FairyMander

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NORTHERN ARIZONA UNIVERSITY
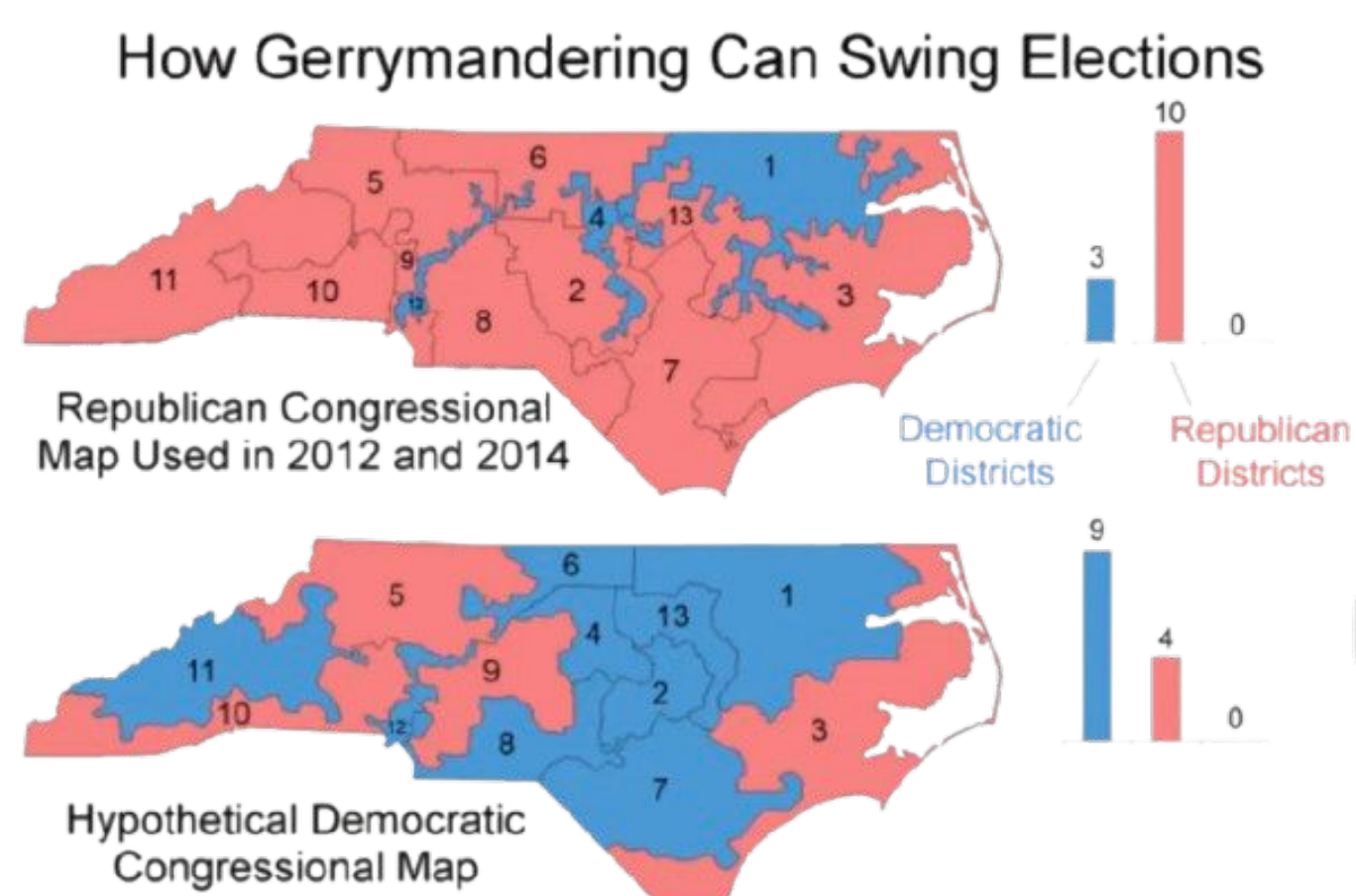School of Informatics, Computing, and Cyber Systems

Motivation

- Congressional districts are redrawn every ten years. The number of districts each state gets is determined by its population.
- Every district votes to elect a member of Congress.
- Congress holds all legislative power. It is the only part of the government that can make and change laws.
- Redistricting in thirty-nine states is done by the legislature, giving representatives the opportunity to gerrymander.

