Facilitating Case Comparison Using Value Judgments and Intermediate Legal Concepts

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ABSTRACT

This paper explains and illustrates in an example context how case comparison in legal case-based reasoning can be modeled in the *value judgment* formalism. It presents a set of argument schemes corresponding to typical moves in case-based reasoning which make use of *intermediate legal concepts* and their impact on the applicable values.

Keywords

value-based argumentation, case-based reasoning, legal reasoning, intermediate legal concepts

1. INTRODUCTION

Formal models of legal argumentation should take into account the values underlying the discourse they model. Contributions have been made in the context of case-based reasoning [28, 22], rule-based reasoning [23], value-based argumentation frameworks [10] and argument schemes [12, 13]. In [21], we have presented a formalism for arguing about decision problems in light of applicable values and illustrated its functionality by applying it to authentic hypothetical legal reasoning in an example case. It was developed with the goal of providing an expressiveness capable of both representing and, to some extent, explaining typical argument moves employed in legal reasoning with the eventual goal of a computational implementation. At the core for the formalism lies the concept of a *value judgment*, a context-sensitive determination that the positive effects of picking a certain decision option outweighs its negative effects.

To be standalone, this paper fully reproduces the core formalism in sections 2.3 and 3.1 from previous work [21] and expands upon it by explaining how typical case comparison arguments employed in legal case-based reasoning can be modeled in a flexible and effective way using the value judgment formalism and *intermediate legal concepts* (ILCs), which are abstractions of fact patterns focal to the applicable values. We give an overview of legal case comparison as

well as a semi-formalized set of argument schemes. Their functionality is then illustrated in a fictional example oral argument based on the *Cady vs. Dombrowski* case, which was decided by the U.S. Supreme Court. We then briefly demonstrate coherence among the presented schemes and the ones previously published on hypothetical reasoning.

2. THE VALUE JUDGMENT FORMALISM

2.1 Interests, Norms and Values

In legal reasoning, a distinction can be drawn between legal rules and legal principles. Rules state that when a certain set of conditions is fulfilled, a legal consequence shall or must follow. Legal principles, on the other hand, relate to higher-level policy-like goals or values which guide the application of rules and cases to fact situations. There has been debate on the theoretical contours of these concepts (see, for example, [18, 4]). We do not take a substantive position on this issue, but use our own working (and in our perception, legitimate) conceptions of values and rules to craft a formalism which, we advocate, furthers the goal of enabling formal (and eventually computationally implementable) models of legal reasoning to not only reason *with* rules and cases, but also *about* them.

We make use of the concept of legal values in that sense, namely as reasoning policies corresponding to individual or collective interests whose interrelation and coordination is undertaken through the creation, application and interpretation of case law and written law, i.e. legal "oughts" or *norms*. Legal reasoning addresses the task of resolving situations of conflicting interests by arguing about possible solutions being consistent or inconsistent with the coordination of the relevant interests contained in the governing norms. Depending on the legal system, the value coordination commands will primarily be made by the legislature and, to a varying extent, by executive lawmaking and courts. In this work, we focus on judicial argumentation with cases only.

There exist a number of terms for the grouping of individual and collective interests into legally tangible concepts. In our formalism, we label these *values* in accordance with work in value-based argumentation frameworks [10] and other work surveyed in [11]. Again, our conceptualization of rules and values is only one plausible metaphor.

Our goal is to computationally model the kind of legal reasoning wherein judges address values in the context of specific factual scenarios. With the help of contending advocates' arguments, judges identify the conflicting values at

stake in a problem situation and the reasonably applicable statutory or precedent-based norms and issues of interpretation. The advocates' arguments help judges consider the effects of alternative decisions in promoting or demoting the applicable values. Characteristically, whether orally or in writing, the advocates' legal arguments proceed in three-ply fashion (see, e.g. [6]): first, a proponent (plaintiff or appellant) presents an argument or brief, the opponent (defendant or respondent) rebuts the argument, and the proponent has a final opportunity for surrebuttal. Initially, the proponent may analogize the problem situation to favorable precedents, pointing out shared facts giving rise to reasons to decide the problem in the same way as the precedents. The opponent responds by citing its own precedents and distinguishing the proponent's, pointing out unshared facts that give rise to reasons for deciding the problem and precedents differently. The surrebutting proponent then distinguishes the opponent's cases or presents an alternative argument. In the process, the advocates evaluate and compare the effects on relevant values of the argued-for alternative decisions given the problem's and cases' facts. Each strives to establish that the precedent's value judgment, i.e. its contextual determination that promoting certain values justifies demoting others, can be transferred to the current case or not. To model comparative reasoning with cases and values, we introduce the following formalism and argument schemes.

2.2 Argumentation Environment

Our formalism builds on top of a generic model of defeasible argument capable of constructing arguments dynamically by means of argument schemes, comparable to the one assumed in [12, 13]. We understand argument schemes as templates for certain types of arguments, whose components are pre-defined and can be filled with information inferred from the available knowledge. For example, arguments by analogy involve a current problem, a precedent problem to analogize and some similarity measure justifying the analogy. These "slots" form an argument scheme and can be filled using search algorithms.

First, if $a = a_1 \wedge a_{...} \wedge a_n$ is a set of conjunctive antecedent propositions and c is the argument's concluding proposition, then we denote an argument as $a \rightarrow c$. Second, if the available schemes and propositions of situation s (see def. 4) allow for the generation of an argument for proposition p, then we shall speak of s argumentatively entailing p (or not), denoted $s \vdash p$ or $s \nvdash p$, respectively.

2.3 The Core Formalism

The definitions in this section as well as some of the basic argument schemes in the subsequent one have been previously published in [21] and are restated here, with minor alterations/corrections, almost indentically. We commence with the definition of a *facts* and *values*:

DEFINITION 1. *A **fact pattern** is an atomic or compound proposition representing a part of the domain of discourse. Let F be the set of all possible fact patterns which shall be closed under union. Further, let $f_1 \sqsubseteq f_2$ be the transitive subsumption relationship among fact patterns which shall be established through argumentation. We speak of $a \sqsubseteq b$ iff the specific fact pattern a is incorporated by the more general fact pattern b according to argumentation based on available knowledge.*

DEFINITION 2. *A **value** is a legal concept abstracting a set of one or more interests of individual or groups of actors in the legal system such that one can speak of a change in a certain fact pattern as promoting or demoting the given value. Let V be the set of values in the domain of discourse.*

We assume that a system has sufficient common sense knowledge to reason about subsumption relationships among facts since the argument schemes we present make frequent use of it. Specifically, it is employed to subsume specific case facts under broad intermediate legal concepts. As a simple example, if f_1 stands for the proposition *"A Cadillac is being searched."* and f_2 corresponds to *"A vehicle is being searched."*, then arguably $f_1 \sqsubseteq f_2$ because a Cadillac is arguably a vehicle. However, the inference may also be more distant and even controversial. For example, if f_3 represents *"A parked car contains a gun"* and f_4 stands for *"There is a danger to the public"*, then one can very well argue that $f_3 \sqsubseteq f_4$ because the gun is dangerous.

