

The law in AI & law

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Where is the law?

- ▶ unwritten law (in thought and action)
 - ▶ tacit-implicit law (social norms, customs, attitudes)
 - ▶ spoken law (proverbs, parables, commandments, advice)
- ▶ written law (in human-readable form)
 - ▶ hand-written law (Hammurabi, the nine tables, Justinian's digest)
 - ▶ printed law (official gazettes)
- ▶ computable law (in machine-readable form)
 - ▶ electronically stored law texts (in legal databases)
 - ▶ electronically processable law (in computer programs and knowledge bases)
 - ▶ electronically supported law (evidence-based legislation, simulation, etc.)
 - ▶ electronically used and created law (in agents' societies, automatic contracting)

Great opportunities, Great responsibilities for AI & law!!

Where have the lawyers gone?

Why are fewer and fewer lawyers involved in AI & law (especially in the younger generations)

- ▶ the winter of AI (but now it is over)
- ▶ increasing theoretical requirements (in logic, computing, etc.). Lawyers educated in elementary logic can no longer cope (and the uneducated could never cope)
- ▶ legal theorists educated in logic a small minority, and not prominent
- ▶ less curiosity for application to lawyering (mere tools)
- ▶ new areas form computable law where lawyers are not present (multiagent systems, IR)

Can our community still be a bridge between lawyers, legal theorists, and computer scientists?

What is the law?

- ▶ Justinian: “Justice is the constant and perpetual wish to render every one his due”
- ▶ Aquinas: "Law is nothing else than an ordinance of reason for the common good, promulgated by him who has the care of the community”.
- ▶ Hobbes: CIVILL LAW, Is to every Subject, those Rules, which the Common-wealth hath Commanded him, by Word, Writing, or other sufficient Sign of the Will, to make use of, for the Distinction of Right, and Wrong
- ▶ Kant: “the whole of the conditions under which the voluntary actions of any one person can be harmonized in reality with the voluntary actions of every other person, according to a universal law of freedom”

What is the law?

- ▶ Holmes: ‘The prophecies of what courts will do in fact, and nothing more pretentious are what I means by the law’”
- ▶ Austin: “Rules established by political superiors”
- ▶ Romano: an “institution”, namely the “organisation of an ordered society”
- ▶ Kelsen: “normative coercive order”, based upon a basic norm stating that “one ought to comply with a constitution actually issued and . . . efficacious and . . . with the norms actually issued in accordance”
- ▶ Radbruch: “The reality whose meaning is serving the legal idea”
- ▶ Hart: “ rules of behaviour . . . valid according to the system . . . generally obeyed, and, rules of recognition ... of change and adjudication . . . effectively accepted . . . by officials”
- ▶ Dworkin: “an equilibrium between legal practice . . . and the best justification of that practice”

Many further definitions provided by other legal theorists authors,

Is the concept of law relevant to us?

Not so much!

- ▶ Who is to legislate about what is the semantics of “law”? Does conceptual analysis make sense at all? Does meaning determine reference or viceversa?
- ▶ How do we distinguish the meaning of the term “law” from the features that are exemplified by its instances?
- ▶ A normative choice? A pragmatistical choice? The needs of inquiry? The nature of reality?

Whatever it is important that we consider what aspects of this phenomenon we want to address and what aspects we may be successful in addressing, in practice and in theory.

Aspects of the law

- ▶ texts (IR, tagging, consolidation, mining, references)
- ▶ norms (knowledge-based systems)
- ▶ doctrines (views about norms)
- ▶ norm-based reasoning (deduction, argumentation)
- ▶ factual reasoning (probability, argumentation)
- ▶ decisions (cases-based reasoning)
- ▶ relationships between individuals (normative positions, norm-oriented strategies and games, negotiation)
- ▶ concepts (ontologies)
- ▶ interpretation arguments (computational argumentation)
- ▶ interactions (agent-based interactions, e.g. e-commerce)
- ▶ social norms and customs (computer simulations)
- ▶ institutions (norm-governed multiagent systems)
- ▶ ...

What do we want to make computable?

