Scientometric Mapping of Interpreting
Evolution of topics, authors and collaboration's over time and space

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Abstract:

Interpreting is the domain of translating speech or signs from one language to another [1]. Although science mapping is relatively established in other domains, the field of "interpreting" has not looked at itself from a Scientometric perspective. The project is a first step toward gaining first insights into this academic field by analyzing the academic articles published in the main journal in the field, Interpreting, using Scientometric analysis methods and information visualization.

Description and Goals:

The client needs visualizations that gives insights about "domain of interpreting" by analyzing the articles that have been published related to this domain. We will be creating visualizations which gives insights about the evolution of topics, authors, collaborations and citations across time (when) and space (where: geo-spatial). Listed below are the various visualization we would be implementing for this project:

1.) **Topic Analysis – Word Cloud:**

The goal is to create a chart in the form of a world cloud. We will overlay topics data. Here is an example visualization:

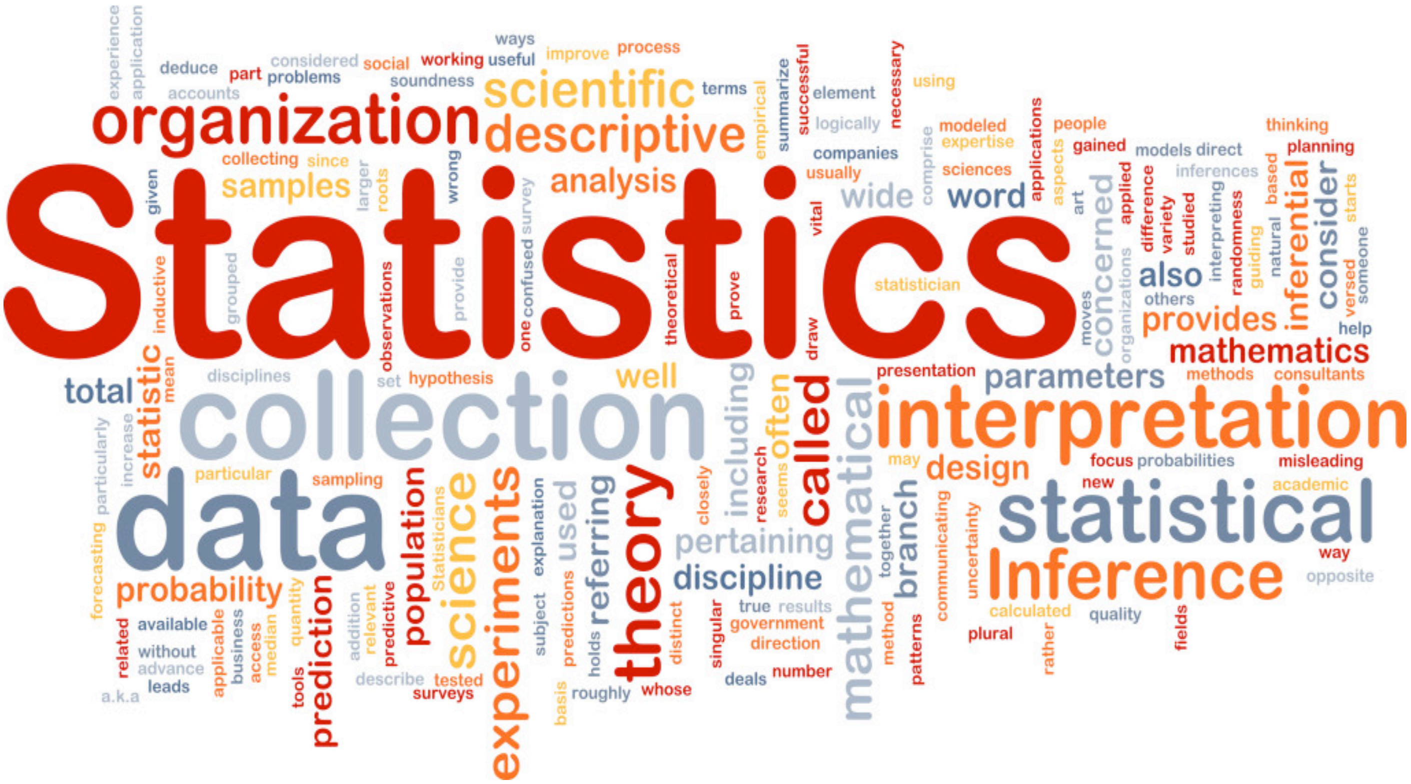
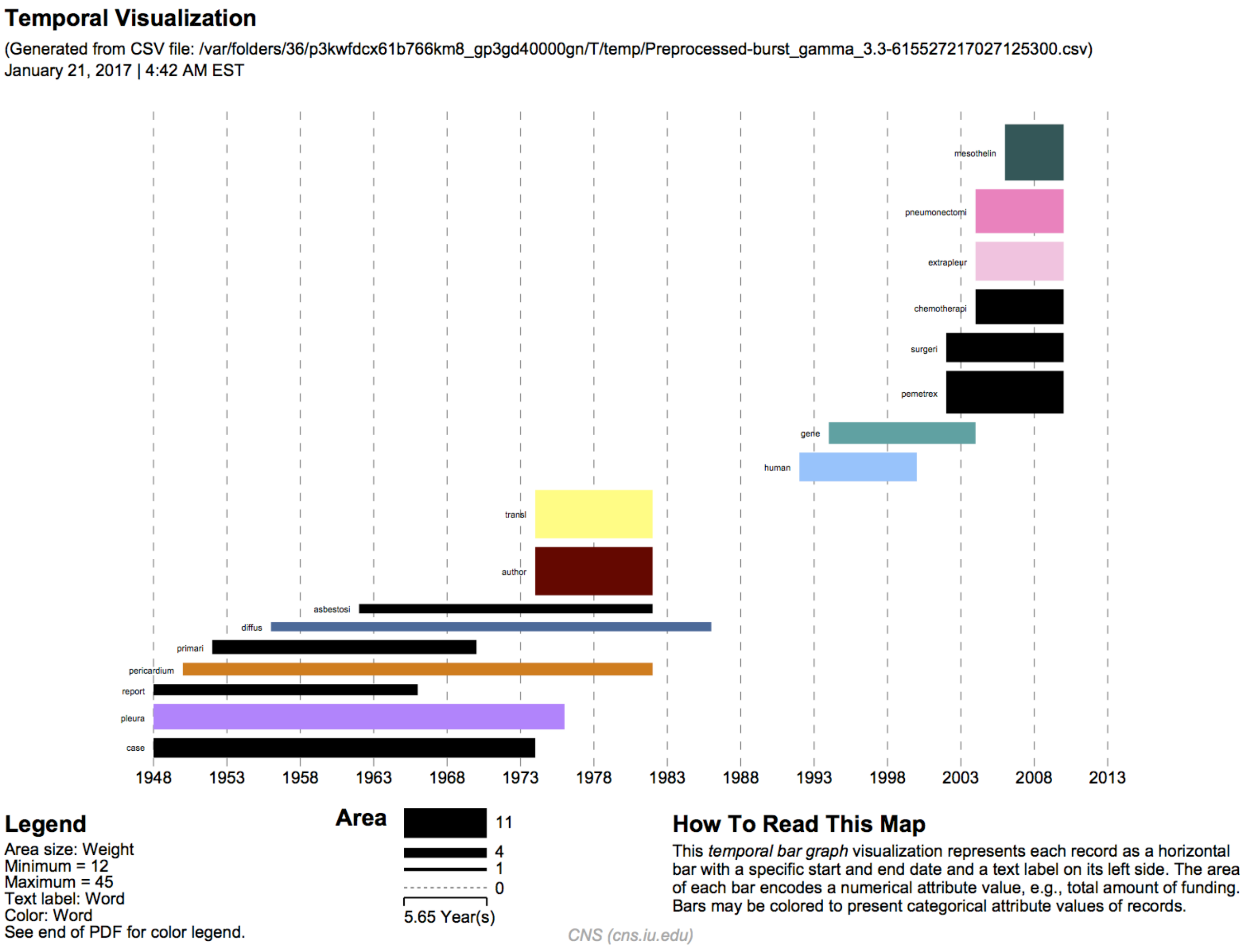