Gerrymandering

Gerrymandering is the act of manipulating district lines to control political outcomes, posing a threat to democracy.

How Gerrymandering Can Swing Elections
Republican Congressional Map Used in 2012 and 2014
Democratic Districts — Republican Districts
Hypothetical Democratic Congressional Map

Methods used to gerrymander:
- **Packing**: Concentrates specific voters into as few districts as possible to limit their representation in Congress.
- **Cracking**: Divides specific voters across different districts, diluting their votes.
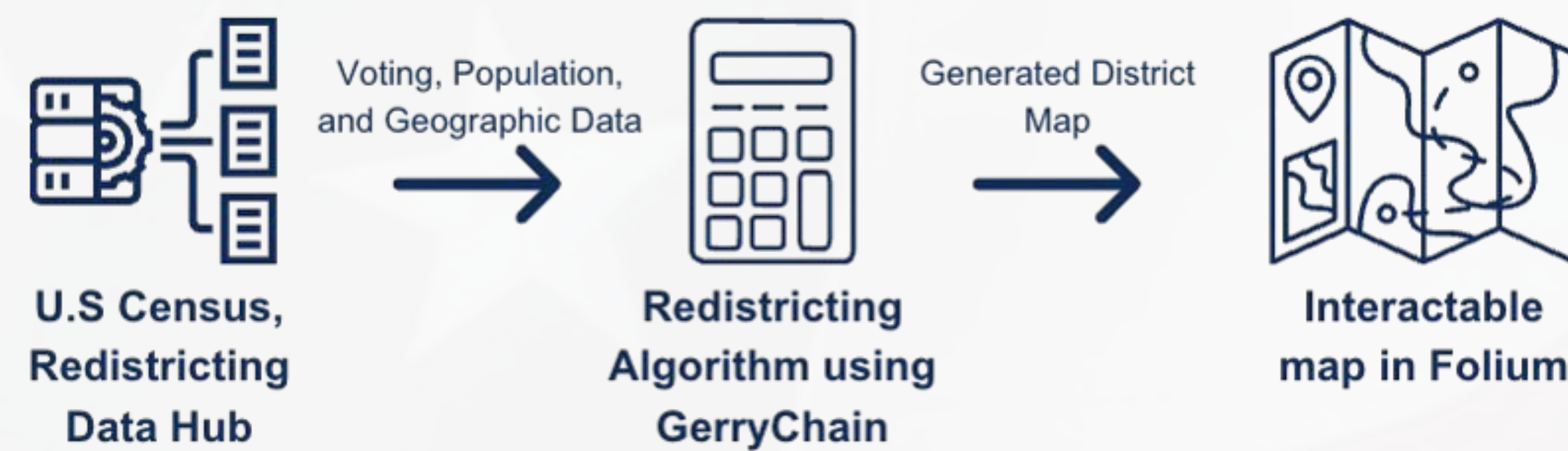