Law as text: legal information retrieval

Input

- ▶ Legal sources (statutes, regulations, cases),
- ▶ relevant documents (e-discovery)

Process

- ▶ boolean IR, statistical IR, conceptual IR, multilingual retrieval, automatic extraction of semantic information, modifications and consolidation

Output

- ▶ selected documents, abstracts

A few references

- ▶ too many (and I am not an expert)

Law as premises set for deduction

Input

- ▶ a set of legal premises (a set of rules) L (law)
- ▶ a set of facts F

Process

- ▶ logical deduction (propositional logic + deontic?)

Output

- ▶ legal consequences, i.e., any (relevant) proposition p such that $L \cup F \vdash p$

A few references

- ▶ Allen (1957), Alchourrón and Bulygin (1971), Yoshino (1978), Allen and Saxon (1991)

Law as premises set for deduction: example

Example

$$\{E_x \text{ Damaged}(y) \rightarrow OE_x \text{ Compensated}(y), \\ E_{Tom} \text{ Damaged}(John)\} \vdash \\ OE_{Tom} \text{ Compensated}(John)$$

Legal knowledge-based system

Input

- ▶ set of rules L (law)
- ▶ facts F (in the KB, extracted by or provided by user)

Process

- ▶ apply norm to facts (backward or forward reasoning)

Output

- ▶ provide an answer A such that $L \cup F \vdash A$

A few references

- ▶ Softlaw, Rulesburst, Oracle's Policy Automation, INDIGO ...

Example

{If THE PERSON damages THE OTHER
Then THE PERSON must compensate THE OTHER
Tom damages John} ⊢
Tom must compensate John

Law as a set of defeasible rules: PROLOG

Input

- ▶ norms L (law) and facts F as extended horn clauses

Process

- ▶ resolution

Output

- ▶ answer A ($L + F \vdash A$)

A few references:

- ▶ Sergot et al. (1986), McCarty (1988a,b)

Example

$\{ \text{mustCompensate}(X, Y)$
 $\Leftarrow \text{damages}(X, Y) \wedge \sim \text{exemptionFromLiabilityToward}(X, Y).$
 $\text{damages}(\text{tom}, \text{john}). \}$
 $\vdash \sim \text{mustCompensate}(\text{tom}, \text{john})$

Law a rule-based argumentation framework I

Input

- ▶ an argumentation framework (rules, assumptions, preferences, contradictions, alternative interpretations, exclusions, values) L
- ▶ facts F

Process

- ▶ construct arguments using L and F (dialogues)
- ▶ assess status (defensible-credulous and justified.skeptical)

Output

- ▶ justified, defensible, or overruled arguments
- ▶ justified-skeptical conclusions p ($L \cup F \stackrel{sk}{\approx} p$) and defensible-credulous conclusions ($L \cup F \stackrel{cr}{\approx} p$)

A few references

- ▶ Prakken and Sartor (1996). Gordon (1995), Hage (1997), Dung and Thang (2008)...

Example

$\{r_1 : \text{damages}(X, Y) \wedge \text{negligent}(X, Y) \Rightarrow \text{mustCompensate}(X, Y)$

$r_2 : \text{medicalCase}(X, Y) \wedge \text{damages}(X, Y) \Rightarrow \text{negligent}(X, Y)$

$r_3 : \text{difficultCase}(X, Y) \Rightarrow \neg r_2$

$f_1 : \text{damages}(\text{tom}, \text{john}); f_2 : \text{difficultCase}(\text{tom}, \text{john})\}$

$\stackrel{sk}{\vdash} \text{mustCompensate}(\text{tom}, \text{john})$

Law a rule-based argumentation framework. Example II

The law is a set of conflicting/prioritised premises allowing for alternative incompatible conclusions according to defeasible inference. Modelling indeterminacy?

