Legal Ontology of Contract Formation:

Application to eCommerce

John W. Bagby and Tracy Mullen

School of Information Sciences and Technology
The Pennsylvania State University, University Park PA U.S.A.
{jbagby, tmullen}@ist.psu.edu

Abstract

Artificial intelligence (AI) has diffused slowly into law, regulation and public policy. The development of complex, reasoning-based applications may be impeded by the structure of legal knowledge that is unlike many other learned professions and scientific domains, law is completely dependant on natural language for the identification of salient factors and determining principles making it difficult to construct necessary or sufficient conditions to produce definite outcomes. Further AI developments in law, regulation and public policy may require much more concentrated effort in representing legal rules, case interpretations and practitioner insights into ontologies. This paper describes our ongoing conversion of previously existing expert systems governing contract formation derived from the Uniform Commercial Code, while integrating electronic contract formation under the Uniform Electronic Transactions Act, into a knowledge-based system using the Web Ontology Language OWL.

Introduction

Artificial intelligence (AI) has diffused slowly into law, regulation and public policy. This research recognizes that AI is inherently interdisciplinary in the law domain requiring domain expertise in both AI and law. Useful expertise in law may come from legal experts and from process observation.

Statutes are legislation embodied in codes, such as the Uniform Commercial Code (UCC) discussed here. Codes may be ideal AI and ontology focci because adapting them to relationship linking and rules-based encoding is transparent. AI cannot rely solely on encoding formal code structure because such efforts are incomplete. They miss practitioner expertise dependant on key relationships and decision heuristics of practitioners and process experts from sociology, political economics, logistics and operations research. The UCC is modeled here because it represents a useful middle ground that overcomes the limitations of reliance on formal code. The UCC is essentially a composite of experience and formalism. The UCC has a unique heritage, derived from the Law Merchant and Lex Mercatoria, essentially codifications of actual practice. The UCC is not primarily a normative codes drafted by inexperienced legislators. AI work on real-world statutory codes like the UCC has both the coding advantages of statutes but is enlightened by realistic experience from development in real-world settings.

This paper describes conversion of an expert system on law from the UCC that covering contract formation, specifically the "Battle of the Forms" problem that resolves the mismatches between contract terms in written offers, acceptances and confirmation. The expert system is being represented in a knowledge-based system using the Web Ontology Language OWL with Jess as inference engine.

Successful Legal Ontology Development

Despite difficulties there have been several interesting experiments in legal AI including some notable functional systems. Consider the complex but deterministic, rules-based systems in commercial tax preparation. Good progress has been made in user assistance from proprietary legal research databases such as Lexis and Westlaw in leveraging traditional legal ontologies. There are numerous electronic transaction processing systems in government found all over the world that assist citizens and regulated entities using AI technologies in areas such as licensing and intellectual property (IP) rights.

New services developed by legal research databases are good predictors of successful AI and ontology work in law because such profit-seeking information services likely invest in AI innovation where a reliable cash flow is predicted. Proprietary databases automate and enhance traditional strategies using key word in context search and retrieval, natural language queries, relevance prioritization with reliability measures, and easy resumption of prior query direction. Recent AI advances permit users easy access to context and subject-sensitive information.

AI Challenges in the Law Domain

The structure of legal knowledge inhibits more complex, reasoning-based AI applications. Many learned professions

and scientific domains differ from law, which is not generally derived from empirical research. Law is an open textured domain requiring AI techniques to classify, link and automate reasoning. Further developments in legal AI may require concentrated effort that starts with the formal statutory structure of legal rules, then modifies with case interpretations and practitioner insights into ontologies.

As in some other professional domains, AI in law runs a malpractice liability risk. AI inference holds promise to improve practitioner reasoning, particularly from the exhaustive search capability. AI in law will likely remain imperfect as sufficient and complete substitute for experienced professional practitioners [Hassett]. Lamkin hypothesizes that legal liability may befall owners or operators of expert systems in medicine if there are misdiagnosis or treatment errors [Lamkin]. There is no good reason to distinguish law from the medical context if a liability shield for AI systems is necessary. Judge and Professor Posner suggests the difficulties of any AI system in predicting legal outcomes beyond the role as assistants useful in organizing and seeking information. Posner notes there are many sources for expertise needed for the inference process. [Posner]

Existing legal AI experiments recognize that legal knowledge is first derived from formal law in constitutions, statutes and regulations. Next it must be interpreted in actual cases as precedents. Finally, this doctrinal legal research must be interpreted through experience of various domain experts. Complexity is increased because law differs between states and among nations. Legal advice based on legal research draws upon huge collections of statutes, legislative history, regulations and cases issued by thousands of discrete authorities. All these sources are raw data that require expert interpretation before constituting reliable advice. With law broken down into manageable-sized sub-domains it becomes more susceptible to internal consistency and coherence and less effected by external domains. Consider Groothuis postulate that expert systems in law should provide advice and decision support for more manageable sub-domains such as government-administered social insurance in the Netherlands [Groothuis]. Also consider the decision support expert system in New York that assists prosecutorial choice of cases to investigate and prosecute [Hassett]. Another example is the assessment of evidence in litigation by Levitt [Levitt, et. al.] .

