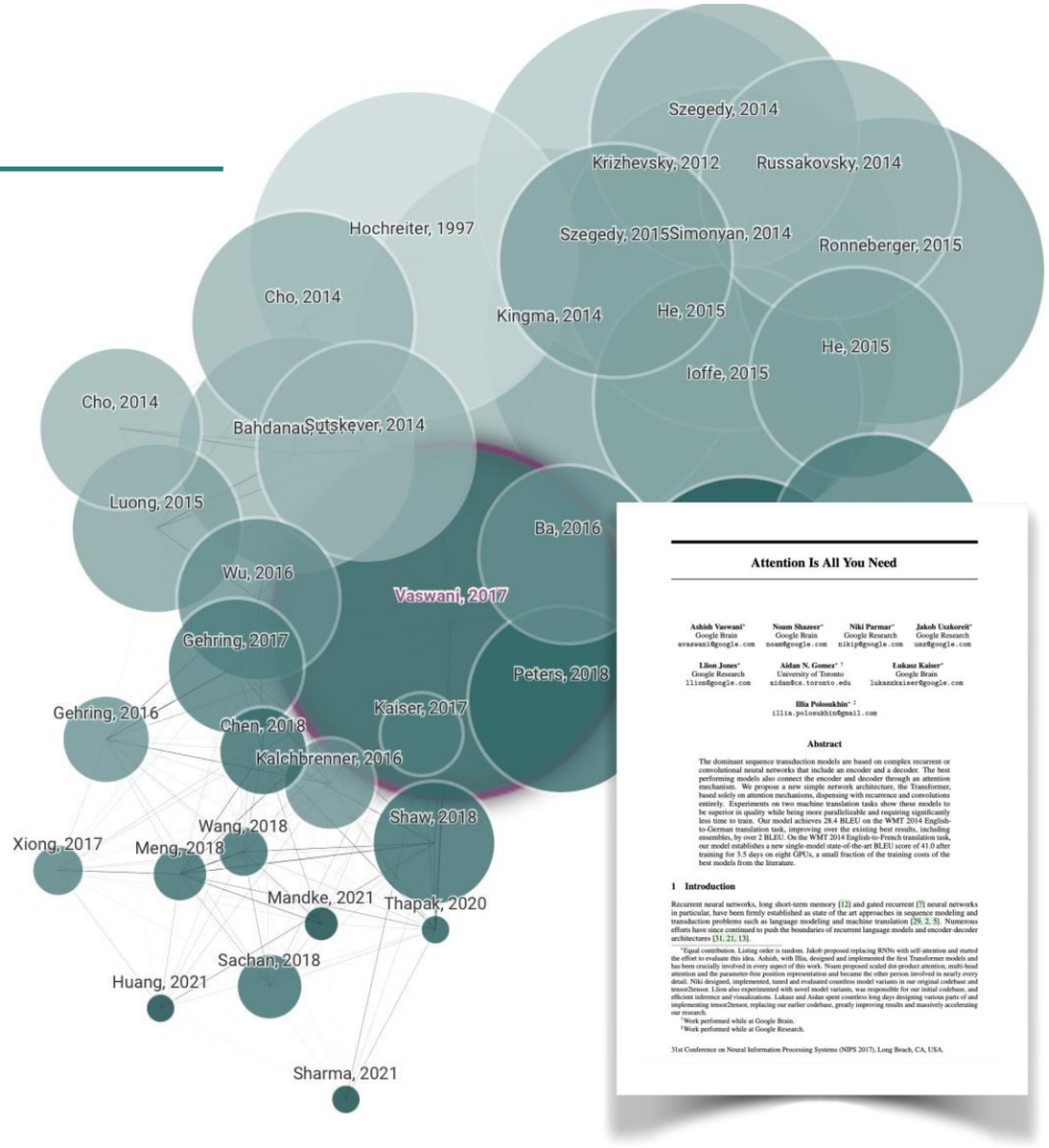
Lecture 3: Scientometrics

Scientiometrics

- Today, we will learn how to analyze **citation networks** to help the **literature review** before defining the **problem statement** and **hypothesis**.

- This type of analyses of the scientific literature is called **scientometrics**.



Definition | Scientometric analysis

A **scientometric analysis** is the quantitative study of the scientific literature that seeks to measure and understand relationships between scientific articles. The analysis may focus on citation relations or shared (sub)topics. It is commonly represented in graphical form.