Example

$$\begin{aligned} & \{r_1 : \text{damages}(X, Y) \wedge \text{negligent}(X, Y) \Rightarrow \text{mustCompensate}(X, Y) \\ & r_2 : \text{medicalCase}(X, Y) \wedge \text{damages}(X, Y) \Rightarrow \text{negligent}(X, Y) \\ & r_3 : \text{difficultCase}(X, Y) \Rightarrow \neg r_2 \\ & r_4 : \text{difficultCase}(X, Y) \Leftrightarrow \text{beyondStateOfArt}(X, Y) \\ & r_5 : \text{difficultCase}(X, Y) \Leftrightarrow \text{requiringSpecialCompetence}(X, Y) \\ & f_1 : \text{damages}(\text{tom}, \text{john}); f_2 : \text{requiringSpecialCompetence}(\text{tom}, \text{john})\} \\ & \downarrow^{sk} \text{mustCompensate}(\text{tom}, \text{john}); \downarrow^{cr} \text{mustCompensate}(\text{tom}, \text{john}) \\ & \downarrow^{cr} \text{difficultCase}(\text{tom}, \text{john}); \downarrow^{cr} \neg \text{difficultCase}(\text{tom}, \text{john}) \end{aligned}$$

Law a a set of arguments

Input

- ▶ Set of constructed arguments,, connected by various relationship (Law)
- ▶ Argument schemes, critical questions

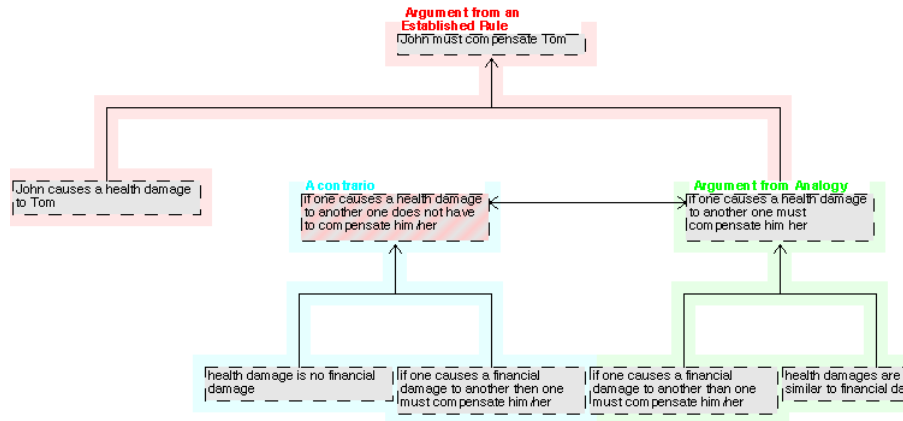
Process

- ▶ classify arguments and their relationships
- ▶ construct argument graph
- ▶ assess arguments

A few references

- ▶ Walton (2005), Walton et al. (2008), Gordon et al. (2007), Gordon and Walton (2009)

Law as a set of arguments



Law as dialogue

Input

- ▶ substantive rules and cases
- ▶ the protocol (procedural law)
- ▶ agents (with their strategies)

Process

- ▶ agents develop arguments
- ▶ state of the dialogue is assessed

Outcome

- ▶ winning arguments
- ▶ decision

A few references

- ▶ Gordon (1995), Walton and Krabbe (1995), Lodder (1999), Verheij (2003), Prakken (2001), Prakken (2010), Riveret et al. (2007),

Law as a set of concepts

Input

- ▶ legal notions, relevant common-sense notions

Process

- ▶ define concepts
- ▶ define relationship

Output

- ▶ set of concepts and relationships (ontologies)

A few references

- ▶ Breuker et al. (1997), Gangemi et al. (2005), Sartor et al. (2011)

Law as a case-based argumentation framework

Input

- ▶ cases (e.g. factors+decisions; facts + rationes +decision) (Law)
- ▶ argument moves (e.g cite cases, suggest hypotheticals)

Process

- ▶ apply moves to cases to answer query

Output

- ▶ argument graph
- ▶ selected argument

A few references

- ▶ Ashley and Rissland (1988), Ashley (1990), Branting (1994), Horty (1999)Prakken and Sartor (1998)

