# Context-sensitive Argumentation for Legal Reasoning

PhD project
Jean-Guy Mailly and Laurent Perrussel

Starting date: September 2024

We look for applicants with a Master degree in computer science, or related disciplines, with a motivation to pursue theoretical research. Background knowledge in artificial intelligence (specifically natural language processing) and knowledge representation would be helpful. Interest for interdisciplinary work is expected as well.

## 1 Research questions

The role of the PhD student will be to work on the following questions:

- Legal reasoning is highly dependent on context. For instance, for a same (general) question, different rules can have a higher priority depending on some specific context, or simply be considered as inapplicable. In order to study argument-based decision in a legal setting, the PhD student will work (in collaboration with lawyers) on the definition of an argumentation formalism that takes into account attacks and supports between arguments as well as context-dependent information, and study computational properties of this formalism.

- In order to apply the formal model studied in the first part of the work, it is necessary to extract arguments and their (context-dependent) relations from real data. Existing argument mining techniques may not be suited to extract from text the kind of information that we want to identify (*e.g.* context-dependent priority between rules). The PhD student will work on the development of such original approaches, using NLP techniques (possibly including Large Language Models).

## 2 Context: formal argumentation, argument mining and legal reasoning

Argumentation is the study of arguments interactions and acceptability, where an argument is a set of reasons (the premises) justifying a claim (*e.g.* a belief or a decision). In the field of Knowledge Representation and Reasoning, formal argumentation has received much attention either in the form of abstract argumentation [Dung, 1995] where one focuses on the relations between arguments in order to assess their acceptability (but ignoring the internal content of arguments), or structured argumentation [Besnard et al., 2014] where one explicitly represent the content of arguments, typically in a logic-based formalism. Various kinds of generalizations of Dung's framework have been proposed, in order to take into account other kinds of information (*e.g.* uncertainty, preferences,

etc.) in the reasoning. A recent overview of the various works in formal argumentation can be found in the Handbook of Formal Argumentation.[1]

The question of obtaining a formal model of argumentation from text (*i.e.* argument mining [Cabrio and Villata, 2018]) is studied in the field of Natural Language Processing. Nowadays, it is possible to extract from textual data the components of arguments (premises and claims) and to predict the relations between arguments (the most classical types of relations are attacks – similarly to what exists in Dung's framework – or supports [Cayrol and Lagasquie-Schiex, 2013]). Recent advancements in the domain rely on (deep) machine learning techniques [Cocarascu and Toni, 2017, Cocarascu, 2019].

The relations between (formal) argumentation and legal reasoning have been emphasized in various works, notably [Bench-Capon and Gordon, 2022, Collenette et al., 2023, Odekerken et al., 2023]. Indeed, legal reasoning is intrinsically an argumentative process which links premises (the particular context of a case, the past cases, the laws and rules, etc.) to a claim (*e.g.* a decision concerning the current case). For this reason, Collenette et al. [2023] showed that using argument-based techniques to model the decisions of the European Court of Human Rights is more efficient than techniques based on machine learning (regarding the accuracy of the model) as well as more easily explainable.

# 3 Job description

The thesis is going to be supervised by Jean-Guy Mailly and Laurent Perrussel from the LILaC (`https://www.irit.fr/LILaC/site/`) group, which are part of the AI Department at IRIT. The PhD student will be given an office and a workstation at University of Toulouse Capitole, at the Manufacture des Tabacs campus located in allée de Brienne.

The PhD student will be expected to conduct research activities leading to publications in scientific conferences and journals, including presenting the work at international conferences. Teaching is possible and encouraged, up to 64 frontal hours per year, and is remunerated around 40 euros per hour on top of the PhD scholarship. Working hours are flexible.

The PhD student will be part of the EDMITT doctoral school, which provides further supervision and training courses (some of them mandatory). For more information: `https://ed-mitt.univ-toulouse.fr/`

As of 2024, the current (gross) salary for PhD students is 2100 EUR.

# 4 Selection procedure

Applicants should send to the contact addresses below their CV, an application letter, a reference letter and any relevant information describing their academic track record. Applicants will be interviewed by the supervisors (*e.g.* in person in Toulouse, or during a Zoom call).

# 5 Contacts

For any question please contact by email Jean-Guy Mailly (`jean-guy.mailly@irit.fr`) and Laurent Perrussel (`laurent.perrussel@irit.fr`).

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[1]`http://www.collegepublications.co.uk/downloads/handbooks00003.pdf`

# References

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J. Collenette, K. Atkinson, and T. J. M. Bench-Capon. Explainable AI tools for legal reasoning about cases: A study on the european court of human rights. *Artif. Intell.*, 317:103861, 2023. URL `https://doi.org/10.1016/j.artint.2023.103861`.

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