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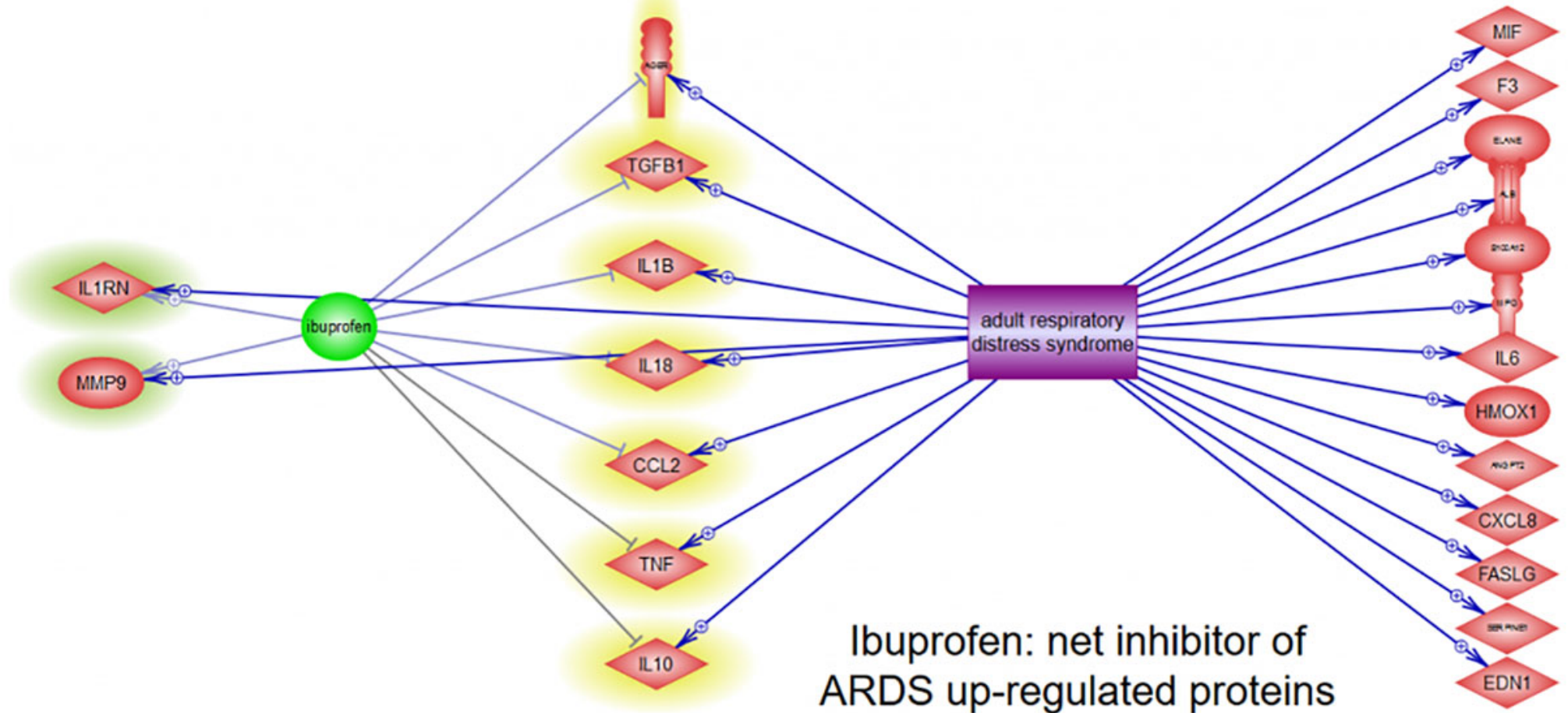
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How AI and knowledge graphs can make your research easier

Data scientists are developing a knowledge graph with researchers in mind in Elsevier's DiscoveryLab, collaborating with Vrije Universiteit and University of Amsterdam

By Mark Siebert - May 27, 2020



This is one of a series of biological knowledge graphs Elsevier colleagues created to identify the effects of various NSAIDs on proteins that are upregulated by ARDS. It shows that while fewer drug candidates (9/21) were related to Ibuprofen, the pattern of net inhibition was maintained for drug interaction with ARDS-related proteins (7/9 inhibited proteins). Source: Pharma R&D Today (<https://pharma.elsevier.com/covid-19/analgesics-use-and-the-coronavirus-finding-answers-through-biological-knowledge-graph/>)

However, all that information brings challenges, with researchers indicating that just navigating all that information takes more time than ever (<https://www.elsevier.com/connect/a-profession-under-pressure-how-can-we-help-researchers-navigate-challenges-posed-by-questions-over-quality>).