Theory construction

Input

- ▶ rule or case-base T_0
- ▶ set of theory constructors C

Process

- ▶ apply theory constructors to C to T_0 , and generate T_i (using analogies, deformation, rules-out-of-factors, specialisation, generalisation)
- ▶ iterate process

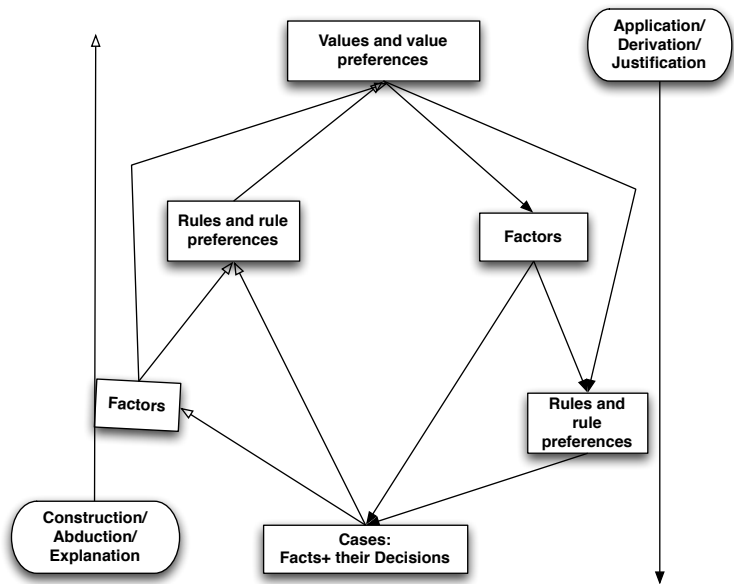
Outcome

- ▶ outcome theories T_1, \dots, T_n , etc.
- ▶ comparison of outcome theories (e.g., according to coherence), to establish which ones are to be preferred, so that its conclusions may be justified or at least defensible

A few references

- ▶ McCarty (1982), McCarty (1995), Bench-Capon and Sartor (2001), Bench-Capon and Sartor (2003)

Theory construction



Metalevel argumentation frameworks

Input

- ▶ a base B of reified norms or cases (Law)
- ▶ a set of inference schemes S (modelled as defeasible rules, including norm-application, analogies, a-contrario, evidence rules, etc.) (Law)

$LRbr : [\phi \rightarrow \psi] \in L \wedge appl_L([\phi \rightarrow \psi]) \wedge satisfied_L(\phi) \Rightarrow \psi_L$

$AL : [\phi_1 \rightarrow \psi] \in L \wedge similar([\phi_1, \phi_2,]) \wedge satisfied_L(\phi_2) \Rightarrow \psi_L$

Process

- ▶ construct arguments by applying schemes S to B
- ▶ assess constructed arguments

Outcome

- ▶ Justified and defensible arguments/conclusions (high indeterminacy)

A few references:

- ▶ Prakken (2005), Verheij (2008), Bench-Capon and Prakken (2010)

Law as including multiple kinds of rules

Input

▶ Basic kinds

- ▶ deontic/permissive: $E_x \text{ Damaged}(y) \stackrel{n}{\Rightarrow} OE_x \text{ Compensated}(y)$
- ▶ constitutive: $E_x \text{ Injured}(y) \stackrel{n}{\Rightarrow} E_x \text{ Damaged}(y)$
- ▶ legality-rules: $\text{legislator}(x) \wedge E_x \text{ Issued}(\phi) \stackrel{n}{\Rightarrow} (\phi \in L)$
- ▶ factors (reasons)
- ▶ goals and values

▶ Complex kinds

- ▶ obligative positions:
 $E_x \text{ Damaged}(y) \stackrel{n}{\Rightarrow} \text{OblRight}_y E_x \text{ Compensated}(y)$
- ▶ power positions: $\stackrel{n}{\Rightarrow} \text{Power}_{\text{Parl}}(\phi \in L, \text{Issued}(\phi))$
- ▶ rights and competences

Outcome (as above) A few references

- ▶ McCarty (1986), Allen and Saxon (1991), Jones and Sergot (1996), Bench-Capon and Prakken (2009), Horty (2001), , Sartor (2010), Sartor (2006), Hage (2011b)Hage (2011a)

Law as an attitude: Neural networks

Input

- ▶ Nodes, their connections, initial weights
- ▶ training set

Process

- ▶ train network

Output

- ▶ trained network, able to process cases

A few references

- ▶ Bench-Capon (1993), Bochereau et al. (1999), Zeleznikow and Stranieri (1995). But neural networks have been used also for other purposes, e.g., measuring coherence.

