The seminar 4: PEAS and ODD+D

Objectives of the seminar:

- to explain the initial steps for the project preparation
  - to explain the abbreviation PEAS and how to use it for the project
  - to briefly explain the ODD+D protocol

Update: 18. 9. 2018

PEAS (Performance, Environment, Actuators and Sensors)

PEAS is the abbreviation of the four basic attributes of the agent(s) (i. e. MAS) – Performance measure, Environment, Actuators (Action) and Sensors (Perception).

Performance measure: specify the description about the possibilities for measuring performance of the agent(s) (MAS). The purpose of the MAS should be obvious thanks to this description.

Environment: Describe the environment where the agent(s) exists. Description cannot be exhaustive. Focus on the substantial attributes of the environment.

Actuators (Effectors): Describe the agent´s actions or actuators that will be used for these actions. If your MAS has more agents, describe the actions (actuators) for all of these agents.

Sensors (Perceptors): Describe the agent´s perceptions or sensors that will be used for perception. If your MAS has more agents, describe the perceptions or sensors for all of these agents.

The example:

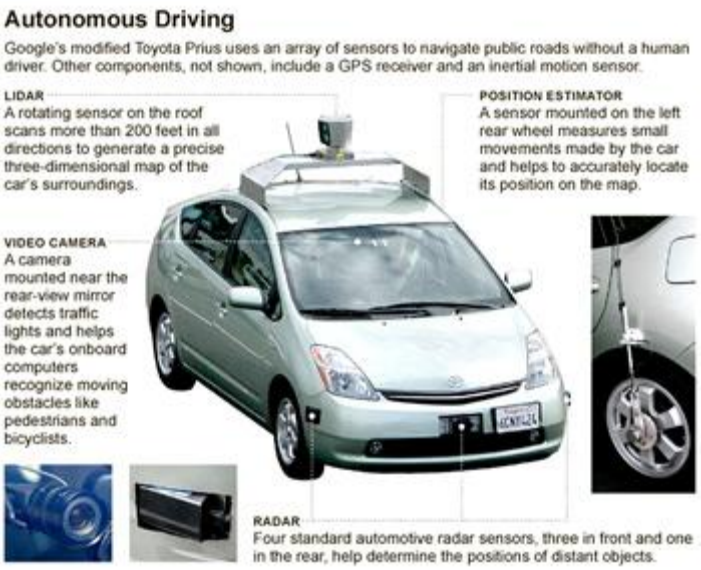
Imagine that your goal is to design the multi-agent system for an autonomous vehicle. The PEAS can be very briefly described in the following way:

Performance measure: safely transportation of persons, reaching the target destination, profit maximalisation, abide by the traffic rules, ...

Environment: The autonomous vehicle moves on the streets or motorways. The autonomous vehicle can meet the pedestrians (passengers). The weather can influence the movement of the autonomous vehicle very seriously.

Actuators: a steering wheel, a break, an accelerator, a clutch, a car horn, ..., (+ description their functions)

Sensors: a GPS, a camcorder, (+ description their functions)



http://www.techspot.com/news/48497-nevada-embraces-driverless-cars-issues-autonomous-vehicle-licenses.html

ODD+D protocol

"*Modelling in general, not only the modelling of human decisions, has to address the challenge of providing transparent and complete model descriptions (Richiardi et al., 2006; Parker et al. 2008a). Standardised protocols for (agent-based) model descriptions and especially the ODD (Overview, Design Concepts and Details) protocol (Grimm et al. 2006) have been well received by the scientific community. The ODD protocol consists of three parts: First, it provides an 'Overview' on the purpose and main processes of the model. Second, in the 'Design Concepts' block, the general concepts underlying the model design are depicted and third, in the 'Details', all of the necessary information is given that would allow for a reimplementation of the model. However, the original ODD protocol focuses primarily on ecological dynamics (Grimm et al., 2006). The first revision of the ODD protocol has attempted to open the standard for all ABMs (Grimm et al., 2010). Nevertheless, a comprehensive description of the human decision process was not a focal point until now.*"

Müller, B., F. Bohn, G. Dressler, J. Groeneveld, C. Klassert, R. Martin, M. Schlüter, J. Schul-ze, H. Weise, and N. Schwarz, 2013. *Describing human decisions in agent-based models - ODD+D, an extension of the ODD protocol*. Environmental Modelling & Software 48, 37-48.

