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ABSTRACT: Our goal is to model reasoning in discretionary legal domains. To do so, we use Knowledge Discovery from Database Techniques. However there are obstacles to this approach, including difficulties in generating explanations once conclusions have been inferred, difficulties associated with the collection of sufficient data from past cases and difficulties associated with integrating two vastly different paradigms. Toulmin's treatise on the uses of argument can be gainfully employed to construct legal decision support systems in discretionary domains. We show how we can use Toulmin's approach to build such systems with examples taken from the domains of eligibility for legal aid, evaluation of eyewitness evidence, family law, refugee law and sentencing. We then show how Toulmin Argument Structures can be developed to construct an Online Dispute Resolution environment that allows for determining BATNAs, exchanging opinions and providing advice about tradeoffs.

KEYWORDS: argumentation, Stephen E. Toulmin, legal decision support systems, discretionary reasoning, online dispute resolution

1. MODELING LEGAL DISCRETION

Our research over the past fifteen years has focussed upon building decision support systems that can be used in legal practice. Zeleznikow (2003) has observed that most commercial legal decision support systems have been rule-based. The major reasons for this occurrence include that it is easy to model rules and there are many tools for building rule-based systems.

Users of rule-based legal decision support systems accept a positivist view of decision-making.[1] Our goal is to model discretionary decision-making.

Flick (1979) defines discretionary domains as those in which a judicial decision-maker has the freedom to select one interpretation or outcome from a number of permissible options. Dworkin (1977) presents a systematic account of discretion by proposing two basic types of discretion, which he calls strong and weak discretion. Weak discretion describes situations where a decision-maker must interpret standards in his own way whereas strong discretion characterises those decisions where the decision-maker is not bound by any standards and is required to create his or her own standards.

Zeleznikow (2004) claims that there are levels of discretion depending on the domain. There are many domains in which the exercise of discretion cannot be explained by the application of rules and principles. They hold this view because there exist domains such as

[1] The German Conceptualist movement assumes that judges are almost totally constrained by rules. Every attempt is made by adherents to this theory to determine one single correct meaning for every term in every rule in a legal system. Once this is achieved, legal reasoning reduces to the logical application of facts to rules. However, few legal academics or professionals accept this view of law today. Legal positivists believe that a legal system is a *closed logical system* in which correct decisions may be deduced from predetermined rules by logical means alone. Hart (1961) is a major proponent of legal positivism.

property division in Australian family law, in which two decision makers may be applying identical rules and principles to facts interpreted in the same way, yet both arrive at different, yet legally valid outcomes. Typically, the statute that underlies these domains presents a list of factors to be considered by the decision-maker, but does not indicate the relative weighting of each factor. Christie (1986) calls these types of statutes shopping list acts. Judges, in such domains, exercise discretion by assigning a relative importance to each factor.

Few automated legal reasoning systems have been developed in domains of law in which a judicial decision maker has extensive discretion in the exercise of his or her powers. Discretionary domains challenge existing artificial intelligence paradigms because models of judicial reasoning are difficult, if not impossible, to specify.

In investigating how Australian Family Court judges distribute marital property following divorce, we will demonstrate that systems for reasoning in discretionary domains can be built by integrating rule sets with neural networks trained with data collected from standard past cases. However there are obstacles to this approach, including difficulties in generating explanations once conclusions have been inferred, difficulties associated with the collection of sufficient data from past cases and difficulties associated with integrating two vastly different paradigms.

We claim that connectionism can be useful in law if a series of smaller, interconnected networks are used instead of one larger network and if explanations are generated independently of the process used to infer a conclusion. This is in keeping with the legal realist philosophy.[2] Our goal is to discover a knowledge representation that assists in the decomposition of a task into smaller sub-tasks and which also enables an independent generation of explanations. The knowledge representation we present that achieves this goal is based on the structure of arguments proposed by Toulmin (1958).

2. THE SPLIT-UP SYSTEM

That section of the Family Law Act (1975) of Australia which is concerned with distributing marital property is regarded as a discretionary Act, in that it makes explicit a number of factors that must be taken into account by a judge in altering the property interests of parties to a marriage but is silent on the relative importance of each factor. Different judges may, and do, reach different conclusions, even when they agree on facts, because each judge assigns different relative weights to factors.