In a sense, subsumption becomes a fact-specific special case of argumentative entailment. Still, we use the distinct symbol ($\sqsubseteq$) and term to apply in situations where a narrow and specific pattern falls under a broader, more general pattern as it is typically done in legal reasoning. Conceptually, it is a special case of the more general notion of s entailing p by means of an argumentative inference chain, which we denote $s \vdash p$ as already mentioned above.

Notice that if $a = b \cup c$ are facts, then $a \sqsubseteq b$ because a is more specific than b. Also, our notion of "facts" is technical and different from the "facts of the case" in the traditional legal sense.

DEFINITION 3. *A **rule** is a proposition of the form $f_1 \Rightarrow f_2$, where $f_1, f_2 \in F$, assigning a conclusion proposition to an antecedent fact pattern. Let C be the set of common-sense-knowledge (CSK) inference rules and L be the set of legal rules stemming from sources of law. Legal rules shall be referred to as **norms**.*

DEFINITION 4. *A **situation** is a tuple $\langle F_s, C_s, L_s \rangle$ where $F_s \subseteq F$ are the given facts, $C_s \subseteq C$ are the available CSK inference rules and $L_s \subseteq L$ are the applicable legal norms. Let S be the set of all possible situations.*

If $s \in S$ and proposition x is either a fact, common sense rule or norm (or set thereof), let $s' = s \cup x$ be a new situation created by adding x to the respective tuple element of s.

Legal decisions typically raise the question of how a situation is governed by the law, i.e. is some conclusion mandated by the law or not. In the formalism, this corresponds to adding a fact pattern or rule to a situation, thereby creating a new one. In this new situation, because of the modification, different things can be argumentatively entailed than in the original situation. The intuition of our formalism is to use this before/after-effect to reason about how the decision option in question affects the applicable values. For example, if the legislator enacts a law requiring the police to obtain a warrant before searching a home, a police officer can no longer spontaneously search a house without committing an illegal act, thereby promoting the value of privacy of private individuals. At the same time, this restricts a police officer's endeavor to, for example, obtain evidence or arrest a suspect. The illegality of the search does not follow without the law being enacted. Hence, one can argue that enacting

the law requiring the warrant promotes privacy and demotes effective law enforcement.

But how does a system infer what constitutes a promotion or demotion of a given value? We model this using qualitative degrees of *value manifestation*. They provide a measure for the extent to which a value is affected in its realization/manifestation by a change in the situation.

DEFINITION 5. *Assume $s_1, s_2 \in S$ and applicable values $V_s \subseteq V$. Then $\delta_{v_i}(s_1, s_2)$ shall be the* **difference in manifestation** *of value $v_i \in V_s$ in s_2 when compared to s_1 as follows:*

$$\delta_{v_i}(s_1, s_2) = \begin{cases} +++ \, , \text{ if } v_i \text{ is overwhelmingly promoted} \\ ++ \, , \text{ if } v_i \text{ is greatly promoted} \\ + \, , \text{ if } v_i \text{ is somewhat promoted} \\ \approx \, , \text{ if } v_i \text{ remains unchanged} \\ - \, , \text{ if } v_i \text{ is somewhat demoted} \\ -- \, , \text{ if } v_i \text{ is greatly demoted} \\ --- \, , \text{ if } v_i \text{ is overwhelmingly demoted} \end{cases}$$

If $m \in F \cup L$ and $s_2 = s_1 \cup m$, then we speak of $e_{v_i}(m, s_1) = \delta_{v_i}(s_1, s_2)$ as the **effects** *of imposing m on s_1. Also, let $E^+_{V_s}(m, s_1)$, $E^-_{V_s}(m, s_1)$ and $E^{\approx}_{V_s}(m, s_1)$ be the set of (value, effect) tuples of values positively, negatively and neutrally affected, respectively, by the imposition of m on s_1.*

To continue the above example, requiring a warrant (wa) in a basic situation (s) for the search of a home (sh) might have a medium positive effect on privacy (Pr) ($e_{Pr}(wa, s \cup sh) = ++$) but at the same time demote effective law enforcement (LE) to a limited extent ($e_{LE}(wa, s \cup sh) = -$). For further illustration, if the warrant were particularly difficult to obtain in situation s, this might even increase to $e_{LE}(wa, s \cup sh) = --$. This particular seven-step scale is arbitrary and only proposed as a working model.

Newman & Marshall [27] suggested an options/goal matrix for representing (with "+" and "-" values) the effect of various definitions of "mobility" on the principles underlying the *Carney* case (i.e., privacy protection, evidence preservation, and diminished privacy expectations in vehicles).

The second element needed to argue about effects of facts are definitions of values which can be compared to the inferences produced by the modification of a situation. We assume that, for every value, fact pattern descriptions are available which state what constitutes a weak, medium or strong promotion/demotion of that value. While such *specifications* need to be carefully crafted, we assess the task as feasible. German legal academia, for example, produces comprehensive definitions of the scope ("Schutzbereich") of the civil rights contained in the state's constitution, which are intended to be applied by courts.

DEFINITION 6. *For a given value $v \in V$ and $x \in \{+++, ++, +, \approx, -, --, ---\}$, let $d^x_v \in F$ be the* **specification** *of v consisting of facts corresponding to a manifestation of v to the degree x. Let $D \subset F$ be the set of all specifications.*

Now that the formalism provides for elements determining how decision options affect the applicable values, we introduce a preference relation to express that one set of effects on values shall be taken over another. We label this determination *value judgment*. Although frequently left implicit in natural argument, it is of considerable explanatory power.

DEFINITION 7. *Assume situation $s \in S$, $f_1, f_2 \in F \cup L$, applicable values $V_s \subseteq V$ and $x, y \in \{+, -\}$. A* **value judgment** *is a proposition comparing value effect sets of the form $E^x_{V_s}(f_1, s) > E^y_{V_s}(f_2, s)$. The relations $<, >$ expressing such preferences are hence defined only over pairs of value effect sets (i.e. not a strict partial ordering), stating that one set of effects is preferable over the other as asserted through argumentation. Let J be the set of all value judgments.*

Where appropriate and comprehensive, the V_s subscripts may be omitted in this paper. The concept of value judgments is the nexus of the formalism. It is a context-relative preference and hence distinguishable from previous work on value-based argumentation in AI&Law (for example, see [10] and derivatives thereof). Modgil [26] has modeled value-based argumentation in hierarchical argumentation frameworks, allowing for contextual argumentation about degrees of value promotion and demotion as well as about preferences among values. His work appears to assume that the preference relation itself is context independent, but he makes it subject to context dependent argumentation. By contrast, our work assumes that even the actual preference is conditioned on the facts.

