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Using Natural Language Processing to Generate Risk Assessment Checklists From Workplace Descriptions

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Workplace risk assessments are mandatory in Germany. Despite this, up to 50% of workplaces are estimated to never have been assessed. We propose to empower occupational safety practitioners by employing artificial intelligence techniques. From previous work we gathered that most of the available risk assessment data is more or less digitalized and more or less structured text. Therefore, we focus the algorithm family of natural language processing to boost the capabilities of analysing large amounts of documents. More specifically, we show the feasibility of retraining an algorithm for handling accident data and hazard identification and risk assessment checklists as well as the transferability to a German text corpus. A dataset of roughly 2500 job descriptions in German forms the basis for this German text corpus .We further explore how the interaction with such a system should be designed to accommodate for the specifics of interacting with artificial intelligence as well as maintaining the users' competencies.

Keywords: Risk Assessment, Natural Language Processing, Occupational Safety, Workplace, Artificial Intelligence, Hazard Identification.

1. Introduction

In Germany, risk assessments are estimated to be missing for up to every second workplace (Arbeitsschutzkonferenz 2014), while they are even mandatory by law. In light of the growing introduction of innovative technologies (Barth, Eickholt et al. 2017) and the overall lack of adequately trained personnel (IFA 2021), this problem will likely only get worse. As checklists for hazard identification and risk assessment are the most common tools for occupational safety practitioners, we set our focus on improving their use. Although the checklists present a useful assessment tool, their availability and applicability leave much to be desired. On the one hand, often only generic and static checklists for broad categories of workplaces are available. On the other hand, since the available checklists are developed to cover as much as possible, some of their items might not be applicable at all. Therefore, for complex workplaces (fitting more than one workplace category), several static checklists have to be merged and adjusted, while for unique workplaces (with no immediate category fit), a checklist would need to be compiled from all the potentially applicable legislations, guidelines, and regulations. As such, due to the large volume of material and the lack of a systematic approach, assuring completeness and consistency of the final checklist requires a large effort. We propose to use Natural Language Processing (NLP, see e.g. Chowdhary (2020)) to generate tailored checklists from textual workplace descriptions.

2. Considerations on Algorithm and Interaction Design

The algorithm is based on the work of Martinc, Škrlj et al. (2022) and Westhoven and Jadid (2023) and compares all the available checklists and the workplace description to identify matches, dependencies and contradictions between the clauses to yield a list of necessary

workplace checklist items together with an additional list of potentially fitting items. Checklists were obtained from an accident insurance. They include all typical hazards and are enriched with meta-data, such as corresponding law texts. Workplace descriptions are hard to come by, which is why we fell back to using related data. We found that internal job descriptions used for assessing the paygrade for different jobs contain rather detailed data about the work processes. We were able to obtain around 2500 such descriptions to fuel our retraining to our application domain. As the final decision to include each item is left to the user, the algorithm also collects feedback to improve the quality of future proposals. Westhoven and Herrmann (In Press) explored the design of Human-AI interaction in this setting already, so this work can expand on it in regard to the implementation of the Human-Machine-Interface. As with the setting of Westhoven and Herrmann (2023), also for this work a hybrid intelligence should be the goal of the interaction.

3. Future Research

In this work, we show how to generate a custom-tailored checklist, which incorporates all the definitely and potentially suitable items while excluding the unnecessary ones, with the use of NLP techniques.

With this drafted setup, new research questions arise, such as the fitness of the used retraining data, and the evaluation of both the algorithm's performance and the user satisfaction during and after use.

We plan to follow up these new questions by assessing means to evaluate the retraining data, and to evaluate how good the AI interaction design can actually cover the requirements set out for such a system.

At the same time, we constantly

References

Arbeitsschutzkonferenz. (2014). Grundauswertung der Beschäftigtenbefragung 2015 und 2011 - beschäftigtenproportional gewichtet.

Barth, C., Eickholt, C., Hamacher, W., & Schmauder, M. (2017). Bedarf an Fachkräften für Arbeitssicherheit in Deutschland.

Chowdhary, K. (2020). Natural language processing. Fundamentals of artificial intelligence, 603-649.

IFA. (2021). Arbeitswelten. Menschenwelten. Prioritäten für den Arbeitsschutz von morgen.

Martinc, M., Škrlj, B., & Pollak, S. (2022). TNT-KID: Transformer-based neural tagger for keyword identification. Natural Language Engineering, 28(4), 409-448.

Westhoven, M., & Herrmann, T. (In Press). Interaction Design for Hybrid Intelligence: The Case of Work Place Risk Assessment.

Westhoven, M., & Jadid, A. (2023). Supporting Work Place Risk Assessments by Means of Natural Language Processing. In: Proceedings of the 69th Frühjahrskongress der Gesellschaft für Arbeitswissenschaften. Bonn, Germany.