Interactive and Geospatial Visualization of the American Civil War of 1861

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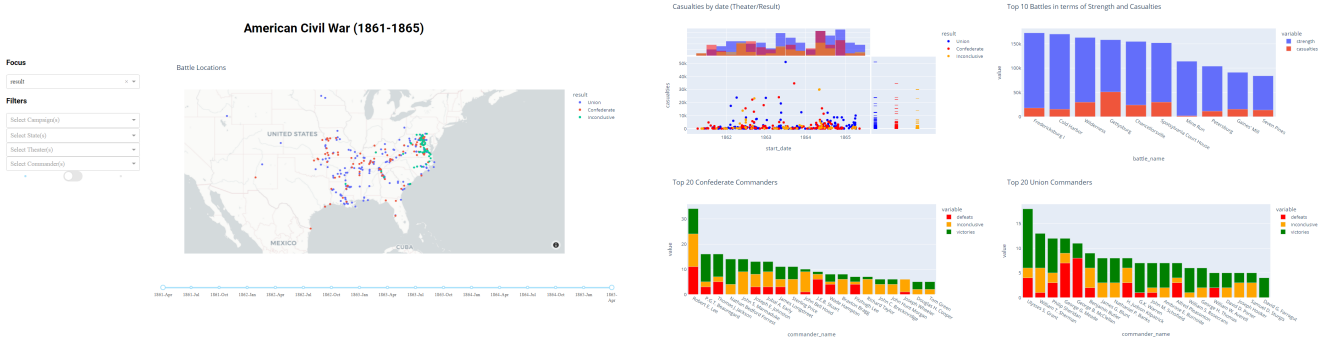

Figure 1: *Example of our implemented dashboard for visualizing the battles and campaigns of the American Civil War of 1861*

Abstract

This paper presents an interactive data visualization tool for the visualization of the battles and campaigns of the American Civil War of 1861. We aim to make learning the specifics of the war easier and more intuitive by making use of graphs and making those graphs interactive. Thoroughly understanding why and how a war evolved can be important to learn about the history of the country and get a better picture of its evolution. In this paper, we use the Civil War Sites Advisory Commission (CWSAC) and the NPS datasets to implement a geographical map showing the location of the battles, and make use of other relevant graphs. In our tool, these battles can then be filtered by selecting a list of campaign(s), US state(s), theaters, commanders and/or time date intervals. This tool allows for a more intuitive understanding of the evolution of the American Civil War of 1861 and wars in general for other similar datasets. An example of our tool can be found here [Our].

1. Introduction

Learning history is important, as the famous saying goes "Those who cannot learn from history are doomed to repeat it" which is nowadays attributed to the philosopher George Santaya. Much of human history consists of warfare, and it does, to a certain extent give context to the development of nations and the rise of civilizations. Although learning warfare history is a matter of memorization of the battles and events that took place in that specific war, there are ways to make that learning process more efficient. This can for example be done by allowing the user to visualize the data in different ways, thereby allowing the user to create an intuitive mental image that can be memorized easier. Our project implements a war data visualizer of the battles during the American Civil War of 1861 using the Civil War Sites Advisory Commission (CWSAC) and the NPS datasets [dat] [CWS]. To make the data visualization intuitive, we have implemented a visualization of the battles on a geographical map and made it interactable where the user can filter battles depending on campaigns, theaters, and other filters. Furthermore, we have implemented graphs that help in visualizing the data, which include information on the commanders, and the impact commanders had on the battles. Our tool gives a general overview of the battles during the American Civil War with possible interactions such as filtering.

2. Related Work

There exists related work within the data visualization of the American Civil War. We have found two instances of these. The first one is a poster which was produced by the Comparative Synoptical Chart Company in 1897 [posa] [posb], and shows the history of the war. From reading the description of the poster in the bl.uk reference, the left of the poster represents the Confederacy while the right presents the Union. The map shows information such as important battles as well as important events such as riots. Although this poster is impressively detailed, it suffers from the fact that it can be too hard to digest and understand it without knowing the historical contexts.

