Publications with the Topic Keyword “information visualization”:

Using VOSviewer to Create Network Visualizations

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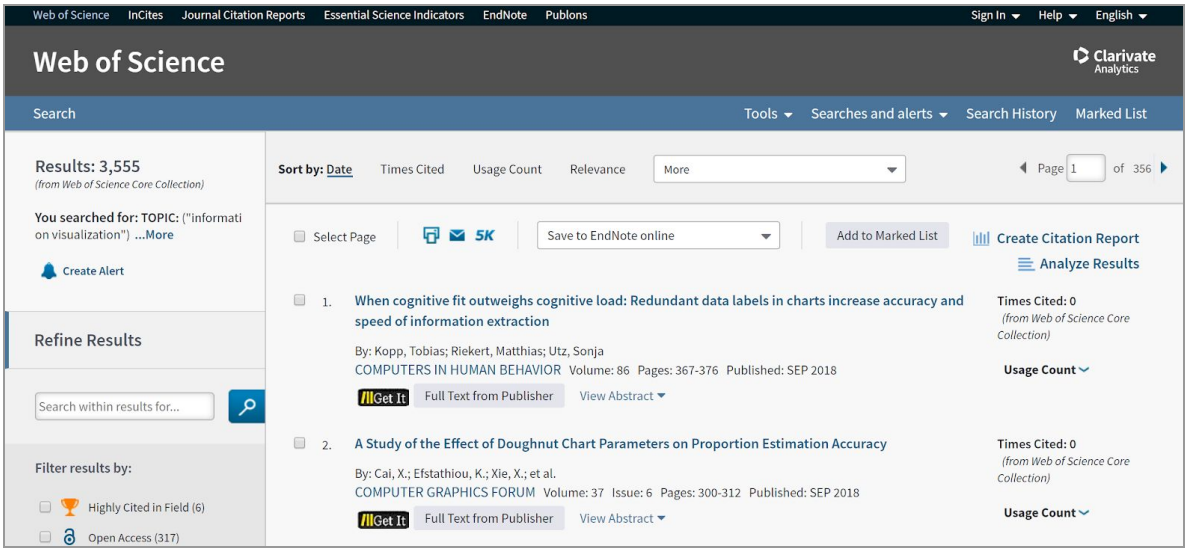
Introduction

For this assignment, I chose the word information visualization and searched for publications in the Web of Science. There are 3,555 results of papers with that keyword. The time frame of the publications seem from 1992 to 2018.

The image below shows the years of the publications. The most publications with the term seem to be from 2016 and the least from 1992 the earliest year in the data.

Select	Field: Publication Years	Record Count	% of 3,559	Bar Chart
☐	2018	106	2.978 %	
☐	2017	256	7.193 %	
☐	2016	325	9.132 %	
☐	2015	282	7.924 %	
☐	2014	289	8.120 %	
☐	2013	191	5.367 %	
☐	2012	191	5.367 %	
☐	2011	194	5.451 %	
☐	2010	214	6.013 %	
☐	2009	220	6.182 %	
☐	2008	228	6.406 %	
☐	2007	199	5.591 %	
☐	2006	128	3.597 %	
☐	2005	144	4.046 %	
☐	2004	111	3.119 %	
☐	2003	100	2.810 %	
☐	2002	84	2.360 %	
☐	2001	71	1.995 %	
☐	2000	75	2.107 %	
☐	1999	28	0.787 %	
☐	1998	40	1.124 %	
☐	1997	34	0.955 %	
☐	1996	22	0.618 %	
☐	1995	11	0.309 %	
☐	1994	7	0.197 %	
☐	1993	5	0.140 %	
☐	1992	4	0.112 %	

The image below shows the top of the results page:



I then clicked the "Save to Other File Formats" option from the dropdown menu and with that created eight text files with the information about the articles. That option only allows to download five hundred records each time so the first file savedrecs.txt are the records 1-500, savedrecs(1).txt 501-1000, etc. The other files are savedrecs(2).txt, savedrecs(3).txt, savedrecs(4).txt, savedrecs(5).txt, savedrecs(6).txt, savedrecs(7).txt.

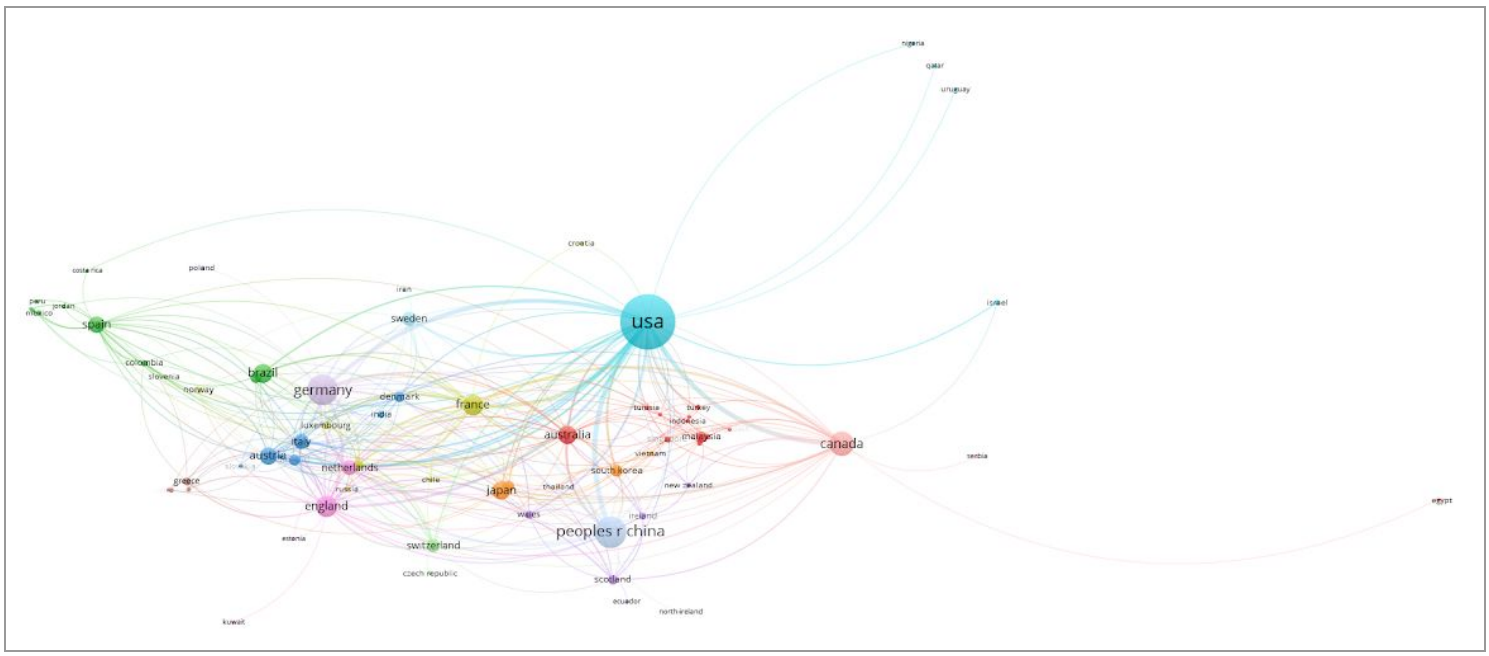
For this assignment I decided to use VOSviewer which is a tool to create bibliometric network visualizations. VOSviewer not only allows for files from Web of Science but also Scopus, PubMed, RIS, Crossref json, Crossref API. After opening VOSviewer I clicked the "Create…" button which allows three options which are "Create a map based on network data", "Create a map based on bibliographic data", "create a map based on text data". After creating the map it shows three visualization "views" which is network visualization, overlay visualization, and density visualization.