Both strategies are used to diminish people's power and representation based on demographics and political affiliation.
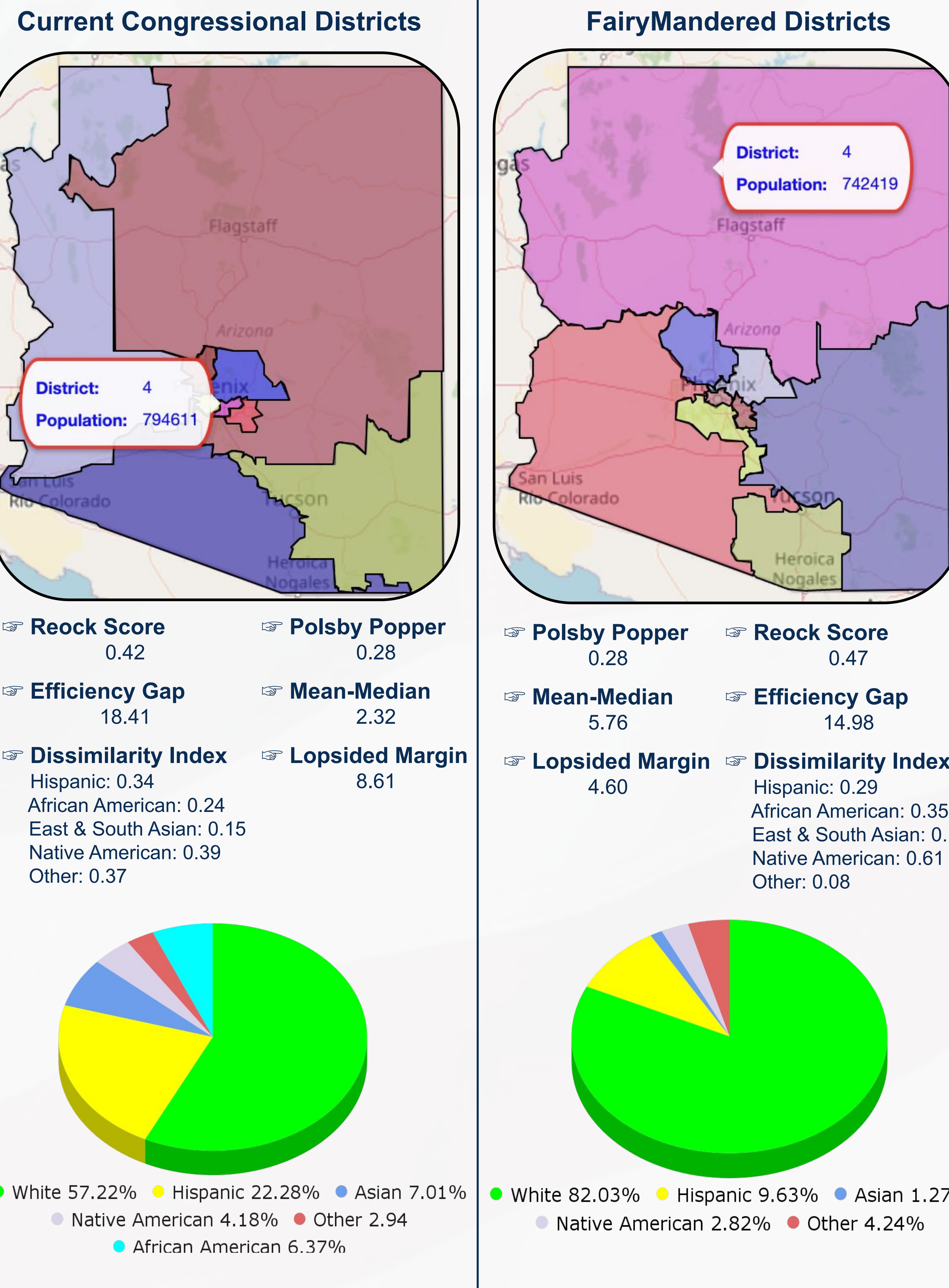
Solution

Generate districts using a redistricting algorithm, and evaluate the results based on fairness metrics:
- **Reock Score, Polsby-Popper:** Compactness
- **Efficiency Gap, Lopsided Margin Test, Mean-Median Difference:** Political competitiveness
- **Dissimilarity Index:** Minority representation

Data for generating these districts will be obtained from the U.S. Census and Redistricting Data Hub.