Figure 1: Word cloud example [2]

2.) Topic Analysis: Burst of terms across time

In this visualization, we can see the burst of topics in the domain of interpreting across time. Below is an example visualization:



Temporal Visualization

(Generated from CSV file: /var/folders/36/p3kwfdcx61b766km8_gp3gd40000gn/T/temp/Preprocessed-burst_gamma_3.3-615527217027125300.csv)
January 21, 2017 | 4:42 AM EST

Legend

Area size: Weight
Minimum = 12
Maximum = 45
Text label: Word
Color: Word
See end of PDF for color legend.

Area

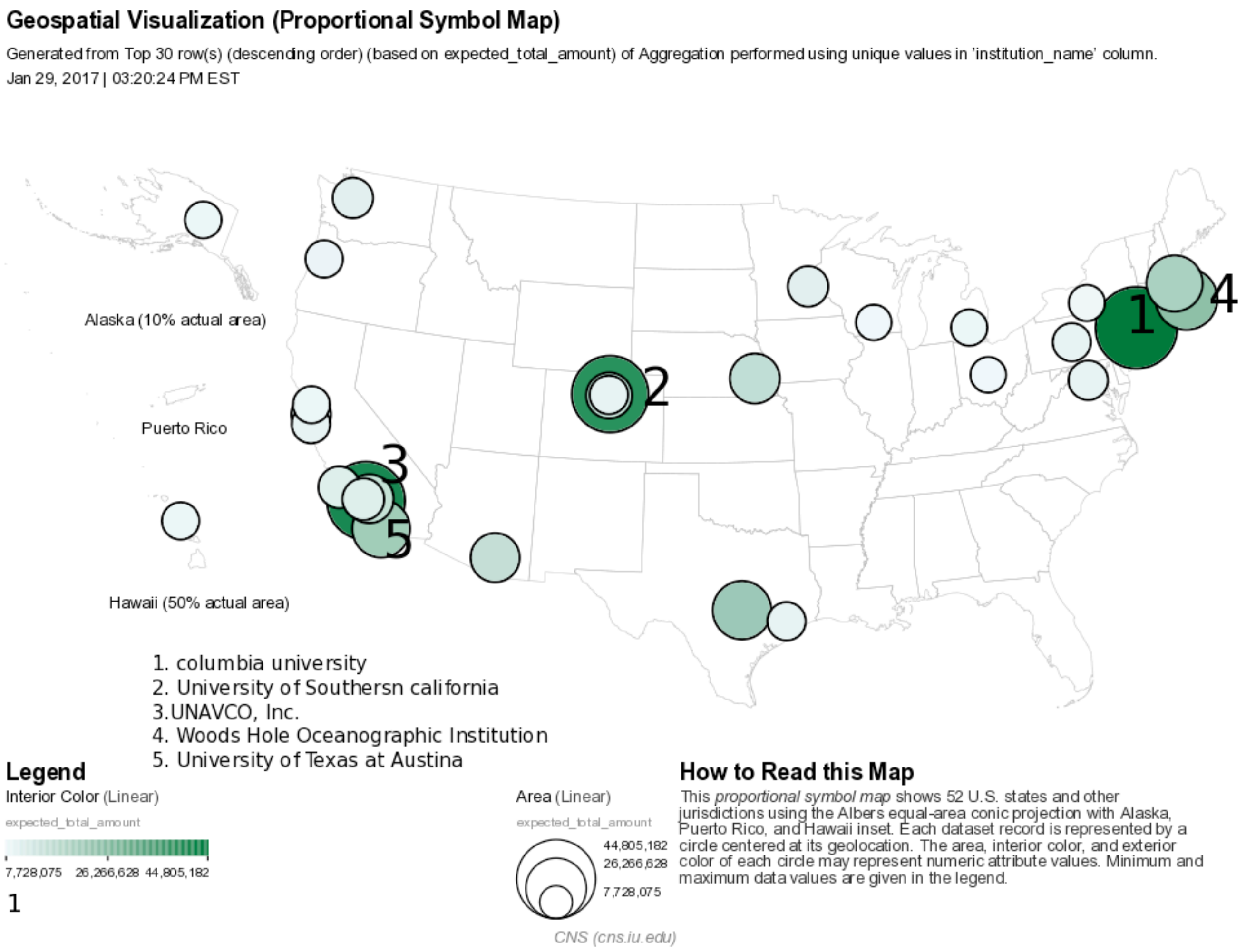
How To Read This Map

This *temporal bar graph* visualization represents each record as a horizontal bar with a specific start and end date and a text label on its left side. The area of each bar encodes a numerical attribute value, e.g., total amount of funding. Bars may be colored to present categorical attribute values of records.

CNS (cns.iu.edu)

3.) Geospatial Location of Lead Authors:

The reference system will be a world map or any other map. We will be using proportional symbol map to overlay the data of number of authors that have contributed towards the domain of interpreting. An example proportional symbol map would look something like this: (It shows the universities that receive the most amount of funding. And size of the symbol is proportional to the amount of funding. In our case this will be the number of authors that have contributed from that university or the location of lead authors i.e the authors who have contributed the most.)



Geospatial Visualization (Proportional Symbol Map)

Generated from Top 30 row(s) (descending order) (based on expected_total_amount) of Aggregation performed using unique values in 'institution_name' column.
Jan 29, 2017 | 03:20:24 PM EST

1. columbia university
2. University of Southersn california
3.UNAVCO, Inc.
4. Woods Hole Oceanographic Institution
5. University of Texas at Austina