Networks have a number of nodes and connections. Nodes may seem to be weak if they don't have many direct connections but if they are connected to a very connected person they might just be powerful. In networks there is a term called structural holes which is a void or gap between nodes and connections. This term is explained more in the magazine article *Structural Holes and Good Ideas*. The figures in the Appendix show attempts at visualizing the data but is either way too much information or does not make sense. *Figures 1-3* show the visualizations that make the most sense for the data and the three views (network visualization, overlay visualization, and density visualization).

Visualizations

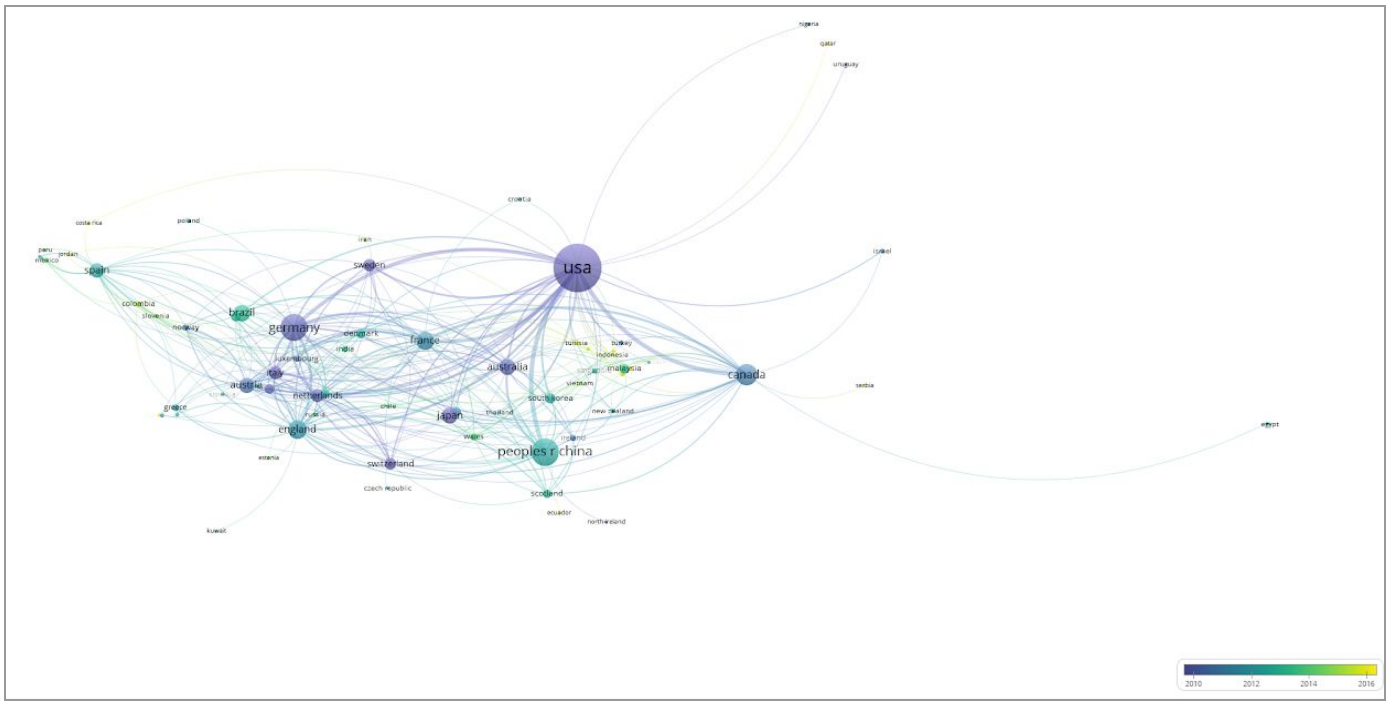
Figure 1: Countries with the Publication Term "Information Visualization"

Network Visualization View



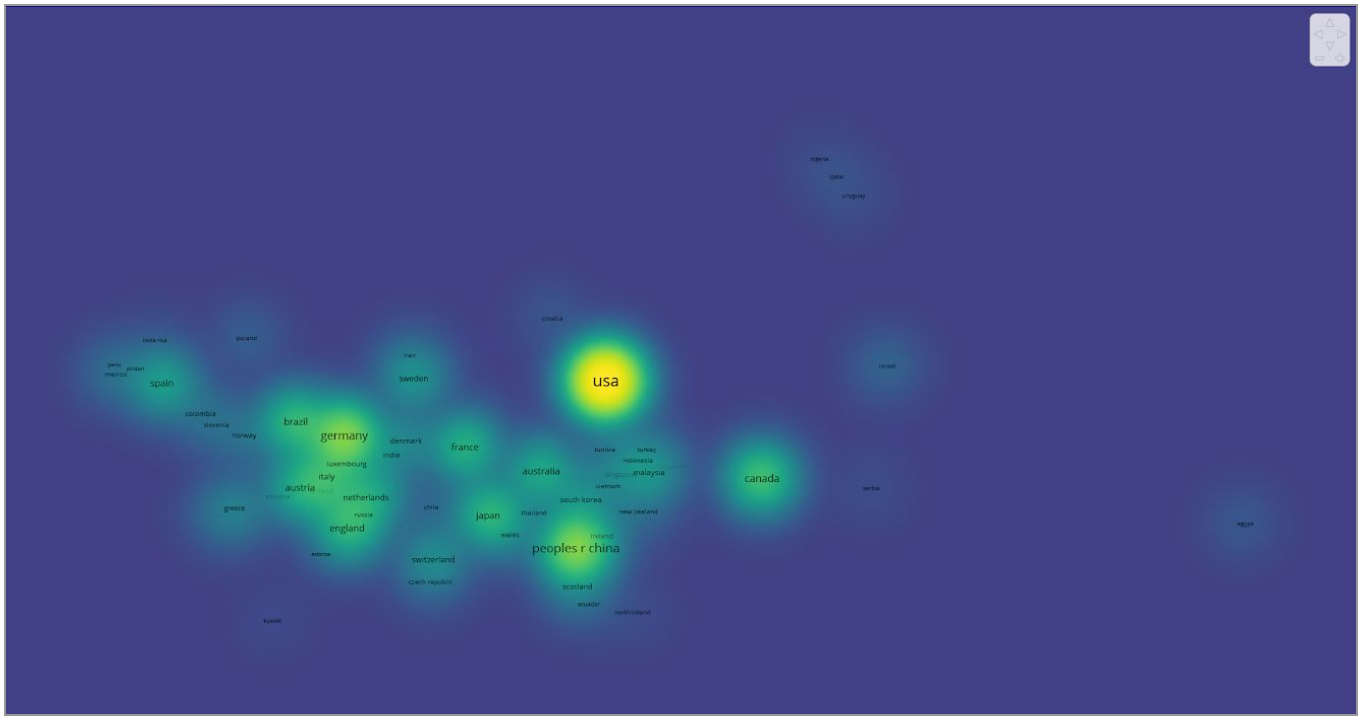
Most of the publications seem to be from the USA followed by Germany and the Republic of China with approximately the same number of publications with the term information visualization. Also, the bigger the country the more direct connections they seem to have with other countries. Some of the smaller countries are connected to the bigger countries so they might be indirectly connected with a lot of countries.

Overlay Visualization View



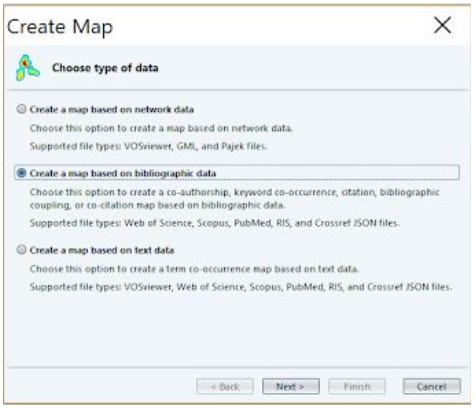
Even though we can see the USA seems to have the most number of publications with the term "information visualization", most of them were published around 2010. Most of the countries with more publications seem to have completed more papers with the term from 2010 to 2014. Some of the countries with the least amount of papers on the keyword seem to published papers around 2014-2018.