Solution Overview

U.S Census, Redistricting Data Hub → Voting, Population, and Geographic Data → Redistricting Algorithm using GerryChain → Generated District Map → Interactable map in Folium

Results

Current Congressional Districts

District: 4
Population: 794611

☞ Reock Score 0.42
☞ Polsby Popper 0.28
☞ Efficiency Gap 18.41
☞ Mean-Median 2.32
☞ Dissimilarity Index
Hispanic: 0.34
African American: 0.24
East & South Asian: 0.15
Native American: 0.39
Other: 0.37
☞ Lopsided Margin 8.61

● White 57.22% ● Hispanic 22.28% ● Asian 7.01%
● Native American 4.18% ● Other 2.94
● African American 6.37%

FairyMandered Districts

District: 4
Population: 742419

☞ Polsby Popper 0.28
☞ Reock Score 0.47
☞ Mean-Median 5.76
☞ Efficiency Gap 14.98
☞ Lopsided Margin 4.60
☞ Dissimilarity Index
Hispanic: 0.29
African American: 0.35
East & South Asian: 0.14
Native American: 0.61
Other: 0.08

● White 82.03% ● Hispanic 9.63% ● Asian 1.27%
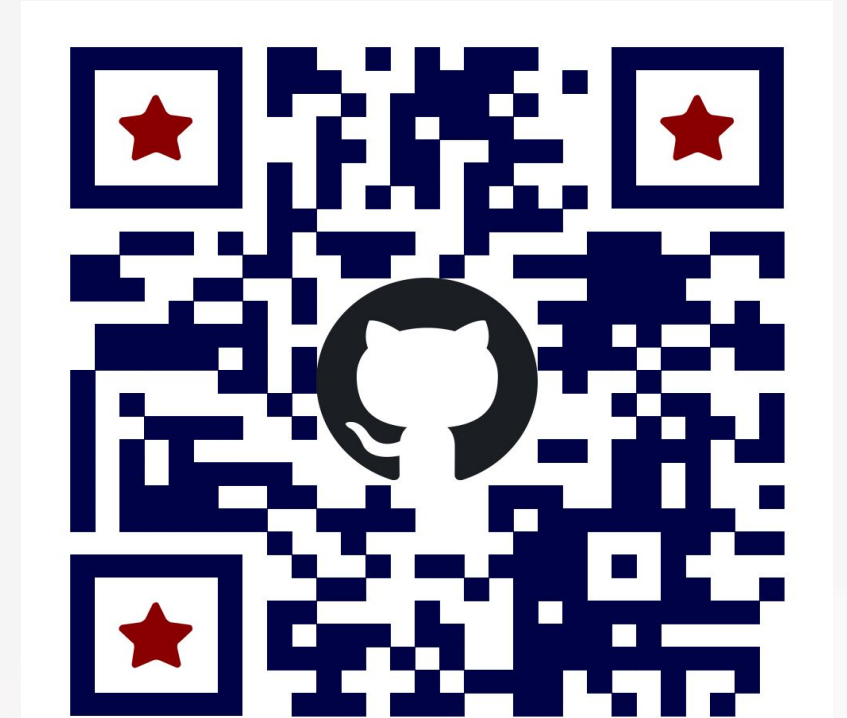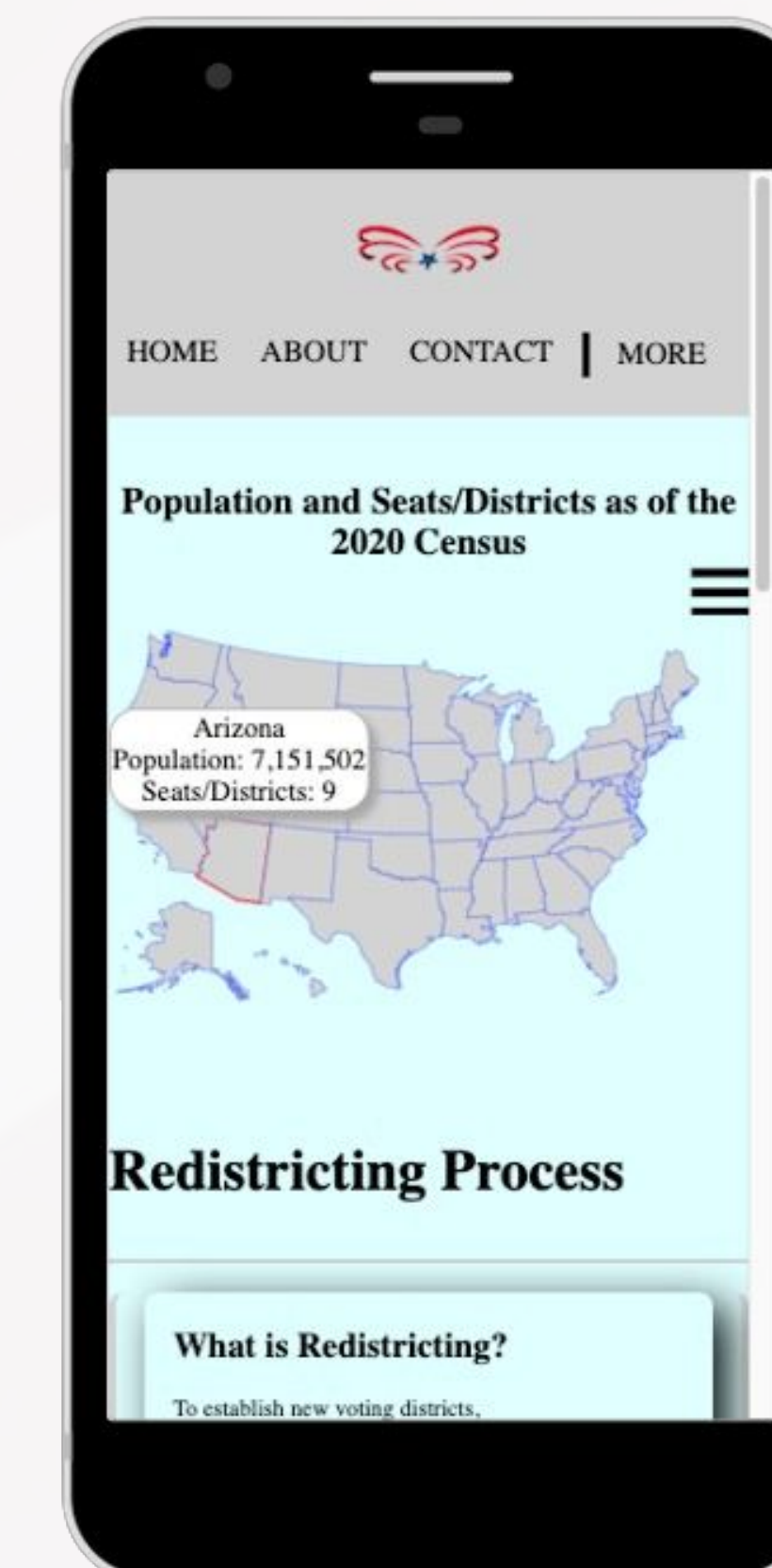● Native American 2.82% ● Other 4.24%

Challenges

- Voting data is inconsistent between states.
- HI, CA, FL, HI, MA, NY, and RI have geographical distortion and/or inconsistencies in census data.
- States with disconnected land, such as islands.

Future Work

- Specific state laws around redistricting are not considered; further work should be done to implement these laws.
- Data is from the most recent census and election (2020 and 2022, respectively). A module could be developed to dynamically pull updated data.

Website

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Population and Seats/Districts as of the 2020 Census
Arizona
Population: 7,151,502
Seats/Districts: 9
Redistricting Process
What is Redistricting?
To establish new voting districts.

Technologies

HTML5, CSS3, JS, APACHE HTTP SERVER PROJECT, GitHub, Folium, United States Census Bureau, Shape, Jupyter, Python, aws, GeoPandas