

Antislavery Petitions Massachusetts

Map View Prototype Delivery

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1. Introduction

The prototype Map View of Massachusetts Anti-Slavery and Anti-Segregation Petitions is a first step towards a rich and intuitive interface for exploring this unique historical dataset. It provides a foundation that builds toward web-based access and support for further scholarly research for this dataset and others of its kind. Future versions of the Map View will expand the design and enhance the implementation with improvements and new features.

A compelling and intuitive visual interface improves the accessibility and utility of data collections. The prototype Map View supports geospatial and temporal analysis of the dataset, and the implementation described here is intended as a guide for implementation of the next iteration. This document includes a collection of examples of other visualizations as context for this work (section 2), a description of the current prototype implementation (section 3), and an evaluation of the prototype with discussion of next steps to expand the Map View capabilities (section 4).

Prototype demo URL: <http://antislaverypetitions.pythonanywhere.com/map>

Source code URL: <https://github.com/garthg/petitions-visualization>

2. Related visualization examples

We enable insight into two main aspects of our petitions dataset: the geographic aspect and the temporal aspect. There is no "single best way" to visualize geo+temporal data, and many different solutions exist in industry and academia, but there are some commonalities to draw upon. To highlight these, shown below are two "best-in-class" data visualization tools: Tableau and Spotfire. Though neither one has a visualization specifically geared towards geo+temporal data, we take lessons from how they approach data visualization.

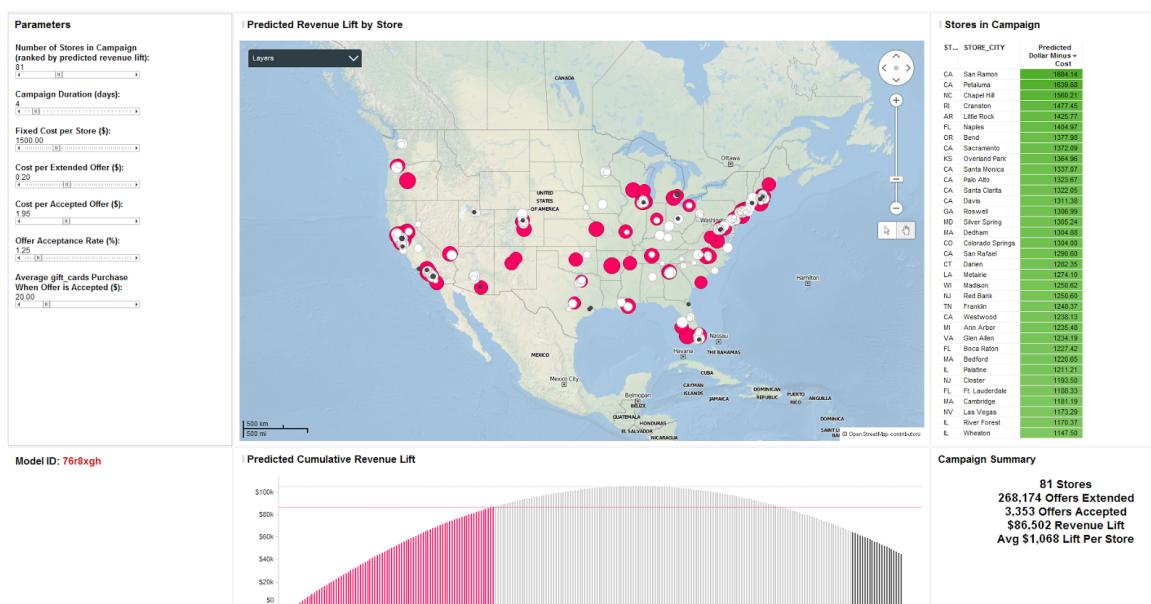
1. Tableau map view



This map view shows a Tableau visualization of geographic data. No temporal aspect is shown.

2. Spotfire map view with other filters

Using the model, TERR generates predictions by store and ranks stores in order of predicted campaign revenue lift. In Spotfire, controls and visualizations are used to find the campaign parameters that maximize campaign revenue lift.



This shows a Spotfire visualization of a map with various slider-based filters on the left side, along with some additional information present on the right side and below.