Law as a dynamical system: Kelsen's idea

Input

- ▶ A fundamental norm, e.g. $n_0 \in L$, where N_0 is a competence norm, e.g.: $n_0 = E_{Leg} Issued(\phi) \stackrel{n}{\Rightarrow} (\phi \in L)$
- ▶ Social facts (sources of the law) F

Process

- ▶ derive further rules belonging to L

Outcome

- ▶ $\{n : L \cup F \vdash n \in L\}$

A few references

- ▶ Yoshino (1995), Governatori et al. (2006), Governatori et al. (2007), Sartor (2008)

NB: temporal aspects are needed, constructive definition (fixed point)

Example

$$L_0 = \{ \text{headOfParty}(x) \wedge E_x \text{Issued}(\phi) \stackrel{n}{\Rightarrow} (\phi \in L) \}$$

$$F = \{ \text{headOfParty}(\text{Esposito}), \text{citizen}(\text{Nancy})$$

$$E_{\text{Esposito}} \text{Issued}(E_{\text{Mellish}} \text{Issued}(\phi) \stackrel{n}{\Rightarrow} (\phi \in L))$$

$$E_{\text{Mellish}} \text{Issued}([\text{citizen}(x) \stackrel{n}{\Rightarrow} OE_x \text{ChangeUnderwearEveryHalfHour}$$

$$L \cup F \quad \stackrel{sk}{\sim} [E_{\text{Mellish}} \text{Issued}(\phi) \stackrel{n}{\Rightarrow} (\phi \in L)] \in L,$$

$$[\text{citizen}(x) \stackrel{n}{\Rightarrow} OE_x \text{ChangeUnderwearEveryHalfHour}] \in L,$$

$$OE_{\text{Nancy}} \text{ChangeUnderwearEveryHalfHour}$$

Pluralism: law as a set of related normative systems

Input

- ▶ set of normative systems: L_1, \dots, L_n
- ▶ relations between them
 - ▶ L_1 may require that L_2 is applied;
 - ▶ L_1 may require that certain cases are decided by the judges of L_2 or according to L_2

Process

- ▶ perform inferences including multiple normative system and their reference, handle conflicts

Outcome

- ▶ single or multiple assessments according to the different system

Reference

- ▶ Modular argumentation? Metalogics? Labelled systems? Dung and Sartor (2010)

Agent-based models of legal behaviour

Input

- ▶ set of agents/roles
- ▶ initial values (included norm endorsement)
- ▶ rules for dynamics (reproduction, imitation)

Process

- ▶ run simulation

Outcome

- ▶ compliance patterns
- ▶ emerging norms
- ▶ evolution of behaviour

A few references

- ▶ Not enough from our community. See AAMAS on electronic institution and similar things. But: Artikis et al. (2002), Artikis et al. (2003), Sartor et al. (2009), Mayor and Sartor (2010)

Hybrid systems

Systems have been developed that address two or more of the above mentioned aspects of the law

- ▶ texts and rules
- ▶ cases and rules
- ▶ rules and attitudes (neural networks)
- ▶ values, rules and cases
- ▶ etc.

A few references

- ▶ Gardner (1987), Rissland and Skalak (1993), Zeleznikow and Stranieri (1995), Bench-Capon and Sartor (2000), Chorley and Bench-Capon (2003)

Conclusion

- ▶ A lot of ways in which the law enters in AI & law
- ▶ the AI & law
- ▶ There are all interesting, not only for our community

Shall we succeed in remaining at the centre of the development of computable models of the law?

Shall we success in exporting these models into other communities while attracting them to ours?

Can we remain (become) the pivot in computational legal research?

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