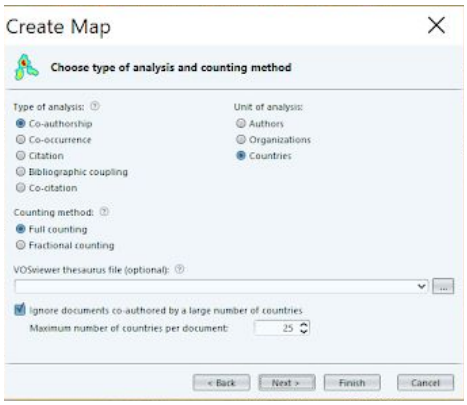
Density Visualization View

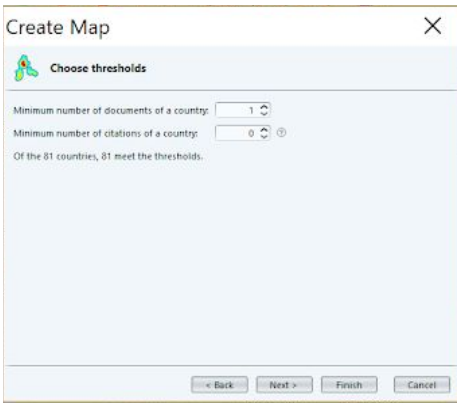


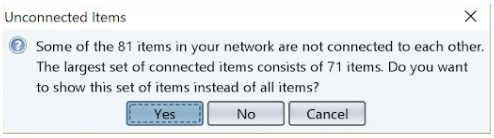
This density visualization shows that most of the nodes of the countries are clustered generally close together and they are shown in green/yellow. The countries that are more in blue are not close which can be because of the lack of indirect connections they have. For example Peru is only connected to Spain but Spain is connected to a lot of other countries.

Options chosen:



