

Information Visualization

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Abstract— Election results have been visualized before but not looking at similarities. This paper describes the techniques to analyze the data set from that point of view and finding relationships between municipalities.

Index Terms—Information Visualization, Election results.

1 INTRODUCTION

In the course Information Visualization at Linköping University a web application that visualizes the election result of 2010 in Sweden was created. The focus was to be able to find similar municipalities to a selected municipality and also to find correlations and relationships between municipalities. This report describes the techniques that was used and how the applications was developed.

2 BACKGROUND AND RELATED WORK

Election result is something that has been visualized for some time and people encounter these visualization often during election time in the newspapers or online. The methods that often was used was a bar chart, showing the individual parties votes and also a map to be able to navigate through the different municipalities.

This application was looking at similar municipalities and relationships between income, population and the election result. The approach is nothing that exactly can be found since application similar to this has focused more to present the actual voting in percent and not on similarities. Therefore this application have another approach then the application that handle this kind of similar problem.

3 DATA

The application deal with three different data sets. The common in every data set is the municipality name.

The first data set was the election result in Sweden for 2010. For each municipality name there are information about each party and the given votes in percent for that party. Has 3200 rows and 3 columns.

The second data set was for the population in each municipality and one row for the total population in Sweden. The data gives the population for year 2002, 2006 and 2010. The data set has 291 rows and 5 columns [3].

The third data set was the average income for people divided in two groups, the age span 0-19 and 20-64, in each municipality for year 2002, 2006 and 2010. The data set has 582 rows and 8 columns [3].

4 METHOD

The application presented information about the election result for 2010 in combination with other data, such as population and income in each municipality. The focus lied on to be able to look for relationship between municipalities and also look for similar municipalities based on different criterias. The criterias such as similar votes on block, votes on parties, what similar municipalities in income and population.

When selecting different data items from the whole data, the year is set to 2010 and also to only pick out the income for the age group 20-64 years.

The different components of the application is explained below.

4.1 Half donut chart

Donut charts is a technique that first and foremost represents the size relationship between parts and entire values. The use of an half donut charts was based on to easily show a block, or parties, part of the whole voting. Since all values are in percentage this was a great way of showing the parts of the entire percent. Also to be able to show if one block was weighing over to one side or if one party has the power of balance. The aim with the application was not to show the individual parties percent compared to each other, but rather to compare the votes on a party in relationship to the whole result. Therefore donut charts was used.

Over the inner donut charts there are an half donut chart. This to be able to show the parties votes and the block votes at the same time. Also that mapping the different parties to an block, making it easy to see which block a party belongs to.

When hovering over a part of the donut chart the user gets more information. The information was displayed in the inner circle that was empty and the information was the actual percentage in numbers. This is only shown when hovering due to only get an overview at first but later a more detailed view. An example of the donut chart can be seen in Figure 1.

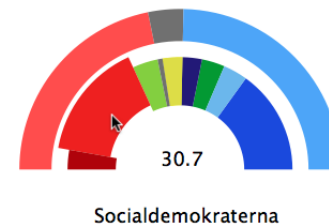


Fig. 1. Half donut chart. Also showing the interaction when hovering over a specific path. The percent and the name of that party is shown.

4.2 Map

A map with all the municipalities in Sweden was used to navigate through the data set. When clicking on a municipality in the map, information about the selected municipality was shown. By using a map it was easy to navigate trough 290 different options, rather than example a drop-down that would been harder to navigate through. When a municipality was selected it is shown in the map, making the border black instead of white.

The map does also a conventional geometric zoom in on that municipality to indicate that it was chosen. The map uses also zooming and panning, this to allow a continuous transition between overview and detail. Also to keep the map on a more manageable view [1, p. 117].

When hovering over the map, a tooltip was showing with the name of the municipalities to easy know which municipality is hovered over.

4.3 Colour the map depending on two different variables

The map can be coloured by two different variables, block and parties. The colour shows which party or block that got the most percentage votes in that municipality. This to draw conclusions if the block has an impact on the voting in Sweden or if does not matter.