Literature search query

- One critical aspect of **scientiometrics** is to build appropriate **search queries** in literature databases.

Definition | Literature search query

A **literature search query** is a set of values for data fields (or ranges for these fields) that are connected by logical operators to extract a set of related articles from a literature database.

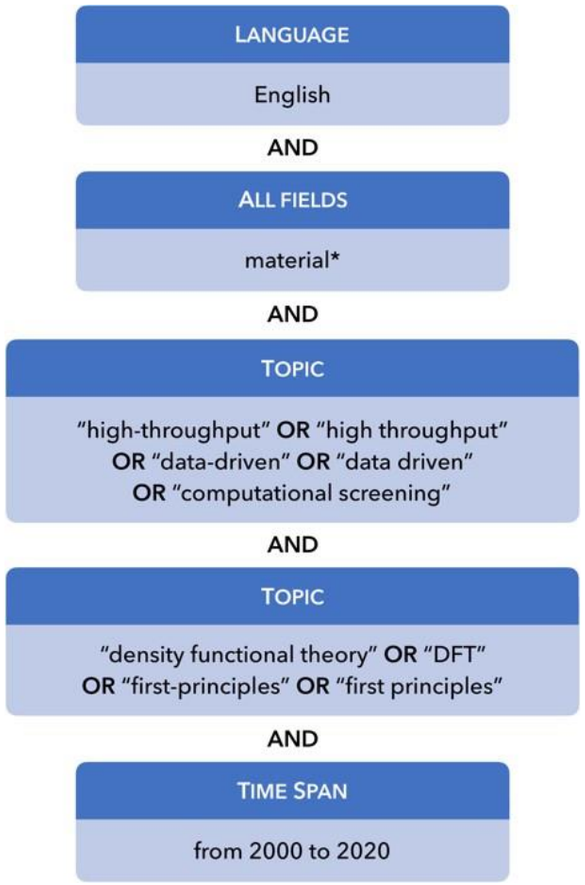
- **Example.** The **Web of Science** database contains 40+ fields.

WEB OF SCIENCE

- TS=Topic
- TI=Title
- AB=Abstract
- AU=[Author]
- AI=Author Identifiers
- AK=Author Keywords
- GP=[Group Author]
- ED=Editor
- KP=Keyword Plus ®
- SO=[Publication Titles]
- DO=DOI
- PY=Year Published
- CF=Conference
- AD=Address
- OG=[Affiliation]
- OO=Organization
- SG=Suborganization
- SA=Street Address
- CI=City
- PS=Province/State
- CU=Country/Region
- ZP=Zip/Postal Code
- FO=Funding Agency
- FG=Grant Number
- FD=Funding Details
- FT=Funding Text
- SU=Research Area
- WC=Web of Science Categories
- IS= ISSN/ISBN
- UT=Accession Number
- PMID=PubMed ID
- DOP=Publication Date
- LD=Index Date
- PUBL=Publisher
- ALL=All Fields
- FPY=Final publication year
- EAY=Early Access Year
- SDG=Sustainable Development Goals
- TMAC=Macro Level Citation Topic
- TMSO=Meso Level Citation Topic
- TMIC=Micro Level Citation Topic

Literature search query

- **Question.** Here is an example of a literature search query to create a **scientometric plot**.