Values are not arranged in an abstract hierarchy, but interact with and prevail over each other given the specific factual circumstances of the case. However, the relation does not speak to which precise value(s) was the most important ones in establishing the direction of the preference. This is subject to argumentation via the schemes for desirable/undesirable consequence given below in definition 10 and other schemes we intend to explore in future work.

Conceptually, a value judgment is similar to the preference relations among principles conditioned on fact patterns [4] and the "Weight Formula" [3] developed by the prominent legal theorist Robert Alexy. The formula arithmetically assesses competing interference with legal values, accounting for the degrees of interference in a given case and the values' abstract weights. Among other variations, Alexy also proposes a triadic model of measuring interference with values (light, medium and strong), which can be extended and used in conjunction with the formula to model the act of balancing. Alexy terms the outcome of the formula to be the "concrete" [3] weight of the values in the case to be decided. Hence, the formula models case-specific weights of values as a function of the abstract weight of the values together with the degree of interference with the values in the given case. Similarly, Araszkiewicz has cast the task of coordinating and balancing of legal values/principles into a constraint satisfaction problem [5]. These support our assumption that while legal values may possess abstract weight, their balancing needs to take into account the case-specific context.

Our concept of value judgments, however, does not provide an arithmetic model of value tradeoffs. It is a general notion of preference among decision alternatives by virtue of their effect on values. We do not take position with regard to the legal theory debate on weighing and balancing. We rather strive for a formal model of legal reasoning with values capable of generating authentic arguments that lends itself to a computational implementation and, eventually, experimental empirical validation. To further the bridge to computability, we embed our concept of value judgments into an argument formalism, including a fact-representation, and provide formal schemes corresponding to typical legal argumentation moves. Alexy has formalized argument schemes

about principle-oriented case analogy, distinction and precedence relations among principles in an analogy context [2], but not yet expanded them to a level of detail suitable for computational implementation. We intend our work to supplement legal theory work in balancing of legal values.

3. BASIC ARGUMENT SCHEMES

As explained in 2.2., our formalism assumes a scheme-driven model of defeasible argumentation. As it undertakes intensive common sense reasoning, we further presume that suitable argument schemes be available.

3.1 Arguments for Norms and Effects

The first addition to these generic schemes is one that allows for the use of legal norms:

DEFINITION 8. *If $f \Rightarrow c \in L$, then $f \to c$ is an **argument from norm**.*

The first argument scheme connecting to values deals with the effects of factual changes to situations on a given value. This takes place in the shape of a comparison of two situations (see def. 5) whose differential propositions form the modification whose impact is to be assessed. The scheme points to a fact pattern not entailed by the original situation but indeed entailed by the modified one. If that pattern falls into a certain fact effect specification (see def. 6), then there is an argument for that effect following from the modification.

DEFINITION 9. *If $s, s' \in S$, $m \in F \cup L$, $m' \in F$, $v \in V$, $d_v^x \in D$ then $(s \cup m = s') \wedge (s' \vdash m') \wedge (s \nvdash m') \wedge (m' \sqsubseteq d_v^x) \to e_v(m, s) = x$ is an **argument for fact effect**.*

When verbalized, this argument scheme means that when there is a decision to be made about modification m on situation s (thereby creating s') and one inquires what this decision entails for value v, one can argue that this effect is of quality x by virtue of there being a fact m' which can be subsumed under v's specification of quality x (namely d_v^x) and m' is arguably true in s' but not in s.

3.2 Arguments about Consequences

We now have the tools to argue about how facts relate to each other, how they create situations and how they affect values. The next step is to argue about why one set of effects on values is preferable over another, i.e. why a given value judgment shall mean that positive effects outweigh negative ones or vice versa.

Intuitively, how do human reasoners decide for or against a decision option? To begin with, one has an intuitive notion of a value judgment, i.e. that something has advantages and disadvantages which can be described in the abstract. For example, allowing software to be patented encourages a certain kind of innovation but at the cost of imposing monopoly prices on consumers. While possible, it is seldom that a decision-maker will justify a decision simply in such abstract terms. Rather, she will point to a more or less specific description of an example scenario (or a group thereof) in which the given decision leads to particularly favorable or unfavorable consequences. Frequently but not necessarily, the argument will involve a set of hypothetical facts rendering the desirability/undesirability of the entailed consequence more illustrative. We capture precisely this line

of reasoning as our basic argument scheme for a value judgment supposedly going one way or another.

DEFINITION 10. *If $s, s' \in S$, $f \in F \cup L$, $h \subset F \cup L$, $f' \in F$ such that $s' = s \cup f \cup h$, $v \in V$ and $d_v^x \in D$ then*

- $s \nvdash f' \wedge s' \vdash f' \wedge f' \sqsubseteq d_v^{+/++/+++} \to E^+(f,s) > E^-(f,s)$ *is an argument from **desirable consequence** of f for the proposed value judgment in situation s under hypothetical circumstances h.*

- $s \nvdash f' \wedge s' \vdash f' \wedge f' \sqsubseteq d_v^{-/--/---} \to E^-(f,s) > E^+(f,s)$ *is an argument from an **undesirable consequence** of f for the proposed value judgment in situation s under hypothetical circumstances h.*

Our formalism for reasoning with values by arguing about consequences is aimed toward the same goal as Feteris's argumentation model [19] for reconstructing judicial reasoning involving weighing and balancing in deciding whether to apply a rule literally. Our formalism can be seen as a particular way to realize, eventually computationally, the kinds of justifications she elaborates in her sections 2.3 and 3.

4. INTERMEDIATE LEGAL CONCEPTS

In reasoning comparatively with precedents and hypothetical cases, as in fashioning legal rules, advocates and judges employ intermediate legal concepts (ILCs). In previous work it was demonstrated empirically that taking account of such concepts improved the accuracy of case-based (factor-based) predictions of legal case outcomes [7]. Here we explain a possible reason why, as has Alexy in recent work [2]. Legal practitioners employ ILCs in order to characterize abstractly the value-laden factual patterns they deem legally significant. They take these concepts from existing legal rules or invent new ones, perhaps by analogy to other areas of law [24] and adapt a concept's meaning to the factual contexts before them. In this way, they represent the abstract contours of values presented in the current case and precedents, allowing for "deeper" comparisons of facts, that is, for comparing facts in terms of their effects on values.

