

THE NETWORKS OF SCIENCE. DATA-DRIVEN UNDERSTANDING OF SCIENTIFIC PRODUCTION.

Diego Kozlowski

FSTM

5/6 March, 2020

AIM AND SCOPE

- Science of Sciences is a developing field that focus on quantitative studies of scientific production.
- As a social activity, scientific output is not independent from the society in which it is produced.
- This project aims to understand how science is shaped by society and vice-versa.

OBJECTIVES

Advance in the understanding of Science's development across *fields* and *countries*, in our current society, from a *data-driven*, *epistemic* and *social* perspective.

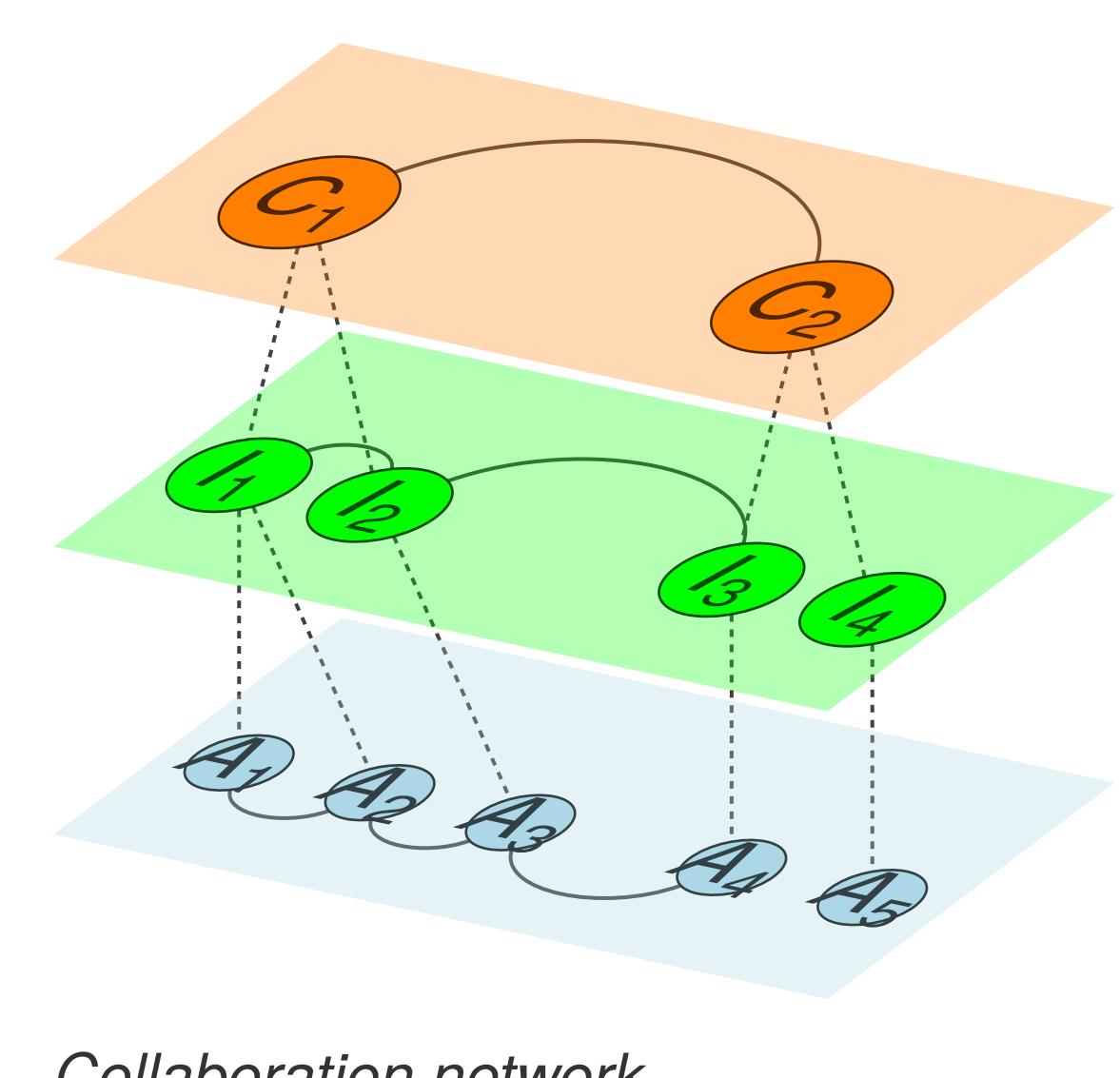
- 1 Analyze the spread of new ideas within a field using semantic analysis,
- 2 Study the spread of knowledge across fields, re-conceptualize the notion of *basic science* based on the evidence found in data of *supplier* and *demanding* fields,
- 3 Analyze the impact of collaboration between authors, institutions, cities, countries. Understand if there are underlying inequalities on these different hierarchical levels, where the *rich get richer* [1],
- 4 Define a author's disambiguation methodology and study career paths across countries and fields. Explore possible inequalities related to gender and ethnicity,
- 5 Extend the concepts of *Globalized Science* and *Knowledge Economy* to the different roles countries play in the international production of science, and its relation with the role these play in global economy as a whole ;

