MIAi PhD Thesis proposals

SECTOR: Higher Education Institution

LOCATION: France, Grenoble

RESEARCHER PROFILE:
□ First stage researcher,

INSTITUTION: Univ. Grenoble Alpes, University of Innovation

One of the major research-intensive French universities, Univ. Grenoble Alpes\(^1\) enjoys an international reputation in many scientific fields, as confirmed by international rankings. It benefits from the implementation of major European instruments (ESRF, ILL, EMBL, IRAM, EMFL\(^*\)). The dynamic ecosystem, grounded on a close interaction between research, education and companies, has earned Grenoble to be ranked as the 5th most innovative city in the world. Surrounded by mountains, the campus benefits from a natural environment and a high quality of life and work environment. With 7000 foreign students and the annual visit of more than 8000 researchers from all over the world, Univ. Grenoble Alps is an internationally engaged university.

A personalized Welcome Center for international students, PhDs and researchers facilitates your arrival and installation.

In 2016, Univ. Grenoble Alpes was labeled «Initiative of Excellence". This label aims at the emergence of around ten French world class research universities. By joining Univ. Grenoble Alpes, you have the opportunity to conduct world-class research, and to contribute to the social and economic challenges of the 21st century ("sustainable planet and society", "health, well-being and technology", "understanding and supporting innovation: culture, technology, organizations" "Digital technology").

\(^*\) ESRF (European Synchrotron Radiation Facility), ILL (Institut Laue-Langevin), IRAM (International Institute for Radio Astronomy), EMBL (European Molecular Biology Laboratory), EMFL (European Magnetic Field Laboratory)

Key figures:

- + 50,000 students including 7,000 international students
- 3,700 PhD students, 45% international
- 5,500 faculty members
- 180 different nationalities
- 1st city in France where it feels good to study and 5th city where it feels good to work
- ISSO: International Students & Scholars Office affiliated to EURAXESS

\(^1\) https://edu.univ-grenoble-alpes.fr/en/
MANDATORY REFERENCES:

PROJECT TITLE: MIAI @ Grenoble Alpes
SUBJECT TITLE: Constraining machine learning with society-induced symbolic knowledge
RESEARCH FIELD (cf mots clefs sur Euraxess Jobs): Computer science, Artificial intelligence, Multi-agent systems, Knowledge representation, Machine learning
SCIENTIFIC DEPARTMENT (LABORATORY’S NAME): INRIA / LIG
DOCTORAL SCHOOL’S: MSTII
SUPERVISOR’S NAME: Jérôme Euzenat and Nabil Layaïda

SUBJECT DESCRIPTION:
Agent knowledge can be learnt directly from their environment, but in a social context, it can also be learnt from interaction with other agents. This is even supposed to be faster. These two types of learning do constrain each others. Although knowledge from the environment naturally constrain social knowledge, the way this happens in the opposite direction is less clear. The goal of this proposal is to study, in the context of cultural knowledge evolution, the mechanisms by which machine learning can be constrained by symbolic knowledge socially acquired.

Cultural knowledge evolution deals with the evolution of knowledge representation in a group of agents. For that purpose, cooperating agents adapt their knowledge to the situations they are confronted to and the feedback they receive from others. This framework has been considered in the context of evolving natural languages [Steels, 2012]; We have applied it to ontology alignment repair, i.e. the improvement of incorrect alignments [Euzenat, 2014; 2017]. We have shown that cultural repair is able to converge towards successful communication through improving the objective knowledge quality.

We want to consider how adaptation of knowledge, resulting from agent communication, may be articulated with learnt knowledge. Machine learning induce knowledge from examples and have proved useful in a variety of tasks. Agent ontologies may be acquired from the environment in which they evolve. However, the learnt knowledge is used for communicating with other agents and this may lead to adaptation constraining this knowledge. This is important when adaptation concerns social norms, e.g. enforcing non discrimination.

If agents continuously learn from their environment, there is a conflict between these two types of knowledge acquisition, because adaptation will be cancelled by the results of relearning. Thus adapting learnt knowledge is not sufficient and it is necessary to adapt the learning process. The question to be addressed by this proposal is how adaptation may be taken into account to influence learning.

Various solutions are possible and depend on the situation: Adding biais to the process may be achieved by generating new examples or modifying the training set. Reward may be integrated within a reinforcement mechanism. More classically, backfeeding the learning process and adapting weights is classical but not always possible, in particular when knowledge is learnt from different stimuli. It may also be possible to control the features from which learning is performed.

We are seeking answers both at the general level, independently from the type of learning and the form of feedback, and at more precise levels, in case of particular types
of learning and knowledge representation. For that purpose, experiments will have to be set up, showing the impact of the proposed solutions on the quality, and in particular the fitness, of the generated knowledge.

This work is part of an ambitious program towards what we call cultural knowledge evolution partly funded by the MIAI Knowledge communication and evolution chair.

References:


Links:

- MIAI Knowledge communication and evolution: https://moex.inria.fr/cooperation/miai/
- MoEx web site: https://moex.inria.fr
- Tyrex web site: https://tyrex.inria.fr
- Lazy lavender: http://lazylav.gforge.inria.fr

ELIGIBILITY CRITERIA

Applicants must hold a Master's degree (or be about to earn one) or have a university degree equivalent to a European Master's (5-year duration),

Applicants will have to send an application letter in English and attach:
- Their last diploma
- Their CV
- A short presentation of their scientific project (2 to 3 pages max)
- Eventually their master thesis, marks or any relevant documents
- Letters of recommendation are welcome.

Address to send their application: Jerome.Euzenat@inria.fr, Nabil.Layaida@inria.fr