For example, in what sense are an almost-captured fox, a nearly-caught baseball, and fish in a closing net, comparable? In an application of an appropriate legal argument scheme, they can all be subsumed under the ILC of a *degree of possession* and thus be related to the values of protection of property and freedom of action, the legally tangible "protectors" of peoples' interests in not being hindered in their intended acquisition of physical control over something (or things) of value not currently controlled by someone else.

Similarly, in the *Carney* argument discussed in [21], an advocate argues the significance of the home-likeness of a place to be searched in terms of whether the "person has exhibited the kind of expectations of privacy ...that ... make a police officer's warrantless entry a little more suspect" [16]. This statement (and others in that oral argument) makes clear that, in the advocate's opinion, the crucial interests are the expectations of privacy of the owner of the place to be searched on the one hand and the exigency of the circumstances in terms of effective law enforcement on the other. All other norm elements (indicia of home, self-propelling vehicles, etc.) are means to make the balance among the values explicit and sufficiently concrete to apply, test, discuss, and transfer to other cases. In the argument examples presented

below, which also deal with search and seizure and the search warrant requirement, in reasoning with precedents, the advocates focus the case comparisons on ILCs such as vehicle mobility, risk, and the form of police custody.

During legal argumentation, these concepts are frequently created on-the-fly. In the example below, we simulate a discussion where advocates make up intermediate concepts ad-hoc in meaningful ways. Formally describing the reasoning process underlying the creation of these concepts is a major challenge and, to the best of our knowledge, yet to be undertaken in AI&Law. We do not intend to reach that far in this paper, but want to further the discussion by proposing a formalism metaphor for how they are used in value-based legal argumentation by characterizing them as focal concepts in arguing about value judgments and by providing corresponding argument schemes for case-based legal reasoning.

5. ARGUMENT SCHEMES FOR CASE COMPARISON

This section introduces a set of argument schemes for case comparison as it is commonly employed in legal case-based reasoning. To ease comprehension, the schemes are presented in a formalism-enhanced descriptive narrative.

5.1 Initial Analogy

Initially, the plaintiff's advocate brings forth the primary precedent case she intends to analogize to the case at bar. We hence assume a basic situation s with case at bar c in which the holding of outcome o is at issue.

The plaintiff's advocate cites precedent p, in which o was held. By acknowledging the precedent, she implicitly affirms that $E^+(o, s \cup p) > E^-(o, s \cup p)$. To justify the imposition of o in c, she must establish that $E^+(o, s \cup c) > E^-(o, s \cup c)$. To do that, the advocate points out a set of ILCs $i = \{i_1, ..., i_j\}$ shared by p and c, i.e. $p \sqsubset i'$ and $c \sqsubset i'$ for all $i' \in i$. Let $i^* = \bigcup_{k=1}^{j} i_k$ be the composite fact pattern of all shared ILCs. She submits this similarity as justifying the inference $i^* \Rightarrow o$ with the underlying value judgment $E^+(o, s \cup i^*) > E^-(o, s \cup i^*)$. This implicity affirms that $E^+(o, s \cup c) > E^-(o, s \cup c)$ because $c \sqsubset i^*$. We name this an **argument from sufficient similarity**.

For reasons of simplicity, we only speak of ILCs being arguably present or absent in a case. We currently have no notion of "strong" or "weak" instances in the formalism.

This similarity inference may be considered equivalent to proposing a legal rule in the traditional sense. There has been debate about the relationships between cases, rules extracted from cases and rules stemming from legislation (see, e.g., in legal theory: Alexy [2]; in AI&Law: Verheij [32]; each with further references). We affirm the distinction for the following reason. A case similarity inference is formally equivalent to a traditional legal rule but differs in the argument schemes that it can be used with. Traditional rules stemming from written (i.e. codified) law are subject to a different legal methodology. As will be shown in the example section further below, the applicability of a similarity inference to a given case stands and falls with the factual (and conceptually-legal) analogizability and/or distinguishability of said case and the precedent. This sets it apart from "conventional" legal rules (i.e. stemming from codification) which are regularly reasoned with in the abstract and with different recourse to their origin (e.g. drafting history, etc.)

5.2 Rebuttal

We only provide schemes for distinctions based on ILCs in the precedent that are missing in the case at bar. The symmetrical schemes for features missing in the precedent but present in the current case are planned to be published in future work.

5.2.1 Distinction from Missing Feature

First, the defendant's advocate challenges the initial analogy by first pointing out an ILC m (or set thereof) present in p ($p \sqsubset m$) but absent from c ($c \not\sqsubset m$) and argues for the significance of that distinction in her favor. She contests the submitted value judgment $E^+(o, s \cup i^*) > E^-(o, s \cup i^*)$ and instead argues for the better adequacy of the inference $i^* \cup m \Rightarrow o$, thereby implicitly advocating that $E^+(o, s \cup i^* \cup m) > E^-(o, s \cup i^* \cup m)$. We label this an argument **from distinction due to a missing feature**.

Second, the advocate brings an argument for undesirability (see def. 10) of the rebutted inference $s \cup i^* \Rightarrow o$ and/or an argument for desirability of the proposed inference $i^* \cup m \Rightarrow o$ which, respectively, attack/affirm the underlying value judgment. She does so by stating an undesirable consequence q, which would arise if m were omitted from the analogy and a desirable consequence of m being included. Third, the advocate can further support a distinction by pointing to the actual opinion in p, where m has explicitly been considered relevant for the decision.

Fourth, the advocate can present an argument from undesirable consequence u in the precedent or a very similar hypothetical ($s \cup p \vdash u$), hypothesizing that the purpose of the rule in the precedent was to prevent u from occurring (possibly with reference to the text of the decision): $s \cup p \cup r \not\vdash u$, where r is either the plaintiff's rule $i^* \Rightarrow o$ or her interpretation $i^* \cup m \Rightarrow o$. Then, she shows that in the case at bar, u is not entailed ($s \cup c \not\vdash u$) and hence the precedent's rule shall not apply in any case because the purpose it serves is moot. We label this a **distinction from non-occuring undesirable consequence** (see example sec. 6.3).

5.2.2 Optionally: State Counterexample

After distinguishing the plaintiff's precedent, the defendant's advocate can bring an argument **from counterexample** by stating her own precedent p', i.e. a case similar to the current one but which has been decided in favor of the defendant. She will choose a case which is as close as possible to the plaintiff's precedent. Ideally, it would share all the similarity criteria that the plaintiff submitted, i^*, suggesting that $E^-(o, s \cup i^*) > E^+(o, s \cup i^*)$. In such a case, the original three-ply argument is interrupted and restarted with p' in focus and the parties in reversed roles.