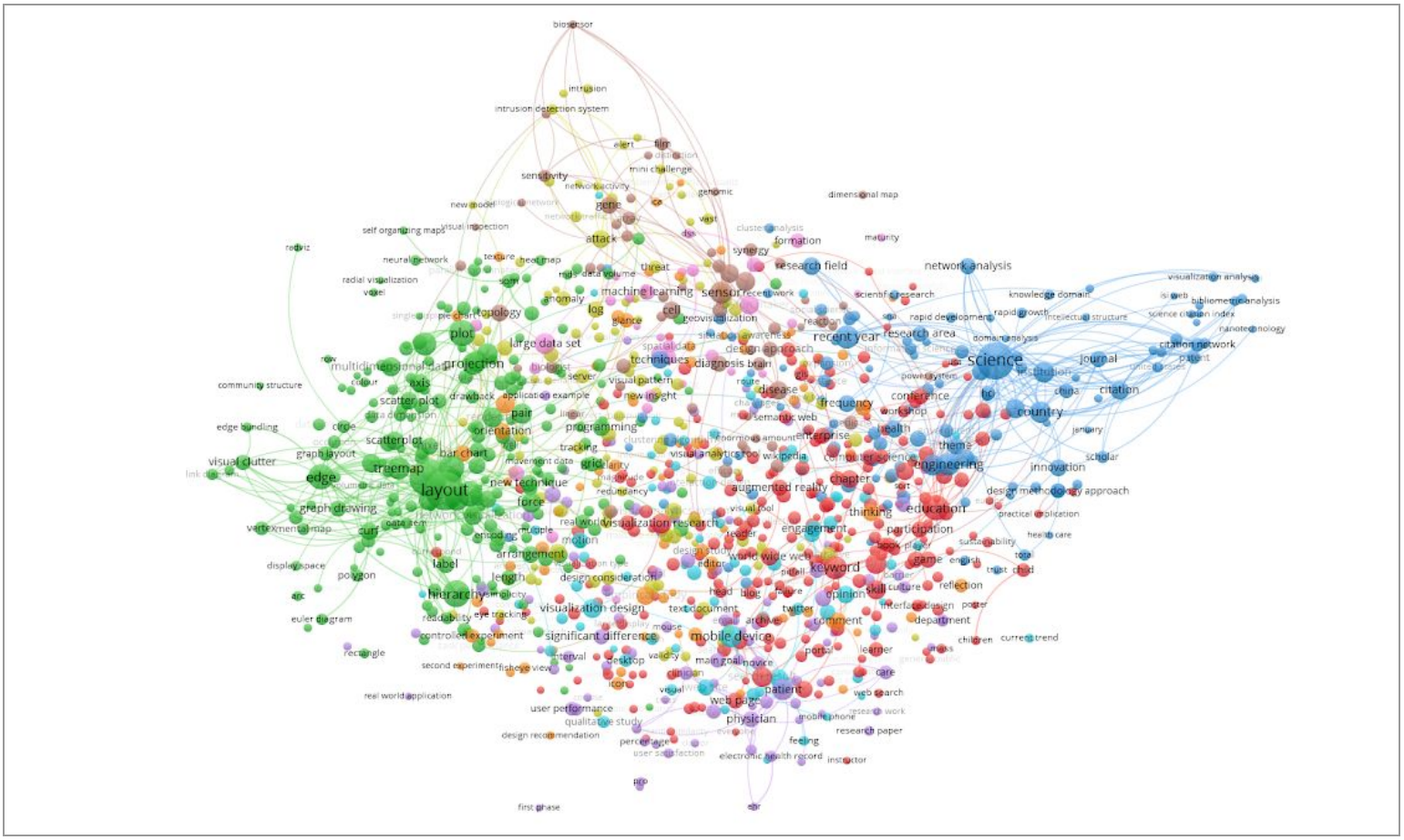






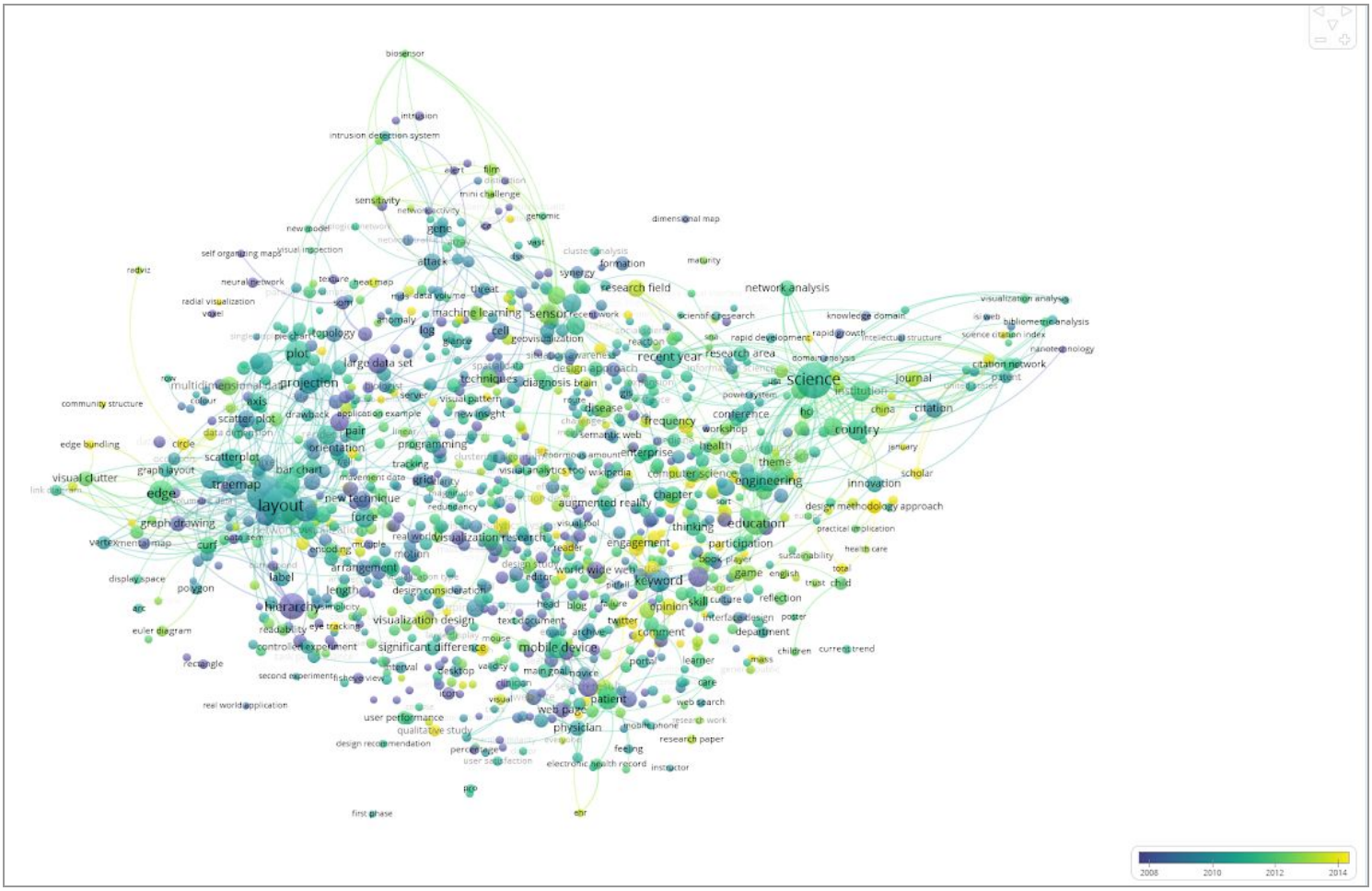
I chose the “Create a map based on bibliographic data” option, selected the unit of analysis to be countries, and set the “minimum number of documents of a country” to 1. I then clicked the yes to unconnected items so only 71 of the connected countries are shown.

Figure 2: Terms in Publications with the keyword "information visualization"
Network Visualization View



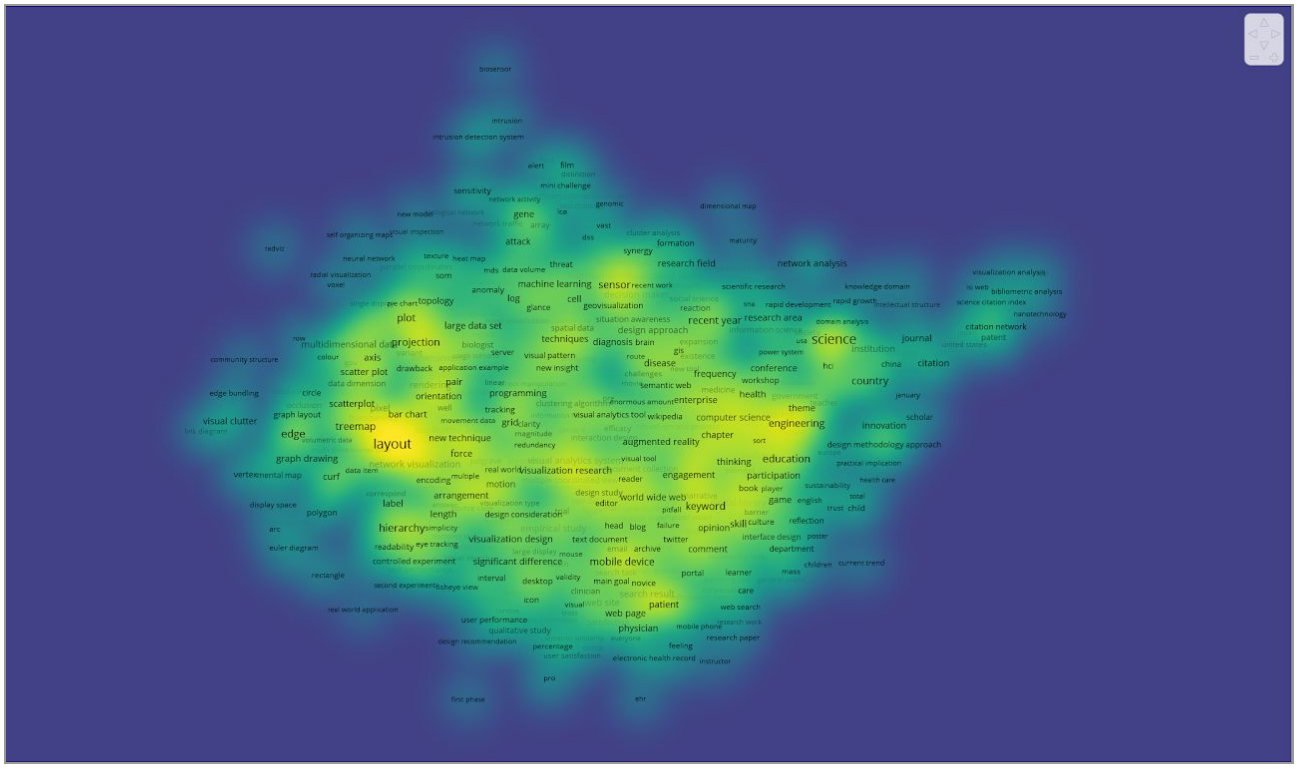
I set the threshold for 7 because as you can see in *Figure 4* in the Appendix a threshold of 2 shows way too much information. I also tried thresholds of 3,4, 5, 6 and 7 seems most manageable to understand. The terms layout and science seem to be used the most in publications overall and have the most direct connections.

Overlay Visualization View



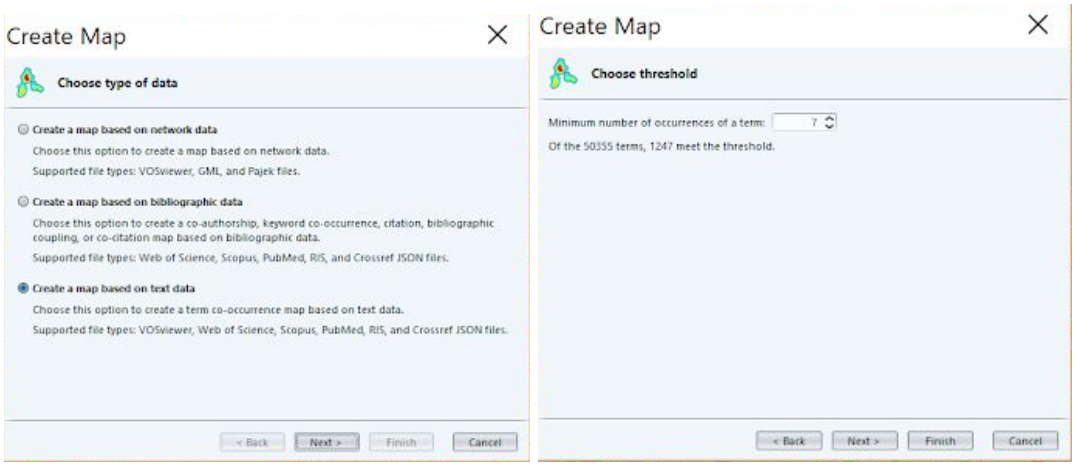
More terms seem to be from before 2014. The terms used in publications around 2014 or later seem to consist of the smaller circles. Some terms are not connected to any others this might be because it is very specific to the particular article or it is just not a common word or words.

