Combining Analogies and Deductions in Legal Knowledge Base Systems - IKBALS II

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Introduction

Legal reasoning is an intellectual process by which lawyers and judges use cases and rules to solve legal problems. Legal practitioners primarily combine two forms of reasoning when dealing with litigation: reasoning by analogy and reasoning by deduction.

This paper describes these two forms of legal reasoning in the context of building Legal Knowledge Base Systems (LKBS) or Expert Systems (ES). The aim is to build an automated litigation support system to allow lawyers to retrieve intelligently and analyze the sources of the law, namely statute and case law, so as to argue their clients case in court successfully.

Motivation for commitment to LKBS

The use of the computer to assist lawyers, judges, and the courts themselves, is not new. Important applications of computers in the legal profession include time recording, billing and document processing systems. Countries like Australia have installed computerized networks in some of their courts (for example the Victorian Magistrates' Court) to help judges with the day to day administration of justice. Other countries have introduced computerized systems which allow judges to receive assistance with sentencing by retrieving a list of recent sentences handed down in previous similar cases.

However, the major use of such computers in law is currently legal information retrieval (also referred to as indexing of legal text). These systems usually comprise on-line databases containing text in the form of legislation, precedent cases and reports.

While such computerized tools are helpful to lawyers for the retrieval of legal material, many believe that they are not very useful in litigation support [Martino & Socci Natali, 1986]. That is, the use of boolean queries is not sufficient to express concisely, or indeed express at all, the query of the lawyer. As a result, searches deliver an excess of irrelevant documents or fail to retrieve the bulk of those relevant texts that are in fact stored within the database. [Gordon, 1988] reports on the difficulties of applying boolean query languages to legal retrieval.

There has therefore been a gradual appreciation by many in the field that it is now necessary to attempt to develop computer systems in law that can be said to embody knowledge, that is, exhibit intelligent behaviour. Such systems could help lawyers with generating plausible arguments for their case, *inter alia.*

With the development of analogical and case based reasoning in law, [Ashley & Rissland, 1988] and [Riesbeck & Schank, 1989], software tools are only now becoming available to make it worthwhile to consider developing automated legal reasoning systems to help with litigation support. The books of [Riesbeck and Schank, 1989] and [Kolodner, 1988] describe numerous legal case based reasoning systems. Judge [Bain, 1986], works in the domain of criminal sentencing attempting to model a judge who is determining sentences for people convicted of crimes; HYPO [Ashley and Rissland, 1988; Ashley, 1990], does case based reasoning in the area of patent law generating plausible arguments for the prosecution or the defence; and Persuader [Sycara, 1987], proposes resolutions for dispute situations.

The authors of this paper support using case based reasoning techniques like the one proposed by

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[Ashley & Rissland, 1988] in attempts to model the highly qualitative legal process. Furthermore, they believe that it is essential that any intelligent legal reasoning system has the ability to couple the reasoning methods employed by lawyers; namely combining deductive reasoning (rule based systems) with analogical reasoning (case based reasoning) systems. Such facilities are necessary in order to allow legal practitioners intelligently to access and analyze statutes and precedents.

Current LKBS

Until recently, most attempts at building LKBS have relied on using the standard deductive ES architecture, consisting of a knowledge base, an inference engine and a user interface. They are similar to those systems used for modelling intelligent behaviour in highly quantitative domains such as medicine, finance, manufacturing and oil exploration. These legal ES have relied on "if-then" production rules [Waterman & Peterson, 1986], [Schlobohm & Waterman, 1987], or logic [Sergot et al, 1986], as the basis of knowledge representation. Although modest systems have been build using the standard ES architecture [Susskind, 1987], such systems have failed to gain the use and support of legal practitioners. A major reason for this is the highly qualitative nature of law. From the point of view of building LKBS, one must be prepared to supplement deductive reasoning with other forms of reasoning, namely analogical, temporal, and fuzzy reasoning in order to effectively deal with the 'open-textured' nature of the law. These processes allow the lawyer to:

- locate relevant norms from a piece of legislation (deductive reasoning);
- retrieve relevant precedent cases (analogical reasoning);
- allow amendments to be easily incorporated in the knowledge base: including the time when such amendments were passed (temporal based knowledge);
- give probabilities that a certain line of legal reasoning will be successful in court (fuzzy reasoning)

Hence, not only are most legal information retrieval systems of minimal utility to lawyers, but so are most LKBS because of the mere fact that their architecture is not flexible enough to allow the type of hybrid reasoning needed to aid lawyers with litigation.