Legal Ontologies Reflecting both Formal Rules and Actual Practice

AI and ontologies in law hold the strongest promise assisting in legal research and inform legal reasoning with quality control as the major objective. Rissland argues that "AI focuses a spotlight on issues of knowledge and process to a degree not found in non-computational approaches." [Rissland] Aikenhead argues that "It is obviously a prerequisite to know what the nature of law is and what the process of legal reasoning involved before incorporating legal knowledge in a computer and making the computer manipulate that knowledge to emulate the legal reasoning process, i.e., the results achieved by lawyers." [Aikenhead] It follows that ontologies are robust when they enrich the deterministic structure of statutory law. Governing statutory codes are the starting places for much AI work. The enhancement of formal law requires two additional levels of domain knowledge. First, case law interpretations add detail and require expert interpretation. Second, heuristics of seasoned practitioners, regulators, litigators, judges, legislators, sociologists, political economists and others are usually relevant heuristics. Consider how Aoki et. al. enhanced an existing general ontology with a case ontology automatically constructed from precedents using international law governed by the Vienna Convention on the International Sales of Goods (CISG) [Aoki, et. al.].

Commercial Law Blending Formal Specificity with Compilations of Reliable Experience

It is unfortunate that very few codes statutes are drafted to facilitate search, analysis or modification by computer. There are clear design benefits for domain with modular organization.. Nevertheless, Blackwel believes there are benefits in object-oriented analysis and design in AI when the domain involves "complex relationships among distinct concepts. [This] structure will allow close consistency with both the real-world situations addressed, and the legal principles applied, by the statute." [Blackwel] Still, there are some better organized codes that transcend a hodge-podge, historical accumulation of political compromises. For example, the Law Merchant and the UCC are models that improve the potential for adaptation through ontologies into AI. First, the UCC is a well-organized code derived from best practice experience accumulated over centuries of commercial conduct making it a codification of practice. The UCC bridges the gap between legislatively prescribed conduct and actual behavior. Ontology based on the UCC are inherently more robust because many details from experience are included. Second, the UCC is organized in modular form enabling analysis and ontological representation. The CISG is derived from the UCC so it promises similar benefits. This research addresses the "battle of the forms" problem in which commercial contract counter-parties construct self-serving documents that usually diverge with at least some terms in disagreement. The UCC §2-207 provides a regime for resolving these disparities reflecting common practice codified as formal law and is adjusted by practitioner heuristics.

UCC Domain Ontology

Ontologies provide an explicit representation of and semantics for domain concepts and properties. This allows for more natural collaboration between humans and computer, and for intelligent automation by software

agents [Berners-Lee]. In the legal domain, there are two different, but complimentary, ontology modeling approaches. The first approach can be characterized as building a "lawyer's ontology". Kabilan and Johannesson's ontology [Kabilan et. al.] draws from international contract law, and represents its conceptual model using the Unified Modeling Language (UML) [UML]. This UML representation can be transformed into various semantic web ontology languages. The second approach follows a "law in practice" or process-based approach based on actual practice for representing legal contracts. The MIT Process Handbook provides the actual business process knowledge used by SweetDeal [Grosof et. al.] encoded in semantic web languages such as DAML+OIL [DAML+OIL] and RuleML [RuleML]. One of their goals is to allow intelligent software agents to play a larger role in automating, creating, assessing, negotiating and performing such contracts.

The day to day practice of law combines existing law, practical experience, and various cultural, political, and economic factors. When new situations arise, such as electronic commerce, the law must be updated both by extending it in a coherent manner and through a case-by-case learning of new practices. The U.S.'s UCC is just such a hybrid model that we hope will allow us to build a composite "lawyer's ontology" that has been refined with law from actual practice.

An existing expert system on contract formation under UCC [Bagby], see Figure 1, provides us with our initial framework for ontology. Our focus area is the "Battle of the Forms" (UCC 2-207), which defines when mismatches between contract terms still allow for a legal contract to exist. Since the original expert system was intended to be used by lawyers who understand basic domain concepts, our first step in transforming this system into a knowledge-based system requires incorporating de jure formal terms and rules from UCC Article II into the legal ontology. Our eventual goal is to explore how it can be useful for electronic agents to navigate.