5.3 Surrebuttal

In the third stage, the plaintiff's advocate has two possible moves to react to a presented distinction. First, she can straightforwardly downplay the distinction by reversing the desirability/undesirability argument brought forth by the defendant's counsel. Second, she can directly counter the distinction's undesirability argument by *substitution*.

5.3.1 Downplay Significance of Distinction

The defendant's advocate has pointed out the distinctive ILC m (or set thereof) and given some desirable consequence of its inclusion in the analogy and a negative consequence

of its omission (see 5.2.1). As plaintiff's advocate, one has the option of presenting the inverse case. To do this, one points out an undesirable consequence if the distinctive ILC m were to be required for the analogy to p. Also, a desirable consequence can be stated which arises if m is not required.

If the respondent has employed an argument from non-occurring undesirable consequence u, the plaintiff's advocate can react by showing that u actually still occurs, possibly using a hypothetical (compare def. 10, example see 6.4).

It shall be noted at this point that the argument could go into a loop as both sides could simply continue enumerating positive and negative consequences of including m in or omitting it from the analogy. In an actual system, a convergence or pruning of the argument would need a heuristic measure of argument strength able to discontinue at either a tied standoff or one side outweighing the other. At present, our formalism does not provide for such functionality.

5.3.2   Counter Undesirability by Substitution

The distinction's undesirability argument can be countered with an ILC n (or set thereof) which is present in c ($c \sqsubset n$) but absent in p ($p \not\sqsubset n$) and which "makes up" for the absence of m in c. The plaintiff's attorney may even concede that $E^-(o, s \cup i^*) > E^+(o, s \cup i^*)$, altering the proposed inference to $i^* \cup n \Rightarrow o$, meaning that implicitly $E^+(o, s \cup i^* \cup n) > E^-(o, s \cup i^* \cup n)$. She justifies this inference with a desirability and/or undesirability argument. Further, she can directly address the undesirable consequence q used in the defendant's distinction of the precedent (see 5.2.1), and show that it does not follow because of n now being a part of the analogy ($s \cup i^* \cup n \not\vdash q$). We call this an **argument from feature substitution**. For a similar substitution move in the CATO program, see [1].

6.   EXAMPLE ARGUMENT

6.1   Cady vs. Dombrowski

Like the *Carney* case of previous AI&Law discussions (see, e.g., Bench-Capon and Prakken [12, 13]; Rissland [30]) Cady v. Dombrowski, 413 U.S. 433 (1973), is another US Supreme Court case dealing with the automobile exception to the warrant requirement of the Fourth Amendment of the US Constitution prohibiting unreasonable governmental searches and seizures. Under the Fourteenth Amendment Due Process Clause, the prohibition applies to state officials as well as federal. Mr. Dombrowski, the defendant/respondent (Mr. D), was convicted in state court of first-degree murder. On appeal, the state Supreme Court upheld the conviction, rejecting Mr. D's contention that evidence admitted at the trial had been unconstitutionally seized. He raised the same constitutional defense in federal district court and the issue made its way to the US Supreme Court.

Mr. D was driving a rented 1967 Ford Thunderbird to his brother's farm in Wisconsin where he had had his own car, a disabled 1960 Dodge, towed the previous day. On the way, Mr. D, who had been drinking, crashed the Thunderbird into a bridge abutment. He abandoned the car and made his way into a neighboring town where he telephoned the police. Two police officers picked him up and drove to the accident. They noticed that Mr. D, who, they learned, was a Chicago police officer, appeared to be drunk. The Wisconsin policemen believed that Chicago police were required to carry their service revolvers at all times. Not finding a

revolver on Mr. D's person, one of the officers looked into the front seat and glove compartment but did not find a gun. The Thunderbird was towed to a privately owned garage a few miles from the police station and left outside with no police guard. Meanwhile, Mr. D was taken to the police station, arrested for drunken driving, and then taken to a local hospital for observation. The next morning, one policeman drove to the garage to look for Mr. D's service revolver. Between the two front seats of the Thunderbird he found a flashlight which appeared to have "a few spots of blood on it." He then opened the locked trunk of the car and saw various items covered with what was later determined to be type O blood, including a pair of police uniform trousers, a nightstick with the name "Dombrowski", and part of a car floor mat with moist blood. The officer took these items to the police station. Upon confrontation, Mr. D requested counsel who later told the police of a body near the brother's farm. Upon finding the body, the police obtained warrants to search both cars and discovered additional items stained with type O blood, the victim's blood type, but no revolver. The State's case at trial was based entirely on circumstantial evidence that the deceased was hit over the head and then shot. The prosecution introduced the nightstick and testimony that it had traces of type O blood, as well as other evidence found in the Thunderbird (and the other car).

This section illustrates the presented argument schemes in the context of a fictional discussion in *Cady*. The debate forms a three-ply argument between the advocate for the state and the advocate of the respondent. For purposes of brevity and coherence, the discussion is fashioned as a condensation of positions that the advocates took in their briefs submitted to the U.S. Supreme Court. One might expect such a discussion to have taken place in arguments on motions before a lower court, in a different format in oral arguments in *Cady* (transcripts of which are not available) or in a law school classroom discussion of the case.

6.2   Argument for Sufficient Similarity

The state's advocate seeks to establish that a warrant was not required by stating a precedent to analogize to:

> Adv. for State: "Your honor, this court must hold that the search by the police did not require a warrant because it was not 'unreasonable' since it falls under the recognized automobile exception of the Fourth Amendment. As this court held in *Carroll v. United States*, a vehicle (vh) can be searched without obtaining a warrant ($\neg wa$) beforehand if obtaining a warrant would create a risk (rsk) because of the delay in time." [See Brief for Petitioner, Cady v. Dombrowski, 1973 WL 171687 (U.S.), Appellate Brief, No. 72-586. p. 21. Although the State's advocate did not expressly rely on *Carroll* in his brief, he noted with disapproval that the Court below found that the *Carroll* "pigeonhole" did not apply, and argued that a search could nevertheless be reasonable when carried out in pursuance of the police officer's responsibilities for protecting public health and safety. Carroll et al. v. United States, 267 U.S. 132 (1925) pp. 153-154, 158-162, the majority holds that probable cause is needed. We use the *risk* analogy for purposes of the example and address probable cause below.]