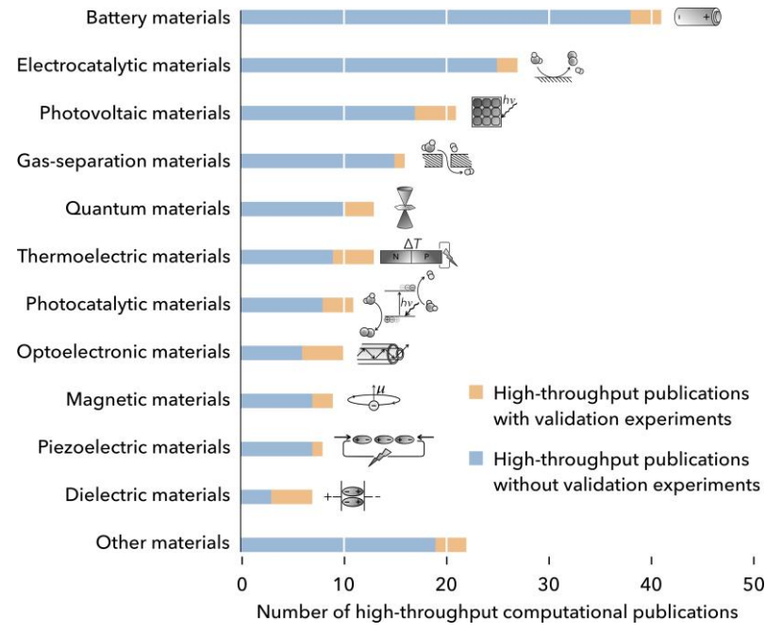


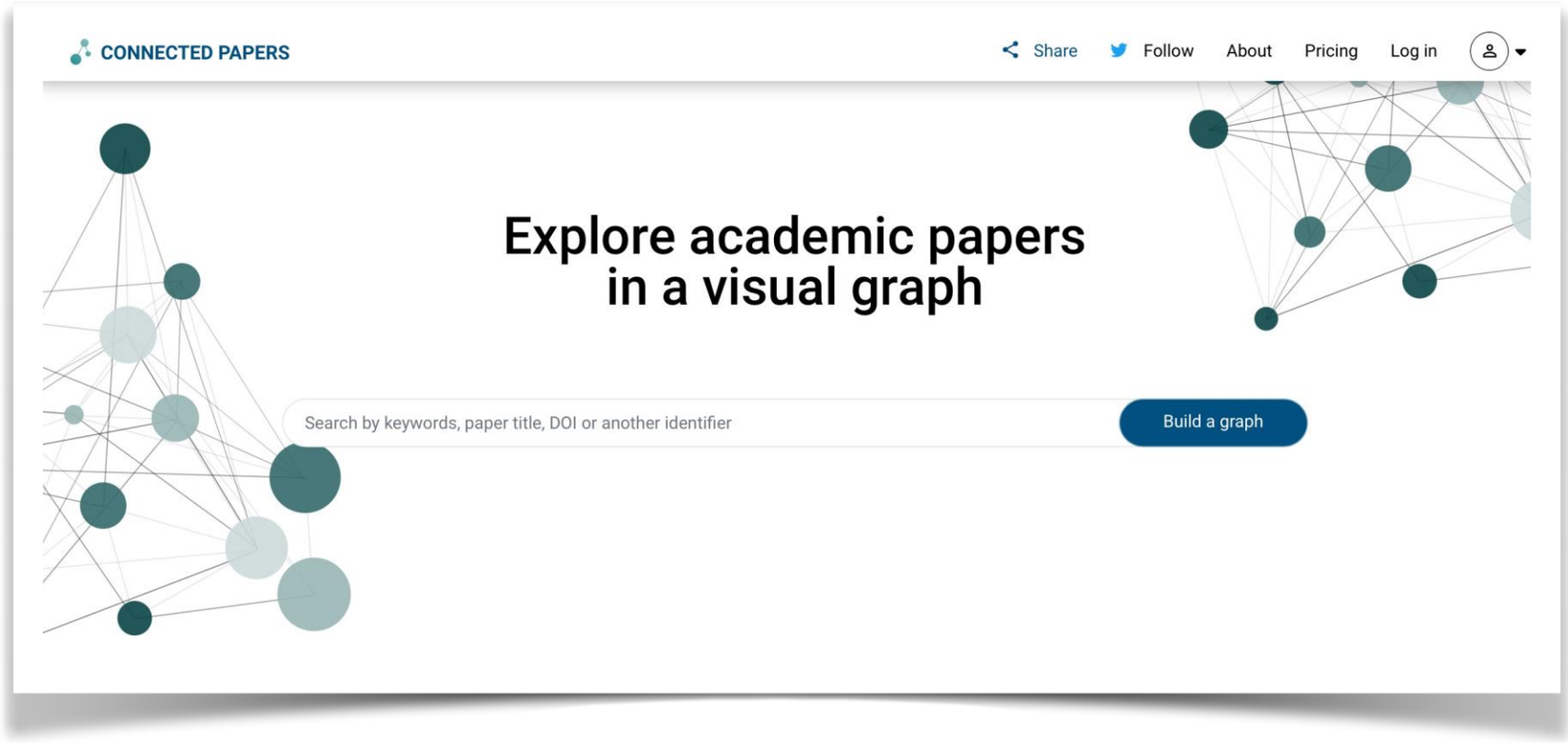
Fig. 1 Survey of peer-reviewed publications in high-throughput computational materials science (source: Web of Science; period: 2000-2020), organized into technological areas with the number of articles containing experimental validation indicated in orange and not containing experimental validation indicated in blue. Although not exhaustive, this survey is representative of the proportion (on the order of 20%) of high-throughput computational predictions that are accompanied with validation experiments. (The criteria of this survey are explained in Fig. S1, ESI†.)

