Intelligent Systems

- Practical Assignments -

Gerald Steinbauer, Stalin Munoz Gutierrez

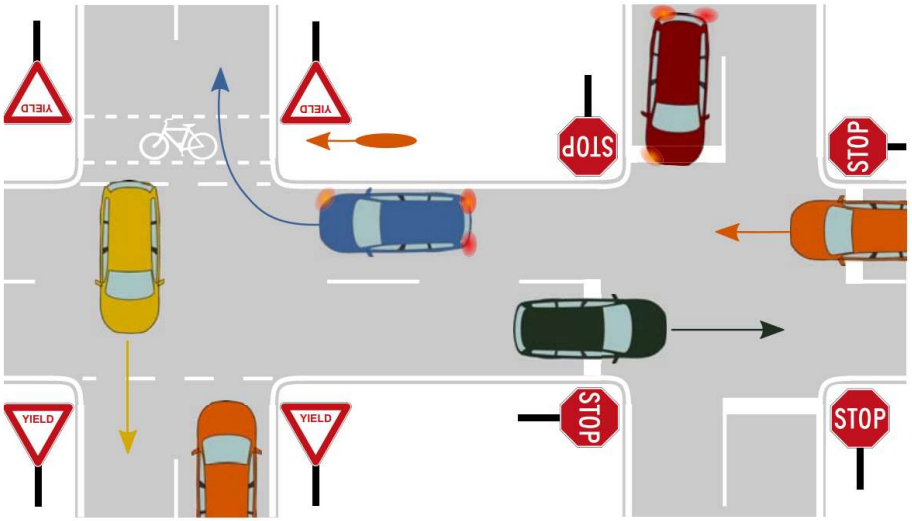
Institute for Software Technology

Inffeldgasse 16b/2

A-8010 Graz

Austria

Assignment



[Ulbrich et.al, ICITS 2015]

- implement a legal expert system – answer if a traffic situation is legal in respect to the STVO
- model the knowledge as an ontology
- write an expert system in JAVA

Knowledge Engineering

- model the knowledge base as ontology
- model the description of a traffic situation
  - environment: lanes, signs, traffic lights, lane markings, …
  - individuals: pedestrians, cyclists, cars, street cars, …
  - state/properties/activities: stopped, turning, accelerating, overtaking, …
- model the rules of the Austrian traffic regulation (STVO)
  - what situations and activities are legal: right of way, overtaking, parking, …
- model a particular traffic situation using individuals

Tips

- define all necessary concepts und roles (predicates, facts, rules)
- in order to minimize the effort for modelling, think about which general concepts and object hierarchies are possible, e.g. lanes of the same type have the same properties
- abstract spatial and temporal (action/effects) aspects: e.g. behind, left of, turning left

Tools and Resources

- model the knowledge base using description logic and the ontology editor Protégé (http://protege.stanford.edu/)
- the Jena Java semantic web framework (https://jena.apache.org/)
- SPARQL – a SQL-like query language for ontologies (integrated in Jena)
- Check for instabce the Toyota Smart Vehicle Ontology (http://www.toyota-ti.ac.jp/Lab/Denshi/COIN/Ontology/)

What to Do?

- model the knowledge base of the domain as ontology
  - representation of traffic situations
  - rules of the traffic regulation
  - individual satiations
- implement a JAVA program that
  - is able to load the needed ontology(ies)
  - allows to specify an observed traffic situation
  - answers the question if the situation is legal

Process

- develop and test your solution
- work as team of max. 2 students
- submit only the source archive in the teach center due 14.7.2021
- discussion of the solution after the submission
- we will provide a online list to signup for a slot

Some Further Literature

- Lihua Zhao, Ryutaro Ichise, Tatsuya Yoshikawa, Takeshi Naito, Toshiaki Kakinami, Yutaka Sasaki, Ontology-based Decision Making on Uncontrolled Intersections and Narrow Roads, IEEE Intelligent Vehicles Symposium (IV2015), Seoul, Korea, June 2015.
- S. Ulbrich, T. Menzel, A. Reschka, F. Schuldt and M. Maurer, "Defining and Substantiating the Terms Scene, Situation, and Scenario for Automated Driving," 2015 IEEE 18th International Conference on Intelligent Transportation Systems, Las Palmas, 2015, pp. 982-988.
- M. Buechel, G. Hinz, F. Ruehl, H. Schroth, C. Gyoeri and A. Knoll, "Ontology-based traffic scene modeling, traffic regulations dependent situational awareness and decision-making for automated vehicles," 2017 IEEE Intelligent Vehicles Symposium (IV), Los Angeles, CA, 2017, pp. 1471-1476.