2018-00331 - Knowledge representation and multi-agent simulation: Experimental cultural knowledge evolution - Post-Doctorant Inria Grenoble Research center

Contract type : Public service fixed-term contract
Level of qualifications required : PhD or equivalent
Fonction : Post-Doctoral Research Visit

About the research centre or Inria department

Grenoble Rhône-Alpes Research Center groups together a few less than 800 people in 35 research teams and 9 research support departments.

Staff is localized on 5 campuses in Grenoble and Lyon, in close collaboration with labs, research and higher education institutions in Grenoble and Lyon, but also with the economic players in these areas.

Present in the fields of software, high-performance computing, Internet of things, image and data, but also simulation in oceanography and biology, it participates at the best level of international scientific achievements and collaborations in both Europe and the rest of the world.

Context

The work will be carried out in the mOeX team common to Inria & LIG. mOeX is dedicated to study knowledge evolution through adaptation. It gather permanent researchers from the Exmo team which has taken an active part these past 15 years in the development of the semantic web and more specifically ontology matching.

This work is part of an ambitious program towards what we call cultural knowledge evolution. Its results may be of experimental or theoretical nature and it may provide practical, e.g., new adaptation operators, or methodological, e.g., better experimental procedures, contributions.

Assignment

Agents hold knowledge, expressed formally, about their environments and the society they live in. This knowledge evolves with agent experiences. We aim at establishing experimentally how this evolution occurs and what are its consequences for knowledge (e.g., agreement, consistency, growth) and for agents (e.g., survival, knowledge increase, efficiency).

In this perspective, we use and adapt techniques developed by Luc Steels and his colleagues for studying the cultural evolution of language [Steels, 2012], i.e., the way language features can be selected or created by agents through constantly attempting to communicate. Instead of focussing on language (the communication vehicle), we consider knowledge (the hidden content of communication). So, we are interested in how agent knowledge, described formally as ontologies and alignments between these ontologies, can evolve as agents try to communicate. This knowledge may be proper to agents (like personal ontologies) or shared (like alignments between ontologies).

This raises questions such as:
- How can agent populations with different knowledge communicate?
- How is their representation influenced by their environment and communication with others?
- How can agents preserve knowledge diversity and is this diversity beneficial?

This can be experimented by simulating this communication activity through language games that can reach successful communication or failure. In case of failure, agents will perform a repair action in order to improve further communication. In our case,
the action may be to adapt the ontology used by the agent or modify their common alignments. The merits of repair strategies in this context are judged by the evolution of the success rate in a population over the number of games played.

We have applied this approach to ontology alignment repair, i.e., the improvement of incorrect alignments [Euzenat, 2014; 2017]. For that purpose, we performed experiments in which agents react to mistakes in alignments. Agents only know about their ontologies and alignments with others and they act in a fully decentralised way. We showed that this cultural repair approach is able to converge towards successful communication through improving the objective correctness of alignments. The obtained results are on par with a baseline of state-of-the-art alignment repair algorithms and agents can start with empty knowledge at first.

This is part of an ambitious program towards what we call cultural knowledge evolution. Many aspects of these experiments may be systematically developed. For instance, we may have agents arbitrate between maintaining alignments or adopting the ontologies of other agents. We may want to change the environment in which agents live so that they have to evolve their ontologies. We may want to have homogeneous populations of agents to encounter other populations.

The main goal of the position is to contribute experimenting with cultural evolution techniques in the context of distributed knowledge representation. In particular, two main lines of actions will be performed by the successful candidate:
- Helping us to develop a cultural knowledge evolution workbench offering facilities for recording, replaying, reproducing and tracking experiments.
- Designing and performing experiments with cultural knowledge evolution. We are in particular interested in studying the creation, evolution and persistence of techniques used by agents for dealing with different representations (like people dealing with different language levels) and the co-evolution or confrontation of different homogeneous populations.

References:


Links:
Exmo web site: http://exmo.inria.fr
Lazy lavender: http://lazylav.gforge.inria.fr
This topic: http://moex.inria.fr/training/2018-PD-ecke.html

Main activities

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Skills

- Interaction with other researchers.
- Willingness to tackle new and challenging problems.
- Experimentation skills.
- Programming skills.
- Autonomous researcher.

Benefits package

- Subsidised catering service
- Partially-reimbursed public transport
- Social security
- Paid leave
- Flexible working hours
- Sports facilities

Remuneration
Gross salary: 2650 Euros per month