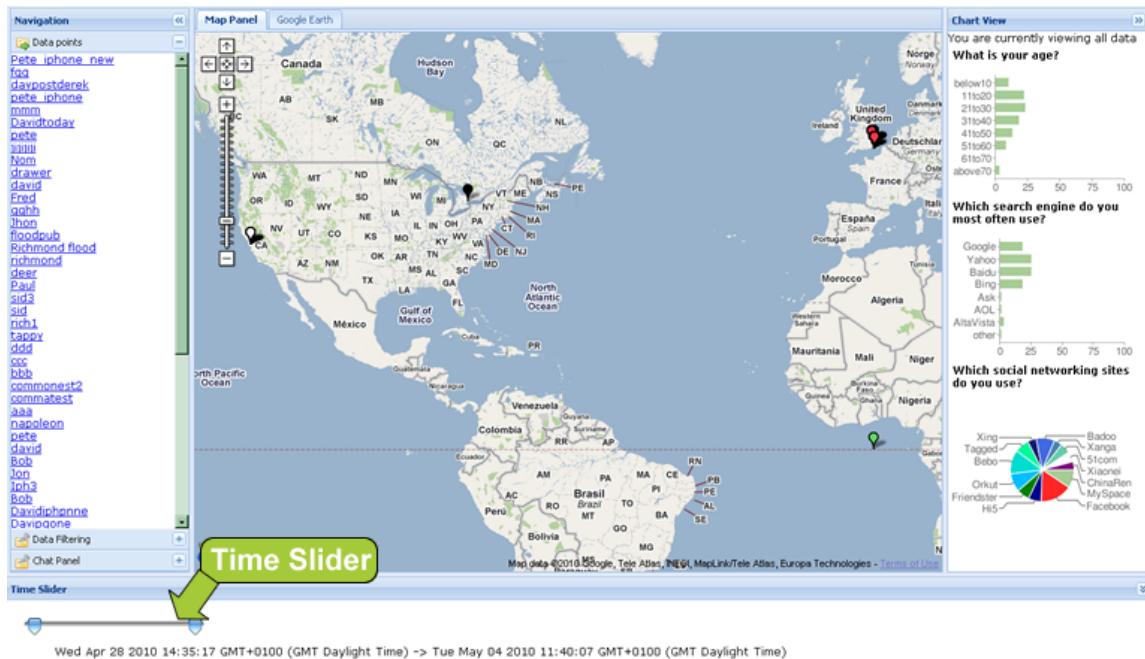
The Antislavery Petitions Map View visualization design combines some parts of both of these. As in the Tableau visualization, we place different-sized circles on the map to convey the volume of petitions at different locations. As in the Spotfire visualization, we present the map

front and center but include interactive controls as well as additional information on the rest of the page.

The Tableau and Spotfire products are polished from many years of research and development at the companies. They are also geared more towards expert analysts, meaning they are powerful and flexible but can have a steeper learning curve. In contrast, we are emphasizing simplicity and rapid prototyping in order to quickly construct an exploratory interface, so there are some particular parts of our design that differ from the examples:

- Our time slider control is larger than the Spotfire controls. This is because we are only filtering on the temporal aspect of our data, so we can place the control prominently to make the interface more clear. There is potential to later add multi-dimensional filtering and querying, which is something we put in the NEH proposal and intend to include in our work with the Harvard Center for Geographic Analysis.
- Our design includes a very detailed popup when clicking on the map. This is because our dataset has rich metadata that we can make available to users on demand.
- Our design is linked to separate external resources (the Dataverse and PDS viewer). This is because we have those representations of the data already available, and we want to take advantage of them.

Here is an example of a visualization that includes both geographic and temporal data, although it is not as stylistically polished as the Tableau or Spotfire examples.



Overall, our design combines the map representation from Tableau with the slider-based interactive filtering from Spotfire, modified to focus on simple and intuitive temporal filtering, and with the additional on-demand drill-down details and linking.

3. Current prototype implementation

The Map View data visualization supports simple and intuitive exploration of the dataset through its geographic and temporal aspects. This section details the functionality provided and the approach used to create the visualization. The prototype is available online at <http://antislaverypetitions.pythonanywhere.com/map>.

