Systematic Literature Review

Abhay Singh

Bibliometrix Analysis using R

- Bibliometrix (https://www.bibliometrix.org/) allows R users to import a bibliography database generated using SCOPUS and Web of Science stored either as a Bibtex (.bib) or Plain Text (.txt) file.
- The package has simple functions which allows for descriptive analyses as shown in table-1 to table-3.
- The analysis can also be easily visualised as shown in figure-1.

```
library(bibliometrix)  #load the package
library(pander)  #other required packages
library(knitr)
library(kableExtra)
library(ggplot2)
# use scopuscollection data from the package Manuscripts
# including the term 'bibliometrics' in the title.  Period:
# 1975 - 2017 Database: SCOPUS Format: bibtex
data("scopusCollection")
file1 = data("scopusCollection")
# M=convert2df(file='insert
# filename',format='bibtex',dbsource = 'scopus')#convert the
# data to data frame
```

Descriptive Analysis

```
# Descriptive analysis
M = scopusCollection  #just to reuse the other code
res1 = biblioAnalysis(M, sep = ";")
s1 = summary(res1, k = 10, pause = FALSE, verbose = FALSE)

d1 = s1$MainInformationDF  #main information
d2 = s1$MostProdAuthors  #Most productive Authors
d3 = s1$MostCitedPapers  #most cited papers
pander(d1, caption = "Summary Information")
```

Table 1: Summary Information

Description	Results
MAIN INFORMATION ABOUT DATA	
Timespan	1975:2017
Sources (Journals, Books, etc)	280
Documents	487
Average years from publication	11.6
Average citations per documents	10.36

Description	Results
Average citations per year per doc	0.7799
References	12245
DOCUMENT TYPES	
article	417
book	12
conference	58
DOCUMENT CONTENTS	
Keywords Plus (ID)	1436
Author's Keywords (DE)	722
AUTHORS	
Authors	949
Author Appearances	1187
Authors of single-authored documents	162
Authors of multi-authored documents	787
AUTHORS COLLABORATION	
Single-authored documents	184
Documents per Author	0.513
Authors per Document	1.95
Co-Authors per Documents	2.44
Collaboration Index	2.6

Productive Authors

```
pander(d2, caption = "Most Productive Authors", table.split = Inf)
```

Table 2: Most Productive Authors

Authors	Articles	Authors	Articles Fractionalized
BORNMANN L	13	BORNMANN L	6.75
KOSTOFF RN	8	HOLDEN G	4.25
GLNZEL W	7	WHITE HD	4.00
HOLDEN G	7	MARX W	3.42
MARX W	7	ATKINSON R	3.00
HUANG L	5	NA	3.00
HUMENIK JA	5	GLNZEL W	2.67
LARIVIRE V	5	KIRBY A	2.50
LEYDESDORFF L	5	PERITZ BC	2.50
ZHANG X	5	SMITH DR	2.50

Most cited papers

```
pander(d3, caption = "Most Cited Papers")
```

Table 3: Most Cited Papers

Paper	TC	TCperYear
DAIM TU , 2006, TECHNOL FORECAST SOC CHANGE	331	22.07
BORGMAN CL , 2002, ANNU REV INF SCI TECHNOL	312	16.42

Paper	TC	TCperYear
WEINGART P, 2005, SCIENTOMETRICS	208	13.00
NARIN F, 1994, SCIENTOMETRICS	169	6.26
CRONIN B, 2001, J INF SCI	160	8.00
HOOD WW , 2001, SCIENTOMETRICS	144	7.20
HICKS D , 2015, NATURE	130	21.67
CHEN Y-C , 2011, SCIENTOMETRICS	129	12.90
D'ANGELO CA , 2011, J AM SOC INF SCI TECHNOL	81	8.10
GLNZEL W , 2006, SCIENTOMETRICS	78	5.20

