Modular logic & Argumentation in Arg-tuProlog

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Context & motivation I

Dealing with multiple normative systems

Application and enforcement of the law makes it necessary to take into account the interplay of multiple normative systems

→ international contracts and other commercial and social interactions involving different countries

→ coexistence of national legal systems and of various transnational or international laws and conventions

Focus on the field of private international law (PIL):

- deals with the coexistence of multiple normative systems
- its logical analysis has highlighted how can be suitably modelled by modular argumentation [Dung and Sartor, 2011]

  ! not yet been captured and implemented in ready-to-use technology

Context & motivation II

Creating a ready-to-use technology

An extension for the Arg2P framework [Pisano et al., 2020b, Calegari et al., 2020] enabling the use of modular knowledge bases

(i) seamlessly integrate different legal knowledge bases

(ii) support for standard Prolog (*deductive reasoning*) evaluation

(iii) support for argumentation models and semantics (*defeasible reasoning*)

In this paper:

- presentation of the technology
- evaluation in two PIL case studies

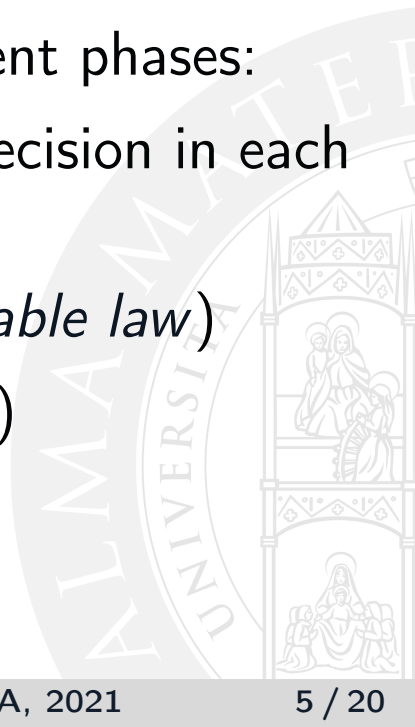
Private International Law I

Private international law (PIL)

Deals with the coexistence of multiple normative systems
$\rightarrow$ tries to establish priorities between them

The decision-making to solve *conflicts* is distributed in different phases:

- identifying which authority is responsible for making a decision in each given case (*jurisdiction*)
- identifying which set of norms should be applied (*applicable law*)
- applying the identified law to the case (*substantive laws*)



Private International Law II

PIL Model

Can be suitably modelled by modular argumentation [Dung and Sartor, 2011]
→ provide a formal model of the interaction among multiple legal systems

- PIL not concerned with specific inconsistencies between rules of different legal systems
- only one legal system will be selected and applied
  - ! regardless of how the others would regulate the same case
- modules where different legal systems are represented separately
  - → legal-system module is further split in separate modules
    1. determining jurisdiction
    2. establishing the law to be applied
    3. providing substantive legal outcomes

Arg2P

Arg2P

A lightweight Prolog-based argumentation framework that combines logic programming and legal reasoning [Pisano et al., 2020b].

It makes it possible to:

- represent legal sources
- argument on conditional norms featuring obligations, prohibitions, and permissions
- consider the burden-of-persuasion constraints that may apply

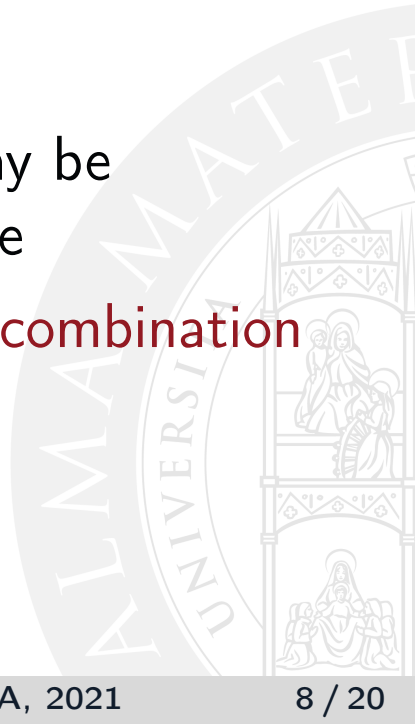
Enabling Modularity I

Modularity support

Arg2P[Pisano et al., 2020a] supports modularity according to the concepts introduced in the PIL logical model [Dung and Sartor, 2011]
→ knowledge organised in distinct modules that can "call" one another

The modularity support enables:

- organization of the knowledge: distinct modules that may be dependent on and/or pertinent to a hierarchical structure
- creation of compound-modules and dynamic evaluation/combination of knowledge from different sources
- modular argumentation



Enabling Modularity II

call_module/2

```
call_module([Module1, ..., ModuleN], Goal).
```

- modules are identified by distinct Prolog files (`.pl` files)
- `Modules` is an input parameter containing the list of the required modules
- `Query` is the query that must be evaluate

The location of the modules must be included in the *root* theory (main module) the predicate `modulesPath(++FileSystemPath)`