Section 79(1) of the *Family Law Act (1975)* empowers judges of the Family Court to make orders altering the property interests of parties to the marriage but does not lay down procedural guidelines for judicial decision makers. In practice, judges of the Family Court follow a five-step process in order to arrive at a property order:

1. Ascertain the property of the parties.
2. Value all property of both parties.
3. Determine which assets will be paramount in property considerations. This is referred to as common pool property distribution.
4. Determine a percentage of the property to be awarded to each party. This is referred to as percentage split determination.
5. Create an order altering property interest to realize the percentage.

The Split-Up system (Stranieri *et al,* 1999) implements steps 3 and 4 above, the common pool determination and the prediction of a percentage split. According to domain

[2] Legal realists are jurisprudes for whom the reliance on rules is anathema. They argue that judges make decisions for a range of reasons that cannot be articulated or at least are not apparent on the face of the judgement given.

experts, the common pool determination task (Step 3) does not greatly involve the exercise of discretion, in stark contrast to the percentage split task (Step 4).

The aim of the approach used in developing Split-Up was to identify, with domain experts, relevant factors in the distribution of property under Australian family law. We then wanted to assemble a dataset of values on these factors from past cases that can be fed to machine learning programs such as neural networks. In this way, the manner that judges weighed factors in past cases could be learnt without the need to advance rules. The legal realist jurisprudence movement inspired this approach.

For legal realists exemplified by Llewellyn (1962), rules and principles may be invoked after a decision has been reached in order to ensure that a decision is just, moral and legally correct. Rules and principles are invoked to explain a decision but there is no need to assume they are used to reach the decision.

Ninety-four variables were identified as relevant for a determination of the distribution of marital property. The way the factors combine was not elicited from experts as rules or complex formulas. Rather, values on the 94 variables were to be extracted from cases previously decided, so that a neural network could learn to mimic the way in which judges had combined variables.

However, according to neural network rules of thumb, the number of cases needed to identify useful patterns given 94 relevant variables is in the many tens of thousands. Data from this number of cases is rarely available in any legal domain. Furthermore, few cases involve all 94 variables. For example, childless marriages have no values for all variables associated with children so a training set would be replete with missing values. In addition to this, it became obvious that the 94 variables were in no way independent. Thus, in the Split-Up system, the relevant variables were structured as separate arguments following the argument structure advanced by Toulmin (1958).

For the philosopher Stephen Toulmin, practical reasoning, as distinct from analytical reasoning, involves the construction of an argument. Arguments, regardless of the domain, have a structure, which consists of six basic invariants: claim, data, modality, rebuttal, warrant and backing. Every argument makes an assertion based on some data. The assertion of an argument stands as the claim of that argument. A warrant justifies why the claim follows from the data. The backing supports the warrant and in a legal argument is typically a reference to a statute or a precedent case. The rebuttal component specifies an exception or condition that obviates the claim.

The Toulmin Argument Structure has been used by a number of researchers in various fields to model reasoning. However, a survey by Stranieri *et al* (2001) illustrates that the majority of researchers vary the structure to suit their particular use. The variation that we used aimed to facilitate Knowledge Discovery from Databases. The structure is illustrated in Figure 1.

We see from figure 1 that there are three data items (contributions, resources, level of wealth). Each of these is the claim item of other arguments leading to a tree of arguments ((Zeleznikow, 2004, p. 160) where the ultimate claim of the system is the root of the tree (percentage split determination).

Our variation on Toulmin’s theory of argumentation does not include either modality or rebuttal. Whilst these are important components of legal disputation, it was not felt worthwhile to include these invariants, given the programming difficulties involved in representing them.