How to Read this Map

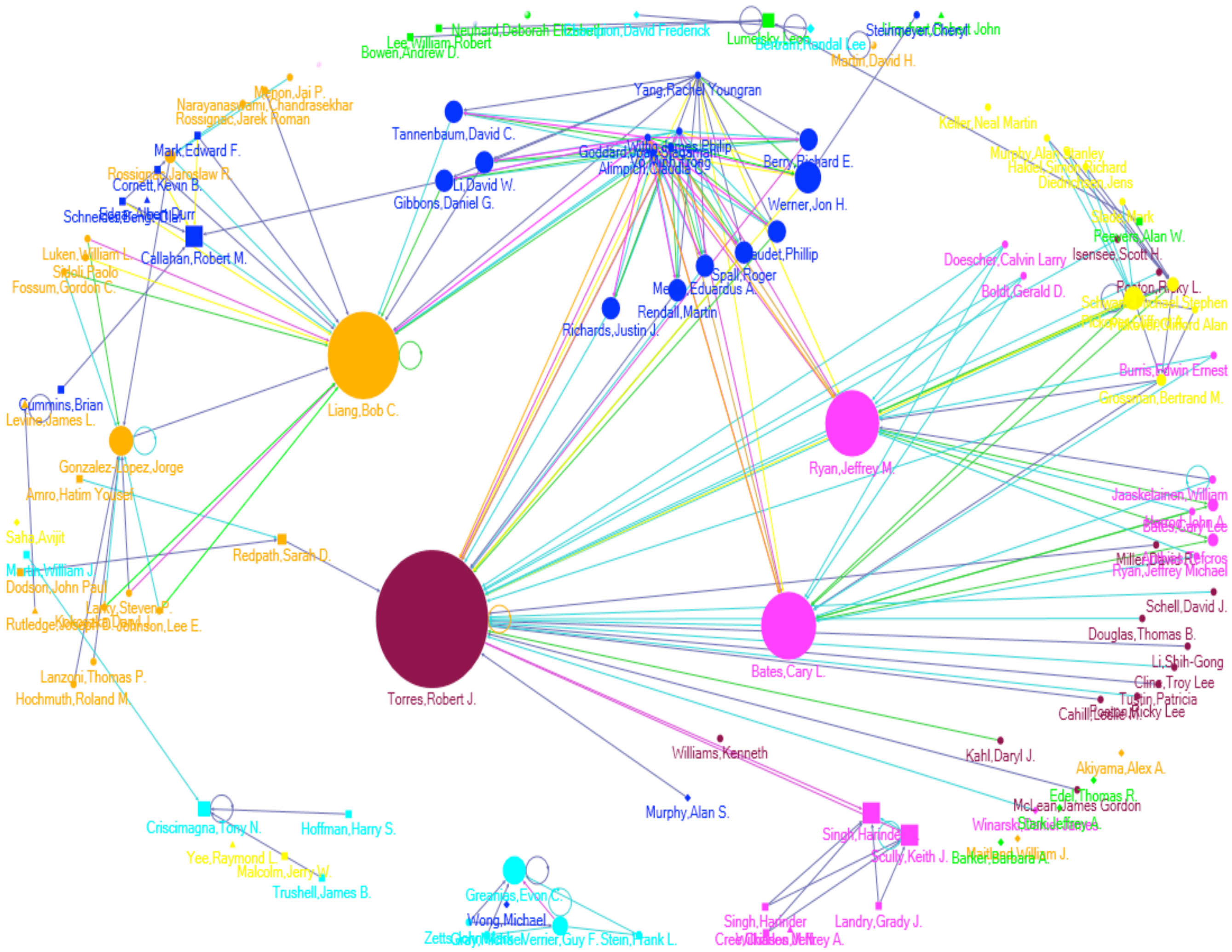
This *proportional symbol map* shows 52 U.S. states and other jurisdictions using the Albers equal-area conic projection with Alaska, Puerto Rico, and Hawaii inset. Each dataset record is represented by a circle centered at its geolocation. The area, interior color, and exterior color of each circle may represent numeric attribute values. Minimum and maximum data values are given in the legend.

CNS (cns.iu.edu)

4.) Paper Citation Network:

The reference system that will be used here is a network graph that shows the citations network of the authors. This depends on the dataset that we have and how much information it holds as the dataset is still tentative and not yet finalized. But here is an example of Patent Citation network of Computer Graphics Processing Group [3]

Number of Patent Citiations among companies with images



Created with NodeXL (http://nodexl.codeplex.com)

5.) **GeoSpatial location of topics across time:**

This uses world map or Country maps as a reference system. We will overlay lead topics that have evolved at various locations across the world. We can also include one more factor which is the time. We can produce series of maps for various time frames.

Interactive Visualizations:

Though client is looking just for visualization's that just gives insights, a better visualization would always be the one with which we can interact. We can use the Shiny web app with plotly/ D3 or any other program for this purpose to implement interactive visualizations.

Various levels of interactions can be as follows:

1.) Time Toggle affect: With this we can select the time / year to see how the topics/authors have evolved during the particular time frame.
2.) Filters: Using filters we should be able to sub select authors, Countries, Topics etc
3.) Data Overlay: Based on the time/Filters used the appropriate data must be overlaid.

Related Work:

There is not much of a work done in the Scientometric analysis of the interpreting studies domain. But we have found very few works related to this . In Xu and Pekelis_Chinese Interpreting Studies A Data Driven Analysis_Peerj 2015 paper [5] it discusses about how we can identify various trends in the interpreting studies using quantitative and qualitative analysis. But this study focusses on mainly the Chinese works. Doors and Gambier Measuring relationships in Translation Studies Perspectives 2015 [6], in this study they mainly focus on the geographical spread of the Translation and Interpreting Research using Affiliations.

About the Data (Statistics and Attributes):

The required data for this project is obtained from the Scopus database. It has research papers related to various domains including the field of interpreting.

The search query is as follows: "interpreting studies" OR "conference interpreting" OR "court interpreting" OR "medical interpreting" OR "sign language interpreting" OR "community interpreting" OR "simultaneous interpretation" OR "consecutive interpretation".

The dataset has 2932 records in them. Which suggests that there are 2932 records of different papers/articles related to Scientometric Interpreting. But it has a lot of noise. It Should be filtered to exclude publications related to statistics, remove non-articles such as books etc. The main attributes in the dataset which are relevant and interesting for our analysis were the below ones:

- **Authors**: This column gives us the name(s) of the authors who were responsible for the publication
- **Title**: This column gives us the title of the paper/publication
- **Year**: This column gives us the year in which the paper was published
- **Affiliations 1**: This column gives us the information of the author's affiliation to an organization/University
- **Abstract**: This column gives us the brief abstract of the paper's content
- **geo_latitude**: The latitude value of the author's affiliated organization meaning from which place the paper emerged
- **geo_longitude**: The longitude value of the author's affiliated organization meaning from which place the paper emerged
- **Cited by**: This attribute gives us the information on how many times the article was cited by other authors in their work

For the geo-spatial mapping, we can use the Affiliation’s filed. It has the university location address. This address can be used for geocoding to obtain the latitude and longitude which can then be used for spatial mapping.

