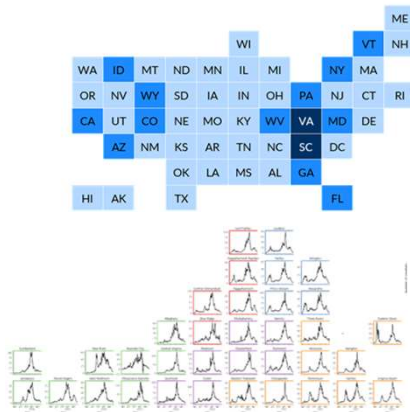


Automatic Tile Grid Map Production Software

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Background

- Tile grid maps arrange subdivisions of an area into equal area shapes to display information
- The information conveyed usually is a graphic for each subdivision which fits within its respective tile
- This way of information presentation is useful because it allows viewers to easily find their subdivision and view information
- Tile grid maps can also illuminate trends within a general area
- At the Biocomplexity Institute, these maps are used to display Covid-19 regional data within Virginia



Problem

- Tile grid maps can require a lot of manual work especially as the number of subdivisions increases
- It is difficult for human's to create the most geographically accurate solution
- This provides the need for a program that can automatically generate a tile grid map given hyperparameters

Requirements

- Shapefiles to provide outline of an area and borders of its subdivisions
- Knowledge of Geopandas and Numpy library within Python
- Excel file output listing positions on grid

Research

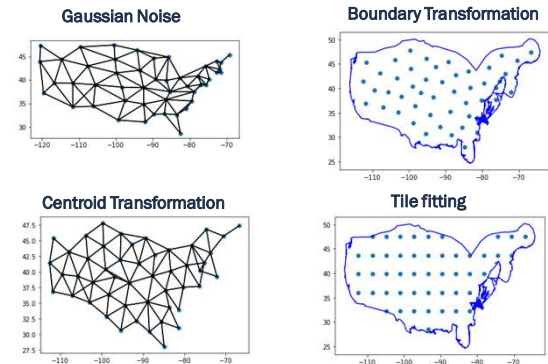
- Two papers, McNeill & Hale and Meulemans et al., were two most established, recent solutions
- The McNeill & Hale Implementation was chosen because the map style was more simple

McNeill & Hale Steps

1. Add Gaussian noise to region centroids.
2. Transform centroids so that (ideally) neighbors are equidistant (more grid-like), but the relative orientation of neighbors is pre-served
3. Transform boundary polygon (global shape) to reflect changes in centroids
4. Fit tiles (any shape) inside transformed boundary polygon—same number of tiles as regions.. Assign transformed centroids to tile centroids so as to minimize the sum of squared distances.

Procedure

- The steps detailed in the McNeill & Hale Paper were followed

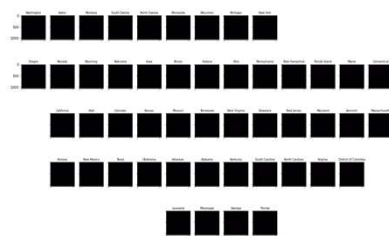
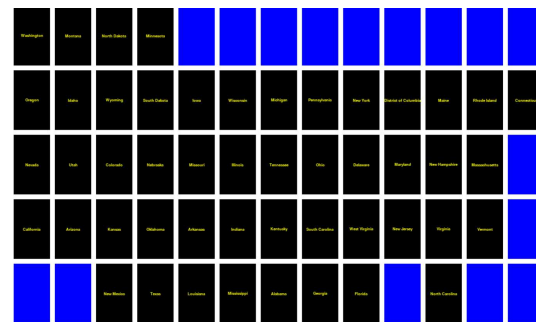


Hyperparameters

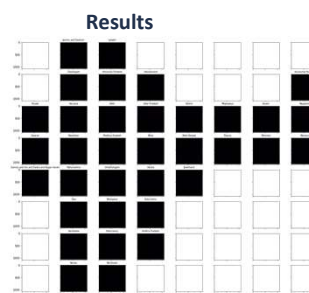
1. Interpolation- percent transformation of centroids
2. Origin of grid during tile fitting

User Interface Software

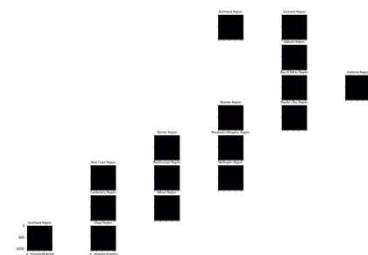
- Utilizes Pygame to allow user to adjust position of tiles to match aesthetic and geographical preferences



U.S. Tile Grid Map



India Tile Grid Map



New Zealand Tile Grid Map

References

McNeill, Graham & Hale, Scott. (2017). Generating Tile Maps. Computer Graphics Forum. 36. 435-445. 10.1111/cgf.13200

Meulemans, W., Sondag, M. F. M., & Speckmann, B. (2021). A Simple Pipeline for Coherent Grid Maps. IEEE Transactions on Visualization and Computer Graphics, 27(2), 1236-1246. [9216586]. <https://doi.org/10.1109/TVCG.2020.3028953>