

ALMA MATER STUDIORUM
UNIVERSITÀ DI BOLOGNA

Legal, Politological, Economic and Statistical Sciences
PhD in Law, Science and Technology

Cycle 36
Academic Year 2020-2021

1. Who am I

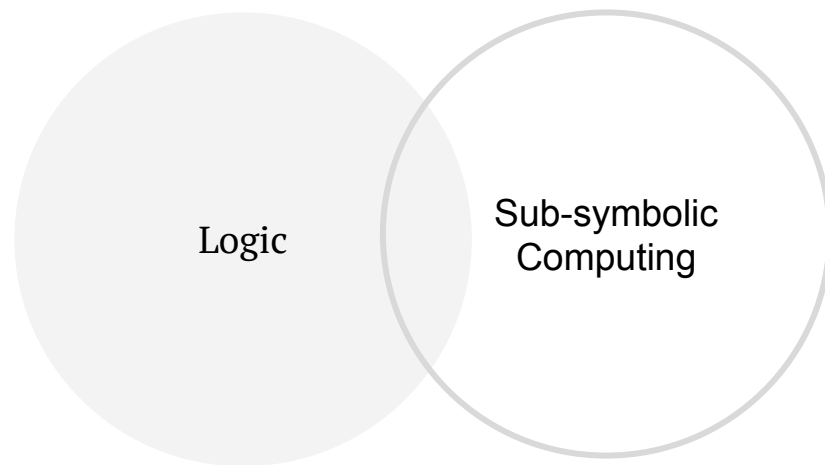
A little background...

My journey

- ▣ I obtained my bachelor's and master's degree in Computer science and Engineering in Cesena
- ▣ I worked as a cloud engineer for the past two years

During my master studies I developed a growing interest in computational logic, then confirmed in my final thesis...

NSC & Explainability



Exploration on the hybridisation of logic and machine learning in the pursuit of a human-understandable intelligent system

2. PhD project

“Legal reasoning: argumentation and explanation”

Background

AI

Exponential growth in the use of techniques related to the field of artificial intelligence.

Pervasive Systems

Massive union of commonly used objects with IT components

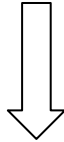
Mixed Society

Creation of a hybrid society. Human and computational agents working together

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Trustworthiness

Explainability assumes primary importance.

Pervasive Systems

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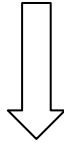
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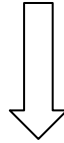


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Scalability

Models suitable for distribution and parallelisation.

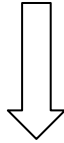
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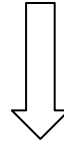


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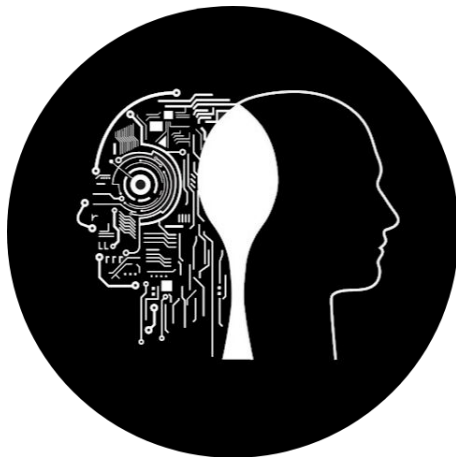
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Common Rules