Data analysis/visualization (algorithms) applied and resulting visualizations:

1. **Burst Detection: Temporal Analysis**

We decided to perform 'Burst Detection' on two different fields namely 'Title' and 'Abstract' to understand on which topics/areas, the publications concentrated on. And finally, to create a temporal bar graph to visualize the burst detection over time.

Following are the steps which were carried out in executing 'Burst Detection':

- Load the data into Sci2 in 'Standard csv format'. The dataset loads and appears in Sci2's data manager
- Right click on the data and click on 'view' to check the right data have been loaded. We can also explore different fields of our data by doing so
- Since we want to perform Temporal Analysis via 'Burst Detection' and to visualize it via Temporal bar graph, our main concentration is on the fields Title, Abstract and Year

- The first and foremost step in our analysis to perform 'Burst Detection' is to normalize the 'Title' field. This will first lowercase the words, break the words into tokens, stem the words and remove all the stop words. This process will make sure that the 'Burst Detection' algorithm runs effectively
- In Sci2, click on the dataset and go to Preprocessing -> Topical -> Lowercase, Tokenize, Stem, and Stop word Text. Since we are interested in normalizing the 'Title' field, we need to select that and click on 'Ok'. The algorithm runs successfully and the 'Title' field gets normalized. We can cross-check this by viewing the file again
- After this pre-processing, the next step is to run the 'Burst Detection' on the normalized 'Title'. To do this, click on the normalized file, go to Analysis -> Topical -> Burst Detection. We need to input the below parameters. Keep rest of them to its default.

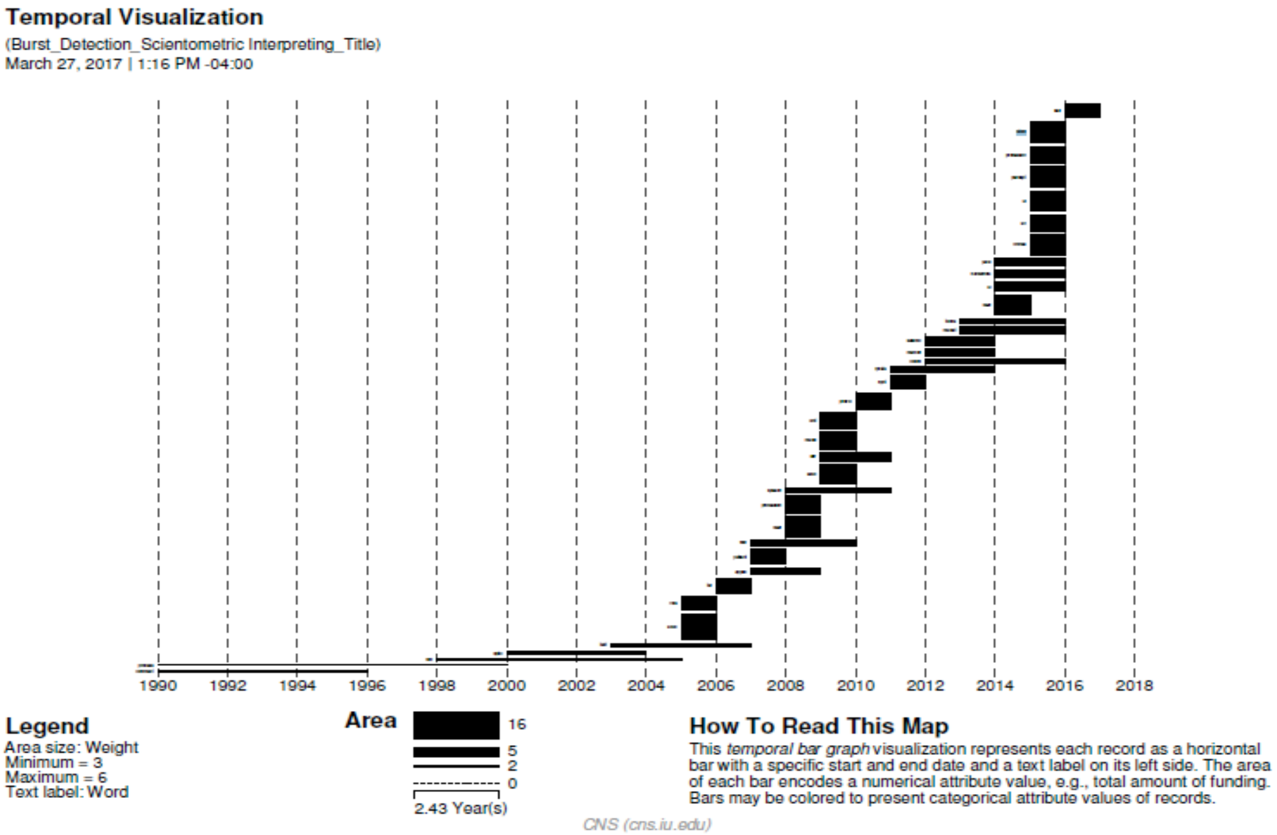
  Data Column - Year
  Text Column - Title