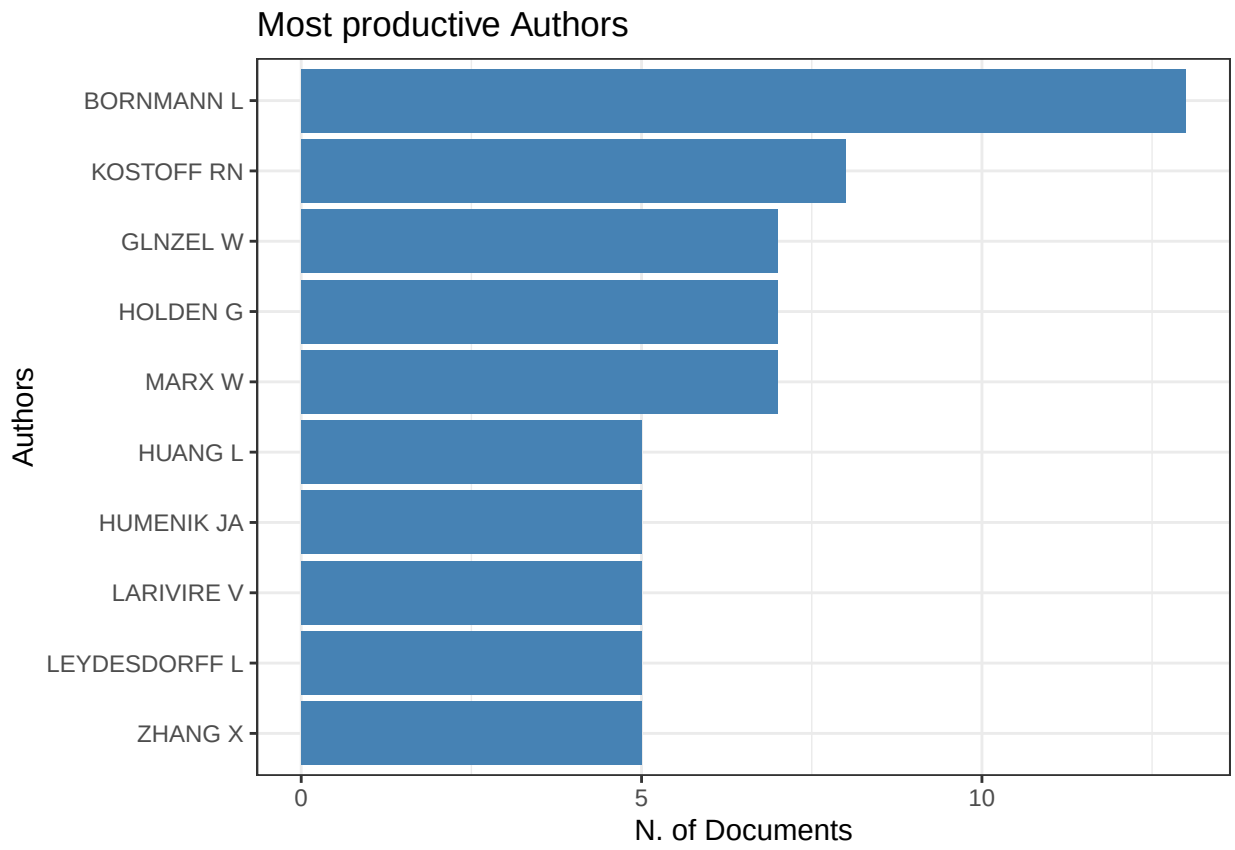
Information Plots

```
p1 = plot(res1, pause = FALSE)
```

Summary Plot-1 (Most Porductive Authors)

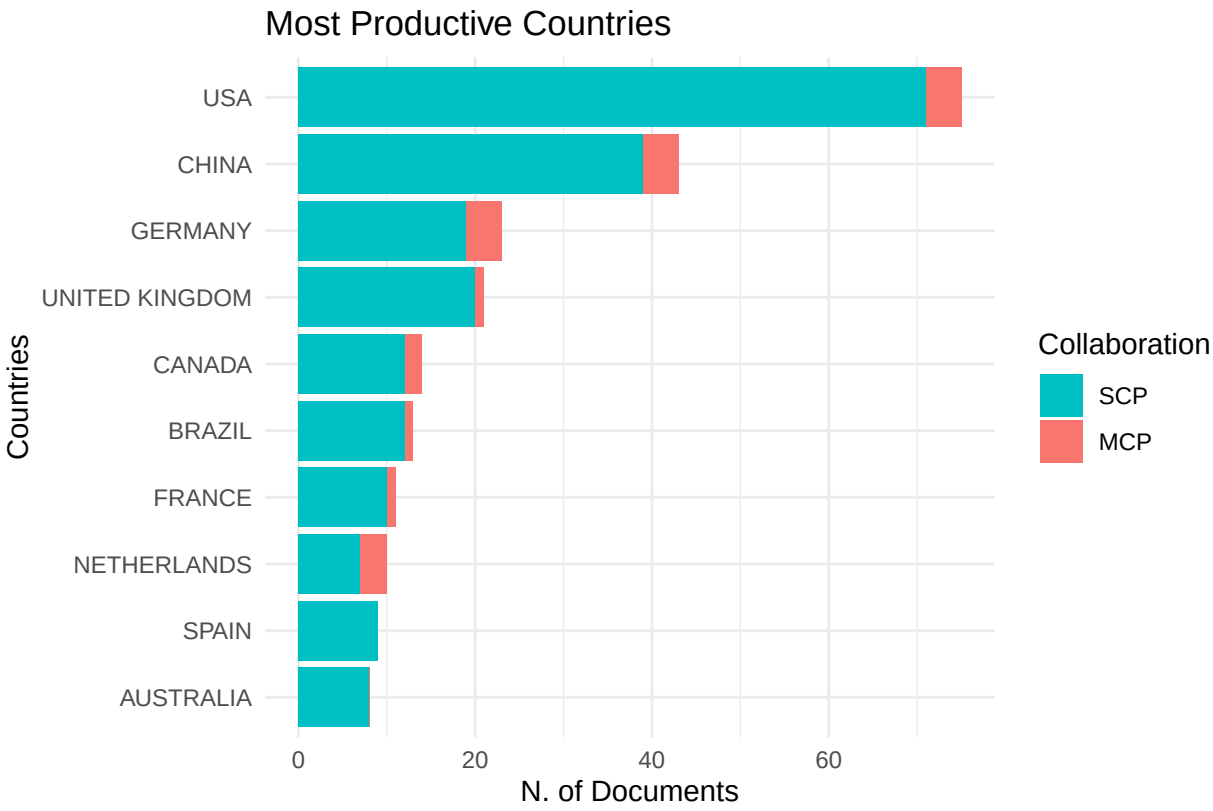
```
library(ggplot2)
theme_set(theme_bw())


p1[[1]] + theme_bw() + scale_x_discrete(limits = rev(levels(as.factor(p1[[1]]$data$AU))))
```