Density Visualization View



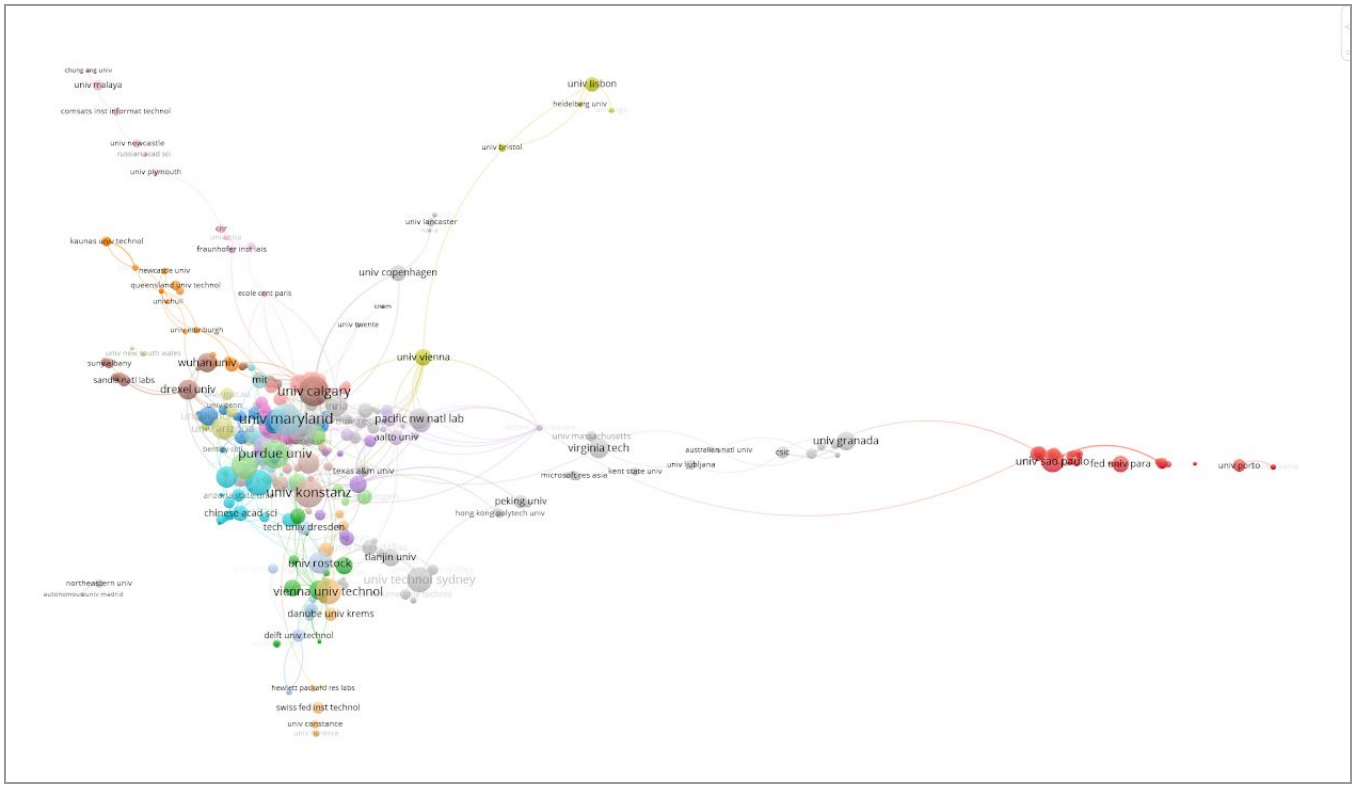
Most of the terms in this visualization seem to be clustered together and there does not seem to be any outside the main cluster.

Options Chosen:



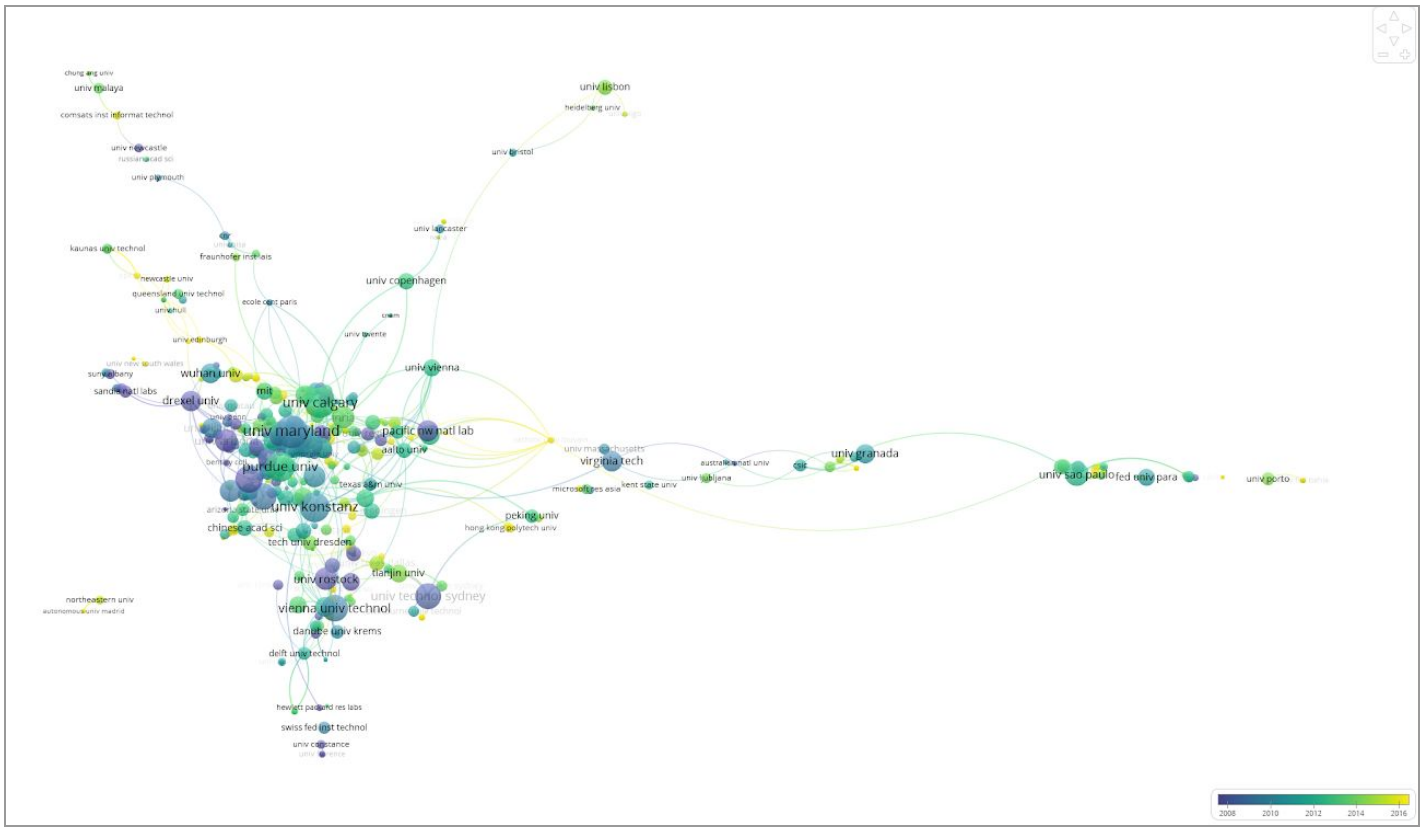
The visualizations shown in Figure 2 show all terms included in publications with the keyword “information visualization” using the option “Create a map based on text data”.