Explain the meaning of the quotes (“”) and wildcards (*).
Do you know another wildcard? How would you create this literature search query in the **Web of Science**?

Literature network

- Once a search query has been run, one can create **graphical literature networks.**

- There exist several **online tools** to create such networks (e.g., www.connectedpapers.com)



- Nevertheless , to access more functionalities, it is recommended to use scientometric software.

Hands-on activity: VOSviewer

A tool for building scientometric networks

VOSviewer

Visualizing scientific landscapes

Overview

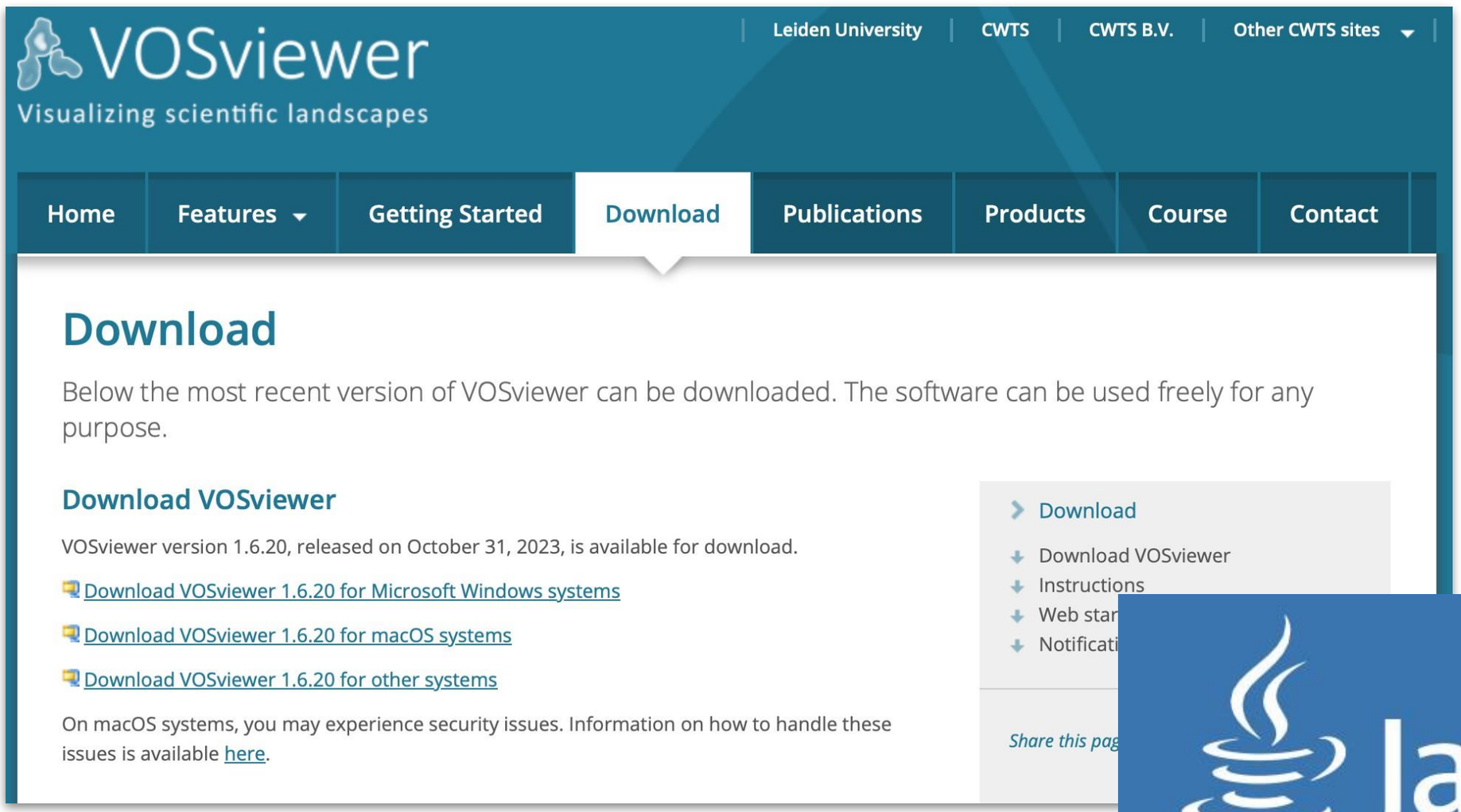
- **VOSviewer** enables one to create literature networks (based, for example, on co-authorship, citations between journals, and co-occurence of topical terms)

- There exists a web-based version of **VOSviewer** that can be accessed at app.vosviewer.com.