Summary Plot-2 (Most Productive Countries)

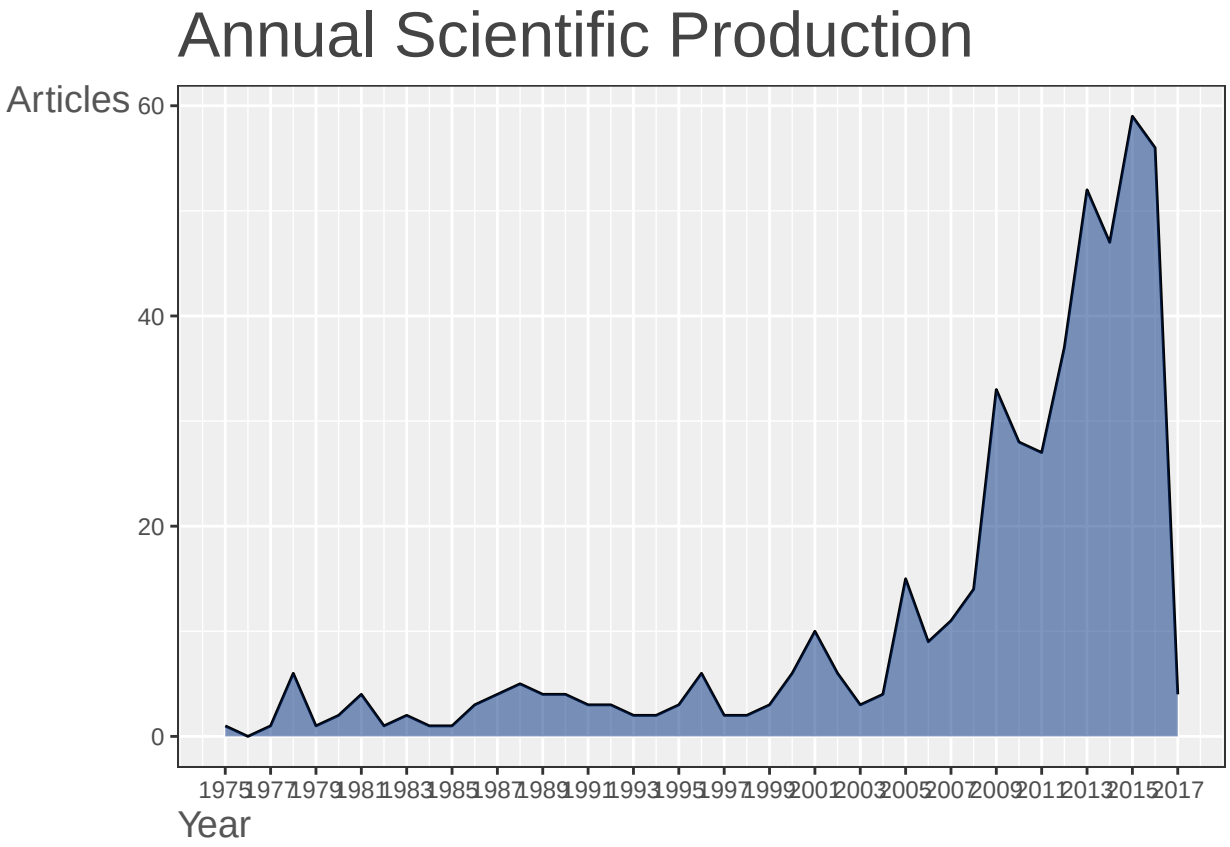
```
p1[[2]]
```



SCP: Single Country Publications, MCP: Multiple Country Publications

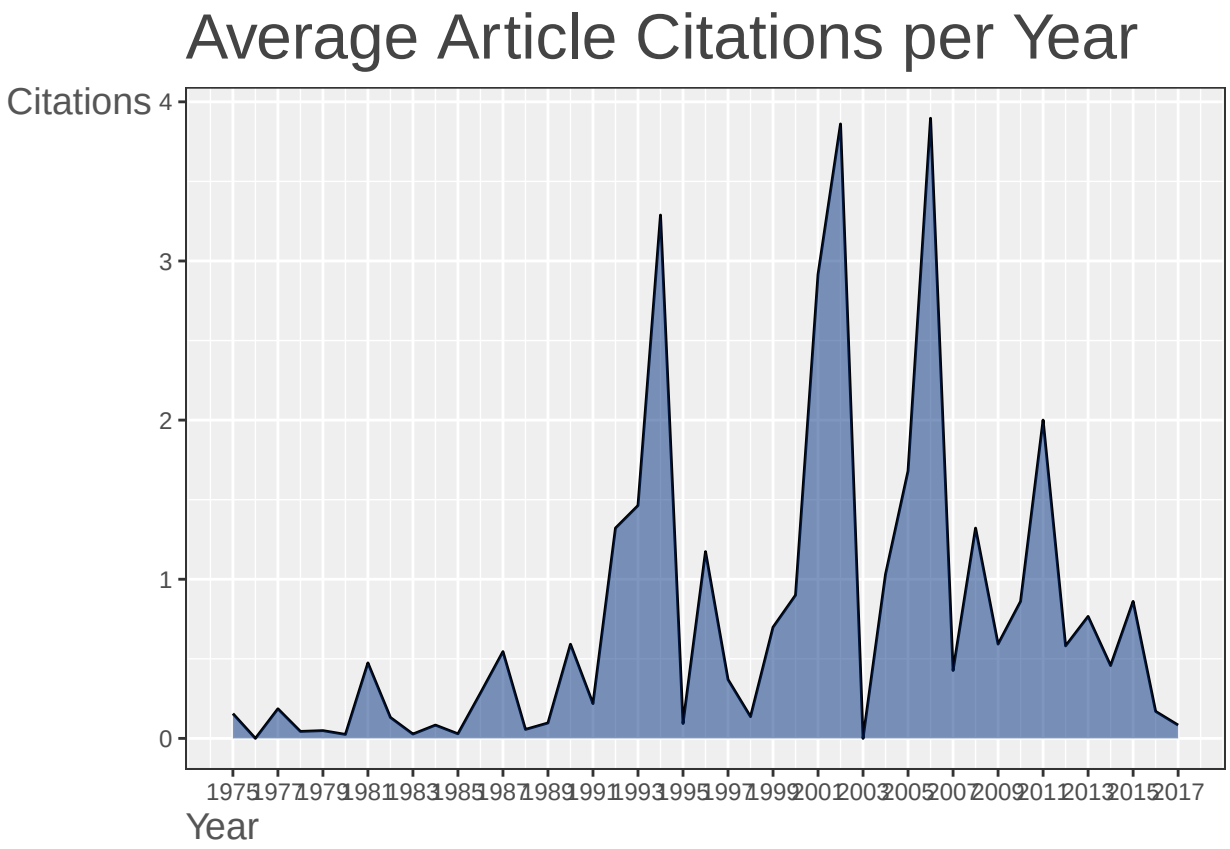