3.1. Data pre-processing

In order to construct a geographic and temporal visualization, it is necessary to convert all geospatial and temporal information in the dataset into a canonical and machine-usuable form. To accomplish this, we store a pre-processed derivative of the dataset, which is supplied to the web browser for rendering of the visualization. The following two steps were done in pre-processing.

For geography in the dataset, all town names were converted to latitude/longitude coordinates. This was done using an automated approach through the Google Geocoding API (<https://developers.google.com/maps/documentation/geocoding/>), which handled about 90% of the data, supported with some manual corrections. This automated approach is a good first approximation, but likely lacks some historical accuracy, which would be good to address in a future version.

For temporal information, all dates provided for a petition (creation date if available and dates of any legislative actions) were collapsed into a single minimum and maximum date in order to provide a single active time period for each petition. This active time period is used by the visualization to determine whether a particular petition is included or excluded by the time range filter.

To improve performance when the view is loaded, the following lookup tables are also precomputed and stored:

- **Location -> latitude/longitude**

For each unique location in the dataset, store the latitude and longitude coordinates. This makes it possible to quickly create the circles on the map.

- **Location -> row numbers**

For each unique location in the dataset, store the row numbers for petitions at that location. This makes it possible to iterate over locations and set the appropriate information in the view, rather than having to re-aggregate the data over all rows every time the view changes.

- **Year -> row numbers**

For each year in the dataset, store the row numbers for petitions active during that year. This makes it possible to quickly apply the date range filter to determine which petitions

are visible without having to re-aggregate over all rows every time the range filter is changed.

These lookup tables are loaded from the server when the view first loads, and are stored in memory on the client side for the duration of operations.

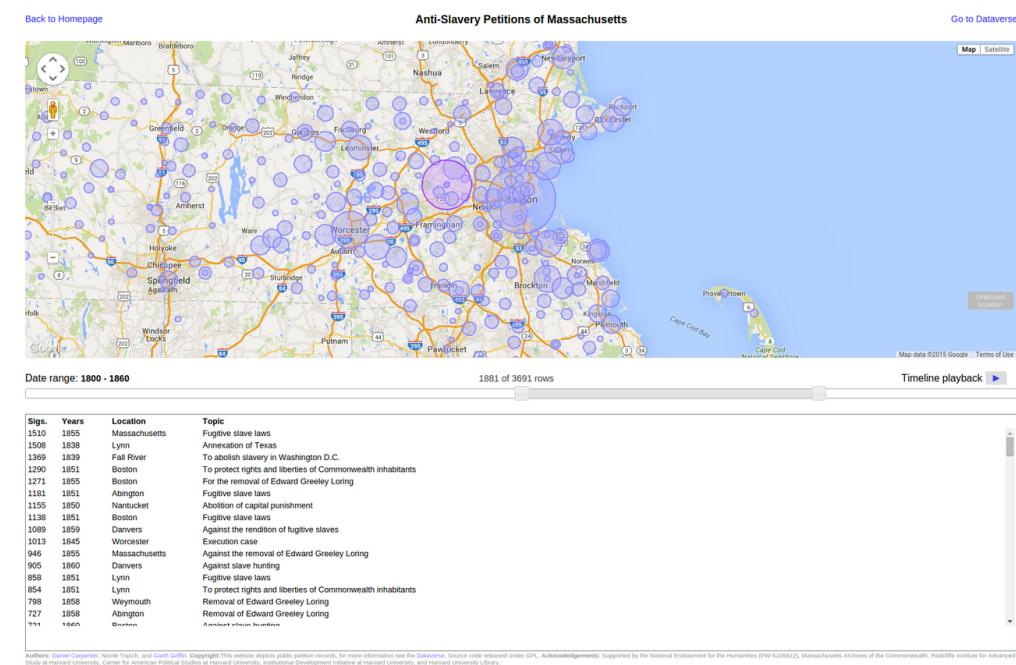
3.2. Visualization features

Exploration of the dataset through the Map View visualization relies on the following key features that have been implemented in the prototype:

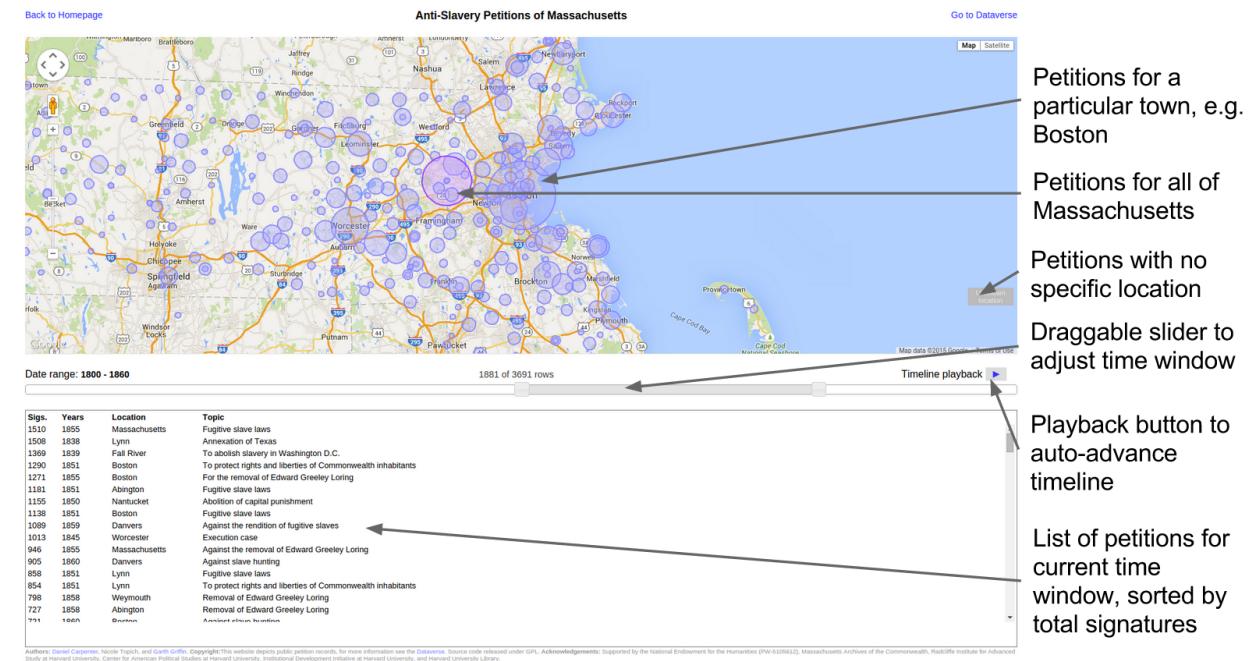
- A map of Massachusetts with pan/zoom is shown through a viewport
- A draggable timeline slider control filters the dataset by time
- Overlaid on the map are circles for individual petitions, scaled by number of petitions
- There is a list of petitions sorted by signature count showing topic, location, and date
- A playback button causes the timeline filter to auto-advance to show change over time
- Hovering over a row in the list shows the location on the map for easy reference
- Hovering over a circle on the map highlights the rows for easy reference
- Clicking a circle or row shows an overlay with petition details for that time and place
- The overlay details include links to the scanned document and to the Dataverse metadata for each particular petition

The following screenshots show the features referenced above.