VOSviewer Online
Visualizing scientific landscapes

Installing the software

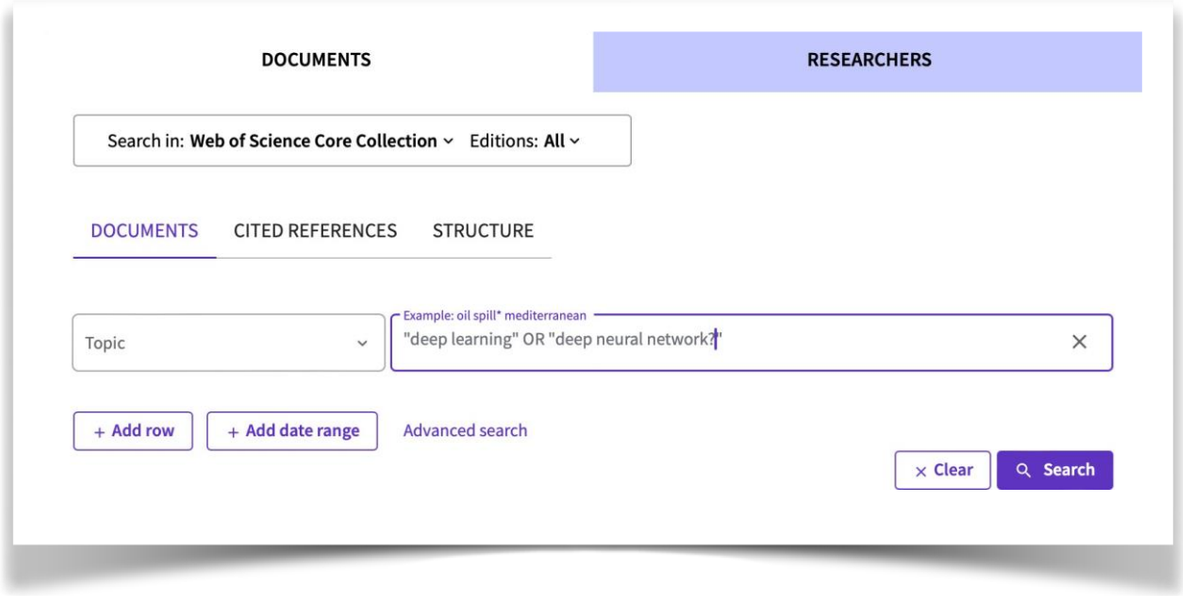
- Yet it is generally preferable to install **VOSviewer** on your computer from www.vosviewer.com/download