The advocate thus proposes a similarity standard which would justify the analogy to Carroll et al. v. United States, 267 U.S. 132 (1925). It takes the shape of the inference $vh \cup rsk \Rightarrow \neg wa$, all of whose elements are present in the precedent. She thereby implicitly proposes that $E^+(\neg wa, s \cup vh \cup rsk) > E^-(\neg wa, s \cup vh \cup rsk)$.

> Adv. for State: "In this case we find that there is a risk because the police had knowledge of a firearm (fa) in the vehicle (vh). Since the car was parked in a lot far from the police station, a delay in searching would have created the risk of the car being opened and the firearm being stolen (st). Hence, the *Carroll* holding applies and a warrant is not required." [Brief for Petitioner, Cady v. Dombrowski, 1973 WL 171687 (U.S.) (Appellate Brief) No. 72-586. pp. 27-28; Cady v. Dombrowski, 413 US 433, 442-3, 447 (1973).]

These arguments show that the relevant similarities are shared by the case at bar: $c \sqsubseteq vh$ (there is a vehicle) and $(fa \cup st) \sqsubseteq rsk$, hence $c \sqsubseteq rsk$ (there is a risk by the possibility of the firearm being stolen). We assume such arguments to be available via CSK and argument schemes. This completes the scheme of an argument for sufficient similarity.

6.3 Rebuttal from Distinction

> Adv. for Respondent: "Your honor, the plaintiff's argument cannot hold. Contrary to this case, *Carroll* involved the police acting with probable cause (pc) as they had a reasonable suspicion of an offense being committed and the car containing evidence of this offense. Further, said car was functioning and intact (mobility mb). This legitimized the warrantless search as the evidence could instantly be driven beyond reach (ebr). Requiring a search warrant in that case would have seriously impaired effective law enforcement." [Brief for Respondent, Cady v. Dombrowski, 1973 WL 171688 (U.S.), Appellate Brief, No. 72-586. p. 24. See Carroll et al. v. United States, 267 U.S. 132 (1925) pp. 153-154, 158-162 (suspicion of contraband smuggling)]

The respondent's advocate contests the submitted similarity inference (i.e. analogy) using a distinction due to a missing feature (see sec. 5.2.1), disagreeing with the underlying value judgment $E^+(\neg wa, s \cup vh \cup rsk) > E^-(\neg wa, s \cup vh \cup rsk)$. She points out the ILCs *probable cause* and *mobile vehicle*, which were present in the precedent (since the car was intact and the police acted on a suspicion of contraband smuggling, $p \sqsubseteq (pc \cup mb)$) but absent from the current case (where the vehicle was immobile and the police did not yet know of the crime: $c \not\sqsubseteq mb$, $c \not\sqsubseteq pc$). She then submits that the rule in *Carroll* was in fact $vh \cup mb \cup rsk \cup pc \Rightarrow \neg wa$ with an underlying value judgment $E^+(\neg wa, s \cup vh \cup rsk \cup pc \cup mb) > E^-(\neg wa, s \cup vh \cup rsk \cup pc \cup mb)$.

To justify her claim, she points out the desirability of her version of the *Carroll* ruling by explaining its main purpose, namely that of preventing evidence loss. Assume the *Carroll* situation of probable cause and a mobile vehicle $h_1 = vh \cup mb \cup pc \cup rsk$ to which one now applies the rule suggested by the respondent's advocate, i.e. $h_1' = h_1 \cup (vh \cup rsk \cup pc \cup$

$mb \Rightarrow \neg wa)$. She submits that $s \cup h_1 \vdash ebr$ but $s \cup h_1' \not\vdash ebr$ because in h_1', a warrantless search would be possible, thereby allowing to secure the evidence before it disappears. In this context, such a disappearance is arguably a demotion of the value of effective law enforcement (LE), e.g. $ebr \sqsubseteq d_{LE}^-$. Hence, it is an undesirable consequence (see def. 10).

> Adv. for Respondent: "The actual test in *Carroll* requires probable cause and evidence of functioning vehicles. Here, however, the vehicle was rendered immobile by an accident. It cannot be driven away instantly. Also, at no time before the search did the police have knowledge or suspicion of an offense having been committed. [Brief for Resp., Cady v. Dombrowski, 1973WL 171688 (U.S.), Appellate Brief, No. 72- 586. p. 24]

The advocate distinguishes the present case from her 'corrected' version of the *Carroll* rule using a distinction from non-occuring undesirable consequence (see 5.2.1.): $c \not\sqsubseteq mb$ and $c \not\sqsubseteq pc$, thus $s \cup c \not\vdash ebr$ (no risk of evidence loss because the vehicle is not mobile). This supports the adequacy of her reading of *Carroll* and the significance of requiring features mb, pc in the rule. She then shows the undesirability of the plaintiff's interpretation of *Carroll*:

> "However, the rule from *Carroll* is not to be expanded beyond scenarios of functioning cars and probable cause, as plaintiff suggests, to an abstract 'risk'. Imagine a risk (rsk) emanating from a motor home (mh) with a broken engine ($\neg mb$) on a campsite. This is very similar to a home, where there is no risk resulting from mobility. Not requiring a warrant to search a dwelling compartment (sdc) frustrates the owner's expectation of privacy." [Hypothetical inspired by California v. Charles B. Carney, 1984 US TRANS LEXIS 209, No. 83-859 (US Sup. Ct.), Argument of Mr. Homann for Respondent p. 27]

The advocate argues for the significance of the distinctive ILCs mb and pc using hypothetical $h_2 = rsk \cup mh \cup \neg mb \cup sdc$ to present an undesirable consequence of ignoring them (see def. 10). The hypothetical falls under the state advocate's rule: $h_2 \sqsubset (vh \cup rsk)$ (assuming $(\neg mb \cup mh \cup rsk) \sqsubset (vh \cup rsk)$), resulting in the searchability of a dwelling compartment without a warrant, $s \cup h_2 \cup (vh \cup rsk \Rightarrow \neg wa) \vdash sdc$ (and $s \cup h_2 \not\vdash sdc$), which is arguably a considerable demotion of privacy (Pr): $sdc \sqsubseteq d_{Pr}^-$. This suggests the inadequacy of the rule: $E^-(\neg wa, s \cup vh \cup rsk) > E^+(\neg wa, s \cup vh \cup rsk)$.

Note that, when involving a hypothetical (see def. 10), an argument from undesirability/desirability may be rebutted on other grounds (e.g. the hypothetical not falling under the rule). We do not address these possibilities here but see our previous work on hypothetical reasoning [21].