So how about a system of information that could give researchers precise answers to their questions immediately, rather than having to browse a list of webpages that might hold the answer deep in the text?

Researchers at Elsevier's DiscoveryLab – part of the Innovation Center for Artificial Intelligence (ICAI) (<https://icai.ai>) in Amsterdam – are building a system to deliver just that. Dr. Frank van Harmelen (<https://www.cs.vu.nl/~frankh>), Professor of Computer Science at the Vrije Universiteit (VU) Amsterdam and Academic Director of Elsevier's DiscoveryLab, explained:

“What we’re developing is an integrated knowledge graph for research. This model allows machines to identify and understand insights in unstructured data, such as articles, compared to today’s information about it.”



Prof. Frank van Harmelen,
PhD

What are knowledge graphs, and how can they help researchers?

A knowledge graph is a model and a specific way of representing the relationship between data and knowledge entities as “triples” that machines can directly process. Such a triple defines that “A has a specific relation with B.” Those relationships could be manually provided from existing ontologies or automatically extracted. You’ve probably already seen the results of knowledge graphs on search engines: Google “Marie Curie person” and the right hand side of the page will be the results of Google’s knowledge graph, providing a quick summary of the physicist’s achievements, education and some notable quotes.

With the knowledge graph Frank and his team are working on, you might search for a chemical compound on ScienceDirect (https://www.elsevier.com/solutions/sciencedirect) and immediately be shown its characteristics rather than just a list of articles that mention it.

Dr. Rinke Hoekstra (https://www.linkedin.com/in/rinke-hoekstra-0289aa2) , Lead Architect at Elsevier and Industry Director at Elsevier's DiscoverLab, explained:

“Research support systems and search engines already use machine-learning over structured and big scientometric data. However, excavating the hidden knowledge in research data, images and texts is still a huge challenge for machines, lacking a sense of meaning and context. This is largely due to the fact that cleaning, structuring and validating the data is still a largely manual process, and that AI systems rely on a critical mass of data before they can start learning.”



Rinke Hoekstra, PhD

Elsevier's DiscoveryLab will build an integrated “Research Knowledge Graph” from various research ontologies, data and content across existing research support solutions, such as Reaxys (https://www.reaxys.com) (e.g., to identify chemical compounds), Entellect (https://www.elsevier.com/solutions/entellect) (e.g, drug repurposing for rare diseases) or topic pages on ScienceDirect (https://www.elsevier.com/solutions/sciencedirect/topics).

Dr. Michael Cochez (https://research.vu.nl/en/persons/michael-cochez) , Assistant Professor of Artificial Intelligence at VU and lab manager, talked about the way knowledge graphs work:



Michael Cochez, PhD



“The main difference between the knowledge graph for more accurate query answers and the global connections between different knowledge entities, such as substances, methods and experiment data. Existing analytic systems, like Scopus (<https://www.elsevier.com/solutions/scopus>) or SciVal (<https://www.elsevier.com/solutions/scopus>), work with the tagged and metadata mainly on the article level. Retrieving information from within the content along with its relations and context requires richer models (knowledge graphs) and we are developing new techniques to handle their complexity and performance.”