→ in case of nested calls, it is not necessary to re-specify the path in the submodules

Enabling Modularity III

call_module/2

```
call_module([Module1, ..., ModuleN], Goal).
```

In details, the predicate:

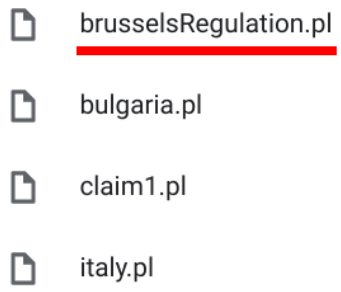
1. creates a new environment containing *only* the required modules data
2. executes the query in the newly created environment
3. feeds the result to the caller module
   - ! the original caller environment is not altered by the procedure

Reasoning on Jurisdiction

Brussels Regulation

Provides common EU rules on jurisdiction
→ some cases where it points to national legislation for the relevant answer

We can transalte the case exploiting the Arg2P modular extension...




```
hasJurisdiction(Article, Country, Court, ClaimId):-
        personRole(PID, ClaimId, defendant), memberState(ML),
        call_module([ML, ClaimId],
          hasJurisdiction(Article, Country, Court, ClaimId)).
hasJurisdiction(Article, Country, Court, ClaimId):-
        claimObject(ClaimId, rightsInRem), memberState(ML),
        call_module([ML,ClaimId],
          hasJurisdiction(Article,Country,Court,ClaimId)).
```

General jurisdiction rule I

The case

Let us consider the case of Marius, an Italian citizen with:

- his primary *residence* in the city of Rome
- his *place of business* in Sofia

```
personRole(marius, claim2, defendant).
personDomicile(marius, italy, rome).
personPlaceOfBusiness(marius,bulgaria,sofia).
memberState(bulgaria).
memberState(italy).
```

General jurisdiction rule II

We consider article 3.1 of the Italian Law No. 218 of 31 May 1995 (Reform of the Italian System of Private International Law)...

```
hasJurisdiction(art3_1, italy, Court, ClaimId) :-
        personRole(PersonId, ClaimId, defendant),
        personDomicile(PersonId, italy, Court).

hasJurisdiction(art3_1, italy, Court, ClaimId):-
        personRole(PersonId, ClaimId, defendant),
        personAgent(AgentId, PersonId),
        personDomicile(AgentId, italy, Court).
```

General jurisdiction rule III

...and article 4 of the Bulgarian Law DB, bp. 42 ot 17.05.2005 r. (Private International Law Code).

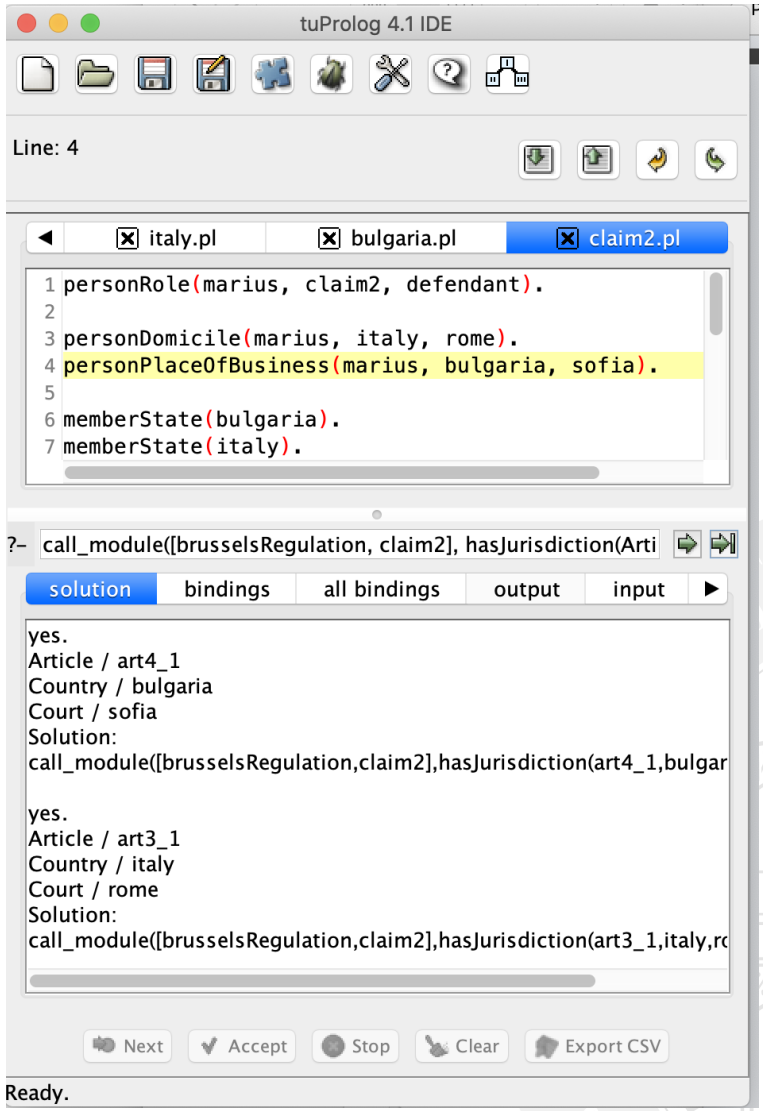
```
hasJurisdiction(art4_1, bulgaria, Court, ClaimId):-
        personRole(PersonId, ClaimId, defendant),
        personDomicile(PersonId, bulgaria, Court).

hasJurisdiction(art4_1, bulgaria, Court, ClaimId):-
        personRole(PersonId, ClaimId, defendant),
        personPlaceOfBusiness(PersonId, bulgaria, Court).
```