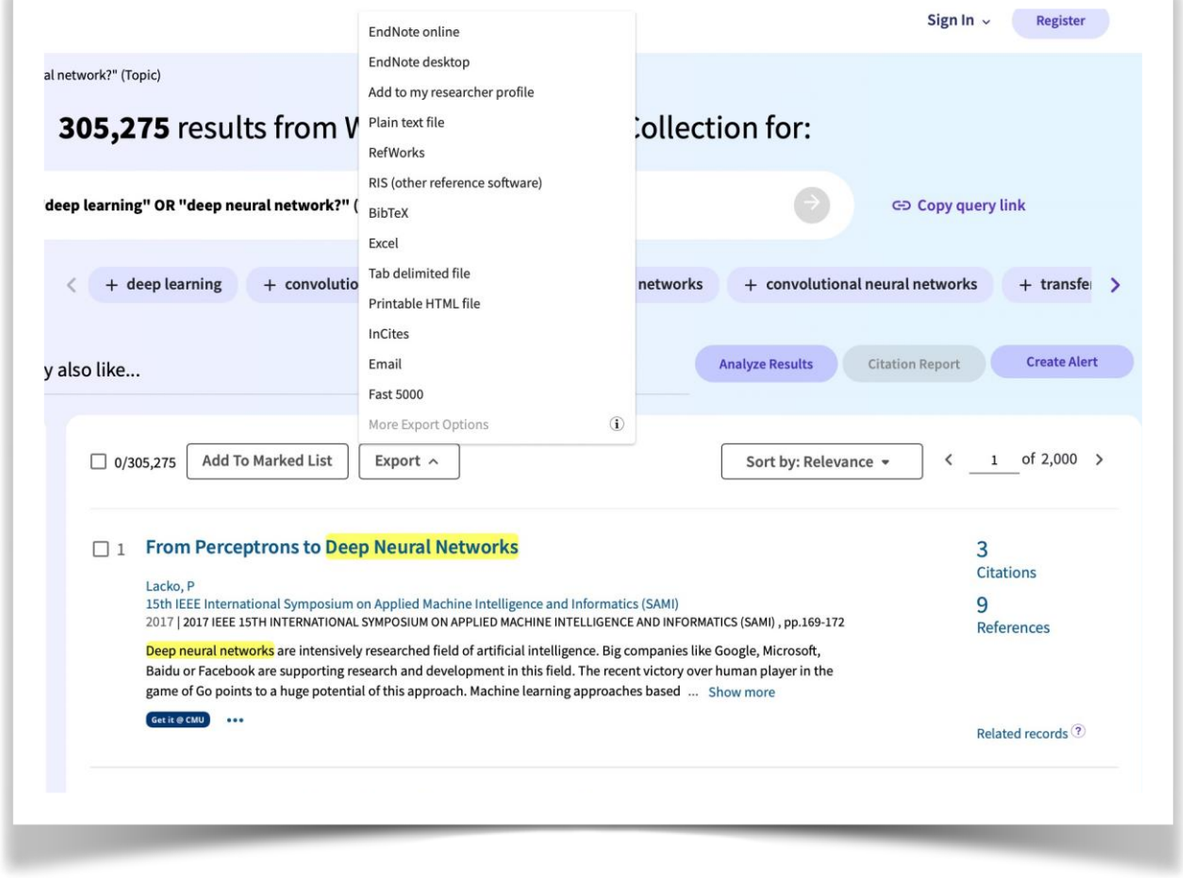
- **Note.** You may need to install Javascript from www.java.com/en/download/

Getting literature data

- To create a network, you will first need to **create a query** in one of the compatible literature databases.



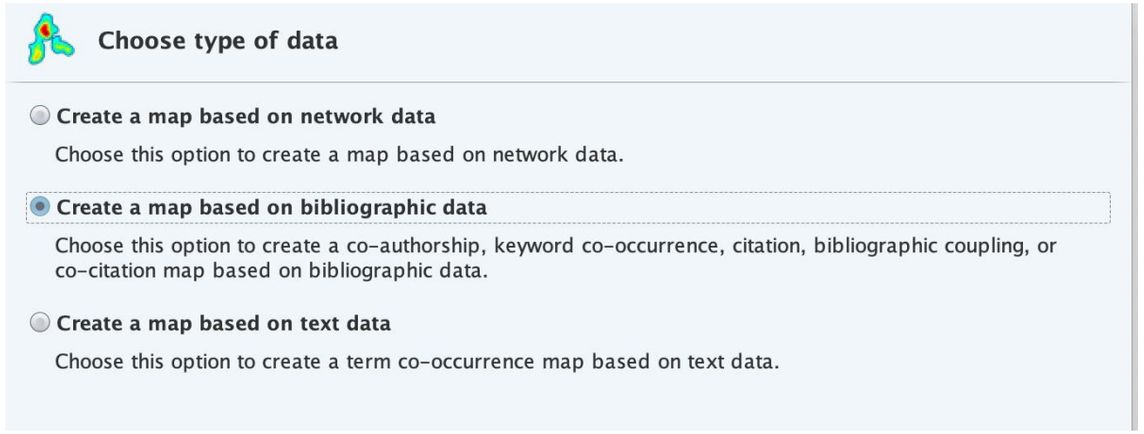
- **Download the results** in Plain Text format (.txt) using the Export function (for ‘full record and cited references’).