The ontology is being built in Protégé [Noy et. al.] using the OWL Web Ontology Language [OWL]. For each domain concept, we attach a definition from either UCC Article II code, standard textbook or other authority. Thus for Merchant, we have a description paraphrased from UCC 2-104. In the future, we would like to link to a Legal Dictionary such as the European Legal RDF Dictionary [LEXML]. Currently we are defining necessary property relationships, such as the "hasSpecialDuties" property of merchants, shown in Figure 2. This property helps capture that UCC Battle of the Forms assumes that merchants can assume additional duties to make contract formation more flexible that non-Merchants should not have to assume. Figure 3 shows our current prototype UCC ontology. Our next steps are 1) to further define properties and property restrictions, and 2) to incorporate Jess (via JessTab in Protégé [Eriksson]) to reason over individual contracts. In step 2, we will start by essentially recreating the existing expert system as an information retrieval system, but defining the rules based on the underlying ontology terms rather than on human understanding.

Conclusion and Future Research

In this paper, we describe our rationale for selecting the UCC commercial laws as the basis for developing a contract formation legal ontology. We describe our initial work on creating a legal ontology for this domain. The authors plan on extending this work to consider several sources of electronic commerce laws that have been implemented in the European Union and the United States. For example, the EU Directive in Electronic Commerce (Dir 2000/31/EC) and the Uniform Electronic Transactions Act (UETA) in the United States are developing sufficient rigor to deserve attention, particularly given their focus on automated transactions, concluded by electronic means including electronic agent activities. Follow-on work will address the impact of deploying intelligent software agents as full-fledged legal persons engaged in these types of transactions. This future work will perform exploratory modeling of additional parts of UETA that acknowledge the validity of electronic agent usage and thereby address some of the barriers to e-commerce presented by traditional rules.

References

Aikenhead, Michael, *The Uses And Abuses Of Neural Networks In Law*12 Santa Clara Computer & High Tech. L.J. 31, February 1996.

Aoki, Chizuru, Masaki Kurematsu & Takahira Yamaguchi, *LODE : A Legal Ontology Development Environment* (1998).

Bagby, John, *Artificial Intelligence in Sales Law: A Decision Analysis Approach To Commercial Transactions*, Working paper in Center for Research, College of Business, The Pennsylvania State University, 87-1, March 1987.

Berners-Lee, T., Hendler, J., and Lassila, O., *The Semantic Web*, Scientific American, May 2001.

Blackwel, Thomas F., *Finally Adding Method To Madness: N1 Applying Principles Of Object-Oriented Analysis And Design To Legislative Drafting* 3 N.Y.U. J. Legis. & Pub. Pol'y 227 (1999 / 2000

DAML+OIL, http://www.w3.org/TR/daml+oil-reference/.

Eriksson, Henrik, *Using JessTab to Integrate Protégé and Jess*, IEEE Intelligent Systems, March/April 2003, pp 43-50.

Grosof, B. N., and T. Poon, *SweetDeal: Representing Agent Contracts with Exceptions using XML Rules, Ontologies, and Process Descriptions*, WWW 2003, Budapest, Hungary, May 20-24, 2003.

Groothuis, Marga M. *Expert Systems In The Field Of General Assistance: An Investigation Into Juridical Quality*, 52 Syracuse L. Rev. 1269 (2002).

Hassett, Patricia, *Essay: Technology Time Capsule: What Does The Future Hold?* 50 Syracuse L. Rev. 1223, 2000.

Kabilan, V., and P. Johannesson, *Semantic Representation of Contract Knowledge using Multi tier Ontology*, SWDB 2003, pp 395-414.

Lamkin, Brian H., *Comments: Medical Expert Systems And Publisher Liability: A Cross-Contextual Analysis*, 43 Emory L.J. 731, Spring, 1994.

Levitt, Tod S. & Kathryn Blackmond Laskey, *Symposium: From Theory To Practice: "Intelligent" Procedures For Drawing Inferences In Static And Dynamic Legal Environments: Computational Inference For Evidential Reasoning In Support Of Judicial Proof*, 22 Cardozo L. Rev. 1691(July, 2001).

LEXML, http://www.lexml.de/rdf.htm.

Noy, Natalya F., Michael Sintek, Stefan Decker, Monica Crubezy, Ray W. Fergerson, and Mark A. Musen, *Creating Semantic Web Contents with Protégé-2000*, IEEE Intelligence Systems, March/April 2001, pp 60-71.

OWL, http://www.w3/2001/sw/webont.

Posner, Richard A. *The Jurisprudence Of Skepticism*, 86 Mich. L. Rev. 827, April, 1988.

Rissland, Edwina L. *COMMENT: Artificial Intelligence and Law: Stepping Stones to a Model of Legal Reasoning*, 99 Yale L.J. 1957 (June, 1990).

RuleML, http://www.ruleml.org.

UML, http://www.uml.org.