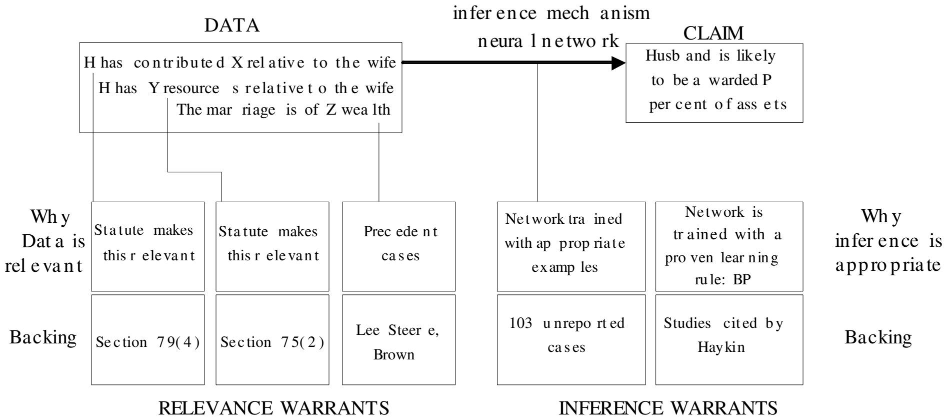

Fig 1. Toulmin argument structure for one of the Split-Up arguments

3. LEGAL DECISION SUPPORT SYSTEMS CONSTRUCTED USING TOULMIN'S THEORY OF ARGUMENTATION

The Toulmin structure has been used to structure knowledge in many studies. The representation facilitated the organisation of complex legal knowledge for information retrieval by Dick (1987), Marshall (1989) and Ball (1994). Clark (1991) represented the opinions of individual geologists as Toulmin structures so that his group decision support system could identify points of disagreement between experts. Johnson *et al* (1993) identified different types of expertise using this structure, Bench-Capon *et al* (1991) used Toulmin Argument Structures to explain logic programming conclusions, and Matthijssen (1999) represented user-defined tasks with Toulmin Argument Structures. Branting (1994) expands Toulmin Argument Structure warrants as a model of the legal concept *ratio decidendi*.

Toulmin proposed his views on argumentation informally and never claimed to have advanced a theory of argumentation. He does not rigorously define key terms such as warrant and backing. He only loosely specifies how arguments relate to other arguments and provides no guidance as to how to evaluate the best argument or identify implausible ones. Although there are substantial examples of benefits with the use of the Toulmin structures that conform to the original formulation, the majority of applications vary the structure.

In our implementation of Toulmin Argument Structures we include:

- A variable-value representation of claim and data items;
- A certainty value slot associated with each variable-value to represent the degree of confidence that the value assigned to the variable is correct;
- Reasons for relevance of the data items;
- A list of inference procedures that could be used to infer a claim value from data values;
- Reasons for the appropriateness of each inference procedure;
- Context variables to represent the context of the possible uses of the argument.

Having adapted Toulmin's work on Argumentation to build a decision support system in the domain of Australian Family Law, we next wanted to investigate whether there are certain generic principles involved in constructing web-based legal decision support systems. Given the interests of our industry, government and university partners,[3] we have been developing systems in the domains of:

[3] Phillips and Wilkins, Software Engineering Australia, JUSTSYS, Victoria Legal Aid, Australian Refugee Review Tribunal, University of Edinburgh and Glasgow Caledonian University.

a) Eligibility for Legal Aid – GETAID (Hall *et al* 2002) – 8 arguments;
b) Computer copyright – RIGHTCOPY (Stranieri and Zeleznikow, 2001a) – 50 arguments;
c) Refugee decision-making – EMBRACE (Yearwood and Stranieri, 1999) – 200 arguments;
d) Evaluation of eyewitness evidence - ADVOKATE (Bromby and Hall, 2002) – 23 arguments;
e) Scottish Family Law – (Kingston *et al,* 2002);
f) Sentencing – (Hall *et al,* 2005) – 23 arguments.

3.1 GetAid

When an applicant for legal aid approaches Victoria Legal Aid (VLA), their application is assessed to determine their eligibility for legal aid. If the applicant satisfies a financial test, the application undergoes a merits test. The merits test involves a prediction about the likely outcome of the case. A web-based system GetAid has been developed which advises solicitors and their clients as to whether the client is eligible for legal aid (Stranieri and Zeleznikow, 2001b). GetAid has captured the reasoning of VLA grants assessors.

Knowledge about an applicant's prospects for acquittal could not readily be represented by experts as a decision tree as was the case for knowledge regarding statutory guidelines. This motivated us to model the decision as a tree of Toulmin arguments.