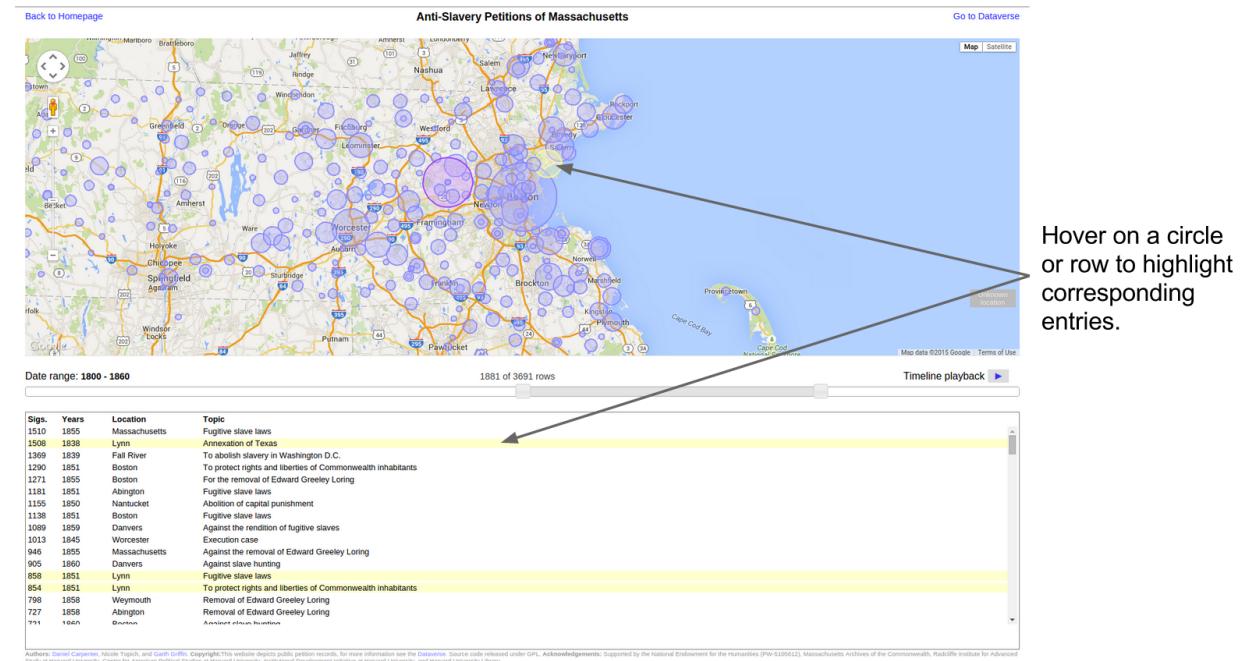
1. Screenshot of Map View showing the years 1800-1860 centered on Boston.



2. Labeled aspects of Map View screenshot.



3. Row and circle highlighting in Map View screenshot.



4. Screenshot of Map View overlay with details for the town of Lynn 1841-1861.

[Back to Homepage](#) [Anti-Slavery Petitions of Massachusetts](#) [Go to Dataverse](#)

Lynn 1800-1860 :: petition details

Annexation of Texas
Creation date: (unknown)
Activity dates: 1839-01-15 to 1838-01-15
Location: Lynn
Total 159 signatures
Selected signatories: Sarah H. Buffum, Ruth L. Buffum, Mary Newhall
Passed Resolves; Resolves 1838, c.34, SC1/series 228, Petition of Sarah H. Buffum
[View details in Dataverse](#) | [View scanned petition](#)

Fugitive slave laws
Creation date: (unknown)
Activity dates: 1851-02-05 to 1851-02-06
Location: Lynn
Total 859 signatures
Selected signatories: Alonzo Lewis, Aaron Lumus, John Bailey, Aroline A. Chase
Senate Unpassed Legislation 1851, Docket 13162, SC1/series 231, Petition of Alonzo Lewis
[View details in Dataverse](#) | [View scanned petition](#)

To protect rights and liberties of Commonwealth inhabitants
Creation date: (unknown)
Activity dates: 1851-02-05 to 1851-02-06
Location: Lynn
Total 859 signatures
Selected signatories: Alonzo Lewis, Aaron Lumus, John Bailey, Aroline A. Chase
Senate Unpassed Legislation 1851, Docket 13162, SC1/series 231, Petition of Alonzo Lewis
[View details in Dataverse](#) | [View scanned petition](#)

Date range: 1800 - 1860

Sigs.	Years	Topic
1510	1839	Against the admission of Florida and slave states
1508	1838	Against the admission of Texas
1369	1839	To prohibit the importation of slaves
1290	1851	To prohibit the importation of slaves
1271	1855	To prohibit the importation of slaves
1181	1851	To prohibit the importation of slaves
1159	1851	To prohibit the importation of slaves
1138	1851	To prohibit the importation of slaves
1089	1859	To prohibit the importation of slaves
1013	1845	To prohibit the importation of slaves
942	1855	To prohibit the importation of slaves
905	1860	To prohibit the importation of slaves
858	1851	To prohibit the importation of slaves
854	1851	To prohibit the importation of slaves
798	1858	To prohibit the importation of slaves
727	1858	Total 620 signatures
711	1858	Inspecting 24 of 1881 petitions in 1800-1860 out of 3691 petitions total.