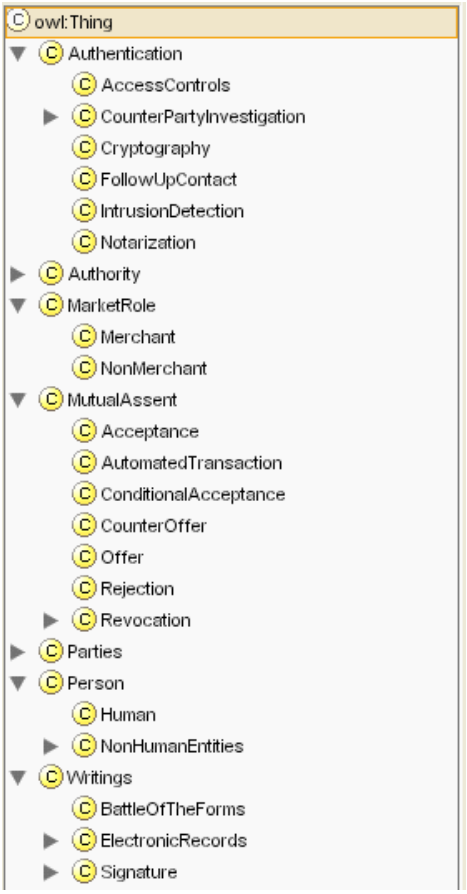

Figure 3: Prototype UCC-based Contract Formation Ontology

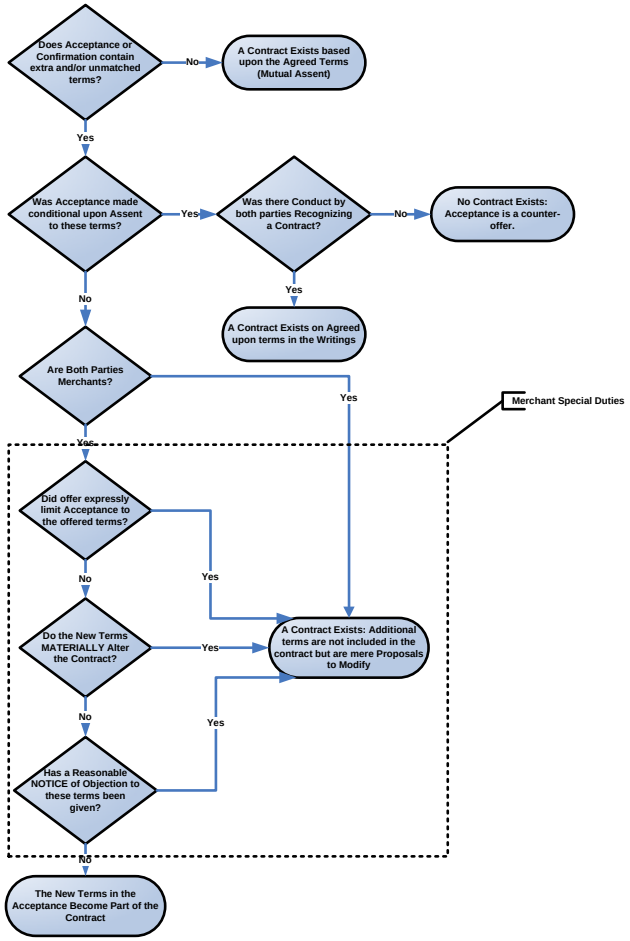

Figure 1: Original Battle of the Forms expert system

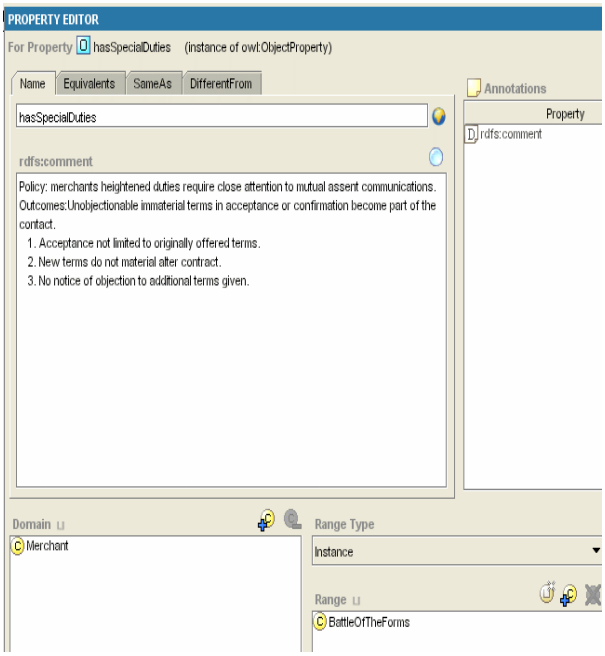

Figure 2: Merchant property of “having special duties”