4.4 Filtering with range slider

To be able to draw quick conclusions about the data set filtering was used. It is often helpful to the process of acquiring insight to remove irrelevant data [2, p. 67]. The filtering hides municipalities that are under the value that was given in the range slider by the user. There was two range sliders, one for population and one for the income. Every municipality is mapped regarding income to the ranking in Sweden. It is then the ranking that the user can filter away, meaning that the slider goes from 290 to 1. When using the filtering the user can draw conclusion about the data set when only seeing municipalities for example with high income and see which block won, or also combine with high population and see if these attributes have some connection.

4.5 Similar municipalities

One other view in the application was the similar municipalities. Here the top three municipalities was shown depending on which attribute the user wanted to look at. The different attributes was either similar block, parties, income or population. Here they were represented as small donut charts so that it would be easy to compare with the main municipality.

4.6 Information box

Beside the active municipality and information box was displayed. Here information about the population, the income and the ranking of that municipality in income was shown. This to be able to compare attributes with other municipalities.

For the similar municipalities, there are only two attributes showing in the information box, the population and the income. They are showing in order to be able to compare different values with the selected municipality and to see if any relationship can be found.

5 IMPLEMENTATION DETAILS

The web application was developed using JavaScript, jQuery, HTML and the library d3.js.

To calculate similar municipalities a scoring function was used. When looking at similar municipalities regarding population and income that only has one dimension, the absolute distance was used and then the three distances that had least values was chosen.

To show the similar municipalities considering the parties votes, the euclidian distance was used looking at the difference at each party. This can be seen in Equation 1 where i is the different parties or block.

$$score = \sqrt{\sum_{i=1}^n (a_i - b_i)^2} \quad (1)$$

The municipalities with smallest summed score was chosen and shown. Regarding block, the same strategy as the parties was applied. By using this scoring function, it was easy to calculate if some municipality had almost the same result regarding parties and therefore see if the difference was small enough to be considered as a similar municipality.

When showing the place of the municipality regarding income, the data is sorted on income with the highest first in the list. Then the place in the sorted list represents where that municipality is in ranking according to income.

Colours in this application has an essential part, especially when representing the different parties. The different parties has a specific colour associated with them and if the mental picture is broken, it would be hard to interpret the visualization as it should.

Table 1. The colour of each party

Party	Hexadecimal	Colour
Moderaterna	#1b49dd, blue	Blue
Centerpartiet	#009933, dark green	Dark Green
Folkpartiet	#6bb7ec, light blue	Light Blue
Kristdemokraterna	#231977, dark blue	Dark Blue
Miljöpartiet	#83cf39, light green	Light Green
Socialdemokraterna	#ee2020, red	Red
Vänsterpartiet	#af0000, dark red	Dark Red
Sverigedemokraterna	#dddd00, yellow	Yellow

6 RESULTS

The end product is an applications where the user can look at the election result for 2010 in each municipality in Sweden and also the whole population in that municipality and average income for people that are 20-64 years. In order to see relationships, a view with the similar municipalities is shown. Can look at similar municipalities regarding voting in block, voting in parties, income or population. The municipalities can be filtered in the map regarding income and population.

When clicking on the map on a municipality, the map zooms in slightly on that municipality to mark that it is selected. Can also hover over the donut chart to get more information. When hovering over information such as the parties name and votes in percent is shown.

The application is fast and zooms in on the map in reasonable time. Also fetching data items for the selected municipality happens instantly.

One limitation is that the application is not responsive, so it can not be seen on smaller screen in its way it is supposed to be shown. Another one is that the user can only select municipalities in the map to be able to show the information, assuming that the user has some knowledge about the geography in Sweden. It is also not possible to let the user decide which municipalities they want to compare and the user can only look at similar municipalities.

One bug in the application is that sometimes the data is not read in the right order, making either the filtering not showing or the similar municipalities. Updating the page might help.