Authored by Daniel Carpenter, North Study at Harvard University, Computed by Radcliffe Institute for Advanced Studies

Click a circle or a row to show a modal dialogue with all petitions for that location in the currently selected time period.

Each entry for a petition includes a link to the full details on Dataverse and a direct link to the scanned image.

5. Side by side comparison of original mockup versus prototype implementation.

Design mockup Prototype implementation

Antislavery Petitions Massachusetts

Sigs.	Years	Town	Topic
670	1839	Lynn	Repeal of interracial marriage, anti-miscegenation laws
247	1842	Worcester	Repeal of anti-miscegenation and all laws making...
207	1842	Ashland	Prohibition of all forms of slavery
141	1839	Boston	Protesting the foreign slave trade
117	1842	Leicester	Repeal of anti-miscegenation and all laws making...
79	1842	(All MA)	To allow free colored foreigners to become United States...
66	1852	(All MA)	Military conscription
20	1842	West Newbury	Repeal of anti-miscegenation and all laws making...

Showing 121 of 3418 petitions.

This website depicts public petition records, for more information see the Dataverse archive. Source code licensed under GPLv3. Supported by the National Endowment for the Humanities (FW-51056-12), Massachusetts Archives of the Commonwealth, Radcliffe Institute for Advanced Study, Harvard University, Harvard Center for Geographic Analysis, and the Radcliffe Institute for Advanced Study, Harvard University, Harvard Center for Geographic Analysis, and Harvard University Library. Developed by Garen Griffis.

Anti-Slavery Petitions of Massachusetts

Sigs.	Years	Location	Topic
1510	1855	Massachusetts	Fugitive slave laws
1508	1855	Massachusetts	Annexation of Texas
1369	1839	Fall River	To abolish slavery in Washington D.C.
1290	1855	Boston	To protect rights and liberties of Commonwealth inhabitants
1271	1855	Boston	To prohibit the importation of slaves
1181	1851	Arlington	Fugitive slave laws
1159	1851	Boston	Abolition of all forms of punishment
1138	1851	Boston	Fugitive slave laws
1089	1845	Danvers	Exemption from military service
942	1855	Massachusetts	Against the removal of Edward Greenley Long
905	1855	Boston	Fugitive slave laws
858	1851	Lynn	To protect rights and liberties of Commonwealth inhabitants
854	1851	Lynn	Resignation of Edward Greenley Long
798	1858	Arlington	Resignation of Edward Greenley Long
727	1858	Boston	Resignation of Edward Greenley Long

Date range: 1800 - 1860 Timeline playback

3.3. Implementation architecture

This section provides some technical details of the implementation.

The prototype relies on three architectural components, summarized below:

1. Preprocess

- One-time offline processing
- Geocoding lat/lng, automate with Google API
- Dataverse IDs, automate with Dataverse API
- Builds data lookup tables required for efficient client-side rendering
- Unified tabular data file supplied to server

2. Server

- Standard web server in Python using Flask framework
- Serves up data file
- Serves up files needed for rendering client: html, css, and javascript

3. Client

- Rich interface for web browser
- Loads entire database file from server, loads into browser memory (1.7 MB)
- Loads rendering code from server
- Builds data structures and visual elements when page loads (generally <5 seconds on modern browsers)
- Handles user interaction

The following software libraries and technologies are used in the implementation:

- Python
- JavaScript
- CSS/HTML
- Bash
- Flask
- Bootstrap
- jQuery

The following services are used in the implementation:

- Google Maps API (<https://developers.google.com/maps/>)
- Google Geocoding API (<https://developers.google.com/maps/documentation/geocoding/>)
- PythonAnywhere web hosting (<http://pythonanywhere.com>)
- Bootstrap CDN (<http://bootstrapcdn.com>)
- jQuery CDN (<http://code.jquery.com>)

4. Prototype evaluation and key areas for future work

The prototype Map View provides a usable demonstration of the key features necessary for a geographic and temporal tool for intuitive exploration of the Anti-Slavery and Anti-Segregation Petitions of Massachusetts dataset. However, there are a number of improvements that could be made in a future version. This section details the most important areas of additional work for further development of the visualization.