6.4 First Option: Downplay Distinction

The state's advocate has the option of employing desirable/undesirable consequence arguments herself:

> Adv. for State: "Your honor, we respectfully disagree. Upholding the mobility requirement ignores that fact that an immobilized vehicle may easily be mobilized again." [See Cady v. Dombrowski 413 US 433, 441f ("warrantless searches

of vehicles by state officers have been sustained in cases in which the possibilities of the vehicle's being removed or evidence in it destroyed were remote, if not nonexistent.")]

The advocate upholds the inference $s \cup vh \cup rsk \Rightarrow \neg wa$ (implicitly $E^+(\neg wa, s \cup vh \cup rsk) > E^-(\neg wa, s \cup vh \cup rsk)$) and presents the undesirability argument (see def. 10):

> Adv. for State: "Suppose the vehicle has only a minor technical malfunction (mtm), which can easily be fixed once a competent person looks at the engine. Under such uncertainty, the police must be free to search immediately to prevent the escalation (esc) of an existing risk (rsk). Such scenarios require the automobile-exception to be upheld without any qualification as to mobility.

The advocate creates a hypothetical $h_3 = vh \cup rsk \cup mtm$ and points out the desirability of her submitted rule, $s \cup h_3 \cup (vh \cup rsk \Rightarrow \neg wa) \not\vdash esc$ (the rule prevents the escalation) but $s \cup h_3 \vdash esc$ (not applying it entails the escalation because of repairability). The escalation might be deemed a medium demotion of public safety (PS), $esc \sqsubseteq d_{PS}^{--}$. Hence, she submits, $E^+(\neg wa, s \cup vh \cup rsk) > E^-(\neg wa, s \cup vh \cup rsk)$.

> There is no reason to limit the risk to situations of probable cause. In the respondent's hypothetical, if the motor home contained a leaking gas tank (lgt), an immediate search is necessary to prevent any danger to the public (pdp) irrespective of whether it is mobile. Otherwise, public safety is severely impacted. If one limits *Carroll* to cases of probable cause and mobile vehicles, the police could not prevent dangers to the public ($\neg pdp$)." [Hypotheticals inspired by California v. Charles B. Carney, 1984 US TRANS LEXIS 209, No. 83-859 (US Sup. Ct.), Argument of Mr. Homann for Respondent p. 27]

The hypothetical $h_4 = mh \cup \neg mb \cup lgt$ is evaluated in light of extending it with the suggested rule: $s' = s \cup h_4(vh \cup rsk \Rightarrow \neg wa)$ (add the state advocate's rule). Assume $lgt \sqsubseteq rsk$. She argues that $s \not\vdash pdp$ (without the rule dangers to the public cannot be prevented) and $s' \vdash pdp$ (without the rule they can) as well as a promotion of public safety (PS): e.g. $pdp \sqsubseteq d_{PS}^{++}$ (prevention of dangers to the public has a medium positive effect on public safety). This completes an argument from desirable consequence (def. 10).

Using another undesirability argument, she states that respondent's interpretation of the *Carroll* rule does not produce an equitable result, as it requires a mobile vehicle as well as probable cause and hence fails to remedy the leaking gas tank situation. Take a situation with respondent's rule, $s'' = s \cup h_4 \cup (vh \cup rsk \cup pc \cup mb \Rightarrow \neg wa)$, argue $s'' \vdash \neg pdp$ (using the respondent's rule hinders the prevention of dangers to the public because it does not apply in h_4) as well as $\neg pdp \sqsubseteq d_{PS}^-$ (not preventing dangers to the public is a medium demotion of public safety), therefore $E^-(\neg wa, s \cup vh \cup rsk \cup pc \cup mb) > E^+(\neg wa, s \cup vh \cup rsk \cup pc \cup mb)$.

6.5 Second Option: Substitute

> Adv. for State: "Admittedly, respondent's car was disabled. Also, there is no dispute about

mobility being a decisive feature in *Carroll* because of a situation of probable cause." [See Petitioner Brief, Cady v. Dombrowski, 1973 WL 171687 (U.S.) (Appell. Brief) No. 72-586. p. 21. State's advocate noted that lower Court found that *Carroll* "pigeonhole" did not apply. See Carroll et al. v. United States, 267 U.S. 132 (1925) p. 153 (mobility considered relevant)]

The advocate concedes that $c \not\sqsubseteq (mb \cup pc)$ and possibly even that $E^-(\neg wa, s \cup vh \cup rsk) > E^+(\neg wa, s \cup vh \cup rsk)$.

> Adv. for State: "Respondent's car, however, was in a form of police custody (fc) at the time of the search. While there was no probable cause, it was parked far from the police station, so the police were responsible that no dangers would emanate from it. As the police officer had reason to believe a firearm was in the car, he searched it and only then found evidence of a crime. Absent the search, the gun might have been stolen. It is in the interest of public safety that no unlicensed guns (ug) are in circulation." [Petitioner Brief, Cady v. Dombrowski, 1973 WL 171687 (U.S.) (Appell. Brief) No. 72-586. p. 21]

Following the possible concession, the advocate points out the distinct ILC *form of custody*, which she submits as upholding the legality of the search in the absence of mobility and probable cause. She implicitly argues for a different value judgment, $E^+(\neg wa, s \cup vh \cup rsk \cup fc) > E^-(\neg wa, s \cup vh \cup rsk \cup fc)$, underlying the now slightly modified submitted inference $vh \cup rsk \cup fc \Rightarrow \neg wa$ (compare initial analogy 6.2). She supports this argument by stating the undesirability of an unlicensed gun being in circulation and the capacity of her rule to prevent it: $s \cup c \vdash ug$, $s \cup c \cup (vh \cup rsk \cup fc \Rightarrow \neg wa) \not\vdash ug$ and, e.g., $ug \sqsubseteq d_{PS}^+$. This is an argument from feature substitution (see 5.3.2). In altering her original submission, she has reinforced the analogy to *Carroll* despite the respondent's mobility and probable cause distinctions.

7. HYPOTHETICAL REASONING

One can recognize that the initial precedent similarity argument (see 5.1) is similar to proposing a test for deciding the case, as it is done in hypothetical reasoning. There, an advocate proposes a test as a suitable rule for deciding future cases and under which the case at bar would be decided in her favor. The judges then may challenge the rule by posing hypothetical situations, which push the rule to its limits and possibly lead to inequitable results. The advocate reacts to the hypothetical by upholding the test, distinguishing the hypothetical or modifying the test as needed, always subject to the constraint that her case be favorably decided under the resulting test. Hypothetical reasoning is employed frequently in legal reasoning and education, most prominently in oral argument before the U.S. Supreme Court.