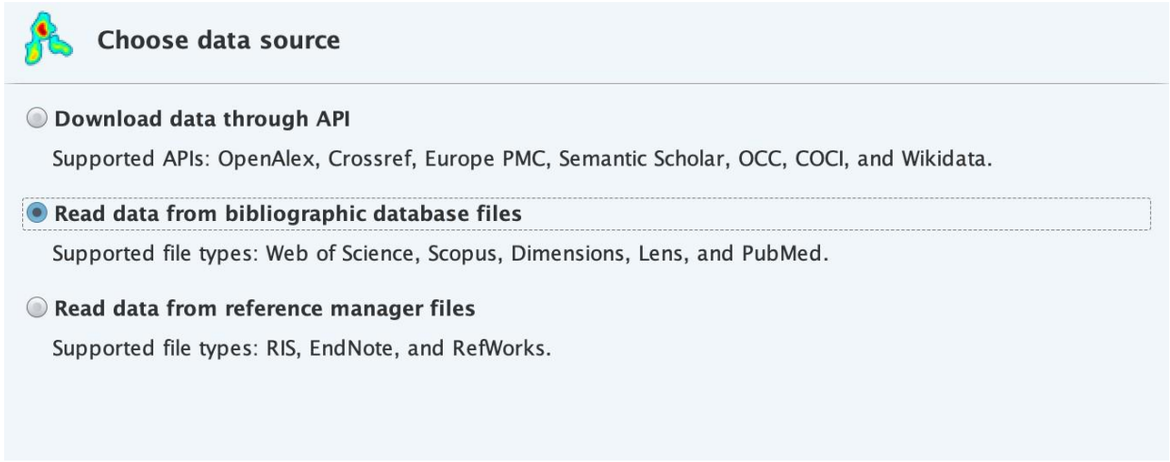
Note. You may need to export as separate files due to reference number limitations.

Importing literature data

- Open **VOSviewer** and import the results using Create > Create a map based on bibliographic data