Taking knowledge graphs to a new level

The joint lab between ICAI and Elsevier will therefore create a suite of tools to extract, integrate, scale, map and optimize rich knowledge graphs and test them on dedicated technical services. Those services will be directly supporting Elsevier's platforms, including as Entellect and Mendeley (<https://www.elsevier.com/solutions/mendeley>), and will connect with existing graphs and solutions, such as the Health and Biology knowledge graphs (<https://pharma.elsevier.com/covid-19/analgesics-use-and-the-coronavirus-finding-answers-through-biological-knowledge-graph>) that underpin products such as Pathway Studio (<https://www.elsevier.com/solutions/pathway-studio-biological-research>) and ClinicalKey (<https://www.elsevier.com/solutions/clinicalkey>). Michael continued:

“Those services will enable large-scale research infrastructure in uncovering and leveraging latent knowledge. Which drugs interact with each other? Which drugs might be repurposed for another disease because the biological processes involved in both diseases are similar? They will even allow for recommending the next question to ask, help formulate hypotheses, suggest experiments and predict the impact of potential answers.”

Elsevier's DiscoveryLab itself is a Netherlands-based collaboration that has allowed Elsevier's data scientists to work more closely with data scientists in academia, contribute to education and science, and pursue a PhD. As people move between universities and Elsevier itself, academics in turn gain a better understanding of how AI is used to innovate research data platforms to solve real-world societal problems.

“Collaborations offer not only great use cases for students, who are asking for concrete applications in their quest for future jobs, they also enrich the research through additional access to data. And it is personally rewarding to see that our research provides a societal impact, rather staying on a server once the research funding ran out. In the end, we’re serving society by enabling innovation.”

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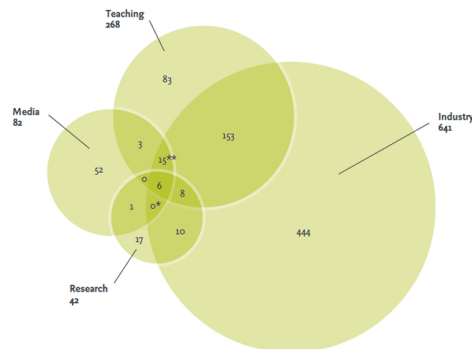


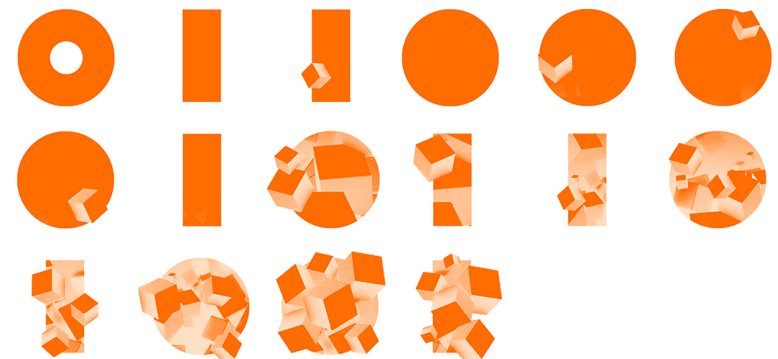
FIGURE 2.1
Keyword mapping (number and percentage of keywords) between AI sectors and perspectives⁵⁶

⁵⁶ *Media/Industry only: 1;
Media/Industry/Research: 0;
** Teaching/Industry/Media: 15;
Teaching/Research: 0
(same as Teaching/Research/Industry)

(<https://www.elsevier.com/connect/nobody-agrees-on-what-ai-is-how-elseviers-report-used-ai-to-define-the-undefinable>)

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Elsevier's Analytical Services Team

December 11, 2018

⌚ 8 mins



January 18, 2019

⌚ 6 mins

Contributors



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Read more from Mark Siebert, PhD >



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Interview

Beyond Reduce, Reuse, Recycle

(<https://www.elsevier.com/connect/atlas/beyond-reduce,-reuse,-recycle>)

Kendall Morgan, PhD

June 29, 2020

⌚ 11 mins



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Interview

Increasing (gender) diversity on a journal: a case study

(<https://www.elsevier.com/connect/editors-update/increasing-gender-diversity-on-a-journal-a-case-study>)

Shivaani Kummar and Christopher

Tancock

June 22, 2020

⌚ 5 mins



(<https://www.elsevier.com/connect/using-knowledge-mining-to-fast-track-innovative-treatments-for-disease>)

Researcher stories

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Ian Evans

June 18, 2020

⌚ A few minutes



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