

*Volume 5, Issue 3, December 2008*

## **AI & Law on Legal Argument: Research Trends and Application Prospects**

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### **Abstract**

*This editorial highlights recent developments and trends in the field of Artificial Intelligence (AI) & Law, including development of computational models of legal argument, rule-based expert systems, information retrieval systems, and the building of practical applications.*

DOI: 10.2966/scrip.050308.449



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Halfway through this year I was invited to serve on *SCRIPTed*'s Advisory Board, since the editors wanted to strengthen the journal's focus on Artificial Intelligence (AI) & Law. I accepted, and a little later I was asked to write an editorial for the present issue on my research interests in AI and the law. How could I refuse...?

The AI & Law research community roughly consists of two kinds of researchers: more theoretically inclined researchers who want to understand legal reasoning by computational means; and more practically oriented people who want to study how information technology can aid legal practice. In this editorial I have chosen to discuss the relation between pure and applied AI & Law research, and I shall do so in light of my own favourite research theme: argumentation.

For a long time, one of AI & Law's central concerns has been the development of computational models of legal argument. It is commonplace in this field that rule-based expert systems, although useful for many applications, do not provide a suitable theoretical model of legal reasoning "when the rules run out". This observation has led to many important theoretical advances; all based on the idea that legal reasoning is adversarial and is about constructing and critically evaluating arguments for and against alternative solutions of a case. Detailed models have been provided of, for example, the role of cases, principles, values and purpose in legal reasoning, of analogical reasoning and of the role of procedure and burden of proof in legal reasoning.<sup>1</sup>

At some point argumentation was even the dominant theme at The International Conferences on AI & Law (ICAIL), pushing traditional research topics such as rule-based expert systems and information retrieval to the periphery as "old-fashioned" or "just applied" research. However, things are changing. While rule-based expert systems and information retrieval systems are in regular practical use, argumentation research is still largely theoretical or results in proof-of-concept computer systems that do not scale up to realistic size. In consequence, argumentation seems to have lost its appeal for many more practically-oriented researchers in this field. Moreover, even the theoretically inclined researchers more often find their topics elsewhere, since research on information retrieval, once regarded as not so exciting, has been revitalised by the spectacular development of the world-wide web, which has put new topics such as information integration and text mining on the research agenda. Information integration is concerned with finding and combining relevant information from various heterogeneous sources (which are abound on the web), while text

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<sup>1</sup> For a recent overview, see T Bench-Capon & H Prakken, "Argumentation" in A Lodder & A Oskamp (eds.), *Information Technology & Lawyers: Advanced Technology in the Legal Domain, from Challenges to Daily Routine* (Berlin: Springer, 2006) 61-80. Some current trends are: reasoning about evidence (H Kaptein et al (eds), *Legal Evidence and Proof: Statistics, Stories, Logic* (Aldershot: Ashgate, 2009)); argumentation schemes, i.e. stereotypical forms of argument combined with stereotypical ways to criticise them (H Prakken, "AI & Law: Logic and Argument Schemes" (2005) 19 *Argumentation* 303-320); theory construction from case bases (A Chorley & T Bench-Capon, "An Empirical Investigation of Reasoning with Legal Cases Through Theory Construction and Application" (2005) 13 *Artificial Intelligence & Law* 9-51); and game-theoretical analysis of legal disputes (R Riveret et al, "Success Chances in Argument Games: A Probabilistic Approach to Legal Disputes" in A Lodder and L Mommers (eds), *Legal Knowledge and Information Systems: The Twentieth Annual Conference of JURIX* (IOS Press: Amsterdam, 2007) 9-108.

mining is about automatically extracting information from unstructured texts (as virtually all texts on the web are). Given the vast number of documents and information sources lawyers are confronted with, this research has large potential practical importance. This explains why a growing number of papers at the field's main conferences – ICAIL and JURIX<sup>2</sup> – are devoted to these topics and why, for instance, the American legal publisher – Thompson-Westlaw – has an AI research department, whose researchers regularly publish at the ICAIL conferences.

That AI & Law research on legal argument has not yet resulted in practical applications is not because the researchers involved would be purely interested in theory. While this may be true for some, others still had a practical vision. For instance, in his book on the influential HYPO case-based reasoning system,<sup>3</sup> Ashley sketched a vision of a system which could support an advocate charged with preparing a case at short notice. The system would be able to accept the facts of the case and then generate arguments for the two sides to the case and counterarguments to them, together with the precedents on which they are based. However, such a system is not yet in practical use at any law firm.<sup>4</sup> The main problem with AI & Law's proof-of-concept systems is that they are critically dependent on the possibility of acquiring a large amount of knowledge and representing it in a form which can be manipulated by the system. This is an instance of the well known “knowledge acquisition bottleneck”, which has proved a major barrier to the practical exploitation of intelligent techniques in many domains. At one time it was expected that this barrier would be lower in the legal domain because of the availability of documented sources, but this has proven to be so only for routine, regulation-dependent tasks.