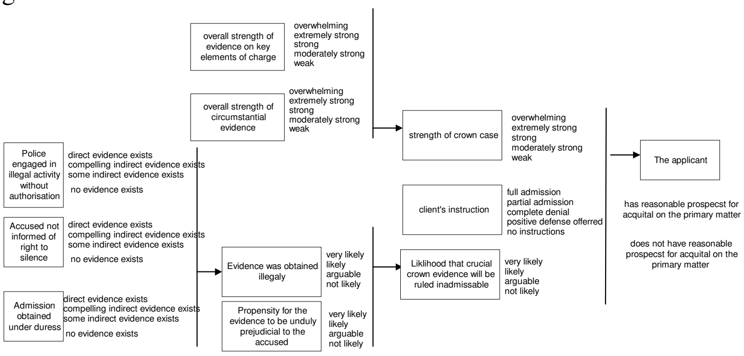

Fig 2. Argument tree for acquittal prospects

3.2 EMBRACE

The Refugee Review Tribunal of Australia determines the refugee status of applicants. Ensuring that the decision-making is as consistent as possible and transparent in this complex and discretionary domain is critical. Toward that end, Yearwood and Stranieri (1999) have modeled reasoning in refugee law as 200 generic arguments that have been used by members of the Refugee Review Tribunal or applicants for refugee status. No inference mechanism has been specified for any generic arguments as no machine inferences can be entertained in this politically sensitive domain. However, even without machine inferences, the argument structures have proven to be useful in modeling refugee decisions. Furthermore, they have shown that the process of automatically generating a document that represents the reasoning made toward a decision is facilitated if the knowledge is represented as a series of actual arguments instantiated from generic templates.

3.3 Sentencing decision support systems

(Hall *et al,* 2005) reports on a project undertaken to provide decision support in discretionary legal domains by referring to a recently created model that involves the interplay and weighting of relevant rule-based and discretionary factors used in a decision-making process. The case study used in the modeling process is the Criminal Jurisdiction of the Victorian Magistrate's Court (Australia), where the handing down of an appropriate custodial or non-custodial sentence requires the consideration of many factors. Tools and techniques used to capture relevant expert knowledge and to display it both as a paper model and as an online prototype application are discussed. Models of sentencing decision-making with rule-based and discretionary elements are presented and analyzed.

The goal is to provide training support for novice lawyers at Victoria Legal Aid. It has 23 arguments. An example of the top-level Toulmin Argument is given in figure 3.

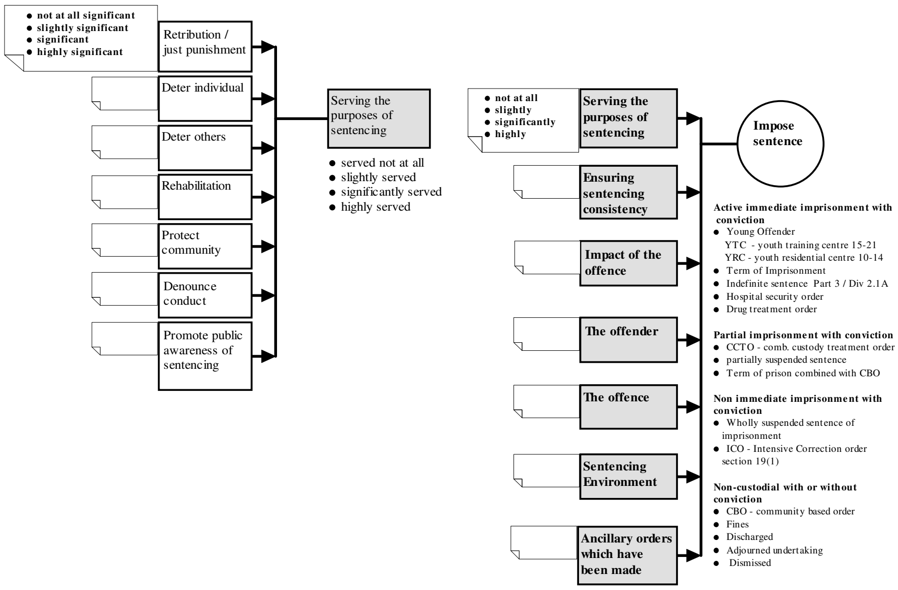

Fig 3. Top-level sentencing argumentation model with expansion of first node

3.4 ADVOKATE

ADVOKATE is a web-enabled knowledge-based decision support application designed for use in criminal investigations, civil litigation or as a teaching aide for investigative training. ADVOKATE provides an indicative assessment of the credibility of eyewitness testimony.

