Concept and Context in Legal Information Retrieval

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Abstract. There exist two broad approaches to information retrieval (IR) in the legal domain: those based on manual knowledge engineering (KE) and those based on natural language processing (NLP). The KE approach is grounded in artificial intelligence (AI) and case-based reasoning (CBR), whilst the NLP approach is associated with open domain statistical retrieval. We provide some original arguments regarding the focus on KE-based retrieval in the past and why this is not sustainable in the long term. Legal approaches to questioning (NLP), rather than arguing (CBR), are proposed as the appropriate jurisprudential and cognitive underpinning for legal IR. Recall within the context of precision is proposed as a better fit to law than the 'total recall' model of the past, wherein conceptual and contextual search are combined to improve retrieval performance for both parties in a dispute.

Keywords. Information retrieval, natural language processing, recall, precision

Introduction

Law was one of the first disciplines to adopt electronic information retrieval (IR), with the first domain-specific legal retrieval system appearing as early as 1960 [6]. The reason for this is self-evident: law is a text-based discipline. There is possibly more textual data for law than any other domain, and in court the possession of all the relevant knowledge can be pivotal. Information is the foundation of law, but the stability of legal information provision and access is now in danger. There is a real risk that the advent of electronic publishing has elicited a premature response from arbiters for the law of professional liability. Whereas previously, access to all relevant cases was only theoretically possible, now the legal requirement to make all cases available in a timely manner, added to the alacrity with which formerly unpublished court opinions are being commercially provided, has resulted in a flood of information that threatens to overwhelm legal systems.

The effects of the current explosion of electronic case law are pointed out by Berring: poorly written or relatively unimportant court opinions are now accessible at the click of a button, readily exposing the comforting myth that all opinions with the same juristic status are equal under the doctrine of *stare decisis* [4]. Overload of information, and particularly low-quality information, has the potential to undermine law if something is not

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done. Survival may turn on how the relevance of case law is defined. Can we improve the way we retrieve cases to the extent that we create a new, digital edifice replacing the single, authoritative reference collections of the past? And can we design these systems robustly enough so that their use constitutes a legal defence against accusations of negligence in overlooking a precedent?

Modern IR may step up to the challenge, but there is a long way to go. Legal IR is currently divided between text-based Boolean retrieval, knowledge engineering (KE) frameworks, epitomized by West's Key Numbers system, and inference network IR. None of these approaches efficiently and reliably produces all and only the relevant cases for a legal search. KE ontologies successfully reflect how advocates recall and leverage legal precedent, but at a great expense of human labour. Blair and Maron [7] clearly demonstrate that Boolean techniques do not meet expected standards in legal retrieval: in their study, legal researchers retrieved less than 20% of relevant documents when they believed they had found over 75%. Commercial legal inference networks offer better performance than traditional Boolean search [25], but remain less popular.

Clearly, more can be done to address the requirements of legal search. The question is where effort is best invested. Manually developed ontologies are more precise than automatically generated features and close to the process of legal reasoning. Indeed, IR is often a constituent of more ambitious projects to model CBR. It is easy to understand the appeal of this intimate relationship, wherein an IR algorithm 'understands' the purpose to which a retrieved case will be put and can use this knowledge to make suggestions. However, KE-based approaches also inherit the more problematic theoretical assumptions of KE. For instance, we will argue that in legal IR, commitment to a singular set of *right* or at least objectively *best* precedent cases for a given problem is counter-productive.

An alternative to KE-based approaches - automated text analysis - has achieved success in combination with hyperlink analysis in open domain search, and there may be much that the legal IR community can learn from this field. However, the fact that law has not adopted practices common in open domain retrieval may be indicative of how, until now, these technologies have been misaligned with the needs, expectations and conceptual presuppositions of legal professionals. In other words, it is plausible that the legal profession has continued to rely predominantly on manually maintained ontologies for two reasons: first, because the desired performance from automated search is not available; and second, because the way in which NLP techniques are implemented does not intuitively match the way in which lawyers understand their work.

We support the view that legal issues, concepts and factors will play a prominent role in legal IR for the foreseeable future but challenge the reluctance of researchers, as well as data providers, to take seriously the advances in open domain IR. Mere gains in efficiency from NLP-oriented IR may be insufficient to compel paradigm change. What we will explore is whether it is possible to align NLP to the cognitive models of legal professionals in a way that is also scalable to rapidly growing stores of legal information.

1. KE-based Retrieval

The KE approach to retrieval is an attempt to translate the way legal experts remember and classify cases into computer algorithms and data structures [16]. Data structures are filled with information about the legal aspects: issues, concepts and factors associated

with each case, indicating the case's content and significance. Legal issues and concepts are self-explanatory; factors play a role in deciding legal issues. The end result is that the knowledge stored is similar to that found in the legal ontologies of commercial providers.