  Click on Ok.
- When we right click, and view our modified dataset, we could see the word column which gives us all the bursting words from Titles. We also have burst Weight and, the Start date and End date for the burst. Many of the End date columns were empty which suggested that those words were still bursting. However, as we knew that the publications/papers till 2016, all the missing rows were imputed with '2016'
- Save the file with csv format
- Reload the saved file back to Sci2 with standard csv format. This new file would be used to create the temporal bar graph
- Select the file and go to Visualization -> temporal -> Temporal Bar Graph and input the below parameters

  Subtitle - Scientometric Interpreting
  Label - Word
  Start Date - Start
  End Date - End
  Size By - Weight
  Scale Output - Checked

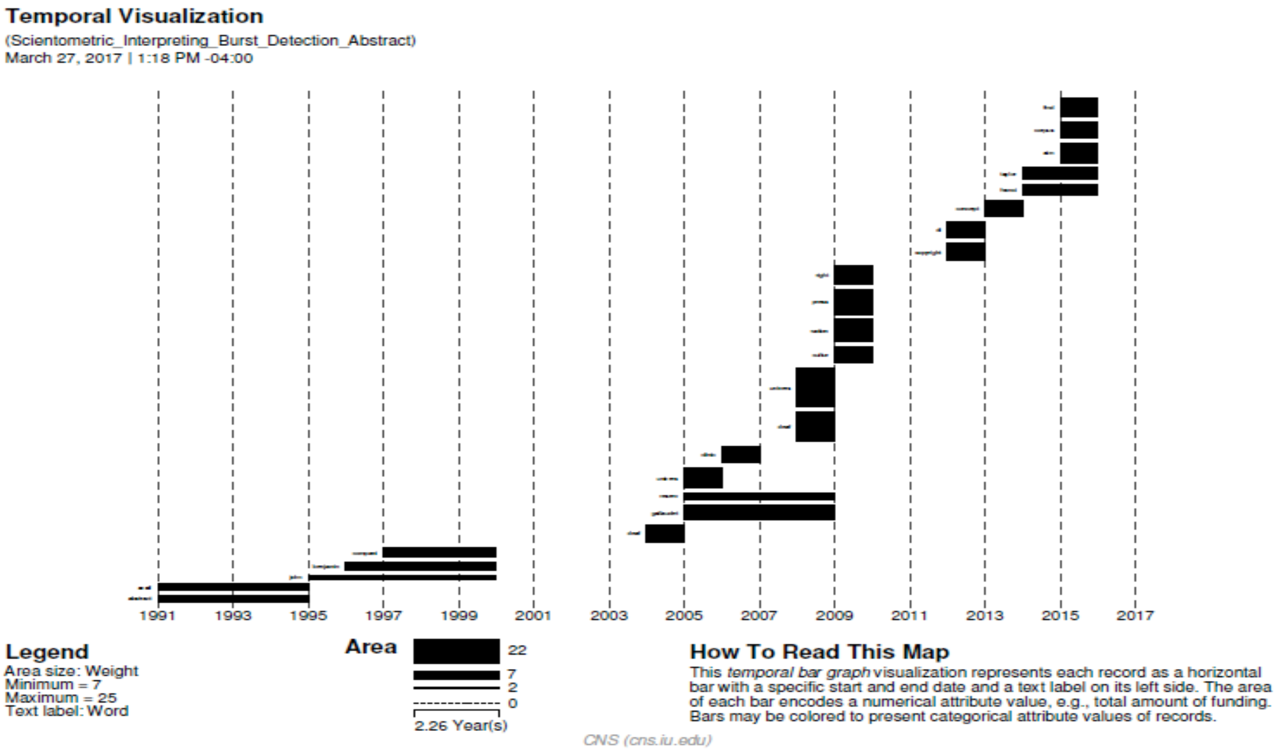
  Click 'Ok'.
- The Temporal Bar Graph would be created in the Data Manager. The next step is to save this file as a 'PostScript' file and convert it into pdf

Perform the same steps for 'Burst Detection' on Abstract field. Below are the visualizations for the same.



This *temporal bar graph* visualization represents each record as a horizontal bar with a specific start and end date and a text label on its left side. The area of each bar encodes a numerical attribute value, e.g., total amount of funding. Bars may be colored to present categorical attribute values of records.

Figure 2 Genrated from title



This *temporal bar graph* visualization represents each record as a horizontal bar with a specific start and end date and a text label on its left side. The area of each bar encodes a numerical attribute value, e.g., total amount of funding. Bars may be colored to present categorical attribute values of records.