Another instance we have found is a more modern approach with an interactive website implemented by Eli Rosen [weba] [webb]. Whilst this is impressive for visualizing the war, it is currently inaccessible, with the link to the website no longer working. Although we can see the visualization from the video uploaded to YouTube, where the creator interacts with the website. This visualization seems to allow for selecting date intervals, and also includes a map to give geographical context to the battles. A feature lacking, however, which we have implemented is exploring the different commanders who had an impact on the war. Another missing feature is filtering away Battles depending on which campaign the battle took place, which theater and which state.

3. Design

The design of this visualization tool required multiple stages including the gathering of the necessary data, preprocessing that data, and then implementing the visualization. The design process required multiple cycles of visualization implementation, and then further preprocessing of the data to achieve the desired implementation in an efficient manner.

3.1. Data

For the data regarding the American Civil War, we used the CWSAC and NPS datasets. From the CWSAC dataset, we used 3 files: `cwsac_battles.csv`, `cwsac_campaigns.csv` and `cwsac_commanders.csv`. From the NPS dataset, we used one file: `nps_battles.csv`.

`cwsac_battles.csv` contains information regarding the battles in the war, where each row is a battle. It contains columns such as the Battle Id, The name of the battle, which US State the battle occurred in, the start- and end date, which campaign the battle belongs to, the result of the battle, the total amount of units in the battle, and the resulting casualties.
`cwsac_campaigns.csv` contains information regarding the campaigns in the war, where each row is a campaign. This contains columns such as the name of the campaign, the start and end date of the campaign, and which theater the campaign belonged to. Here, a campaign is a group of battles, and a theater is a group of campaigns. This is a method of organizing battle data.
`cwsac_commanders.csv` contains information regarding the different commanders leading in the battles, here each row is an instance of a commander leading a certain battle. Here, there can be (and often is) multiple rows regarding the same battle, since there can be more than one commander for either of the two sides in a single battle.

Since we wish to visually display the locations of the battles on an interactive map, we need information regarding the battle latitude and longitude. Since is not available from the CWSAC dataset, which is why we import this information from the NPS dataset. The NPS dataset uses the CWSAC battle ids which makes the two datasets work well together. From the NPS file `nps_battles.csv` we only use the latitude and longitude columns.

3.2. Data Pre-processing

For easier usage of the data, we decided to combine the relevant information into a single file which is based on the `cwsac_battles.csv` file. Here each row will also represent a unique battle, but there will be new columns that are taken from the 3 other files. We also add the latitude and longitude data for each battle from the nps dataset. The added columns include latitude and longitude, commanders present, and the name of the theater to which that battle belongs to.

3.3. Visualizor Implementation

The visualizer is implemented in Python using the libraries Dash and Plotly. Here we have structured roughly two screen-sized pages with several interactive widgets and graphs. Our primary focus was to show information regarding the different battles that had taken place during the war. To allow for a geospatial visualization we used a `scatter_mapbox`, which would display the locations of these battles in the United States. We also used a scatter plot to show the casualty numbers for the different battles by the date of the battle. To be able to visualize the severity of the battles, and how many people fought in them, we implemented a bar chart which shows the strength and casualties of the 10 largest battles. Because of historical obscurity, some battles lack information regarding the number of casualties or the number of troops fighting, or even both. Another visualized aspect is the commanders. Here we display the top 20 commanders for the Union and the Confederates, ranked by the number of battles they fought in. We display the Union commanders and the Confederate commanders separately on two different bar charts.

To make it more interactive, and to allow greater data visualization we implemented filters that would be applied to all 5 graphs. Although our focus is by default on the result of the battle (who was victorious), this can be changed, to for example view the different theaters the battles took place in. Our other filters allow for filtering the campaign(s), the US state(s), the theater(s), and/or the commander(s). As shown in Figure 2.

