

Working group “Learning and Reasoning”

Where we are

group Kay R. Amel

GDR IA

Fall 2018-Fall 2019: 3 meetings
+ a tutorial presentation at Scalable Uncertainty Management'2019 conference
+ *an ArXiv report*

2020-2021 Covid !!

Today we restart !

Motivations - The current situation

- Reasoning and learning:
two basic concerns at the core of AI
- Since more than 30 years, KRR and ML have been developed *independently* with a *large number* of dedicated *sub-fields*, each with *many technical results*
- It results into an almost *complete separation* of the lines of research in the two areas
- making many researchers on one side *ignorant* of what is going on on the other side

Motivations - The aim of this joint work

- going beyond simplistic dichotomies suggesting a large gap between KRR and ML:
 - KRR deals with *knowledge*, ML handles *data*
 - KRR privileges *symbolic*, discrete approaches, while *numerical* methods dominate ML
- KRR and ML may have *more in common* than one might think at first glance
- the goal pursued is to inventory *meeting points* between KRR and ML

An ArXiv report

From Shallow to Deep Interactions Between Knowledge Representation, Reasoning and Machine Learning

Zied Bouraoui (CRIL, Lens),
Antoine Cornuéjols (AgroParisTech, Paris), Thierry
Denœux (Heudiasyc, Compiègne), Sébastien
Destercke (Heudiasyc, Compiègne), Didier Dubois
(IRIT, Toulouse), Romain Guillaume (IRIT, Toulouse),
João Marques-Silva (ANITI, Toulouse, Fr), Jérôme
Mengin (IRIT, Toulouse), Henri Prade (IRIT,
Toulouse), Steven Schockaert (School of Computer
Science and Informatics, Cardiff), Mathieu Serrurier
(IRIT, Toulouse), Christel Vrain (LIFO, Orléans).

December 2019

Structure of the report

- Common Concerns
- Some Methodologies Combining Reasoning Principles and Learning
- Examples of KRR/ML Synergies
- References

Contents Common Concerns

- Types of Representation
- Computational Complexity
- Lack and Excess of Information: Uncertainty
- Causality and Explainability

Contents Methodologies Combining Reasoning Principles and Learning

- Injecting Knowledge in Learning
- Inductive Logic Programming
- Neuro-Symbolic Reasoning
- Formal Concept Analysis
- Rule-Based Models
- Uncertainty in ML: in the data or in the model
- Case-Based Reasoning, Analogical Reasoning and Transfer Learning

Contents Examples of KRR/ML Synergies

- Dempster-Shafer Reasoning and Generalized Logistic Regression Classifiers
- Maximum Likelihood Under Coarse Data
- EM Algorithm and Revision
- Conceptual Spaces and the Semantic Description of Vector Representations
- Combining Deep Learning with High Level Inference
- Knowledge Graph Completion
- Declarative Frameworks for Data Mining and Clustering
- Machine Learning vs. Automated Reasoners
- Preferences and Recommendation