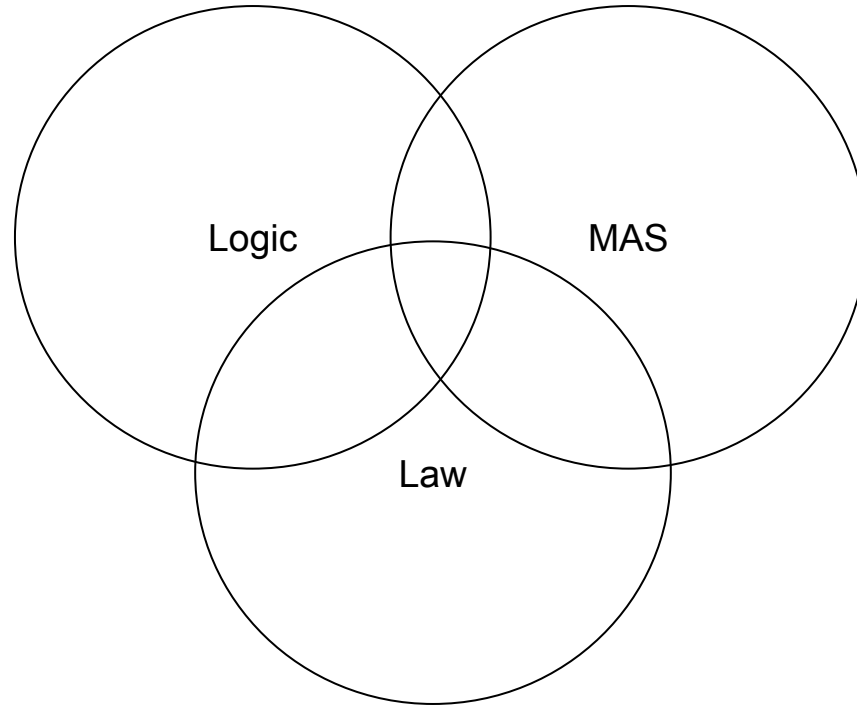
Laws must be coded in a computable format and shared with computational agents.

Desiderata

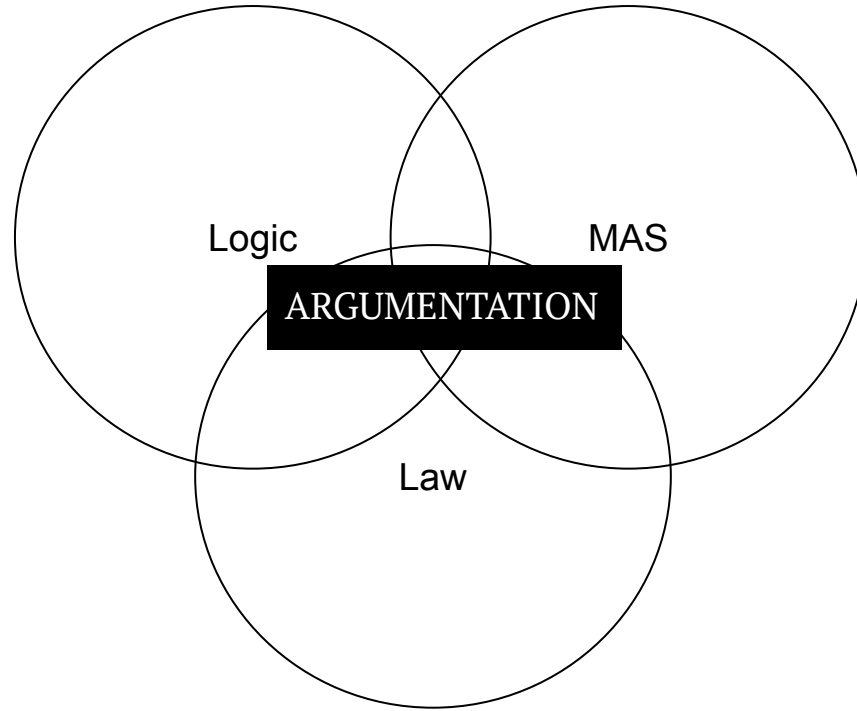


Study possible ways to enable reasoning over empirical data and regulations in a fully distributed context. The resulting model, based both on tools belonging to symbolic and sub-symbolic areas, should guarantee the maximum level of trust to human users.