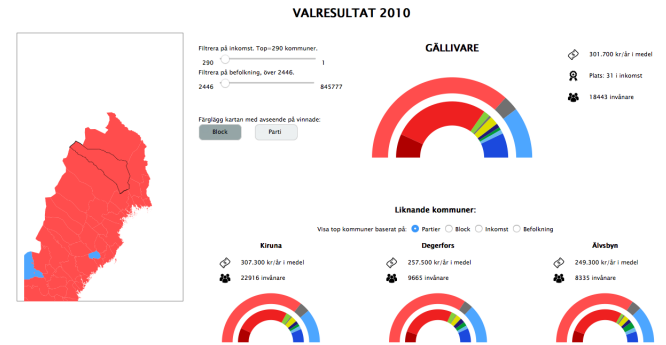


Fig. 2. The final result of the application.

7 EVALUATION

The aim with the usability study was to test the satisfaction of the application and also the learnability.

The evaluation of the application was conducted by three participants. The participants was given a written instruction that told the structure of the evaluation and what was expected from the participants. After that a pre-test was given, collecting information about the gender, age, occupation, political interest and if they had seen some visualization of election result before.

The test was done by giving the participants six tasks to solve and answer. The tasks was aimed to test the filtering, the map, the different views (similar municipalities and the main municipality) and also the donut chart representation. During the test the participant was observed to see how they solved the tasks. The six task that was given:

- How many percent got Moderaterna in the municipality with the highest average income in Sweden?
- How many percent got Centerpartiet in Norrköping?
- Which municipalities is similar to Kiruna when looking at income?
- On which place/rank in Sweden lies Håbo when looking at income?
- Which municipalities have similar election result to Uppsala when looking at parties?
- Which block has the majority for the municipalities with population round 100 000?

After the tasks, a post-test was given. Here with both unstructured question and a question with a semantic scale. The semantic scale had four steps to let the participant decide if they were more positive or negative. The questions was open to give a discussion about the application. The questions: Was something unclear? Did you get any insight in the election result? How appealing/likable was the application from 1 (Little) to 4 (Very much). The last question was other comments.

All the participant was similar in both age, occupation and political interest. They were all 20-25 years old, all studied and that they had very little political interest. Some observation that was made, was that every participant had a rough time with the first question. This may due to an mistake in the text over the filtering and that the municipality with highest average income was so small in the map that it hardly can be seen when not zoomed in. Also that two out of three participants wanted the possibility themselves to enter numbers in the filtering method, not to only use a slider. It seem from the observation that it took some time to get used to the application, and how to exactly interact with it, but when they had solved about half the tasks it got easier.

Other observations was that the zoom in the map was not clear enough. None of the participant noticed that if they clicked on the active municipality, they would zoom out to look at whole Sweden again. It also was hard and not obvious that the municipality name in the similar municipalities was a link to easy navigate to that municipality.

One of the participants did not like the donut charts at all and said that it was to many of those charts at once. Another comment was to separate the view a little bit more. The other two participants thought that the application was very appealing and good to look at (scored 4 in the post-test). Also that the half donuts gave a good overview and a great picture of the result.

8 CONCLUSIONS AND FUTURE WORK

The conclusion about the application was that the user can get a insight of the election and draw connections between income, population and the election result. The donut chart gives a good representation of the voting and that the user can easily see if one party for example has the balance of power or if one block was tipping over and has the majority. The negative was that the application may have a lot of information showing at the same time, leading it to be a bit hard to get a quick overview.

Some things that could have been improved was the filtering. The filtering was a bit misleading regarding the income and might been so due to a mistake in the explanation above the range slider. There are also a lot of information showing at the same time, and might have been better to be able to show and hide the section about the similar municipalities.

One thing to have in mind is that usability is not a property in itself but dependent on something, like different type users, their different goal (tasks) and the context in which they are active. It might be easier for a user that know the area of information visualization to interact with the application, rather than a user that has no experience in the field at all.

There are a lot of features and improvements which not have been implemented in the final application due to time issue and priority. Some future work that could have been done was the calculation of similar municipalities and extend that function so the user can choose several attributes to be taken into consideration. The filtering with the range sliders can be improved so the user can select and low value and a top value to filter on, instead of only one value and show everything above. Other features like colouring the map after the support of parties, making it easier to locate the municipalities with the most support to a party or the lowest support. That would been good for looking at relationships between municipalities and other attributes.

REFERENCES

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