Figure 3: Organizations who wrote publications with the keyword “information visualization”
Network Visualization View



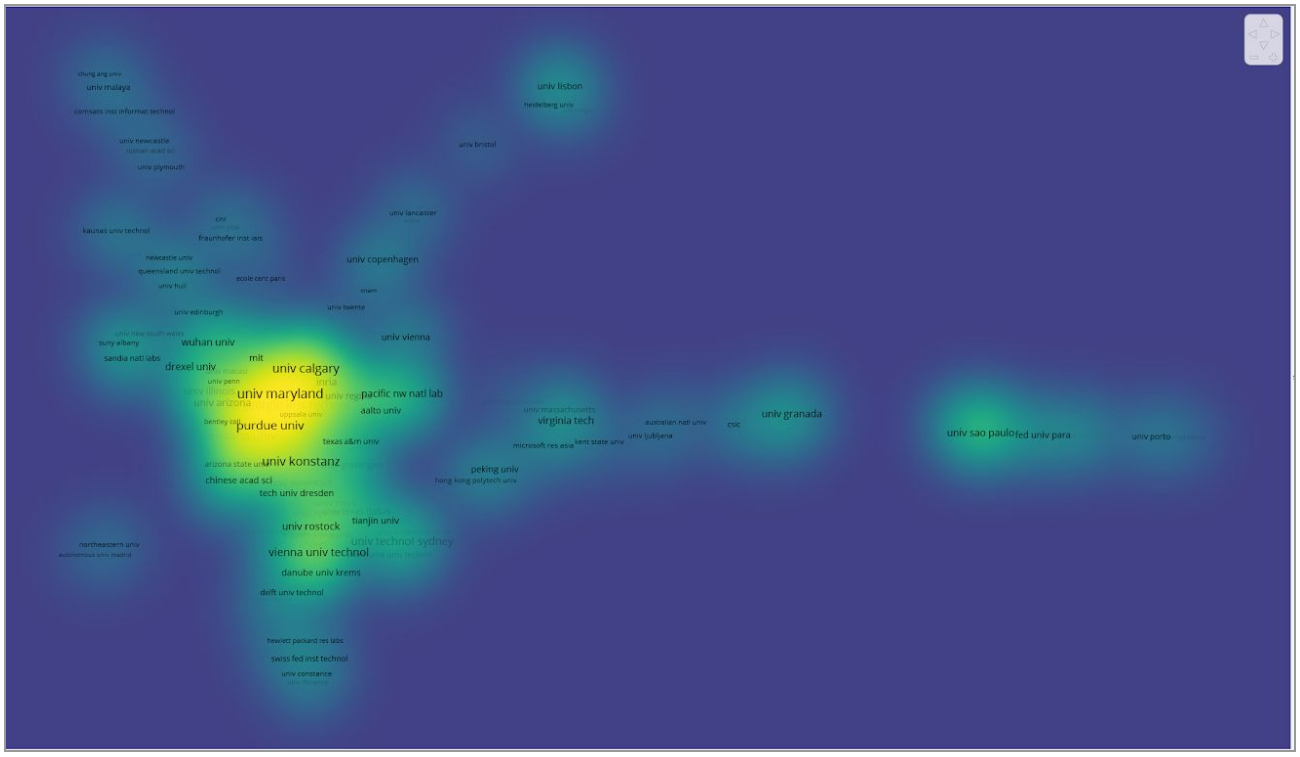
The bigger the node the more publications about “information visualization” the organization has written. It seems that the more connected organizations seem to have written more papers about “information visualization” while the organizations not connected to anyone else seem to have written less publications with a couple exceptions.

Overlay Visualization View



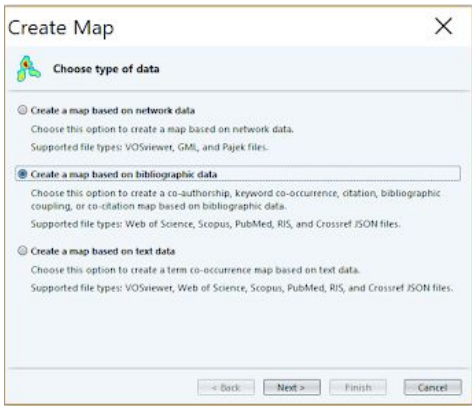
The universities or organizations with the most articles on “information visualization” seem to have created them before or around 2014.

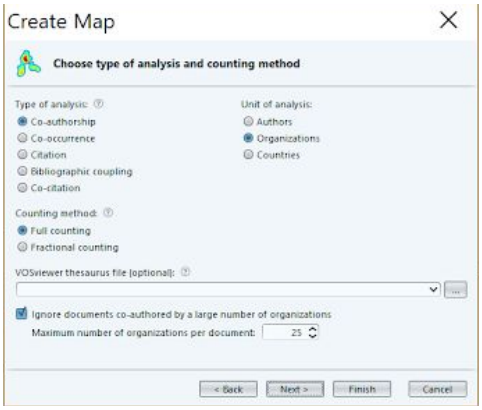
Density Visualization View

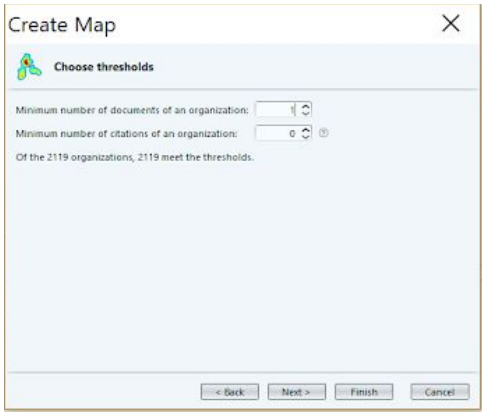


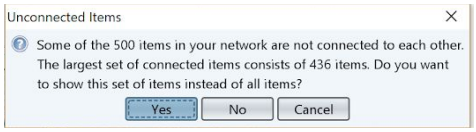
This density visualization is very spread out. Most of the big connections seem to be around Purdue University and University of Maryland. The nodes are all connected in some way since we excluded everything without connections from the data for the visualization. The less green/yellow and more blue the term is, the less connections that node has.

Options chosen:







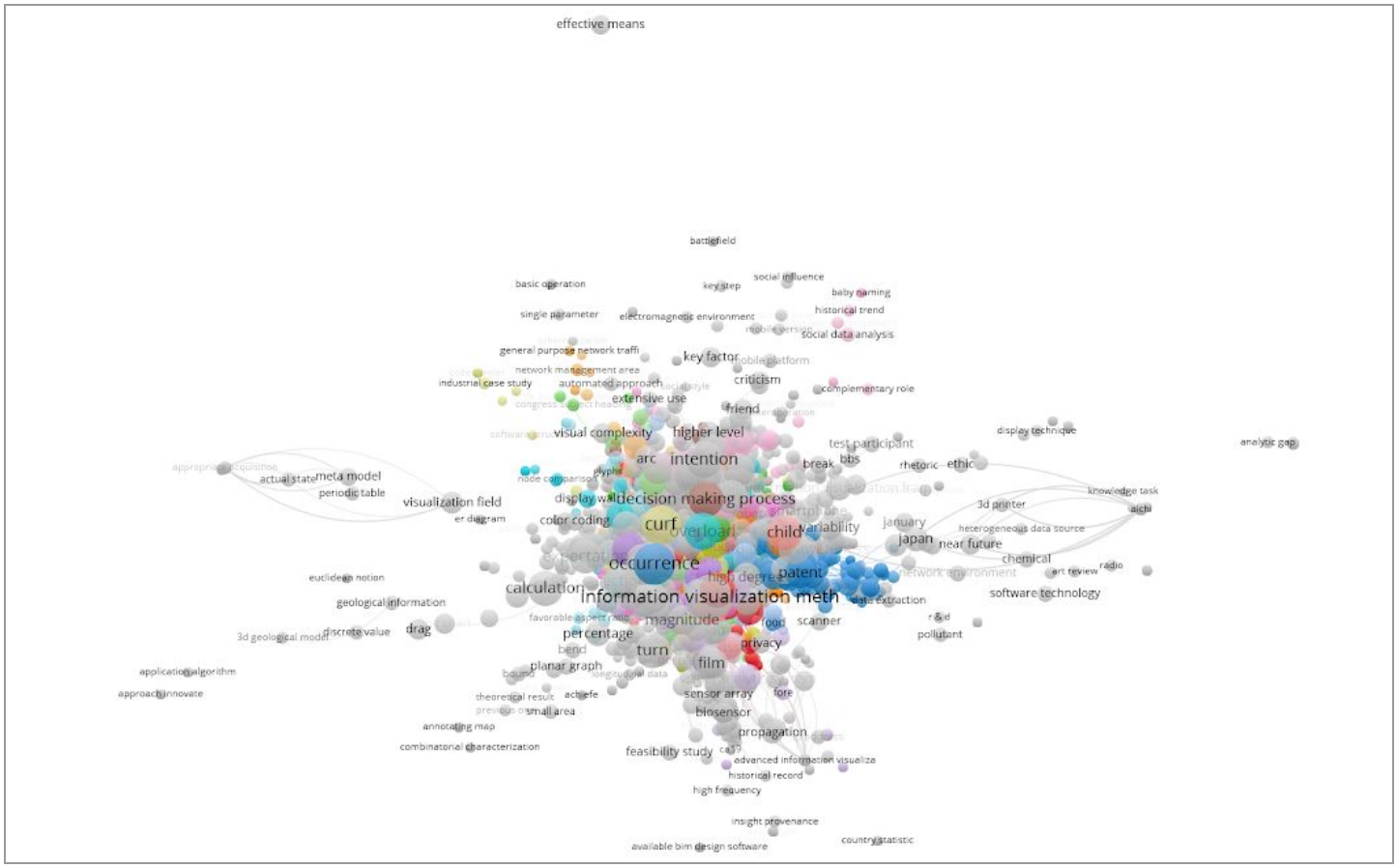


This visualization only shows the connected organizations which make up 436 out of the total 500 countries. I picked the “Create a map based on bibliographic data option” and selected “Organizations” for the unit of analysis.

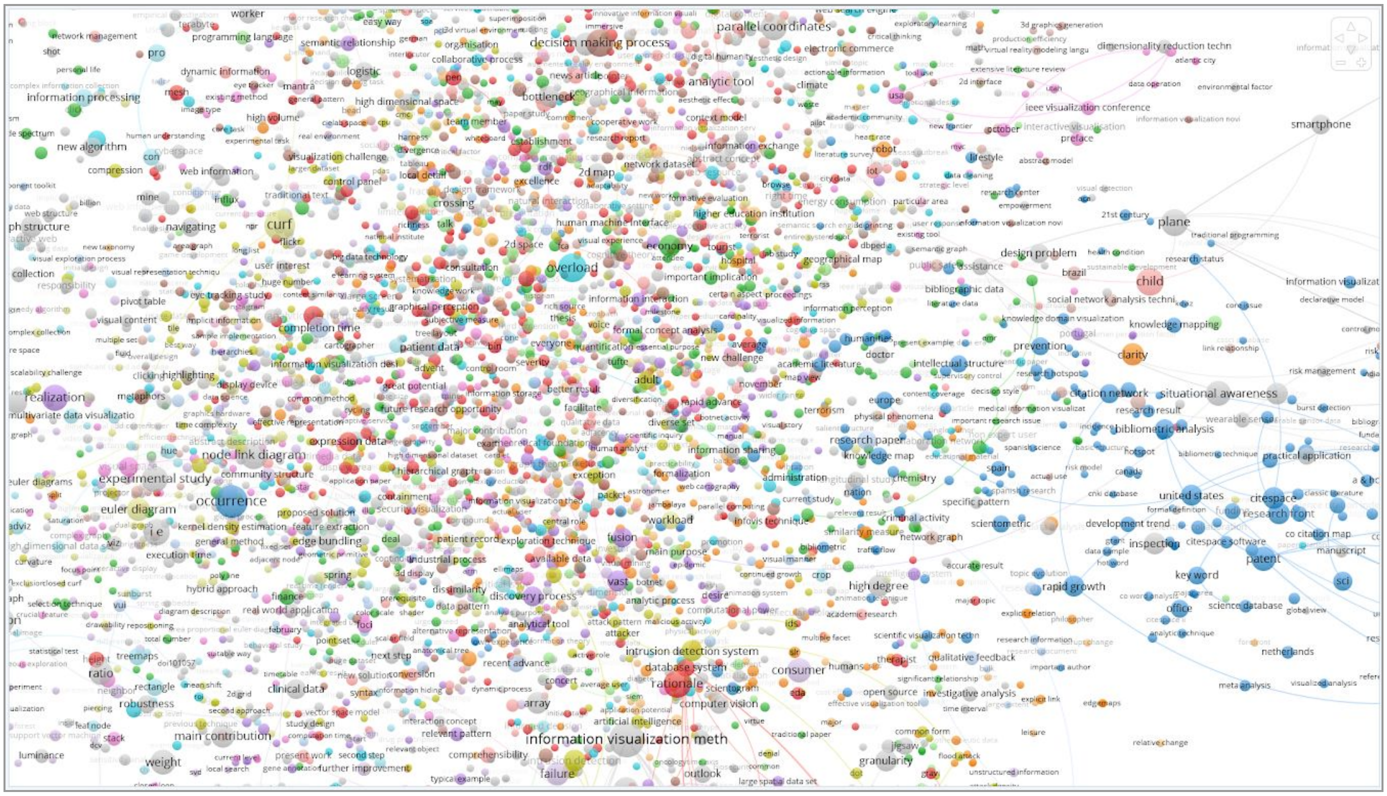
Appendix

Text Data Option

Figure 4: Terms in Publications with the keyword "information visualization"-Too much information

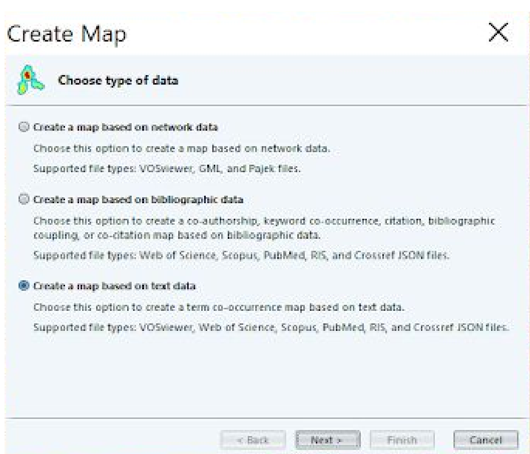


This is not a valuable text visualization in that there are way to many circles and it is hard to make any sense of it even after zooming in:



You can see the bubbles and some of the connections between the article terms. The bigger the bubble the more times that word appears across all the articles. There are way too many bubbles and lines to really make sense of this network visualization of terms. View *Figure 2* for a visualization with less terms but much easier to understand.