In fact, the automation of such routine tasks is one of main practical success stories of AI & Law so far. The problem of modelling the text of regulations in computer-processable form has been essentially solved, and this has proved especially useful in public administration. Here the use of rule-based systems can greatly reduce two major sources of errors in the processing of social benefit applications by “street-level bureaucrats”: their incomplete knowledge of the relevant regulations, and their inability to handle the (often complex) conditions of the regulations.<sup>5</sup> This success of rule-based expert systems may be hidden from most legal professionals since these systems are mainly applied within public administration, but it is nevertheless considerable. For example, Softlaw, an Australian company founded by one-time AI & Law researcher Peter Johnson, (which has changed its name several times and is now called Haley) is active world-wide (although it has partly moved into the related areas of business rules and regulatory compliance), and in the Netherlands several companies develop and market rule-based systems for public administration and regulatory compliance.

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<sup>2</sup> JURIX is the Annual Conference on Legal Knowledge and Information Systems, once Dutch, now international and the main AI & Law event in Europe.

<sup>3</sup> K Ashley, *Modeling Legal Argument: Reasoning with Cases and Hypotheticals* (Cambridge: MIT Press, 1990).

<sup>4</sup> Having said that, I very recently received an email from an American practising lawyer who had been attempting to obtain a copy of HYPO, and of CABARET and CATO, two other influential systems for legal argument, so that he could use it in his practice.

<sup>5</sup> P Johnson, “Legal Knowledge-based Systems in Administrative Practice and Electronic Service Delivery” 2000 JURIX-2000 Tutorial Notes.

In my ICAIL-01 conference report,<sup>6</sup> I expressed my fear that if a theoretical research strand like AI & Law research on legal argument leads to no practical spin-off at all, it will eventually die as a field of research (at least in AI). I nevertheless saw some reason for optimism – namely the development of argument structuring systems.

Arguments, as found in case files and judicial decisions, can often be rather complex, so that understanding the web of relationships becomes difficult. There is clear potential for computers to provide a means of addressing this problem. AI & Law has addressed this need in research on argument structuring systems, which are a form of so-called sense-making systems.<sup>7</sup> Such systems avoid the knowledge acquisition bottleneck since they do not have knowledge which they apply to solve a problem. Instead, they support humans in making sense of a problem, by providing tools for structuring (usually visualising) the problem and the user's reasoning in solving it. Some sense-making systems also support communication between different people working on the same problem.

Argument structuring systems have uses in areas where the clear presentation of the argument is of prime importance, such as preliminary fact investigation, teaching or case management. In all these cases, the usefulness of such systems might be increased by integrating them with documentary sources. For instance, when supporting preliminary fact investigation, the structured evidential arguments could be linked to police documents containing the available evidence. Or when used for case management, the software could allow the user to structure a collection of case-related documents in terms of the argumentation structure of a case.<sup>8</sup> The structure would capture: the main issues; the main positions and arguments taken by the parties with respect to the issues; the available evidence related to them; and so on. Incoming documents could be indexed according to this structure and new documents (either outgoing documents or internal analyses of a case) could be drafted according to the same structure and linked to relevant background documents (statutes, case law, journal articles, testimonies, letters, and so on). Work on argumentation schemes can further augment the usefulness of such systems. When constructing arguments, argumentation schemes provide a repertoire of forms of argument to be considered, and a template prompting for the pieces that are needed; when attacking arguments they provide a set of critical questions that can identify potential weaknesses in the opponent's case. Two research systems that support the use of argumentation schemes are Avers and Araucaria.<sup>9</sup>

Since argument structuring systems avoid the knowledge acquisition bottleneck, they scale up to realistic size more easily than knowledge based argumentation systems.

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<sup>6</sup> H Prakken, "The Spirit of St. Louis – An ICAIL-2001 Report" (2002) 19 *BNVKI Newsletter* 18-120, available at <http://www.cs.uu.nl/groups/IS/archive/henry/icail01report.html> (accessed 12 December 2008).

<sup>7</sup> See P Kirschner et al. (eds.), *Visualizing Argumentation. Software Tools for Collaborative and Educational Sense-Making* (London: Springer Verlag, 2002).

<sup>8</sup> M Lauritsen, "Intelligent Tools for Managing Factual Arguments" in G Sartor (chair), *Proceedings of the 10th International Conference on Artificial Intelligence and Law* (NY: ACM Press, 2005) 95-104.

