

Knowledge Representation and Reasoning for Human Resource Management

Jorge Martinez-Gil

Software Competence Center Hagenberg GmbH

Softwarepark 21, 4232, Hagenberg, Austria

jorge.martinez-gil@scch.at

Abstract

Digitalization in industry has increased the use of data-driven methods for automating human resource processes. Advances in Big Data and Machine Learning now allow organizations to automate decision-making tasks, including the alignment of job openings and candidates. In human resources, matching candidates to positions is a central process for organizational effectiveness. However, formal knowledge representation methods, especially those based on description logics, have received limited attention in this setting. This work reviews the application of ontologies for structuring and reasoning about information in human resource management, with a focus on supporting candidate selection and related decision processes.

1 Introduction

In the field of human resources, selecting the right personnel is crucial for managing operational, tactical, and strategic aspects of an organization's activities. The ability to effectively choose and hire from a diverse pool of candidates is essential for an organization's future success. This highlights the importance of a process that efficiently connects employers with potential employees, which is highly sought after by many organizations.

This work concentrates on methods that provide a formal framework for a knowledge domain through knowledge bases, often in the form of ontologies. These ontologies represent entities, properties, relationships, and foundational rules of a domain. The process involves formally defining the conditions and constraints of knowledge formation and organization. It employs logical specifications using propositional expressions and symbolic structures like taxonomies, classes, operations, and axioms. These constructs are interpretable as propositions and should accurately represent the domain theory.

A key approach used by researchers and practitioners is Description Logics (DL), which are logics designed for formally describing concepts and roles. Developed from efforts to formalize semantic networks and frame-based systems, DLs are grounded in predicate logic. Their language is tailored for practical modeling, ensuring good computational properties like decidability.

2 Benefits of the approach

A critical aspect is the structured representation of information, and the sources used to acquire it. Knowledge bases, created in line with ontologies, store structured domain-specific knowledge. For example, Wordnet is a knowledge base that represents semantic-level concepts and relationships. Ontologies as knowledge models offer several scientific benefits:

- They address semantic heterogeneity by enforcing a shared vocabulary, ensuring consistency between employers and candidates.
- They allow for information validation by identifying inconsistencies in data from both parties.
- They enable automatic computer processing. While natural language processing has advanced, it still lacks full understanding beyond the explicit text.
- They facilitate inference, revealing implicit information through reasoning mechanisms.
- They enhance interoperability between different databases and information systems, especially when the information refers to public ontologies or knowledge models.
- They allow complex queries, such as finding programmers skilled in object-oriented programming languages or musicians proficient in string instruments.

3 Key Performance Indicators

Beyond these scientific and technological advantages, ontologies also offer practical, measurable industry benefits, observable through Key Performance Indicators (KPIs). Automatic matching algorithms, for instance, significantly impact organizations with hiring needs. The application of ontology-based methods in Human Resources leads to:

- Reduced costs and time in matching job offers with applicant profiles, particularly beneficial in high-volume recruitment organizations.
- Improved syntactic matching, enhanced opportunities for qualified candidates, and helping recruiters identify potential talent.
- Reduced need for recruiters to have deep, specialized industry knowledge, as these techniques work across various industrial domains.
- Decreased time spent on initial preprocessing of applicant profiles, enabling recruiters to use preference-based search expressions for efficient results.

This work aims to provide an overview of the current state and future challenges of using ontology-based knowledge representation techniques in the human resources industry.

4 Conclusions

The digital transformation of human resources has brought significant benefits, including reduced costs, time, and effort, compared to traditional methods. From a scientific perspective, moving beyond conventional syntactic matching has opened new avenues for research and the development of innovative business models. The matching of CVs and job openings often involves using knowledge bases that define domain-specific ontologies.

Such systems are also valuable for educational organizations aiming to reduce unemployment. These tools can identify the skills and competencies needed to secure employment efficiently and resourcefully. They can also aid in finding suitable candidates for positions that are challenging to fill. Overcoming the semantic gap between the skills required and those offered by candidates is yielding benefits that are only now beginning to be fully appreciated.

There are several aspects that still require exploration. The research community is aware of the aversion algorithm phenomenon, where people tend to lose trust in computer models that occasionally fail, even if the failure rate is low. Consequently, while these technologies can enhance and streamline many processes, they cannot completely replace the need for human judgment in recruitment decisions.

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