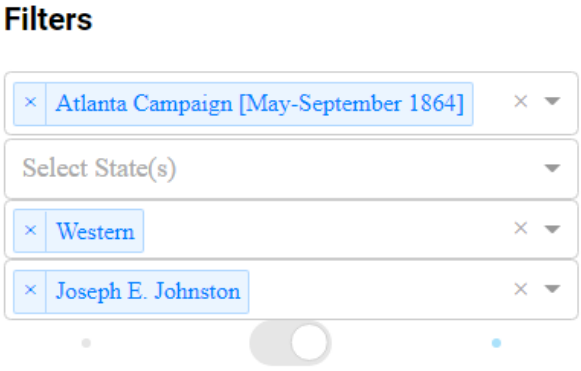

Figure 2: *4 of the 5 applicable filters. Campaign(s), State(s), Theater(s) and Commander(s). The example shown above is with the selected Atlanta Campaign in the Western theater with Joesph E. Johnston as the commander.*

Another implementation to help with the visualization is the range slider to filter an interval of dates that are in a certain time period. By default, this reflects the entire duration of the war. Selecting a filter, or a time interval would then update all the graphs to apply this new information. For updating the graphs after applying these filters we used Dash callbacks. Every time the user interacted with the different widgets used for filtering, a callback is sent from which we update the graphs to represent that filter.

4. Results

This visualization allows the exploration of the American Civil War and the battles that took place in it. The tool displays the battles on a geographical map, thereby giving a geographical reference to the different battles, campaigns, and theaters. From the top commander graphs in Figure 4 and Figure 3, the two overrepresented commanders are the Union commander Ulysses S. Grant and Confederates Robert E. Lee. From this Ulysses S. Grant is victorious in 12 out of 18 battles with 2 being inconclusive, which shows the dominance of Ulysses S. Grant on the battlefield, which potentially had a large factor in the result of the war.

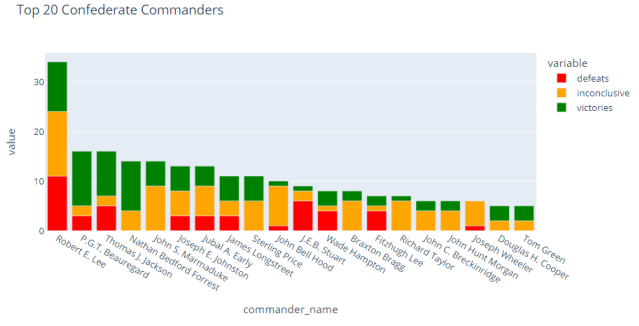

Figure 3: *Top 20 Confederate commanders ranked by the number of battles they led.*

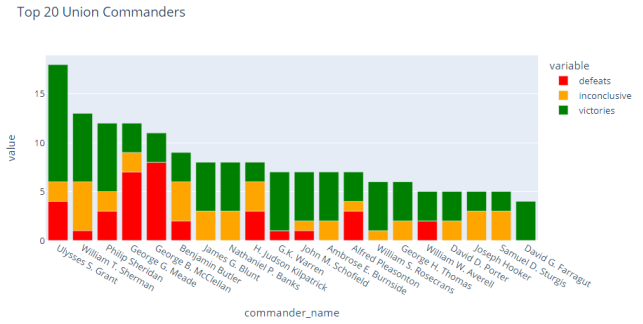

Figure 4: *Top 20 Union commanders ranked by the number of battles they led.*

The visualization also shows that whilst the majority of the battles were fought in the Western and Eastern theaters, there were some battles in the Trans-Mississippi theater. Most notably the operations to Suppress the Sioux during their uprising. This shows that while the war was mainly fought between the North and South, respectively the Union and the Confederates, there were also other minor internal civil wars and Native uprisings that took place within the Union, which also has great important historical contexts.

5. Conclusion

Our tool allows for interactive and geospatial visualization of the American Civil War of 1861. It can give an overview of the important campaigns and battles that took place, and which commanders were most crucial in the war, or a specific campaign or theater. While this is developed to visualize the American Civil War, this could be implemented for the visualization of many different wars which would be educational in learning about the geographics of war and the important battles that have taken place in that war over time.

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