Summary Plot-3 (Annual Scientific Production)

```
p1[[3]]
```



Summary Plot-4 (Average Article Citation)

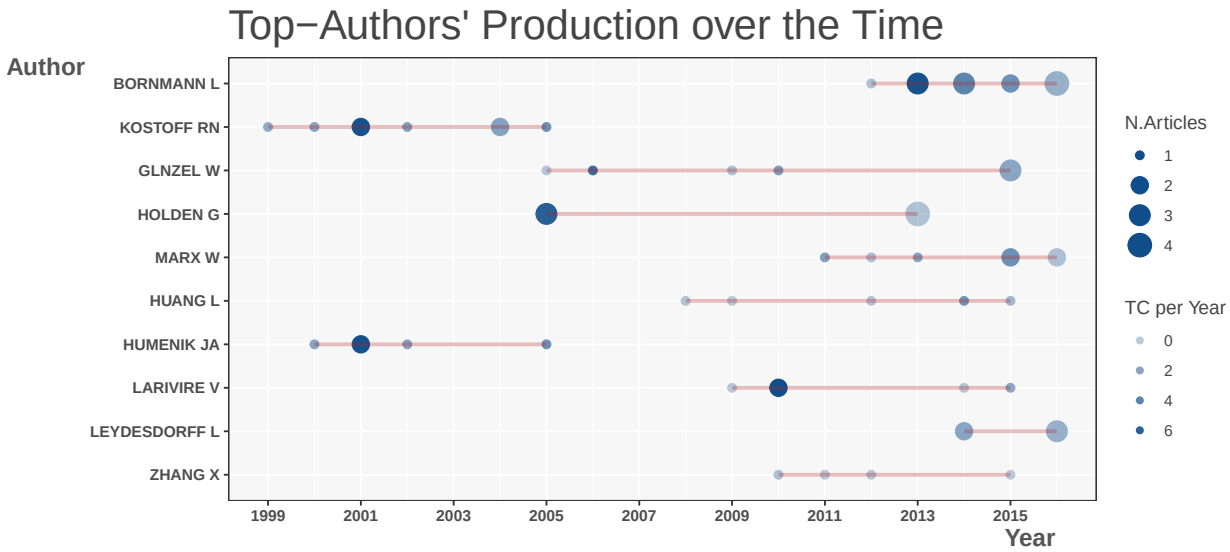
```
p1[[4]]
```



* A graph for author statistics over time can also be produced.