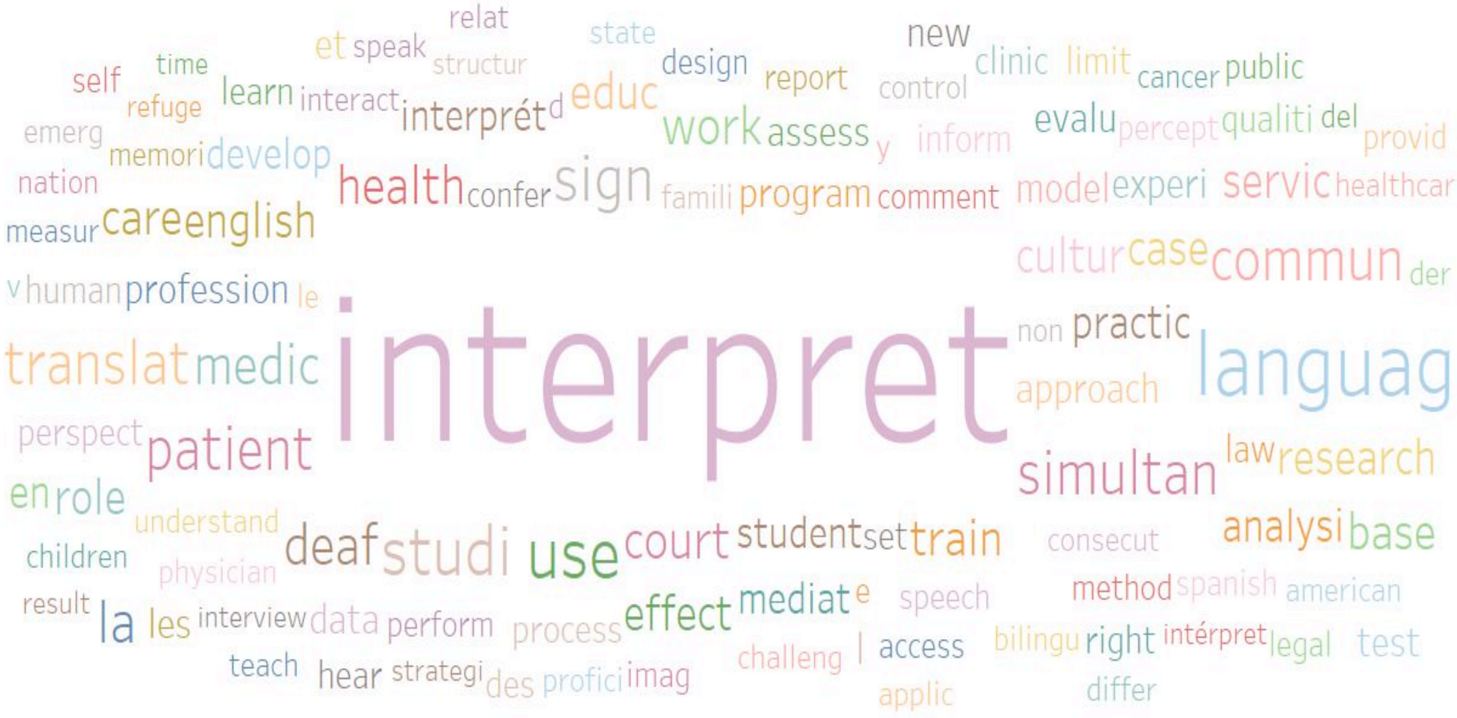
Figure 3 Generated from abstract

2. **Word Cloud:**

    1. Load the csv file onto Sci2 and perform preprocessing on that
       preprocessing -->topical --> lowercase, tokenize, stem and stopword text based on title
    2. Load the resulting file to excel. select the title column and split the words based on spaces. Find the frequency of each word.
    3. Load the words and frequencies into Tableau.
    4. Drag the words to Text and Frequencies to Size
    5. Select words with frequency above 30
    6. Drag the words to color