METHODOLOGY

There are two main methodologies to be use:

- Graph theory, to study the links between science practitioners (researchers, institutions, countries),
- Natural Language Processing, to do large-scale analysis over scientific communications (papers).

FIGURE 1



WORK PACKAGES

- 1 Literature review
 - Science of Science, Sociology of research, Social Network Analysis and Natural Language Processing,
 - Develop an automatic literature review based on NLP;
- 2 Data collection and assimilation
 - Implement a name disambiguation over Word of Science database
 - collect and process alternative sources of data;
- 3 Modeling
 - Build a hierarchical multi-level network on author-institution-city-country. Study the topological patterns of these networks, both defining links as collaborations, and as a bipartite graph of articles and authors,
 - study the citation map across disciplines,
 - analyze the career path differences across countries and fields. Compare the position of institution in the collaboration network with the researchers movement patterns,
 - aggregate the conclusions on country level and analyze the differences in scientific production across countries.

FIGURE 2

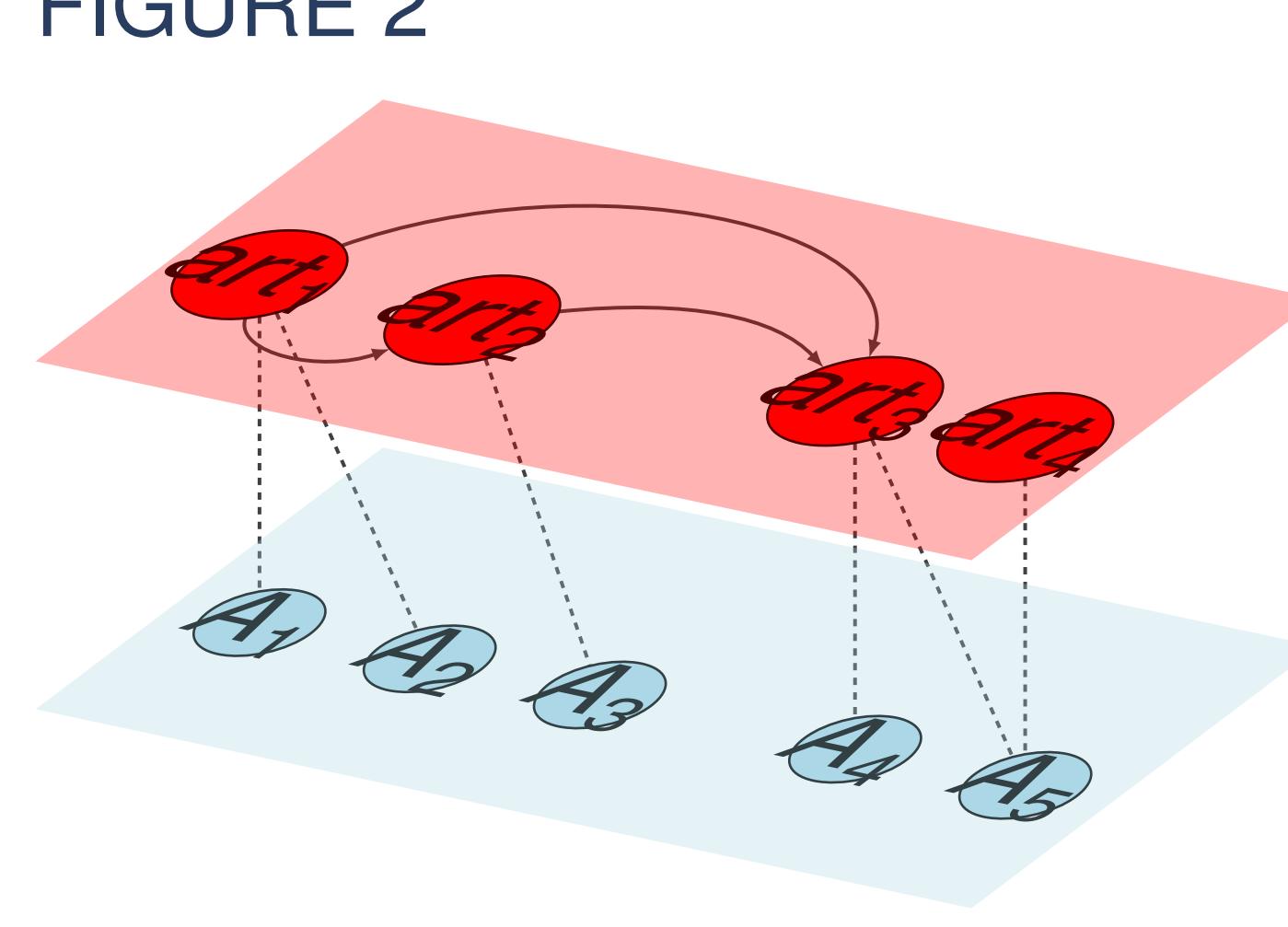
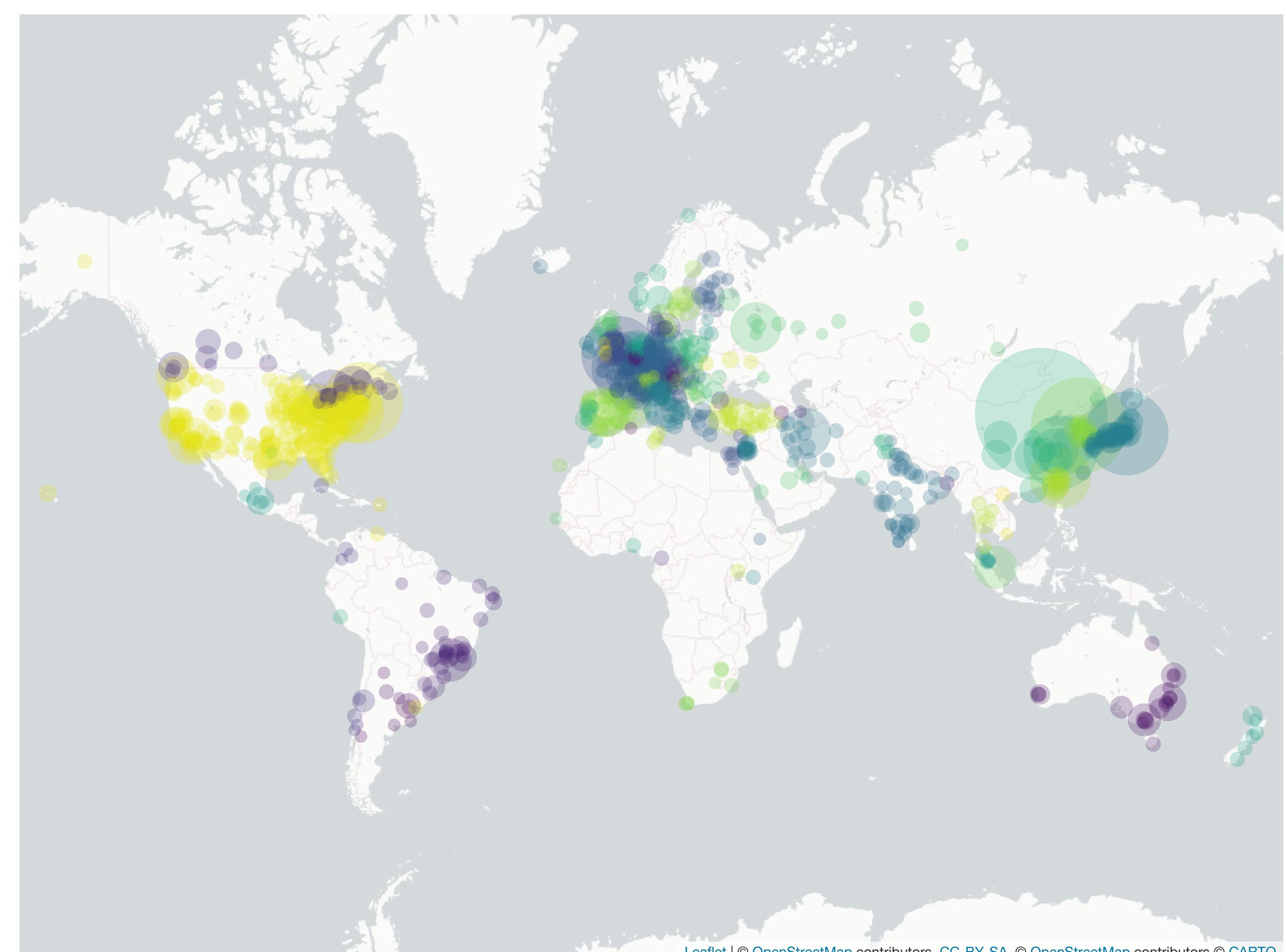


