How to address the role of a journal as a knowledge transfer vector between disciplines? A case study relying on citations analysis

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Extended abstract

Science and technology (ST) journals are a usual diffusion support for scientific results, in which researchers submit their works to peer evaluation and supply them to reuse by a scientific audience. In this diffusion process, each journal plays the role of a knowledge transfer vector. If we hypothesize that a journal has an observed audience perimeter either limited to its own scope or bridging the gap between its scope and other disciplines, then we address the issue: can we formalize a typology in order to characterize its knowledge transfer vector role? Can the analysis of *ex ante* citations (bibliographies of the articles published in the journal) and *ex post* citations (reuse of the journal articles) help us to detect how wide the perimeter of the journal audience is?

The approach we undertake in this work is directly inspired on the methodology we developed within the framework of the European project DBF[1] (Hörlesberger *et al*., 2013), the goal of which was to support the selection process of research projects submitted for financing to the ERC (European Research Council). We have produced an analytical methodology based on the informetric modeling of criteria used by ERC scientific experts. For this purpose, indicators were elaborated in accord with the strategic definition of frontier research by the ERC. In particular, an indicator was devised to characterize any project that "*…stands at the forefront of creating new knowledge… is responsible for fundamental discoveries… achieves occasional revolutionary breakthroughs….*" (EC, 2005), that we defined as innovativeness. To this end, we studied the evolution of a scientific domain, using clustering techniques that generate a representation of the publication scientific landscape based on its extracted terminology, with a diachronic analysis of clustering results (Roche *et al*., 2011).

In the present work, we do not focus anymore on the evolution of a particular scientific field but on the comparative analysis of two landscapes built from a given ST journal: the former consists of the cited references, extracted from the bibliography, of all its publications in a given year; the latter consists of any article, published in any journal, that cites articles of the studied journal published in the said given year.
As with a "spot the difference" game, we aim at answering the question: is there a difference between those two landscapes in term of scientific field representation? Specifically: does the second landscape include only fields already present in the first one, or conversely, display new fields? This diachronic analysis will help us define if the journal plays its role of knowledge transfer vector either exclusively within the restricted perimeter of its original scope or also beyond the frontier defined by this perimeter.


In the following we present the operated methodology, the extracted data and the tools used. The results of two case studies performed on two different journals are then discussed.

Methodology and data

All data are extracted from the Scopus database, which characteristics in terms of cited and citing articles fit perfectly our needs. For a given journal J, we choose a publication year Y with enough hindsight for the published articles to have been cited in more recent published papers. We search for all the corresponding articles and we extract the references cited in their bibliographies and available in the Scopus database. This first corpus, called BIB and represented as a green ellipse in fig.1, can be considered as an image of the landscape of the scientific foundations for the works published in journal J.

In a second time, we look for all the publications that cite the articles published during year Y in journal J. This second corpus, called CIT and represented as an orange ellipse in fig.1, can be considered as an image of the scientific landscape of the works that are based on the results published in journal J during year Y. Our methodology is developed under these assumptions.
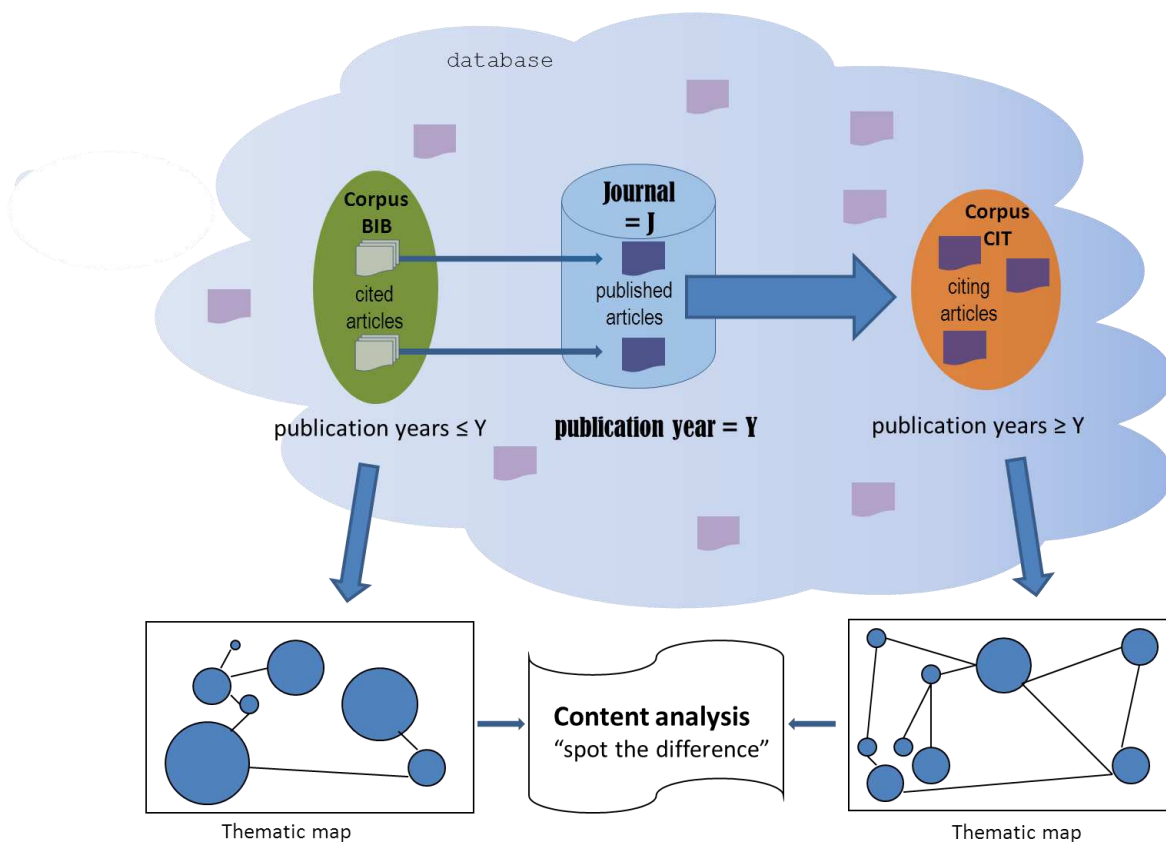
Figure 1 - Methodological schema of the evaluation process of the knowledge transfer vector role of a journal