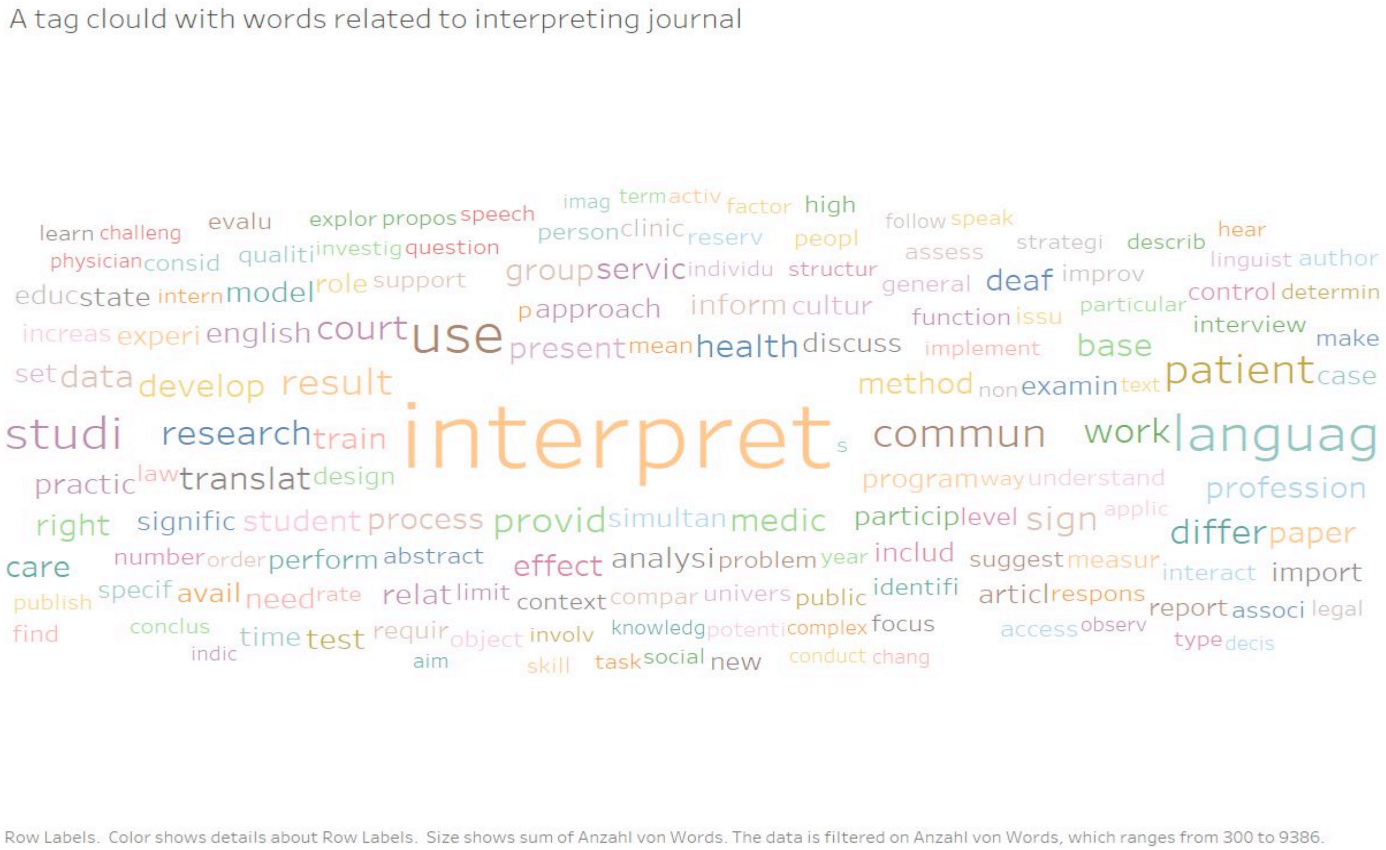
    The word cloud visualization is created
    Repeat the same process on the abstract column.

A tag clould with words related to interpreting journal



Row Labels. Color shows details about Row Labels. Size shows sum of Anzahl von Words. The data is filtered on Anzahl von Words, which ranges from 30 to 2256.

Figure 4 Generated from Title


A tag clould with words related to interpreting journal

Row Labels. Color shows details about Row Labels. Size shows sum of Anzahl von Words. The data is filtered on Anzahl von Words, which ranges from 300 to 9386.

Figure 5 Generated from Abstract

Insights

- We preprocessed the original dataset by filtering out the records specific to the domain interpreting, cleaned the data set by removing nulls etc. But we still observe some noise in the results found as per the visualizations.

- Words like healthcar, servic, patient may not be related to our domain. We still need to look into the dataset to and try removing the unrelated terms.

- In the Temporal Visualization, we can see many bars. Each of the bars are associated with one of the bursting words. We can see these bursting words from 1990 to 2016. We can also see the difference in the weights for each burst term and can check how the topics/areas in Scientometric Interpreting evolved over time.

- Initially the algorithm did not filter away few things like years and single alphabets and these appeared as noise in our processed data as bursting terms. These had to be removed before creating the temporal graph.

- In the Title Temporal graph, we can see terms bursting like 'educ', 'studi', 'mediat', 'percept' and so on which emerged over time.

- In the Abstract Temporal graph, we can see terms bursting like 'gallaudet', 'univers', 'deaf' etc. which emerged over time.

- top 10 words for title: (from word cloud of title)
    - interpret 2,256
    - languag 368
    - use 224
    - studi 208
    - sign 183
    - patient 167
    - commun 163
    - simultan 157
    - translat 156
    - la 152

- top 10 for abstract: (from word cloud of abstract)
    - interpret 9,386
    - use 2,830
    - languag 2,610
    - studi 2,103
    - commun 1,547
    - patient 1,524
    - result 1,259
    - provid 1,180
    - court 1,088
    - differ 1,079

- Both word cloud and topic burst over time, shows which topics/words have more prominence in the domain of interpreting. It's natural to have interpret word more weightage. But there are other interesting terms as well such as deaf, universe, court etc.

Discussion of challenges and opportunities:

1.) The major challenge is to obtain a clean data set as there is a lot of possible noise. But by refining query terms in Scopus database we can obtain a better dataset.
2.) Another challenge is to implement an interactive visualization's. Using appropriate tools such as shiny web app/plotly/D3 etc should help us build interactive visualizations easily.

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References:

[1] Interpretation or Interpreting wikipedia : **https://en.wikipedia.org/wiki/Language_interpretation**

[2] World Cloud example image: http://www.jsquaredanalytics.com/word-clouds/

[3] Citation Network wiki: https://wiki.cs.umd.edu/cmsc734_11/index.php?title=File:Citation_IBm.png

[4] Sci2 Team. (2009). Science of Science (Sci2) Tool. Indiana University and SciTech Strategies, http://sci2.cns.iu.edu.

[5] In Xu and Pekelis_Chinese Interpreting Studies A Data Driven Analysis_Peerj 2015

[6] Doors and Gambier_Measuring relationships in Translation Studies_Perspectives 2015.