The detailed determination of witness' suitability and reliability are not rule-based inferences but rather discretionary decisions where the decision maker, taking account of several input factors, chooses from one of several possible outcomes. Decision-makers may arrive at different outcomes, depending on how they choose to inference from their understanding of the input factors. Thus the ADVOKATE domain can be categorised as a bounded discretionary domain (Zeleznikow, 2000). The factors to be taken into account are known but no norms specified, leaving the decision-maker free to weight the factors as they wish.

ADVOKATE, implemented as a browser accessible application, was made available to forensic experts, lawyers and police who provided feedback to the designers. The knowledge model was iteratively refined and enhanced and is available at http://advokate.bromby.vze.com/.

4. USING TOULMIN'S THEORY OF ARGUMENTATION TO SUPPORT ONLINE DISPUTE RESOLUTION

4.1 Negotiation Essentials

Ross (1980) states *the principal institution of the law is not trial; it is settlement out of court*. To support this argument, Williams (1983) notes that whilst the figures may vary in different jurisdictions, of all the cases listed before the courts only about 5% of the cases are ever heard by the court and only 1% of the cases result in judicial decision-making. Thus, a major goal of useful legal advice should be to avoid litigation.

Alternative Dispute Resolution (ADR) refers to procedures for settling disputes by means other than litigation – such as arbitration and mediation. Arbitration is a process of dispute resolution in which a neutral third party (the arbitrator) renders a decision after a hearing at which both parties have an opportunity to be heard. Mediation is a private, informal dispute resolution process in which a neutral third party (the mediator) helps disputing parties to reach an agreement. The mediator has no power to impose a decision on the parties. Such procedures, which are usually less costly and more expeditious than litigation, are increasingly being used in civil, commercial, family and labour disputes.

Online Dispute Resolution (ODR), the application of Internet technology to ADR, has become an alternative method for resolving disputes that arise both from online transactions and in the offline context.

It is our goal to build an Online Dispute Resolution environment to provide support for parties to a dispute. But what are the essential features of such an environment?

The Harvard Negotiation Project introduced the concept of principled negotiation, which advocates separating the problem from the people (Fisher and Ury, 1981). Fundamental to the concept of principled negotiation is the notion of *Know your best alternative to a negotiated agreement (BATNA)*. The reason you negotiate with someone is to produce better results than would otherwise occur. If you are unaware of what results you could obtain if the negotiations are unsuccessful, you run the risk of:

1) Entering into an agreement that you would be better off rejecting; or
2) Rejecting an agreement you would be better off entering into.

One of our aims is to provide litigants with information about the expected outcome of court proceedings. Data mining techniques or Semantic Web Technology can be used to determine a BATNA. At this moment there is no generic tool available for determining BATNAs.

Thus, the first stage of our integrated tool is the provision of a decision support system that advises upon appropriate BATNAs. For example, Split-Up advises upon property distribution following divorce in Australia and can be used to determine one's BATNA. Split-Up shows both litigants what they would be expected to be awarded by a court if their relative claims were accepted. It gives them relevant advice as to what would happen if some or all of their claims were rejected. Users are then able to have dialogues with the system to explore hypothetical situations to establish clear ideas about the strengths and weaknesses of their claims.

Split-Up does provide disputants with their respective BATNAs. However, more is required of negotiation support systems. Namely they should model the structure of an argument and also provide useful advice on how to sequence the negotiation and propose solutions.