4.1. Summary

Strengths:

- Visual layout works well
- Good audience feedback from small trial presentation
- Pre-processing architecture works and has good performance in web client
- Playback capability is a key enhancement over original design for “exhibit” use case
- Coordinated highlighting between table rows and map circles provides good visual cues
- Modal details with links works well for easy access to Dataverse and scanned images

Areas for improvement:

- Historically-accurate geographic data and maps
- Addition of dataset search/filter within the visualization
- More robust web hosting environment
- Improved browser support for IE and Safari
- Improved user interface rendering performance on slider movement
- User interface fixes and feature enhancements
- Addressing edge cases in database

4.2 Key features for future development

4.2.1 Geocoding

The most important area of future work is on historically-accurate geographic information. In order to quickly obtain a usable prototype, the challenges of historically-accurate geographic information were not addressed in this first version, but should be a significant focus of future work. This has two parts. First, the geocoding efforts so far have relied significantly on automated geocoding, which may have made mistakes, and also likely identifies current-day locations of towns that may differ from the town locations in the historical period referenced in the dataset. These inaccuracies should be corrected. Second, the maps provided are present-day maps. These should be replaced with historically-accurate maps to the time period being shown. Maps change over time, so it is advisable to obtain a number of maps reflecting different time periods within the dataset. A possible solution for selecting which maps to show for a given min/max on the time slider would be whichever covers the plurality of years shown. Another option would be to show all maps within the current range, but partially transparent. This could be implemented using ArcGIS. Experimentation with different options can identify the best approach.

4.2.2 Dataset filtering query box

The next important future development is the addition of search and filter capabilities within the visualization. For example, searching by person or topic is currently possible within the Dataverse, but not from the Map View. Adding this searching and filtering capability within the Map View visualization would allow deeper exploration of the data within the intuitive visual representation of the map and timeline. The query box could be added to the user interface as a simple magnifying glass icon, which expands into a larger box that allows searching and filtering. It's possible that faceted search, with search parameters per dataset axis, would be more effective than open-ended text search. It's also likely that not all aspects of the dataset need to be searchable in this way, and there may be a few aspects that provide high value, such as persons of interest or petition topics.

4.2.3 Web hosting

Currently, the prototype is hosted online through a free web hosting service. This should be upgraded to a professionally-supported web hosting solution in order to provide a high level of robustness and maintenance.

4.2.4 User interface fixes and feature enhancements

A number of improvements and adjustments could be made to enhance user experience.

- Change the order of circles shown on the map to avoid occlusion.
- Add tooltips for place name when hovering over a circle.
- Add buttons for moving the slider a single year up or down.
- Add the ability to type in a specific year to set the slider.
- Show a loading screen on the initial page load with status updates.
- In the modal overlay, add behavior that clicking a location jumps to that location.
- When row highlight is cut off below the bottom of table, make that apparent on the table.
- Add a stateful URL that can be copied and pasted and will show the same view (min/max year, modal, etc.)
- Add the overall volume over time as a graph behind the time slider.
- Improve rendering performance for large numbers of circles on the map.

4.2.5 Edge cases

The following edge cases in the dataset were elided in the current implementation, but should be fully addressed in a future version.

- Some petitions have no date information, and are currently not shown in the visualization. One option would be to provide a checkbox somewhere to show/hide all those rows, or to just show them at all times.
- Some petitions have multiple locations associated with them, and are currently shown for only the first location found in the description. This could be the permanent solution, or they could be shown in multiple locations, or at an average of all the locations.

5. Conclusion

The prototype implementation of a Map View of Massachusetts Anti-Slavery and Anti-Segregation Petitions provides a demonstration of the key features for intuitive visual exploration of this rich dataset. It is a first step towards a complete implementation for this dataset and others of its kind. The evaluation and improvements included in this document provide guidance for future work. The prototype shows the potential of interactive visualization, and serves as a foundation for further development.

6. Project links

A live demo version of the prototype is online at:

<http://antislaverypetitions.pythonanywhere.com/map>

The source code is freely available online at:

<https://github.com/garthg/petitions-visualization>