<sup>9</sup> C Reed & G Rowe, "Araucaria: Software for Argument Analysis, Diagramming and Representation" (2004) 13 *International Journal of AI Tools* 961-980. An overview of various argument-structuring tools and their legal applications is given by C Reed et al, "Argument Diagramming in Logic, Law and Artificial Intelligence" (2007) 22 *The Knowledge Engineering Review* 87-109.

Moreover, there is every reason to believe that such systems may fulfil practical needs. For instance, in the investigation of crime, the need of crime analysts for software tools for structuring their thinking and discussions is well documented. Currently, many of them already use more basic commercial sense-making software, such as *Analyst's Notebook*. However, such software typically only allows them to structure the available evidence into object-event-relation schemes and timelines. There is no support for structuring scenarios about what may have happened and their relation with the available evidence. In a research project at Groningen and Utrecht we aim to overcome these limitations by designing a structuring tool (called Avers) for crime analysts that supports combined abductive reasoning for formulating scenarios and argumentation for linking these scenarios to evidence.<sup>10</sup> It is encouraging that during this project we have been contacted several times by police officers who had found out about our project on the web.

But there is more evidence that argument structuring systems may fulfil practical needs. Reed's Araucaria system has been used by Canadian magistrates in Ontario, Canada, for drafting their decisions; they especially found the system's support for argumentation schemes and their critical questions useful as a checklist.<sup>11</sup> In January 2007, Tillers (one of the first who saw the legal potential of argument structuring software) organised a conference at Yeshiva Law School, New York, where a mixture of legal practitioners and academics discussed the benefits of graphic and visual representations of evidence and inference in legal settings. At this conference, van Gelder, the director of *Austhink*, an Australian company that is a spin-off of research on teaching applications of argument visualisation, told the audience that an Australian law firm had been using his software to support a team of solicitors in preparing a case. Recently, a large Dutch public office that manages the processing of social security legislation contacted me to see if an argumentation-based assessment scheme for working with disability benefit can be developed and supported with argument structuring software. Finally, two weeks ago my PhD student, van den Braak, who works on the Avers system, was called by a civil servant of the Dutch ministry of Social Affairs and Employment, who wanted to buy the Avers system for applications within the ministry. Although this phone call, like the email of the American solicitor about HYPO, reveals a mismatch between practitioners' expectations of our field and what we can currently deliver, it nevertheless clearly illustrates the practical potential of argument structuring software.

Besides bringing AI & Law's argumentation models closer to practical application, argument structuring systems also generate interesting new research issues. One such issue arises from the fact that AI & Law's heavy-weight formal encoding schemes for arguments are less suitable for argument structuring applications. As a result, recent research has turned to the analysis and light-weight structuring of natural-language argumentation.<sup>12</sup> There is even some recent research on automatically extracting

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<sup>10</sup> For more on this, see F Bex et al, "Sense-making Software for Crime Investigation: How to Combine Stories and Arguments?" (2007) 6 *Law, Probability & Risk* 145-168, and S van den Braak et al, "AVERs: An Argument Visualization Tool for Representing Stories About Evidence" (2007) in A Gardner (chair), *Proceedings of the 11th International Conference on Artificial Intelligence and Law* (NY: ACM Press, 2007) 11-15.

<sup>11</sup> Personal communication with C Reed.

<sup>12</sup> See J Sombekke et al., "Argument Structures in Legal Dossiers" in A Gardner (chair), *Proceedings of the 11th International Conference on Artificial Intelligence and Law* (NY: ACM Press, 2007) 277-

arguments from case law decisions.<sup>13</sup> It would be fascinating if such text mining techniques could be combined with argument structuring systems, so that the structures could be automatically extracted from the relevant documents.

In any case, in my opinion the holy grail of AI & Law research on legal argument is to embed natural and flexible representations of legal arguments in formal and rigorous models of legal argument.

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281; K Akinson (ed) (2008) 16 *Artificial Intelligence & Law* (Special Issue on Modelling Legal Cases); R Mochales Palau & M-F Moens, "Study of the Structure of Argumentation in Case Law" in G Sartor (ed), *Legal Knowledge and Information Systems: The Twenty-first Annual Conference of JURIX* (Amsterdam: IOS Press, 2008); and the JURIX-08 Workshop, "Natural Language Engineering of Legal Argumentation", which will probably have a second edition at ICAIL-09 in Barcelona.

<sup>13</sup> M Moens et al, "Automatic Detection of Arguments in Legal Texts" in A Gender (chair), *Proceedings of the 11th International Conference on Artificial Intelligence and Law* (NY: ACM Press, 2007) 225-230.