FIGURE 3

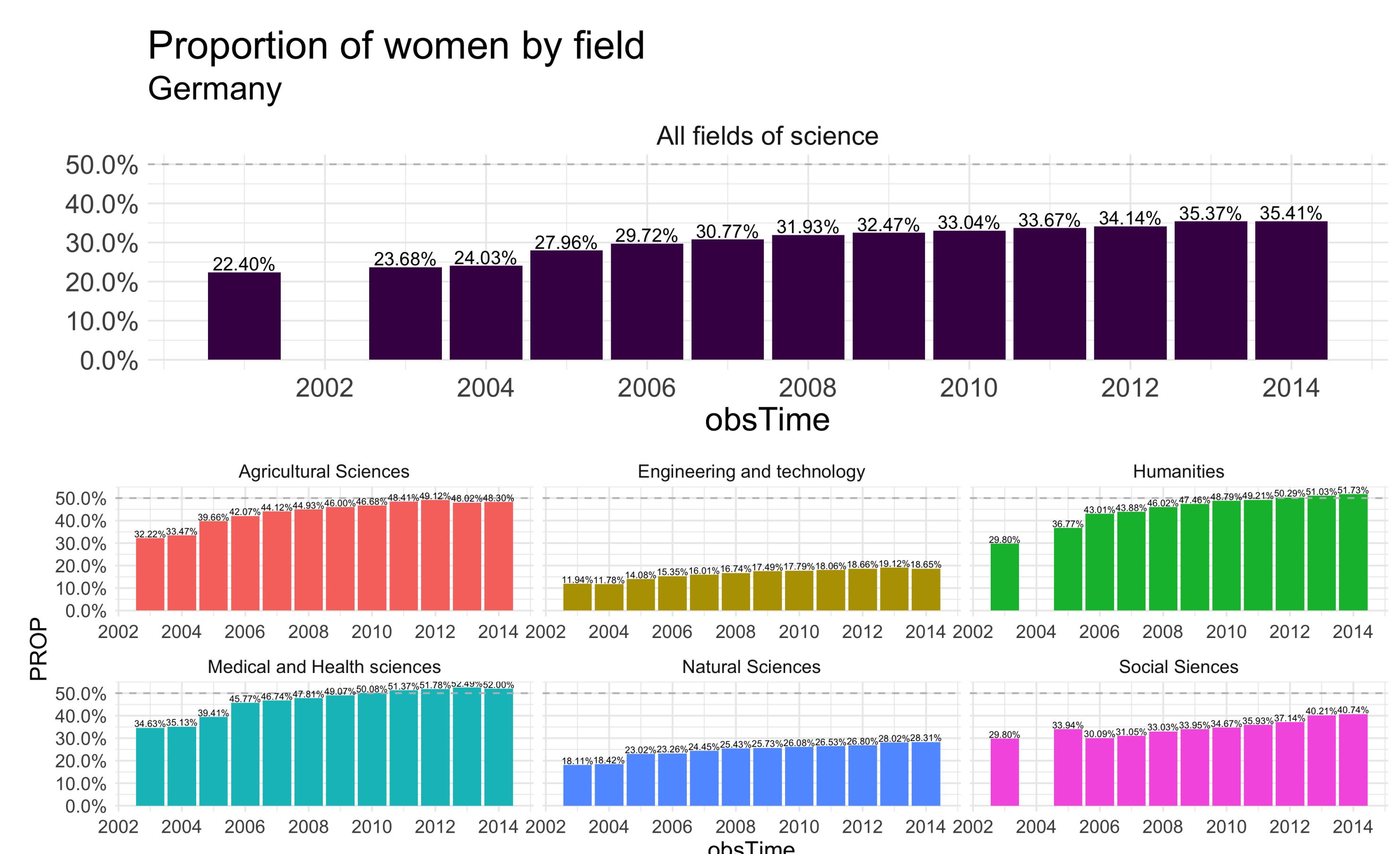


Top 1000 scientific producers on city level. 2010



for evolution of cities, visit:

FIGURE 4



Female researchers across fields. Germany. 2010

ACKNOWLEDGEMENT

The Doctoral Training Unit **Data-driven computational modelling and applications** (DRIVEN) is funded by the Luxembourg National Research Fund under the PRIDE programme (PRIDE17/12252781). <https://driven.uni.lu>

REFERENCES

- [1] Roger King. "Power and networks in worldwide knowledge coordination: The case of global science". In: *Higher Education Policy* 24.3 (2011), pp. 359–376. ISSN: 09528733. doi: 10.1057/hep.2011.9. URL: <http://dx.doi.org/10.1057/hep.2011.9>.