General jurisdiction rule IV

We require the evaluation of the case

```
call_module(
  [brussels, claim2],
  hasJurisdiction(Article,
  Country, Court, claim2))
```

Results show how the courts to which the case is assigned are both Rome and Sofia.



Jurisdiction related to rights in rem I

The Case

Let us consider the case of Marius, an Italian citizen:

- owner of two houses, one in Italy (Milan) and the other in Bulgaria (Sofia)
- a claim is brought against Marius with an action concerning his Bulgarian property

```
claimObject(claim3, rightsInRem).
immovableProperty(claim3, bulgaria, sofia).
memberState(bulgaria).
memberState(italy).
```

Jurisdiction related to rights in rem II

We consider article 5 (Actions concerning rights in rem in immovables situated abroad) of Italian PIL...

```
hasJurisdiction(art51, italy, Court, ClaimId):-
        claimObject(ClaimId, rightsInRem),
        immovableProperty(ClaimId, italy, Court).
```

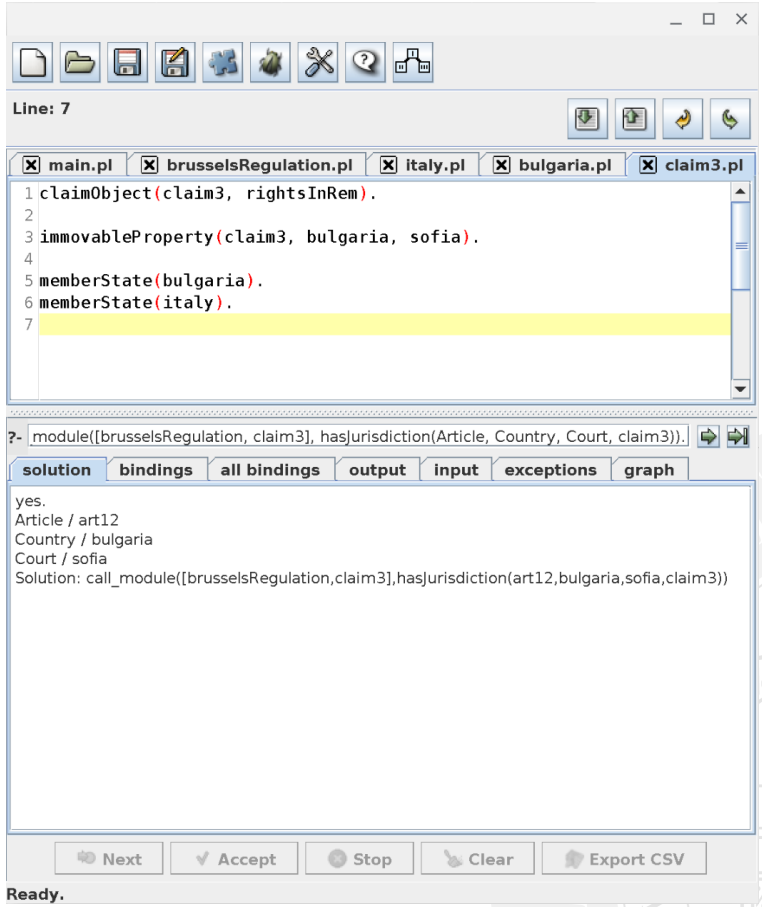
...and article 12 of the Bulgarian Law (Private International Law Code).

```
hasJurisdiction(art12, bulgaria, Court, ClaimId):-
        claimObject(ClaimId, rightsInRem),
        immovableProperty(ClaimId, bulgaria, Court).
```

Jurisdiction related to rights in rem III

We require the evaluation of the case

```
call_module(
  [brussels, claim1],
  hasJurisdiction(Article,
  Country, Court, claim3))
```



Results show how the court to which the case is assigned is Sofia $\rightarrow$ since the immovable property is in Bulgaria, the Brussels Regulation defers to Bulgarian legislation to determine the jurisdiction

Future work

The work needs further analysis w.r.t. the themes of:

- use of argumentation in case of more than one applicable jurisdictions
  - ! determining the most favorable jurisdiction
- reason also on applicable law
- further model legal domains presenting characteristics and issues similar to PIL
  - → internet law
  - → aviation law

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