4.2 Using argumentation in an online dispute environment

Zeleznikow and Bellucci (2003) have integrated game theory and artificial intelligence to advise upon structuring the mediation process and advising disputants upon possible trade-offs. Lodder (1999) developed argumentation tools that support disputants to communicate about their conflict. The negotiation systems of Zeleznikow and Bellucci do not facilitate discussion, whilst the dialogue tools of Lodder do not suggest solutions. Both systems are useful in what they offer to the user, but the weakness of one application is the strength of the other. We therefore propose to combine the dialogical reasoning of Lodder with the game-theoretic based negotiation techniques of Zeleznikow and Bellucci to construct an online dispute resolution environment.

When initiating a two-party dispute, one of the parties introduces her grievances and the remedies she requires. Her opponent responds with counterarguments and her own proposed remedies. Our argument support tool makes explicit how the statements of the parties support their arguments.

The argument tool used in our proposed ODR environment is based on research about dialogical models of legal reasoning, in particular on DiaLaw (Lodder, 1999), a dialogical model of justification. A dialogue in DiaLaw starts when a player introduces a statement she wants to justify. The dialogue ends if the opponent accepts the statement (justified) or if the statement is withdrawn (not justified). The rules of the game are rigid and the language used in the game is formal.

Influenced by John Nash's significant research on game theory (Nash, 1953) and Raiffa's work on using game theory for negotiation support (Raiffa, 1982), Zeleznikow wished to integrate artificial intelligence and game theory techniques to develop intelligent negotiation support systems. He saw that an important way in which mediators encouraged disputants to resolve their conflicts was through the use of compromise and trade-offs (Bellucci and Zeleznikow, 2005). Once the trade-offs have been identified, other decision-making mechanisms must be employed to resolve the dispute.

To construct our environment, we have set forth three basic stages for the effective resolution of online disputes:

1) Determining a BATNA, which helps the disputing parties determine what will happen if the dispute is not resolved (this task is context-dependent);[4]
2) Allowing parties to communicate among themselves using dialogue techniques (this task is generic); and
3) Using game theory techniques that employ compensation/trade-off strategies to attempt to resolve remaining issues in dispute (this task is generic).

Steps 2 and 3 are repeated recursively until either the dispute is resolved or a stalemate is reached. Steps 1 and 2 have been successfully supported using Toulmin's theory of argumentation. Whilst step 3 uses game theory rather than argumentation, we are developing a platform based on Toulmin's theory that supports the development of trade-offs and compromises.

[4] We cannot build a generic decision support system that advises upon BATNAs in all negotiation domains because, for example, family law disputes are very different from disputes about international treaties. Knowing about the context of the dispute is essential. It is possible, however, to build systems that allow disputants to communicate with each other and to build systems that advise upon trade-offs.

5. CONCLUSIONS AND FUTURE RESEARCH

We have shown how Toulmin's treatise on the uses of argument can be gainfully employed to construct legal decision support systems. This is particularly so in discretionary domains.

We have decided to model reasoning in such domains using knowledge discovery techniques. Such techniques do not provide adequate explanations or arguments. The use of Toulmin Argument Structures allows to use a hybrid of different inferencing techniques.

We illustrated how Toulmin's theory has been applied in disparate domains such as family law, eligibility for legal aid, copyright, refugee law, evaluation of eyewitness evidence and sentencing.

To support the development of our systems, we have established an Australian, not-for-profit start up company JUSTSYS (www.justsys.com.au). JUSTSYS is currently building generic tools for constructing web-based legal decision support systems.

We also discussed how we are using Toulmin Argument Structures to develop an Online Dispute Resolution environment that allows for determining BATNAs, exchanging opinions and providing advice about tradeoffs. We are using the environment to provide negotiation support for:

1) Plea bargaining – using our sentencing decision support system to learn how to determine BATNAs in the domain, defence lawyers at Victoria Legal Aid can hold discussions with the Office of Public Prosecutions;
2) Family Law – parties to a family dispute can receive advice about possible outcomes, exchange arguments and receive mediation advice about how best they can attain their objectives.
3) Body Corporate Law – the state of Victoria, Australia has 65,000 body corporate associations. Disputes regularly occur, which leads to expensive and emotionally stressful[5] litigation. A rule-based system has been constructed to advise upon BATNAs. Our environment is being used to facilitate discussions and receive advice upon potential trade-offs.

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[5] At the end of the conflict the disputants may still have to live with each other.

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