Demonstration of Faceted Search on Scholarly Knowledge Graphs

Golsa Heidari  
Leibniz University Hannover  
Germany  
golsa.heidari@stud.uni-hannover.de

Ahmad Ramadan  
Leibniz University Hannover  
Germany  
ramadan@stud.uni-hannover.de

Markus Stocker  
TIB Leibniz Information Centre for Science and Technology  
Germany  
markus.stocker@tib.eu

Sören Auer  
TIB Leibniz Information Centre for Science and Technology  
Germany  
auer@tib.eu

ABSTRACT

Scientists always look for the most accurate and relevant answer to their queries on the scholarly literature. Traditional scholarly search systems list documents instead of providing direct answers to the search queries. As data in knowledge graphs are not acquainted semantically, they are not machine-readable. Therefore, a search on scholarly knowledge graphs ends up in a full-text search, not a search in the content of scholarly literature. In this demo, we present a faceted search system that retrieves data from a scholarly knowledge graph, which can be compared and filtered to better satisfy user information needs. Our practice’s novelty is that we use dynamic facets, which means facets are not fixed and will change according to the content of a comparison.

KEYWORDS

Knowledge Graph, Scholarly Knowledge, Information Retrieval, Search System, Faceted Search

ACM Reference Format:

Golsa Heidari, Ahmad Ramadan, Markus Stocker, and Sören Auer. 2021. Demonstration of Faceted Search on Scholarly Knowledge Graphs. In Proceedings of the Web Conference 2021 (WWW '21), April 19–23, 2021, Ljubljana, Slovenia. ACM, New York, NY, USA, 2 pages. https://doi.org/10.1145/3442442.3458605

1 INTRODUCTION

Scholarly Knowledge graphs are knowledge bases for representing scholarly knowledge [3]. Faceted search is a method that augments traditional search systems with a faceted exploration system, allowing users to narrow down search results by applying multiple filters based on the classification of the properties [1]. A faceted classification system lists each knowledge component along various dimensions, called facets, facilitating the classifications to be reached and managed in multiple forms.

Although faceted search is exceptionally beneficial for knowledge retrieval, search engines have not used it for the scholarly literature. Google Scholar is a well-known example: Despite its vast database, it has facets just on the date and, thus, limited support for refining queries. The next section briefly describes how implementing a faceted search over scholarly knowledge supports granular refinement of search queries.

2 APPROACH

We implemented our faceted search system on top of Open Research Knowledge Graph (ORKG) Comparisons. The ORKG1 is an online service that represents research contributions (papers) in the form of an interconnected knowledge graph [4] and enables the generation of tabular representations of contributions as comparisons, which is the main focus of our system.

The data about each paper is defined in properties that each one has a predefined template. These templates support the dynamic and automated construction of facets for ORKG comparisons. Facets work on different types of data throughout comparisons. For String properties (i.e., properties that have strings for values), a user can select one or more values among all. This is also supported by an auto-complete feature to help find candidate options. For numerical data, users may not only want to filter by a distinct value but also by a range. Hence, different operators can be selected for the filtering process, specifically greater or smaller than a specific amount. Furthermore, a user can exclude values. Similarly, operators can be applied for values of type date. In addition to including or excluding a date, a duration can be selected as a valid filtering criterion. A date picker is activated on date properties so a user can easily select the date on a calendar. For example, papers that used a special method of research and got special value(s) in a specific duration of a particular location and so on, can easily be discovered. Our system is empowered by these dynamic facets, which are inferred automatically from the property type, and the facets that would be different for each comparison, in contrast to other search systems which use just a predefined set of static facets.

Figure 1 depicts an example of the faceted search performed on a COVID-19 contribution comparison, which consists of 31 papers. When the filter icon is pressed, a dialogue box containing

1https://gitlab.com/TIBHannover/orkg
the relevant values for the property appears, thus enabling the user to choose some of the candidate values. When applying a filter, the colour of the filter icon is highlighted in red, and a tool-tip is displayed when hovering over the mentioned icon with the selected value(s). Additionally, all applied filters are indicated clearly on top of the table. The results are directly reflected on the screen.

Furthermore, the system provides the opportunity to save these configurations and the subset of retrieved data as a new comparison to the database, with a permanent URL that can be shared with other researchers and users. We provide a link to the system to enable independent testing and investigation.2

3 CHALLENGES
What made the problem of faceted search challenging are the following points:

- Knowledge graphs are heterogeneous by nature. Different KGs have different structure. Thus, they are not compatible with a strict search system. Various schemas and APIs make the exploration of federated systems even harder.
- Completeness matters. The more complete the database is, the more data would be discovered. Unfortunately, some well-structured systems suffer from a complete data source [2].
- Specifically concerning the ORKG, each paper is related to one or more research fields. Therefore, Finding the appropriate facet according to the user’s search expression is challenging.

The code of the system is publicly available and documented on GitLab.3

4 CONCLUSION
Nowadays, knowledge graphs are central to the successful exploitation of knowledge available in the growing amount of digital data on the Web. Such technologies are essential to upgrade search systems from a keyword match to knowledge retrieval, which is vital for achieving the most relevant answer to a query, especially also in research. Despite remarkable gains by search portals, full-text scholarly search engines have remained ineffective. In this project, we implemented a faceted search system over a scholarly knowledge graph. To ease information retrieval, facets adapt to content. The more the knowledge graph is implemented in details, the search results would be more fine-grained. In future work, we will federate knowledge graphs to further improve dynamic faceted search. For instance, we intend to use GeoNames4 to enable spatial filtering on scholarly knowledge.

ACKNOWLEDGMENTS
This work was funded by the Leibniz University of Hannover. The authors would like to thank Allard Oelen, Mohamad Yaser Jaradeh, and Kheir Eddine Farfar for helpful comments.

REFERENCES
[1] Leila Feddoul, Sirko Schindler, and Frank Löfler. 2019. Semantic Relatedness as an Inter-Facet Metric for Facet Selection over Knowledge Graphs. In The Semantic Web: ESWC 2019 Satellite Events. Springer International Publishing, Portorož, 47–51. https://doi.org/10.1007/978-3-030-32327-1_10
[2] Nicolas Heut, Sven Hertling, Daniel Ringler, and Heiko Paulheim. 2020. Knowledge Graphs on the Web – an Overview. arXiv:cs.AI/2003.00719
[3] Mohamad Yaser Jaradeh, Allard Oelen, Manuel Prinz, Markus Stocker, and Sören Auer. 2019. Open Research Knowledge Graph: A System Walkthrough. In Digital Libraries for Open Knowledge. Springer International Publishing, Oslo, 348–351. https://doi.org/10.1007/978-3-030-30760-8_31
[4] Allard Oelen, Mohamad Yaser Jaradeh, Kheir Eddine Farfar, Markus Stocker, and Sören Auer. 2019. Comparing research contributions in a scholarly knowledge graph. https://doi.org/10.15488/9388

3https://www.orkg.org/orkg/comparisons
4https://www.geonames.org/