At the end of section 6.3., a hypothetical is used to make an undesirability argument, i.e. point out an undesirable consequence of extrapolating a certain rule from a precedent. In a sense the hypothetical challenges the state advocate's suggested rule from *Carroll* as overbroad, i.e. covering more scenarios than it should. The state's advocate has a number of options. For example, she can distinguish the

hypothetical by arguing that a disabled motor home on a campsite is not really a vehicle in the sense that she had submitted the rule ($mh \not\sqsubseteq vh$) and that hence the rule would not apply. Or she could state that a person living in a motor home has less expectation of privacy than a person living in a house, i.e. $e_{Pr}(\neg wa, s \cup mh \cup rsk) = -$ (see def. 9) and uphold the value judgment that the promotion of public safety outweighs the demotion of privacy: $E^+(\neg wa, s \cup vh \cup rsk) > E^-(\neg wa, s \cup vh \cup rsk)$ using what we call an argument **from lesser severity**.

We have modeled this type of discourse using the value judgment formalism in [21] and provided detailed explanations and argument schemes. The discourse can shift from case similarity to hypothetical reasoning and back whenever the participants deem it appropriate. For example, if the court were to adopt $vh \cup rsk \cup fc \Rightarrow \neg wa$ as a governing test and it were to come up in a future case, an advocate could legitimately challenge its applicability based on factual distinctions with *Cady*. Our formalism represents case similarity inferences and tests in hypothetical reasoning as norms with underlying value judgments. It enables a spectrum of argument schemes, however, to treat these two in different discourse patterns. A system based on the formalism may seamlessly shift back and forth as well, depending on the circumstances and argumentative goals.

8. FURTHER RELATED WORK

Our ultimate aim is to computationally model, through argumentation, the interpretive legal process of proposing a rule for deciding a case in terms of ILCs of the sort familiar in legal practice, defining its concepts intentionally with rules and extensionally with case examples, assessing the fit of the proposed decision and rule with respect to legally protected values and to past decisions as elucidated through hypotheticals, and adjusting the rule and the concepts to accommodate the objections as expressed in arguments. No existing AI&Law model or program does all of this but many do some part of it. In [21], we presented a value judgment model that accounts for value-based and hypothetical reasoning. In our framework, proposing a legal rule involves a value judgment that the positive effects on relevant values are preferable to the negative effects, both for the more general scope of the rule and in the specific scenario to be decided. Unlike [12, 13], our approach avoids incorporating value tradeoffs explicitly into legal rules as it is not consistent with legal practice. For a detailed distinction, see [21].

In this work, we extend the value judgment framework to account for employing ILCs in the proposed rule and for defending the value judgment in the problem scenario as compared to relevant precedents. These extensions improve the manner in which AI and Law models (and eventually programs) can draw and justify inferences from case-based comparisons. Cases and their facts are still represented in terms of expert-supplied factors that enumerate legally relevant patterns with which to analogize a problem to or distinguish it from precedents (e.g., [6, 31, 1, 17, 8, 35]). The factors are still associated with values; [14, 17, 9] present models or programs that represent cases as factors whose significance is based on abstract values.

The manner in which the values inform the comparisons in the value-judgment framework is different, however. Chorley & Bench-Capon [17] modeled arguments and rule induction that reflect preferences among conflicting values and

applied the rules in analyzing new cases, but did not support arguments about how the conflicts should be resolved in a particular case and did not use intermediate legal concepts in the rules in a manner consistent with legal practice. The argumentation models in [9, 20] label argument propositions with the values promoted if the arguments were accepted, and add meta-level arguments about the evidence underlying facts and preference ordering of values under the precedents and authorities. Atkinson & Bench-Capon [9] provide a framework for applying standards of proof and value preferences, derived in part from precedents, to evidentiary arguments. Our approach, however, addresses the comparative tradeoffs in values affected by the proposed rule as represented in terms of intermediate legal concepts.

Our work contributes to the field's current program of specifying specific argument schemes. In Prakken et al.[29], domain-specific critical questions about an argument's weaknesses are represented as argument schema in a general argument diagramming platform. The questions come from legal argumentation schemes identified in [33], some of which relate to analogical reasoning from precedents or hypotheticals. We contribute a set of argument schemes corresponding to typical moves in case-based reasoning that address how applying ILCs impacts the applicable values in and across the specific factual scenarios.

More specifically, the argument framework by Atkinson & Bench-Capon [9] addresses values but does not involve ILCs. Wardeh, et al. [34] address intermediate concepts but not values. Rissland [30], Ashley [6], and Aleven [1] explored models of legal argument based on representing cases in terms of dimensions or factors that did compare and contrast cases in a manner sensitive to the cases' facts, but did not explicitly take underlying values into account. CATO [1] and IBP [8], however, did represent reasons why the factors mattered and used them in comparing cases more effectively. Similarly, AS-CATO (Wyner, 2008), a reworking of CATO and IBP, implements factual context-specific case comparisons, but none of these programs addresses reasoning with proposed tests, hypotheticals or underlying values. McCarty and Sridharan [25] developed a program that modeled arguments that did take ILCs and precedents into account but not values, at least not obviously or explicitly, and did so for only in one Supreme Court tax case. Rissland and Skalak [31] as well as Branting [15] took ILCs from statutes and precedents into account but not values.

9. CHALLENGES AND FUTURE WORK

One conceptual problem is that certain values may apply in more than one way and in more than one instance in a given case. For example, in a sales contract case, both plaintiff and defendant are concerned in their interest to protect their property and commercial freedom. It is the same value but the interests of multiple actors regarding this value need to be balanced. We leave this for future work as it requires the development of an actor-and-role model for the formalism. Another area for improvement is the fact representation, which we intend to refine.

Crafting a knowledge representation which allows for the generation of specific examples (hypotheticals) as well as the algorithmic formation of meaningful abstractions (ILCs) is a challenge on the way to a computational implementation. Also, a suitable experimental setup for empirical evaluation needs to be conceptualized. Possibilities to consider

are, for example, the generation of textual arguments to be compared against human-created ones or the creation of a dialogue-system which would specify the kind of information necessary to craft an argument for a particular configuration.

10. CONCLUSION

We have explained the value judgment formalism, which builds upon the interaction between facts and values, and provided an application by modeling case comparison arguments of legal case-based reasoning. Particular emphasis has been focused on the role of intermediate legal concepts in the creation of meaningful arguments using the schemes we provided. We further have established a firm and coherent connection to our previously published model of hypothetical reasoning. We consider our main contribution to lie in the flexibility in expressing context-sensitive value preferences through the concept of value judgments and the possibilities it opens to interface different discourse patterns. Besides striving for a computational implementation and empirical validation, we plan to develop more argument schemes in future work to expand the formalism for other kinds of legal argumentation, such as statutory reasoning.

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