RAKI: Rapid Explainable Artificial Intelligence for Industrial Plants
Overview

Use Case Siemens Prototype 1

• Data Acquisition and Semantic Modeling
• Verbalization and Machine Learning
• Further Results
Siemens Use Case: Skill Description Learning

Motivation

- Cyber-physical systems for more flexibility, adaptability, and transparency in production, and increased autonomy of machines
- Skill matching assigns operations in a production process to machines
- Need skill descriptions of the machines and skill requirements of the operations
- In some cases, skill descriptions might not be available at all, e.g., in the case of a legacy module
- Defining and digitizing skill descriptions of a production module are typically done manually by a domain expert

- Equip machines with explicit digitized skill descriptions, detailing their capabilities

Automatically skill description learning would minimize the labor time and domain expertise needed to equip production modules with their descriptions.
Siemens Use Case: Skill Description Learning

**Given:**

- Production log data – instance data
- Production ontology – background data

**Desired:** skill descriptions of machines
Siemens Use Case: Skill Description Learning

Data acquisition and Semantic Modeling

- Data Acquisition: BoP and BoM
- Data Exploration
- Concept development and modeling
- Semantic annotation and transformation in required format

Verbalization and Machine Learning

- Support of concept for verbalizing: data modeling
- Based on industrial requirements and available data
Use Case – Evaluation

Evaluation Concept

- Functional testing rather than performance testing: to a small data set only
- Reference test with full dataset
- Data preparation:
  - Modification of BoP and BoM
  - Modification of equipment
  - Evaluation tests
Siemens Use Case: Skill Description Learning

Current Status

- Created ontology for the use case and adapted it for the methodology
- Generated positive and negative examples for all machines and tasks
- First feedback received from UPB
- Hobbit Platform received from UPB – installation in progress

Next Steps

- Transfer of the RAKI framework to Siemens
- Evaluation of results and discussion (with UPB)
- Technical interpretation of results (with UPB)
- Integration of verbalization (with ULEI)
Further Results

Related publications

- "Integrating Logical Rules Into Neural Multi-Hop Reasoning for Drug Repurposing", Yushan Liu, Marcel Hildebrandt, Mitchell Joblin, Martin Ringsquandl, Volker Tresp, ICML 2020, Graph Representation Learning and Beyond Workshop
- "Ontology-based Skill Description Learning for Flexible Production Systems", Anna Himmelhuber, Stephan Grimm, Thomas Runkler, Sonja Zillner, ETFA 2020, Vienna
- „Neural Multi-Hop Reasoning With Logical Rules on Biomedical Knowledge Graphs“, Yushan Liu, Marcel Hildebrandt, Mitchell Joblin, Martin Ringsquandl, Rime Raissouni, Volker Tresp , ESWC 2021

Related internal work

- RAKI Roadmap under development: Brownfield Initiative
- Work on Use Case for Prototype 2 started: Turbine Package Classification
Thank you for your attention!