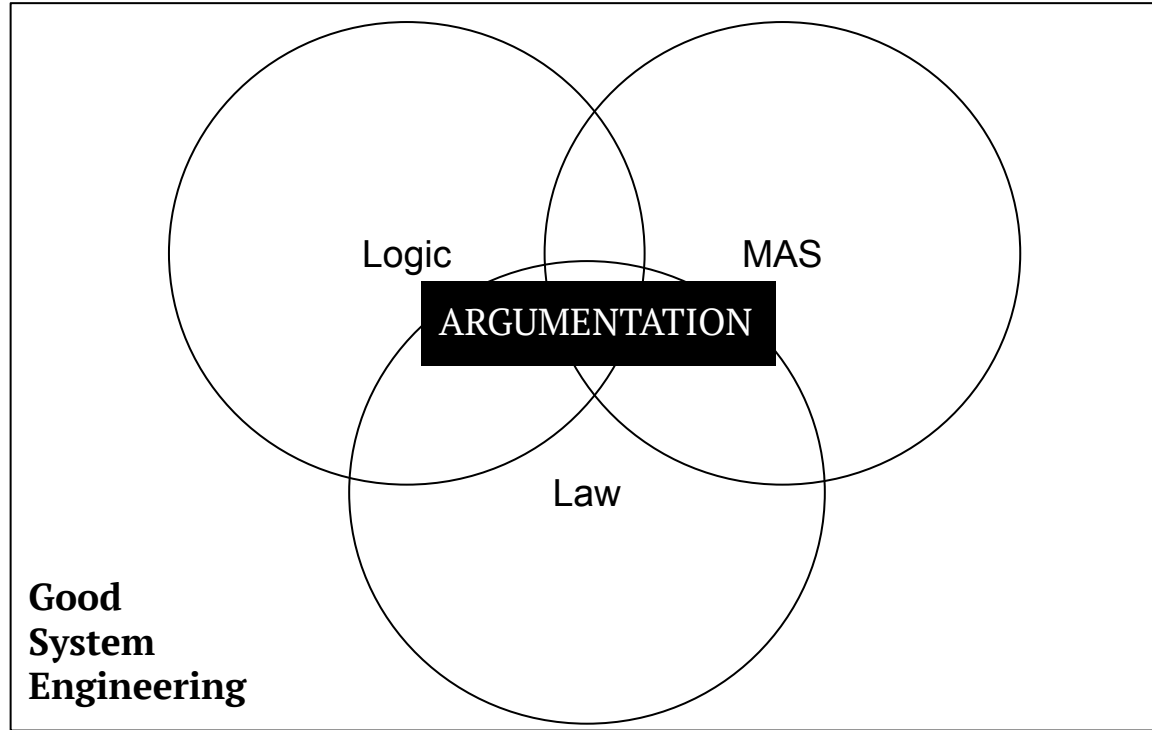
Main Ingredients



Keystone



The Global Frame



General Research plan

First Year

Study of the state of the art: legal analytics, defeasible reasoning and argumentation research fields.

Model design: fundamental abstraction and properties.

Second Year

Exploration of integration of automated learning and symbolic techniques and methods.
Formal model definition.

Third Year

System implementation and testing.
Evaluation of the model in real-world application scenarios

Until now in short

These first 6 months have been mainly spent in studying:

- ▣ Strengthening of my **legal tech** background
- ▣ Exploration of the state of the art in **argumentation** theory from both a **theoretical** and **technological** point of view. Particular attention given to works in the field of **structured argumentation**
- ▣ First **design** and **implementation** of the PhD project technological **backbone**

State of the Art: Argumentation

Exploration in the formal argumentation field

- Abstract argumentation, schemes, labellings
- Extensions (bipolar frameworks, value-based frameworks, preferences, probabilities, ...)
- Meta-Argumentation

and in the structured field with its main models:

- ABA
- DeLP
- ASPIC
- ...

State of the Art: Technological Analysis

Structured argumentation is a flourishing field from a formal point of view but lacking of strong technological reifications.

No available technology satisfies the need of **scalability**, **flexibility** and **modularity** needed for the research.

A new technology: Arg2p

Arg2p is a state of the art implementation of the *ASPIC+* framework for structured argumentation:

- ▣ Solid foundations (**tuProlog**/kotlin)
- ▣ **Deontic** capabilities
- ▣ Support for **strict/defeasible** rules, **weak/strong** negation, multiple **preference-handling strategies**
- ▣ Support for multiple **semantics**
- ▣ Multiple computational strategies: **abstract** and **query** mode

Right now

Currently, we are experimenting on:

- ▣ Use of argumentation in the domain of *procedural rights for criminal proceedings* (**H2020 CrossJustice** project)
- ▣ Models for argumenting over preferences
- ▣ Models and applications of meta-argumentations techniques

Open Paths...

The Arg2p tool enables the experimentation in multiple directions:

- ▣ Argumentation in a **MAS** as a deliberation mean
 - Injection of human crafted rules for a **lawful** and **ethical** behaviour
 - Emergency of **endogenous** rules
- ▣ Argumentation as a vehicle of **explanations** in **human-machine** and **machine-machine** communication

Open Paths II...

The Arg2p tool enables the experimentation in multiple directions:

- ▣ **Distributed** computation for performance boosting and **scalability**
- ▣ Integration of **sub-symbolic** based techniques
- ▣ ...

thanks!

You can find me at
g.pisano@unibo.it