- Figure-1 shows a graph of top 10 authors over time. The information from these plots can be easily extracted to summarise them in a table.

```
topAU = authorProdOverTime(M, k = 10, graph = TRUE)
```



- The package also facilitates various network analysis like, co-citation analysis, coupling analysis, collaboration analysis or co-occurrence analysis. Figure-2 shows a key word co-occurrence plot

```
M <- metaTagExtraction(M, Field = "AU_CO", sep = ";")
NetMatrix <- biblioNetwork(M, analysis = "collaboration", network = "countries",
    sep = ";")
# Plot the network
net = networkPlot(NetMatrix, n = dim(NetMatrix)[1], Title = "Country Collaboration",
    type = "circle", size = TRUE, remove.multiple = FALSE, labelsize = 0.7,
    cluster = "none")
```

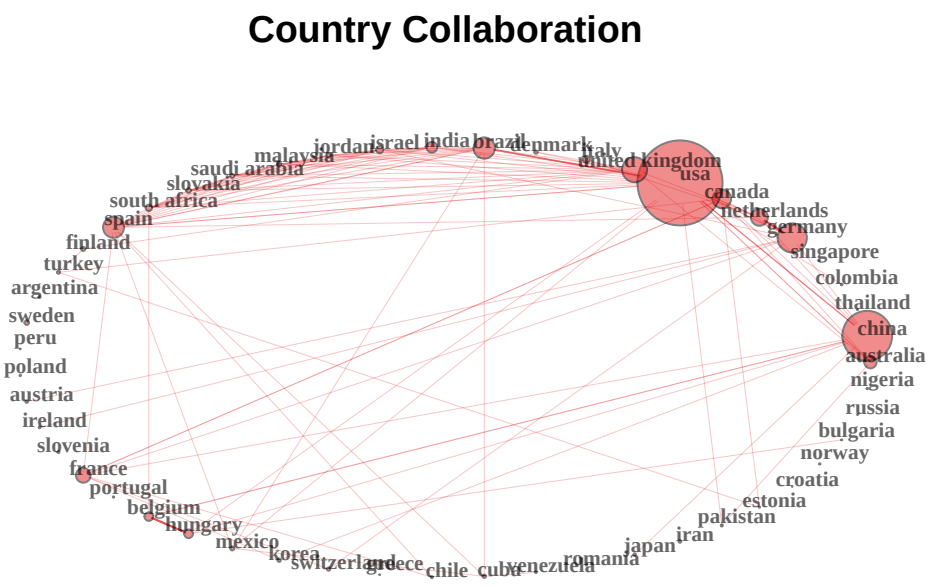
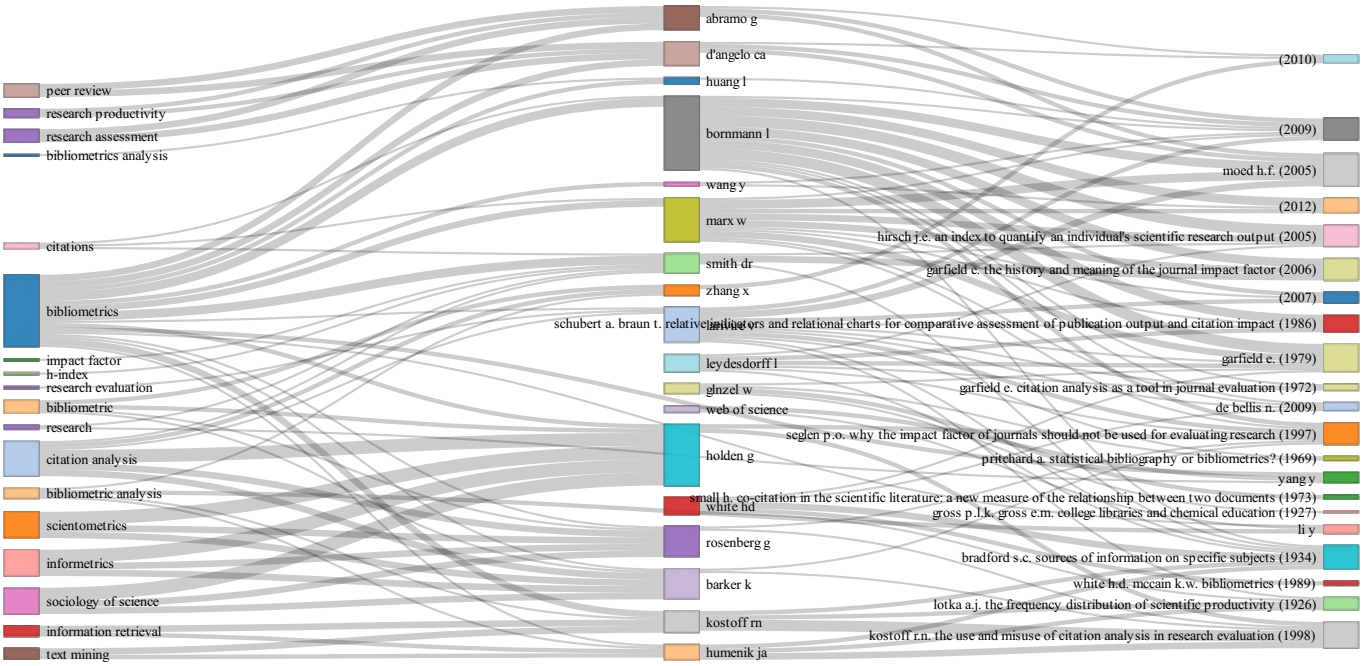


