Dataset Discovery using Semantic Matching

Enas Khwaileh [1], Yannis Velegrakis [1]

[1] Information and Computing Sciences, Utrecht University, The Netherlands
{e.t.k.khwaileh,i.velergakis}@uu.nl

The increasing volume of large datasets poses significant challenges for data discovery, particularly in federated systems where data is distributed across multiple platforms. Traditional keyword-based search methods often yield fragmented results, forcing users to manually compile relevant data. Moreover, these methods struggle to accurately capture the semantic context of complex queries, especially in table-based datasets [1].

In this work, we introduce three innovative dataset discovery methods—*Exhaustive Search*, *Approximate Nearest Neighbors Search*, and *Clustered Targeted Search*—that leverage advanced *semantic matching techniques* to significantly improve both retrieval speed and accuracy. Our methods go beyond surface-level syntactic matching, employing cell-level semantic analysis and *clustering techniques* to uncover deeper relationships within the data [2].

We designed our approach to address the limitations of existing methods [3], which often fail to consolidate fragmented results and overlook important table content. Our system is particularly effective in federated data environments, where datasets are dispersed across different locations and lack a unified view. By incorporating *dimensionality reduction* and *clustering*, we optimize the discovery process, offering a unique balance between speed and precision [4].

Extensive benchmarking on datasets comprising 1.5 million tables and 90 complex queries demonstrates the effectiveness of our approach. Our methods achieve up to **98% faster retrieval times** and **95% higher accuracy** compared to four state-of-the-art baselines [5]. These improvements mark a significant advancement in the field of dataset discovery, providing a robust solution for consolidating distributed data and enabling more efficient semantic search in large-scale, federated systems.

Our results indicate that *Clustered Targeted Search*, in particular, outperforms *Exhaustive Search* and *Approximate Nearest Neighbors Search*, delivering both higher accuracy and faster retrieval times. This counterintuitive result highlights the effectiveness of our clustering-based approach in navigating large datasets and finding the most semantically relevant tables [6].

This work presents a breakthrough in dataset discovery, offering a scalable and efficient solution that surpasses the limitations of traditional search methods. By focusing on semantic matching at the table level, our methods provide more accurate and comprehensive results, revolutionizing the way data is discovered and consolidated in large, federated environments.

References

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