodate a variety of measures

Quantitative Approach to Redistricting

- Represent all of the possible objectives in redistricting as a quantitative value

\[ \text{Objective function} = W_1F_1 + W_2F_2 + W_3F_3 + \ldots \]

- Where \( F_n \) is a value of a metric (e.g., partisan Gerrymandering, compactness, population equality, etc.)
- Weights \( (W_1, W_2, \ldots) \) are selected by the user, and reflect the relative importance of each factor in the calculation
**Background Info**

- Every state has a number of congressional districts proportional to the state population.
- Population is recalculated after a US Census, and district boundaries must be recalculated if the number of representatives change.
- District boundaries can also change due to court decisions (e.g., Pennsylvania, North Carolina, etc.).

**Precincts (sometimes known as Wards)**

- Lowest level government division
- Contains one polling place
- Data usually available for voting totals

Precinct voting rate data would be helpful.

US Census is performed every 10 years.
Restatement of Project Goals

- Now that we’ve defined a few more terms, we can restate the goals of the CSE308 project as ...
- Create a system that will generate multiple solutions to the problem of automatically assembling precincts into congressional districts in accordance with state and federal redistricting requirements while optimizing political fairness

A given solution will likely not be optimal, but your approach should develop many solutions, some of which might be optimal

Graph Formation

- The set of precincts will form an incomplete graph
- You will need to add information to fully form the graph
- Nodes
  - Election results
  - Demographics
  - Political unit (e.g., county, town, etc.)
- Edges
  - Contiguity
  - Weights (e.g., different political unit, dividers, demographic similarity)

The weight of edges will be used to determine how to combine precincts into districts
Algorithmic Approaches

- Simulated annealing
- Region growing
- Graph partitioning

Choice of graph partitioning or region growing will be given to you in the second set of requirements.

We will take a 2-step approach in which the user specifies the number of congressional districts, and the algorithm uses either graph partitioning or region growing to define an initial set of districts then uses simulated annealing to refine the districts.

Extensive testing will be required to identify algorithmic heuristics.

Start to Think About Project Issues

- GUI design
- Metrics used in your objective function
- Data needed in DB
- Sources of data in DB
- Algorithms used

You are still about 1-2 weeks away from SW design.
Session 3 – Project Background (Part I)

Web GUI

Top-level page will likely be something like this

Insert boundary data with an existing mapping tool (e.g., Leaflet and Google Maps)

http://www.washingtonpost.com/wp-srv/special/politics/gerrymandering/

State Display

- Second level will likely show a state
- Interface requires
  - Request to select algorithm, metrics, etc.
  - Robust map functions (e.g., zoom, layers, mouse-overs, etc.)
  - Show real-time interim progress
  - Show final results with comparisons
User Interface

How do you convey the results of a large number of gerrymandering measures, especially when the measures are not consistent in format?

When you get to SW design issues, one major decision will be to use client side graphing or server side graphing

Mapping Accuracy

How accurate are your maps?

You will need to consider the precision of your data, and use that in your algorithm and your result displays

2011 Republican Redistricting

- 9 Districts, Favoring Republicans
- 2 Districts, Illegally Packed with Dems.
- 2 Other Districts, Favoring Democrats
How Much Data Do You Include in Maps?

* Some data associated with measures might be included in measure results, but might not be included in GUI

African-American population in North Carolina

Percent of total population

- 1-5%
- 5-14.99
- 15-24.99
- 25-34.99
- 35-44.99
- 45-54.99

N.C. population = 21.6 percent African-American

Source: U.S. Census

© Robert Kelly 2017-2019