Options Chosen:



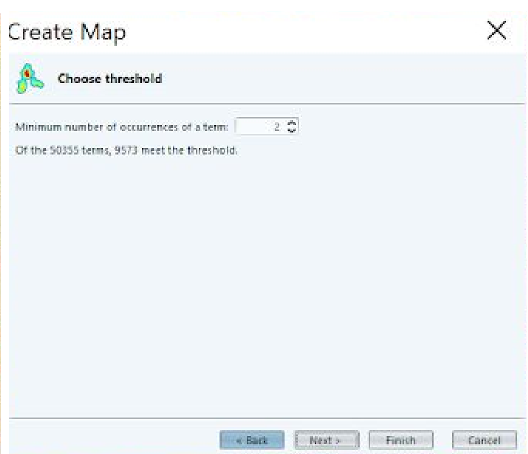
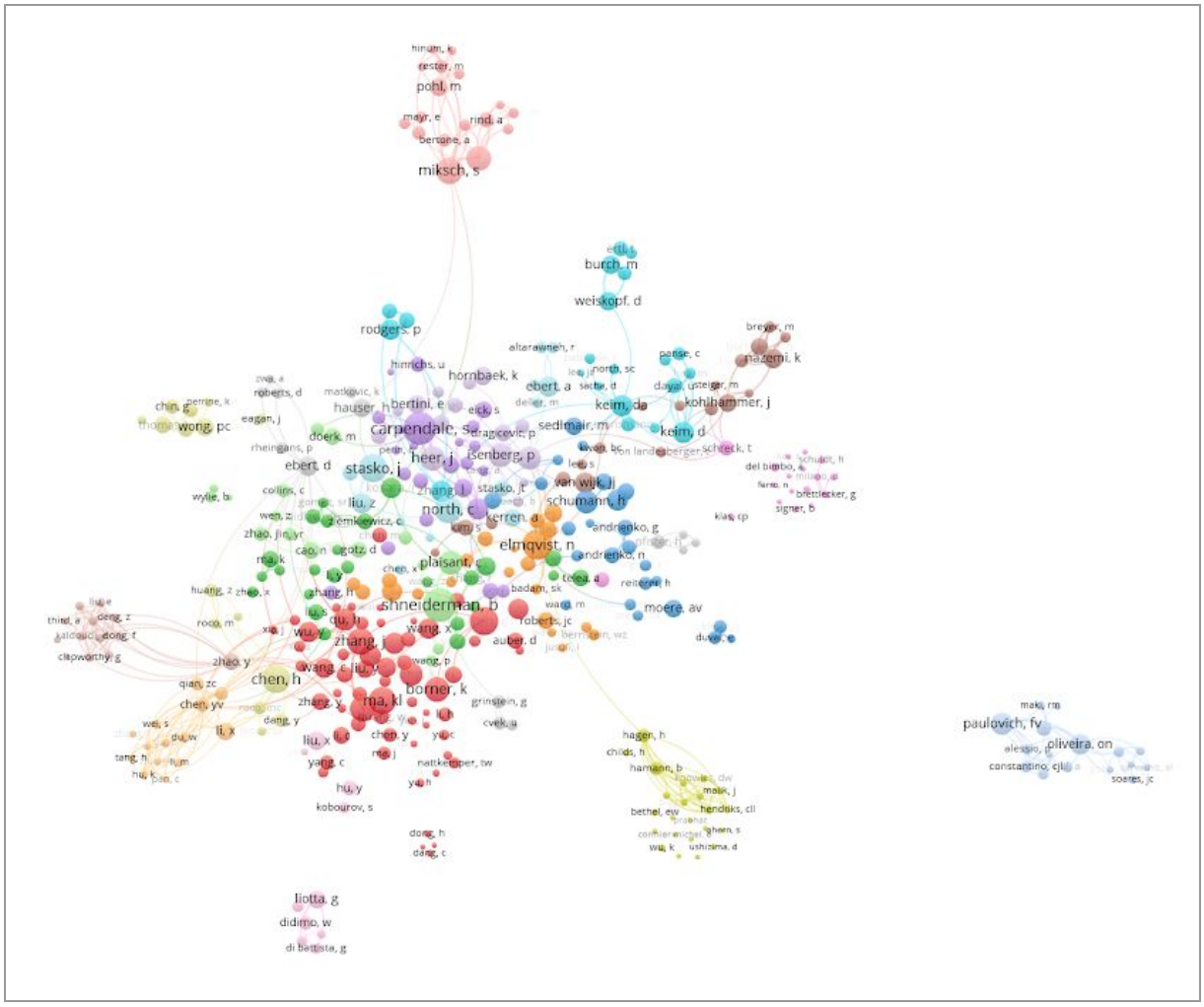
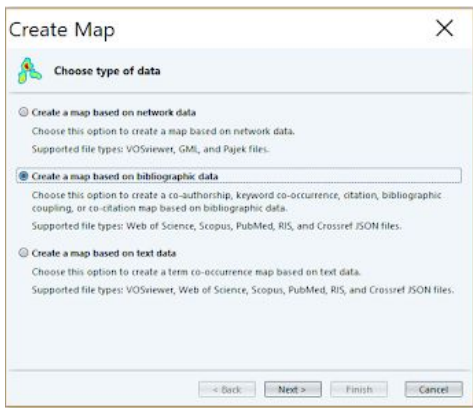


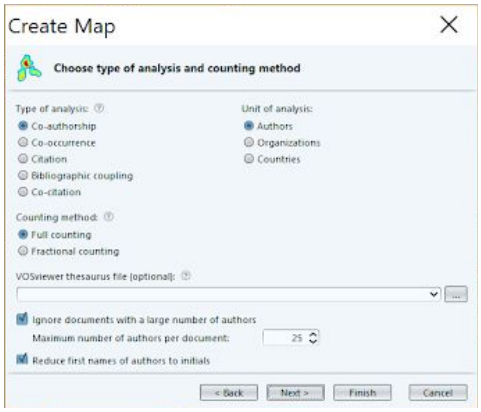
Figure 5: Authors who wrote publications with the term "information visualization"

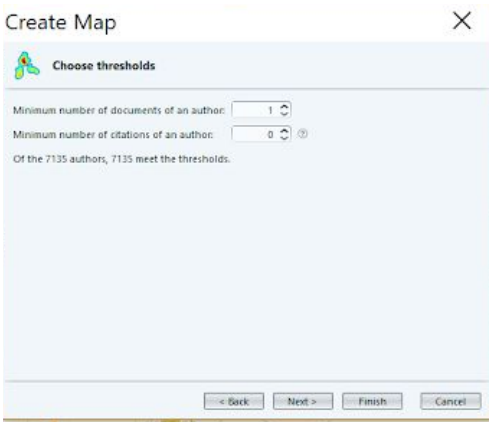


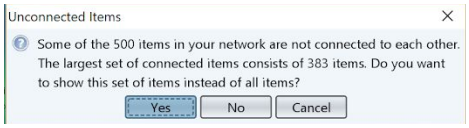
This is a hard network visualization to make sense of simply because if looking at different authors names unless they are really popular or well known it is hard to make sense of. It is also hard to tell why they are connected. It is possible that the connections are because they wrote a publication together. The bigger the node the more papers they wrote on the topic of "information visualization".

Options Chosen:









All authors who wrote publications with the keyword "information visualization" and were connected were included in this visualization.

Conclusion

VOSviewer is a good tool to show network visualizations and is generally easy to use. It allows for multiple file formats and allows you to import, edit or use the default colors. The font type can be changed as well but there are a limited number of options. The background seems to only be either black or white so it would be a nice feature if we could change it to something else. The visualizations can be hard to read at times if it there is too much information so it would be nice if there would be a table or tables showing the counts for each bubble and the connections. According to the journal article *Structural Holes and Good Ideas*, "people who stand near the holes in a social structure are at higher risk of having good ideas." Structural holes are gaps between connections these gaps can help reduce redundancy. In the article *The Strength of Weak Ties,* Granovetter mentions that "no strong tie is a bridge" basically meaning that some weak ties or connections might actually be stronger and more valuable. So in some of the figures above the seemingly more lightly connected nodes might be connected to less but have more of an indirect network of people, countries, organizations, or terms.

References

Burt, Ronald S. "Structural Holes and Good Ideas." *American Journal of Sociology* Vol. 110, no. 2 (September 2004): 349-99. doi:10.1086/421787.

Granovetter, Mark S. "The Strength of Weak Ties." *American Journal of Sociology* Vol. 78, no. 6 (May 1973): 1360-380. doi:10.1086/225469.

Waltman, Ludo, and Nees Jan Eck. *VOSviewer Manual*. www.vosviewer.com/documentation/Manual_VOSviewer_1.6.5.pdf.