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Incentives for Developing IKBALS II

Legal practitioners are in general not solely interested in the likely outcome of a court case. They are more concerned with providing support to argue the case that their client wishes to put forward, although admittedly they do encourage their client to pursue a path that has a reasonable chance of success. Hence what is really needed is a litigation support system which will allow the lawyer to navigate through the vast amount of legal sources available, permitting him to find the relevant rules and precedent cases to successfully argue his client's case.

Instead of having the LKBS drive the consultation, the system needs to be able to advise the lawyer on the probable outcome of pursuing each possible course of action (hence the need for fuzzy reasoning). The system also needs to take into account the fact that statutes regularly change and hence it will be necessary to develop knowledge bases that have a temporal aspect. Such a system will be able to:

- identify the relevant legal norms;
- identify the relevant precedent cases for the particular dispute at hand, in a reliable efficient manner, from a very large number of possible cases;
- having identified the relevant precedent cases, compare it with other cases in the system, and in particular, distinguish the current case from others whose conclusions run to the contrary;
- suggest arguments which can be made in favour of the current case and the facts and precedents which can be cited to support them.

IKBALS II is an attempt at providing such facilities to lawyers.

Using Cases and Rules

A legal rule is an abstract or general statement of what the law permits or requires of classes of people in classes of circumstances. A case on the other hand represents a short story of an incident in which the state acted or may act to settle a particular dispute [Burton, 1985]. Expressions of the law take the form of both rules and their interpretation and cases (particular instances of rules).

To persuade a court what it should do in a current case, a lawyer points out what courts have done in other, similar cases. The practice of com-

paring and contrasting cases is seen to be more advantageous than using rules, as cases supply particularities that general rules leave untreated [Levi, 1948].

Forms of Legal Reasoning

In Australia, Parliament drafts the laws and the courts interpret the laws with the assistance of the common law when appropriate. The courts also interpret the law where parliament has left a gap, e.g. legislation covering murder under the Crimes Act is relatively short, but the precedent base and literature about it is voluminous. Hence lawyers, when considering a particular dispute, normally try to find all the relevant cases to that particular dispute. They then extract the applicable principles or interpretations from these previous cases in order to form a judgement as to whether to proceed with the dispute. If so, they then develop an argument in support of their position in the dispute and anticipate counter arguments used by the other party. By this method lawyers reason analogically.

Some means of organizing the overwhelming mass of legal material a lawyer must process when reasoning about a case is essential. Generally speaking, it is difficult to express such knowledge simply as production rules. It appears therefore that in modelling legal reasoning, one requires the doctrines of the law (e.g. Habeas Corpus, Mens Rea, negligence); the particular statutes; and the legal arguments and particular facts contained in precedents.

Whilst there might be some chance that rule based or logic based systems could capture some of the elements of the statutes, it is highly unlikely that they will be able to capture the remaining requirements. This has led to our interest in IKBALS as a means of dealing with the subtlety and complexity inherent in legal reasoning problems by experimenting with analogical reasoning.

Reasoning by analogy in LKBS

In order to incorporate analogical reasoning into a LKBS, the process by which the system will operate must be understood. A working analogical reasoner would be expected to (a) retrieve similar cases, (b) choose the best case(s), and (c) use the solution in the current problem in some way. What makes the task very difficult is that the underlying architecture must be based on a conceptual model of legal analysis. A conceptual model will 'understand' concepts of a particular area of law. In contrast, most legal information retrieval systems only aim at retrieving legal sources based on boolean key word matching.

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Our strategy for IKBALS II, uses a conceptual clustering algorithm to classify the different precedent cases into clusters, given the data about these cases [Tyree et al, 1987]. The central principle used is that the cases which are close to one another should be included in the same cluster. The efficiency of this method will crucially depend on :

- The set of attributes selected;
- The chosen measure of closeness;
- The algorithm of forming clusters out of sets of cases, given the data on their distances.

Reasoning by Deduction in a LKBS

Most current LKBS reason by deduction. These systems use a production system formalism, where rules can be seen as a series of antecedents which are linked to a consequent. If all the antecedents are "true" then it logically follows that the consequent is "true". These production rules are in a form where the conclusion represents some legal concept and the condition represents all the important facts which are required in order tor the legal rule to be applicable.

There are essentially three steps in legal reasoning by deduction:

- Identify the legal rules that plausibly may govern the case at hand. This is often referred to as formulating the major premise;
- Formulate a minor premise in the language of the major premise. The problem here is that the facts in any case can be described in a variety of terms;
- Combine the second and third steps to package the facts as a minor premise and to use the premises to yield a conclusion through deductive reasoning.