A content analysis is then performed on both corpora. In order to perform it, each corpus of bibliographic records is formatted and integrated in two information analysis tools: Stanalyst (Polanco *et al.*, 2001) and VOSviewer (Van Eck and Waltman, 2010). In both cases, a data mining step, based on automatic language processing techniques, is used to obtain an assisted indexing of the records by assigning at them keywords. A clustering is then applied to this enriched corpus. Thematic networks emerge from the relations between clusters and, according to a geographical metaphor, build a map of the corpus research landscape, as shown in figure 1. A scientific expert performs an analysis of the clusters in terms of the scientific fields which they deal with, and of their relative position and relations in the maps. Finally, the comparison of the analyses obtained for both corpora allows us to determine if they show thematic differences. Especially, the expert is asked to look for the occurrence of new scientific fields in CIT, with regards to BIB.

Case study

We choose two journals to implement our methodology, "Electronics Letters" (EL) and "Neural networks" (NN), and the publication year Y=2010. The number of extracted records for both corpora is shown in table 1. Figure 2 shows the cluster maps obtained with VOSviewer for NN.

Table 1 –Size of the extracted corpora of cited (BIB) and citing articles (CIT), for both journals (publication year = 2010)

journal	cited articles Y≤2010	citing articles Y≥2010
Electronics Letters (EL)	5936	1872
Neural Networks (NN)	3362	749

Initial results indicate that EL and NN play diversely their role of knowledge transfer vector. Indeed, EL seems to act autarkically, since its BIB and CIT cluster maps show a great similarity in terms of thematic fields. Conversely, as shown in fig.2, NN seems to play its role of knowledge transfer vector in an interdisciplinary way, as its CIT map shows scientific fields that are not highlighted in its BIB map.
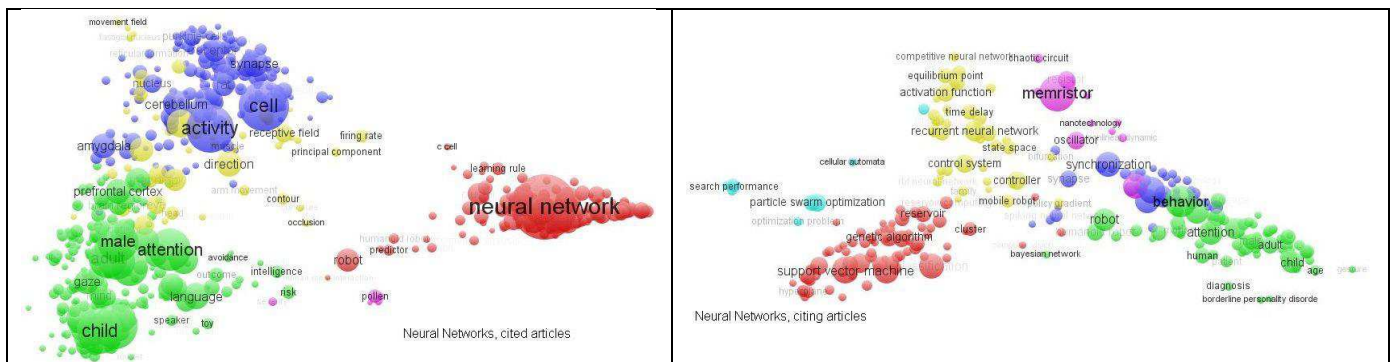
Figure 2 – Cluster maps obtained for Neural Networks, 2010.
Left: cited articles (BIB corpus), right: citing articles (CIT corpus)

For instance, a sub-network of keywords dealing with *cellular automata* and *optimization*, absent from the BIB map, emerges in the CIT one. This expansion of the original scientific perimeter of NN could bring us to conclude that this journal has a wider scientific audience than EL. This led us to discuss the relevance of a complementary comparative study of maps, by the yardstick of an applicability criterion, in order to refine our analysis. More detailed results will be presented in the full paper.

References

EC – European Commission (2005). Frontier research: The European Challenge. High Level Expert Group Report, EUR 21619.

Hörlesberger M., Roche I., Besagni D., Scherngell T., Francois C., Cuxac P., Schiebel E., Zitt M., and Holste D. (2013). A concept for inferring 'frontier research' in grant proposals, Scientometrics (to appear)

Polanco X., François C., Royauté J., Besagni D., Roche I. (2001). STANALYST: An integrated environment for clustering and mapping analysis on science and technology, 8th ISSI conference, Sydney, Australia, Proceedings Vol. 2, 871-873

Roche I., Ghribi M., Vedovotto N., François C., Besagni D., Cuxac P., Holste D., Hörlesberger M., Schiebel E. (2011). Detecting domain dynamics: Association Rule Extraction and diachronic clustering techniques in support of expertise, 1st Global TechMining conference, Atlanta, USA.

Van Eck, N.J., Waltman, L. (2010). Software survey: VOSviewer, a computer program for bibliometric mapping. Scientometrics, 84(2), 523-538