So, the ODD+D protocol is generally used for documenting of agent-based models. A lot of various versions of the ODD protocol were presented, see table below. The version presented in 2010 was extended by the section *Decision* emphasising individual decision making in the MAS and including empirical and theoretical foundations for the choice of a decision model. We are going to use the last extended version ODD+D including individual decision making in the MAS. Open the protocol for the seminar project – part B and study the structure of the ODD+D protocol (*aZT1-ProtocolForSeminarProject-2-2016.docx (Seminar 01)).*

Categories	ODD (2006)	ODD (2010)	ODD + D (2013)
	Structural elements		
Overview	Purpose	Purpose	Purpose
	State variables and scales	**Entities, state variables, and scales**	Entities, state variables, and scales
	Process overview and scheduling	Process overview and scheduling	Process overview and scheduling
Design concepts	Design concepts • Emergence • Adaptation • Fitness • Prediction • Sensing • Interaction • Stochasticity • Collectives • Observation	Design concepts • **Basic principles** • **Emergence** • Adaptation • **Objectives** • **Learning** • Prediction • Sensing • Interaction • Stochasticity • Collectives • Observation	Design concepts • **Theoretical and empirical background** • **Individual decision making** • Learning • **Individual sensing** • Interaction • Collectives • **Heterogeneity** • Stochasticity • **Observation (+emergence)**
Details			**Implementation details**
	Initialization	Initialization	Initialization
	Input	Input	Input
	Sub-models	Sub-models	Sub-models

End of the seminar

Exercises

- Prepare the PEAS for your project.
- Read the following documents:
    - Müller, B., F. Bohn, G. Dressler, J. Groeneveld, C. Klassert, R. Martin, M. Schlüter, J. Schul-ze, H. Weise, and N. Schwarz, 2013. Describing human decisions in agent-based models - ODD+D, an extension of the ODD protocol. Environmental Modelling & Software 48, 37-48.
    - Polhill, J. G. 2008. Using the ODD protocol for comparing three agent-based social simulation models of land use change (http://jasss.soc.surrey.ac.uk/11/2/3.html)
- Study the ODD+D protocol and complete it for your project.

The most important keywords:

- PEAS
- ODD
- ODD+D

References

- Autonomous vehicle picture: http://www.techspot.com/news/48497-nevada-embraces-driverless-cars-issues-autonomous-vehicle-licenses.html
- Richiardi, M., Leombruni, R., Saam, N.J., Sonnessa, M., 2006. A Common Protocol for Agent-Based Social Simulation. Journal of Artificial Societies and Social Simulation 9 (1), 15.
- Parker, D.C., Brown, D.G., Polhill, J.G., Deadman, P.J., Manson, S.M., 2008a. Illustrating a new 'conceptual design pattern' for agent-based models and land use via five case studies: the MR POTATOHEAD framework., in: Paredes, A.L., Iglesias, C.H. (Eds.), Agent-based modelling in natural resource management. Universidad de Valladolid, Valladolid, Spain, pp. 23-51.
- Grimm, V., Berger, U., Bastiansen, F., Eliassen, S., Ginot, V., Giske, J., Goss-Custard, J., Grand, T., Heinz, S., Huse, G., Huth, A., Jepsen, J.U., Jørgensen, C., Mooij, W.M., Müller, B., Pe'er, G., Piou, C., Railsback, S.F., Robbins, A.M., Robbins, M.M., Rossmanith, E., Rüger, N., Strand, E., Souissi, S., Stillman, R.A., Vabø, R., Visser, U., DeAngelis, D.L., 2006. A standard protocol for describing individual-based and agent-based models. Ecological Modelling 198 (1-2), 115-126.
- Grimm, V., Berger, U., DeAngelis, D.L., Polhill, J.G., Giske, J., Railsback, S.F., 2010. The ODD protocol: a review and first update. Ecological Modelling 221 (23), 2760-2768.