Figure 1: Country Collaboration

- Bibliometrix provides another useful function to plot a Sankey diagram to visualise multiple attributes at the same time. For example, figure-9 provides a three fields plot for Author, Author Keywords and Cited References.

```
threeFieldsPlot(M, fields = c("DE", "AU", "CR"))
```



Co-word Analysis

- Analysis of the conceptual structure among the articles analysed.
- Bibliomentrix can conduct a co-word analysis to map the conceptual structure of a framework using the word co-occurrences in a bibliographic database.
- The analysis in Figure-2 is conducted using the Correspondence Analysis and K-Means clustering using Author's keywords. This analysis includes Natural Language Processing and is conducted without stemming.

```
library(gridExtra)
CS = conceptualStructure(M, field = "DE", method = "CA", minDegree = 4,
    clust = 5, stemming = FALSE, labelsize = 10, documents = 10,
    graph = FALSE)

grid.arrange(CS[[4]], CS[[5]], CS[[6]], CS[[7]], ncol = 2, nrow = 2)
```

Author collaboration network

```
NetMatrix <- biblioNetwork(M, analysis = "collaboration", network = "authors",
    sep = ";")
net = networkPlot(NetMatrix, n = 20, Title = "Author collaboration",
    type = "auto", size = 10, size.cex = T, edgesize = 3, labelsize = 0.6)
```