- **Choose the data source** to be Read data from bibliographic database files

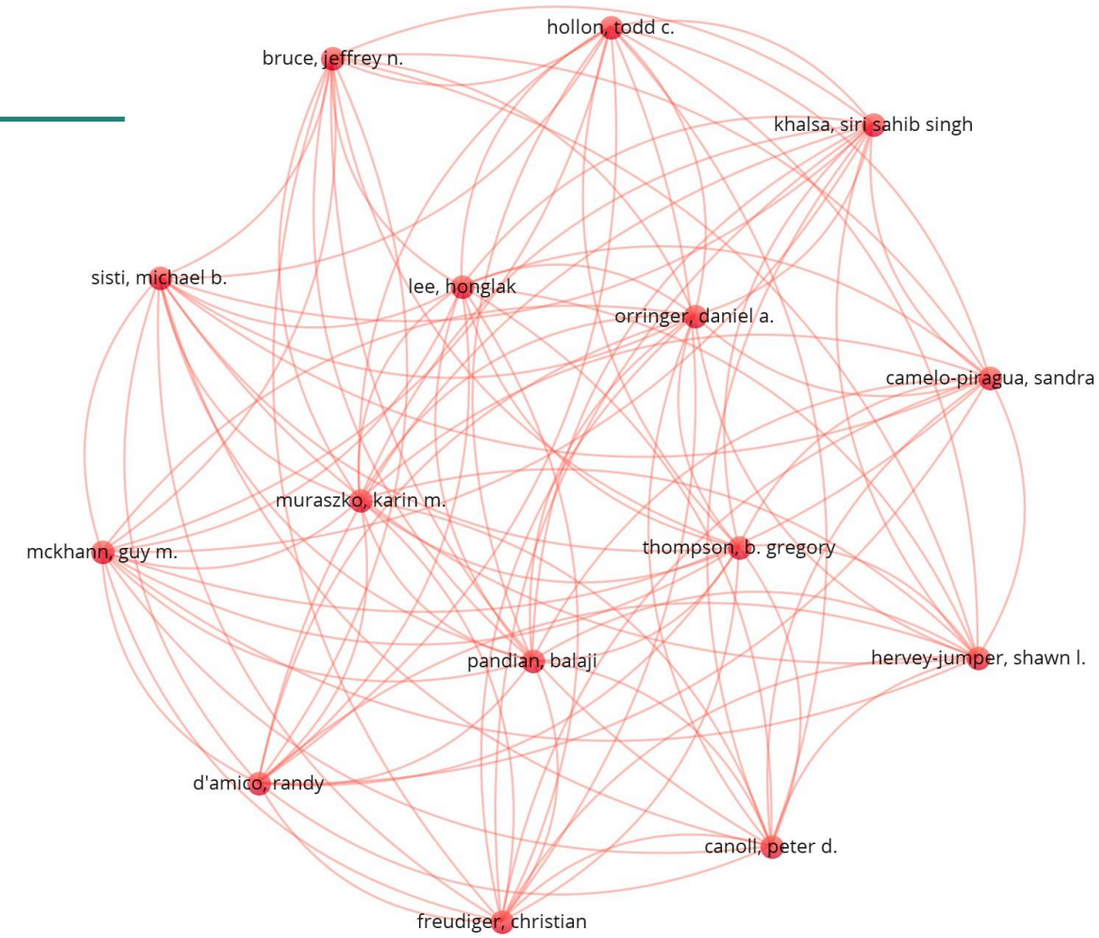


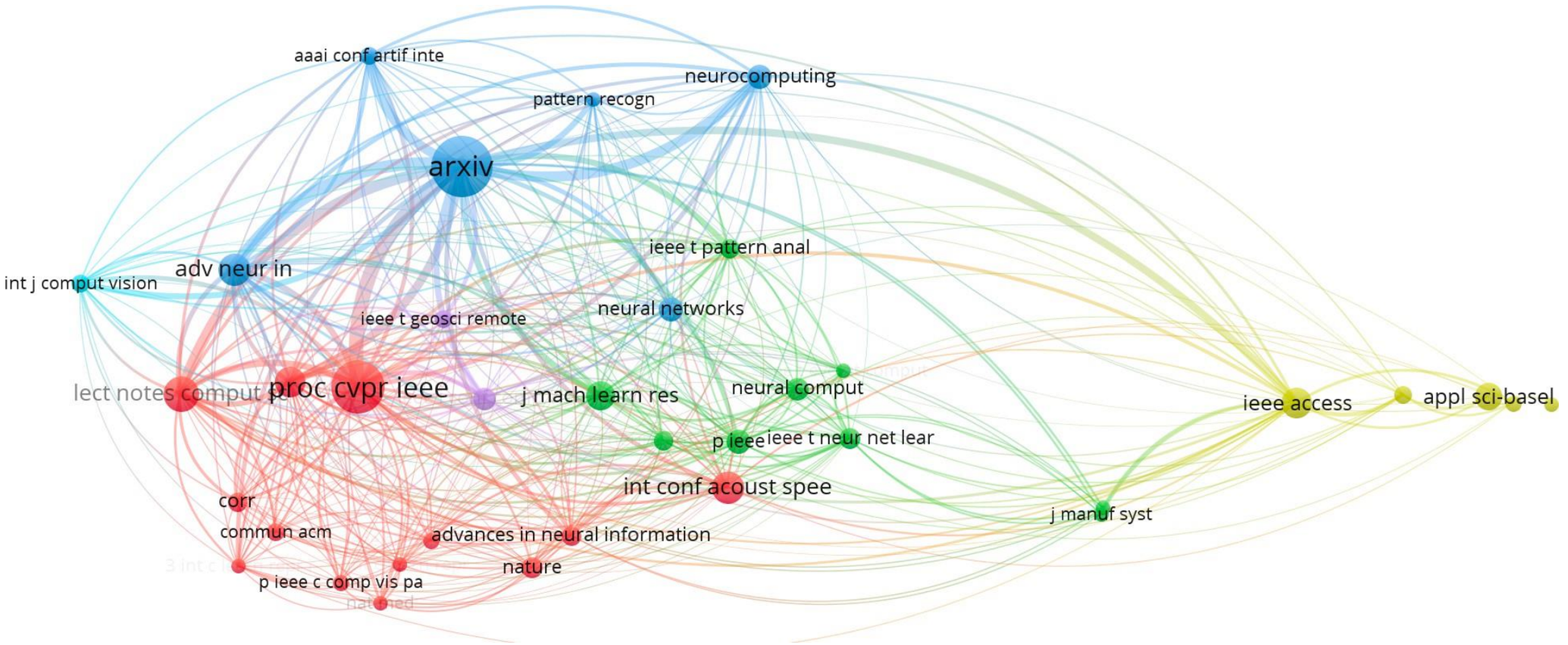
- **Upload** the data file extracted from the **Web of Science** (or other databases)

Summary

- We are now able to **create literature networks** based on **scientiometric criteria.**

- We will practice and develop these skills in the next homework assignment.





Addendum & Erratum

- P. 3: et al. added
- P. 5: diagram to determine *h* has been corrected
- P. 9, P. 10: scientiometric scientometric