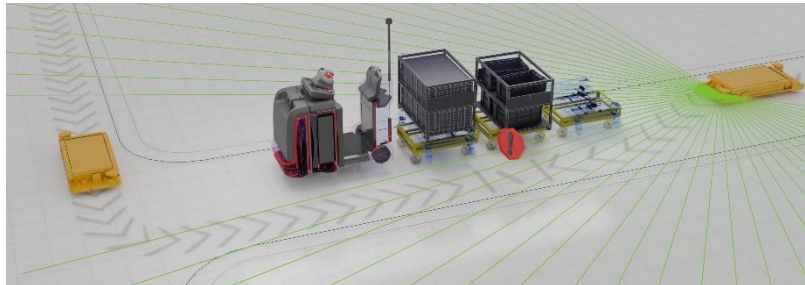


November 24, 2022

Call for Bachelor/Master Thesis: “Knowledge Graphs for Robots’ Situational Awareness” (in German or English)

What is the topic?

Situational awareness has been defined in [1] as the (a) perception of relevant elements in the environment, (b) the comprehension of their significance, and (c) the projection of their future status. In that context, the task of imbuing autonomous mobile robots with cognitive abilities to be situationally aware requires fulfilling functional capabilities, namely perception, reasoning, and projection.



Knowledge graphs (KGs) have been used to enable such cognitive abilities by representing the robot’s knowledge, being the repository of all known information processed by the autonomous mobile robot. In other words, KGs were used as a form of common agreement and consistent usage of identifiers and other formal representations, necessary to encode knowledge into a model/data structure that is machine-readable. Given this setting, it is crucial to study how existing robotics KGs in robotics cognition projects are leveraged, and how these KGs are characterized.

In this thesis, the student will address the research questions

(R1) *What is the status quo of existing KGs in ontology-based projects for robot autonomy?*

(R2) *How predisposed are the KGs of the ontology-based projects for robot autonomy to support situational awareness of mobile robots operating in a manufacturing environment?*

To answer these questions, the student will study and compare existing KGs and apply them in the above described scenario.

This thesis will be conducted in collaboration with the BMW Group (contract for the thesis possible if the student works in Munich).

[1] Endsley, M.R., 2017. Toward a theory of situation awareness in dynamic systems. In *Situational awareness* (pp. 9-42). Routledge.

[2] Olivares-Alarcos, A., Beßler, D., Khamis, A., Goncalves, P., Habib, M.K., Bermejo-Alonso, J., Barreto, M., Diab, M., Rosell, J., Quintas, J. and Olszewska, J., 2019. A review and comparison of ontology-based approaches to robot autonomy. *The Knowledge Engineering Review*, 34.

[3] Färber, M., Bartscherer, F., Menne, C. and Rettinger, A., 2018. Linked data quality of dbpedia, freebase, open-cyc, wikidata, and yago. *Semantic Web*, 9(1), pp.77-129.

What should you bring along?

- Basic knowledge in knowledge graphs and solid programming skills.

Keywords: data science, knowledge graphs, robots, ontologies, simulation

Contact:
Dr.-Ing. Michael Färber
michael.farber@kit.edu