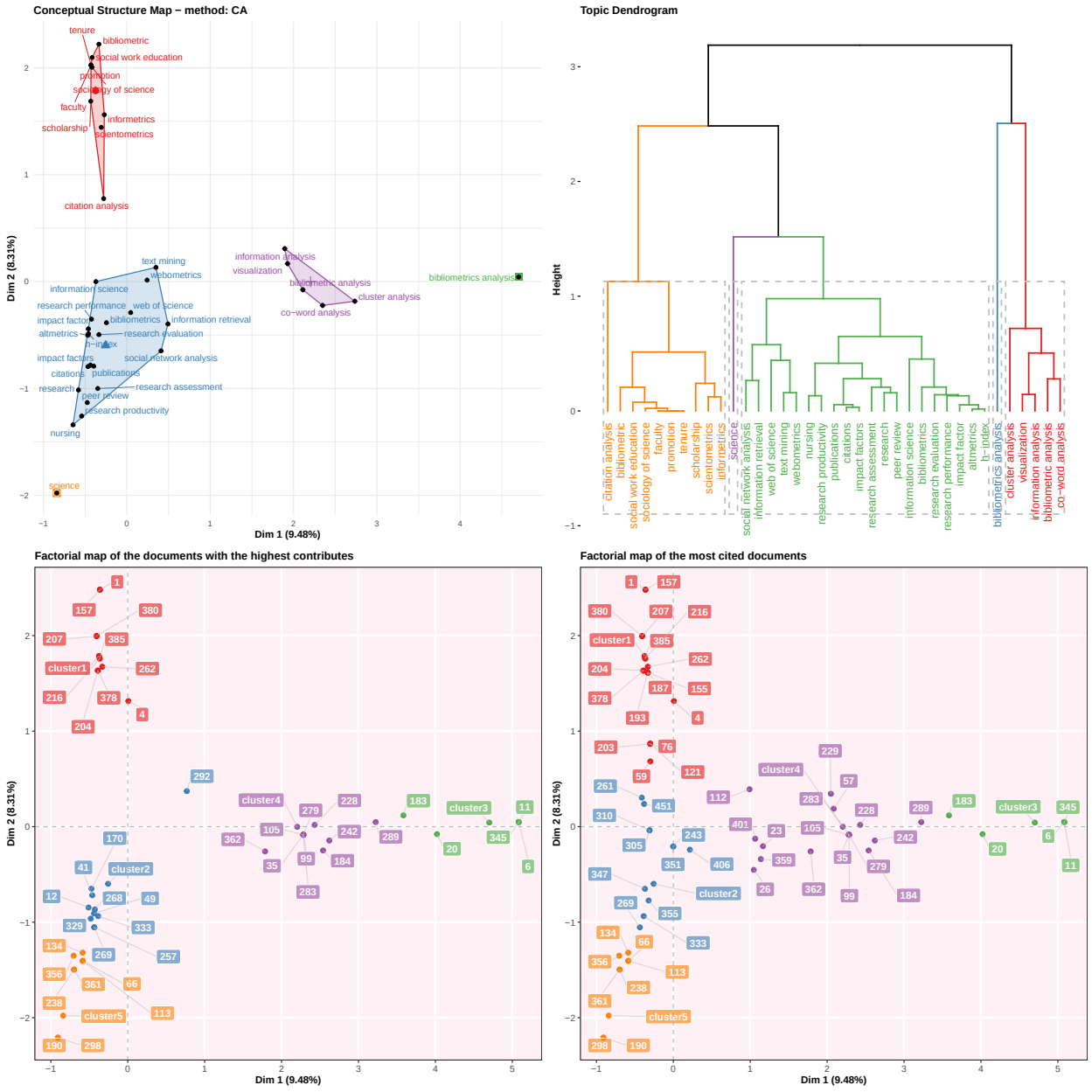
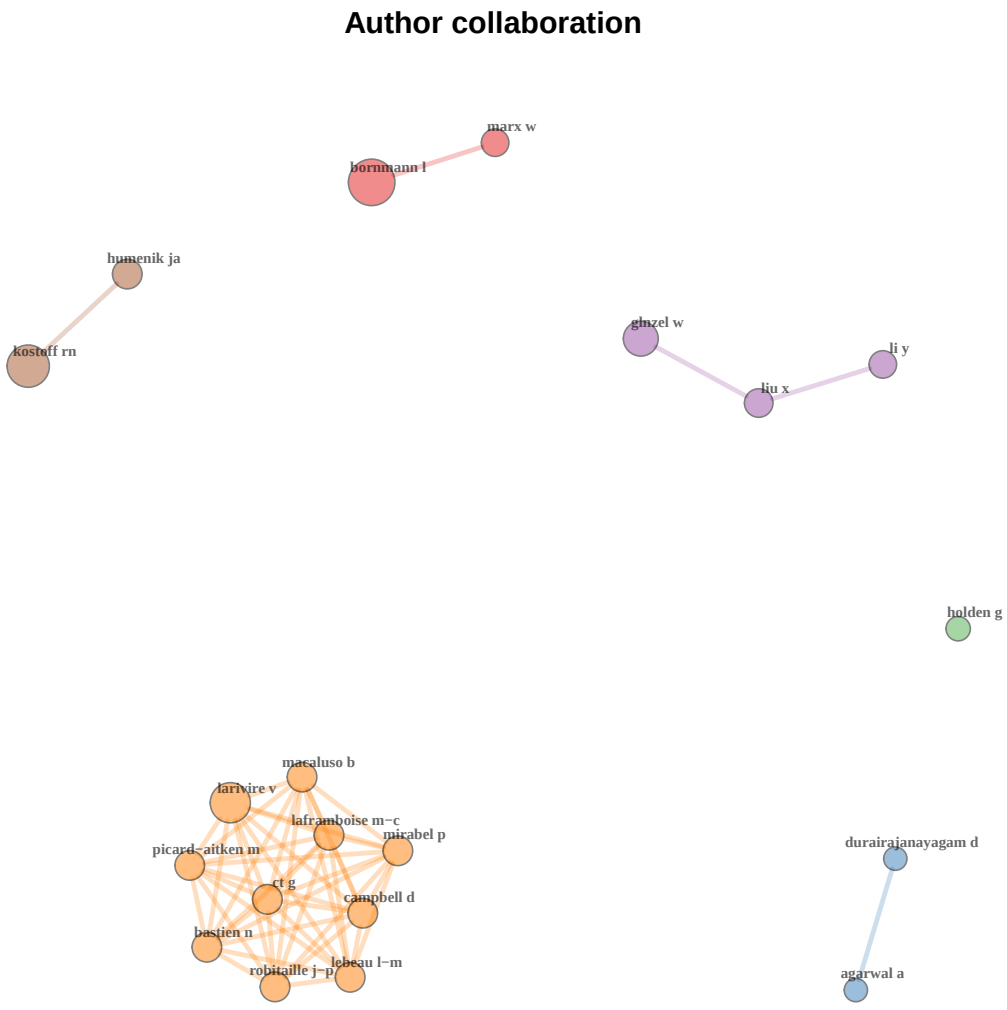