Combining the Two Forms of Legal Reasoning - IKBALS II

Because of our desire to develop a real life prototype dealing with the complex issues of combining analogical and deductive legal reasoning, the authors of this paper have used the IKBALS prototype [Vossos et al, 1990a and Vossos et al, 1990b] to extend its present hybrid object-oriented/rule based architecture to handle case based reasoning; IKBALS II.

IKBALS II deals with applications for compensation under the **Accident Compensation Act** 1985. The regime which the Act establishes is called WorkCare. In particular, the system advises injured workers on the likelihood of a successful application for compensation, be it for weekly payments, lump sum entitlements, or medical and like expenses. In the following sections, we illustrate the principles mentioned above by discussing the deductive module and the analogical reasoning module of IKBALS II,.

Modelling of The Act

It is possible to delineate clear stages in dealing with claims under WorkCare. These are:

Stage 1 Elements giving rise to a WorkCare entitlement

- Is the claimant a worker?
- Is there an injury?
- Was the injury sustained in the course of employment?

Stage 2 Is the claim under the jurisdiction of the Act?

Stage 3 Statutory Entitlement

- Weekly payments for total incapacity
- Compensation for partial incapacity
- Lump sum compensation for injury to limbs
- Lump sum compensation for industrial deafness
- Lump sum compensation for dependents of a deceased worker Compensation for medical and like expenses

Stage 4 Advising the client

- Interim financial relief Make-up pay
- Social security entitlement
- Common Law claim
- Legal costs

Stage 5 Weekly payments disputed - the Arbitration Process

- Options where genuine dispute found
- Genuine dispute not found

In order to exploit the reasoning structure used by the expert[1], IKBALS used a hybrid object oriented/rule based approach employing a lattice of classes and objects.

"The importance of knowledge representation cannot be underestimated."

To summarize, the hybrid object oriented/rule based representation:

- captures the natural knowledge structure of the problem,
- makes for easier maintainability, and
- makes for efficient execution through limiting the attention of search to within a particular object's rule set.

Modelling of Precedent

Efforts to build serious LKBS will be of no use unless they are able to reason with precedent. In order to reason with case law, each case must be represented in such a way as to facilitate the identification of that case, i.e., 'indexing'. More precisely, what is needed is an intelligent retrieval process which will identify similar 'target' cases to a particular current 'source' case. Our technique extends the object oriented/rule based architecture to incorporate analogical reasoning.

The importance of knowledge representation cannot be underestimated. In order to implement case based reasoning, it is important to structure the key elements of the case at hand in the knowledge base so as to facilitate identification and retrieval. Our technique involves the use of object/class structures with intersecting decision lattices.

Faster indexing of similar cases is facilitated by classifying resolved cases under as many case types as possible in order to maximize the range of applicable precedents. In particular, resolved cases are indexed by Points to Argue (PTA). Each PTA represents a way of arguing about a case. PTAs are the subset of facts of a case that the court deemed significant in determining the case's outcome; that is, the subset of facts that were relied upon in identifying the significant legal principle in question.

Currently, problems are input in a form, based on what the knowledge engineers have deemed 'important' attributes of the case. Note, that the choice of these attributes is quite crucial to the success of the system. When the current legal problem requiring a solution is input, a rule based engine determines which PTAs apply to the current case. These PTAs are then used to retrieve those cases that are indexed under the same PTAS in the system. The PTAs prerequisites determine what features to look for in a case. Since a case can be indexed under several different PTAs, after a number of candidate resolved cases have been retrieved, the most similar case(s) is chosen. For each of the most relevant precedents, IKBALS then proceeds to justify that the outcome of

the current case should, or shouldn't be, the same as the precedent's outcome by drawing the analogy between them focussing on their important similarities and differences. This approach is similar to the one proposed by [Ashley, 1988].

Conclusion

In this paper, we have shown that it is important that LKBS act as litigation support systems rather than the more conventional judgement systems that generally only aim at interpreting statutes using a simple production rule representation. To offer genuine litigation support, a LKBS must allow arguing with precedents. We have hence shown how to incorporate the type of analogical reasoning employed by lawyers when reasoning with past cases by introducing case based reasoning into our object oriented prototype IKBALS. IKBALS is a LKBS that supports deductive and analogical reasoning.●

Footnotes

[1] The IKBALS project uses as its domain expert Graeme Taylor. For the purpose of this project, Taylor helped in developing the knowledge structure of IKBALS. The model was based on what he considered to be the legislation's purpose.

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