Figure 2: Conceptual Structure

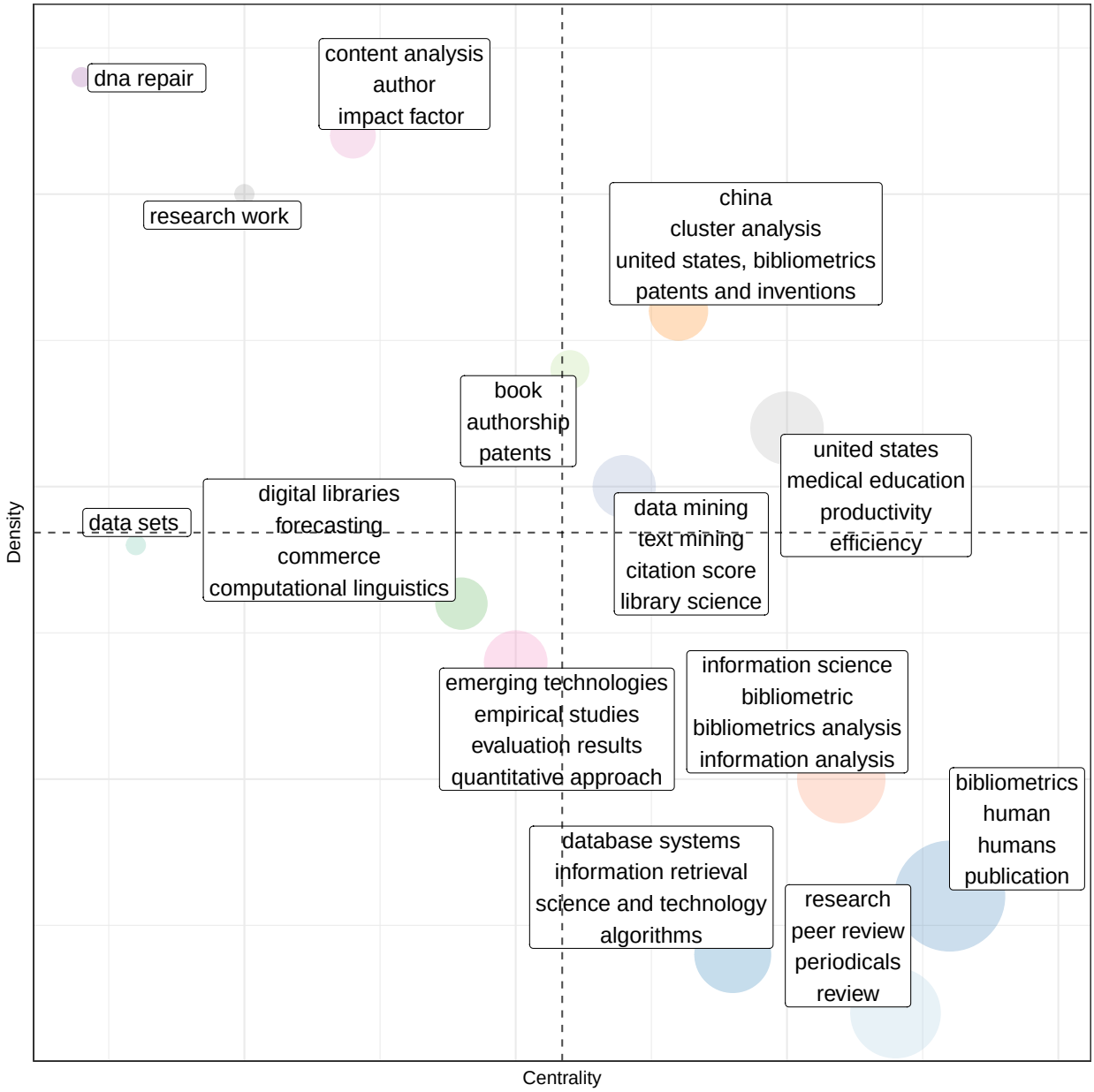


Thematic Map

Co-word analysis draws clusters of keywords. They are considered as themes, whose density and centrality can be used in classifying themes and mapping in a two-dimensional diagram.

Thematic map is a very intuitive plot and we can analyze themes according to the quadrant in which they are placed: (1) upper-right quadrant: motor-themes; (2) lower-right quadrant: basic themes; (3) lower-left quadrant: emerging or disappearing themes; (4) upper-left quadrant: very specialized/niche themes.

```
# Map2=thematicEvolution(M3,field='ID',n=1000,stemming=FALSE,repel=TRUE,years=2000)
Map = thematicMap(M, field = "ID", n = 1000, minfreq = 5, stemming = FALSE,
    size = 0.5, n.labels = 4, repel = TRUE)
plot(Map$map)
```



There is a gui too!

```
biblioshiny()
```

This concludes the example. There are various online sources to take this further