Additional information is recorded about the normative relationships between legal aspects. These links are pivotal as they affect the degree of influence an issue or factor has on a judgement and therefore whether a case is relevant to a particular query. Factors that are decisive in one case may be cancelled by another in an exceptional case. Calculation over these links, aspects, and the retrieval of relevant cases based on the complex web of relations between them, is a type of legal IR that has grown out of legal theory and CBR. In a sense, it is the embodiment of a formal logic approach to IR: there are underlying 'truths' (issues, concepts, factors), and we can reason from these truths in order to find relevant case texts, or resolve the case in hand.

Proponents of KE in legal retrieval observe that landmark cases are not necessarily discernible from analysis of text and important future legal concepts may not be mentioned at all. However, the KE approach suffers from the need for highly specific annotation of legal issues, concepts and factors, and detailed knowledge bases encoding the ways in which they interact; both are dependent on the in-depth knowledge of legal professionals. As a result, tags are usually manually assigned, although in commercial environments annotation is assisted by state-of-the-art classification systems.

1.1. Related Work

Hafner [16] proposes a strong, theoretical KE-based retrieval system comprised of three parts: a model of legal knowledge about issues and concepts; representations of cases as frames in which roles are filled by legal concepts; and a graphical representation of relationships between issues, concepts and factors that could be compared to normative relationships in the legal domain.

Silveira and Ribeiro-Neto [20] attempt to improve ranking of search results by matching query terms to concepts in a domain-specific thesaurus. Each query is expanded to include six sources of evidence, including query keywords, thesaurus concepts, and ontological relations, which are used to provide separate document rankings.

Ashley and Aleven [1] propose a tutoring system that contains a KE-based IR component. They recognise that the defence and prosecution in a legal conflict look for different cases to support their respective arguments, and therefore require different search strategies. However, their approach assumes that the only difference between cases is the degree by which they are on point, and which side they favor. For the very small database they use, this does not matter, but for realistic IR this would no longer be feasible.

Best efforts have yet to accurately automatically assign legal factors to cases. Results by Brüninghaus and Ashley [8, 9], whose binary factors more closely resemble facts as described in Section 4, were achieved using separate classifiers on six factors, resulting in precision values between 30% and 80.55% and recall values ranging from 50% to 81.69%. This is short of the performance required from a real-world system.

Despite such set-backs, the prospect of automatically assigning factors to cases is still on the table. In the context of the MOSAIC project, Moens and De Busser [17] identify concepts, factors, issues and rhetorical relations as desirable features of a legal IR system and suggest natural language processing (NLP) and machine learning techniques that might be used to extract such information.

1.2. Benefits and Drawbacks

The benefits of KE-based retrieval have already been outlined. This approach aligns IR technology with the cognitive competencies and skills of lawyers, and uses categories relevant to legal argumentation as schemata for retrieval. However, research in this area is often worked out only in theory, is domain-focused and conducted on small, highly structured data collections or even single examples. It is also often assessed via feasibility studies rather than empirical analysis of comparative performance, in large part because KE-based systems are difficult to implement and scale.

Other disadvantages of the KE approach are the high financial cost and time investment of building and updating manual indexes, the tradeoff between the complexity of case representations and their generality, and the difficulty associated with designing effective text representations. In addition, each case does not just denote a cluster of issues and factors. Case law is performative: it creates issues and factors, and in doing so it continually changes relationships between other cases and how we interpret the law. Analyzing case law with respect to a static set of concepts is therefore a denial of the underlying nature of the common law system.

Finally, and not least, manual, detailed analysis of cases concepts is impractical in the long term. We argue that issues and factors will need to be automatically extracted in order for KE-based IR to scale up, and this task will inevitably need to be resolved through automated NLP. In other words, it may appear that KE-based retrieval gets around the lack of human insight associated with text-based retrieval, but in fact it only postpones the moment when search systems must mimic human insight in order to perform adequately on a large scale.

For this reason, in the absence of a concrete, scalable proposal indicating how legal issues and factors can be extracted or inferred automatically from case text, we propose that developing techniques from NLP might be applied to improve search whilst circumventing the bottle-neck of pure conceptual legal analysis.

2. NLP-based Retrieval

NLP-based IR recognises that there is more than one valid perspective on the organisation of case law, and champions the perspective of the particular searcher, at the time they are searching, over results determined by traditional legal classifications. It does not pose any obstacles to legal ideas by omitting them from a reference ontology, nor does it strengthen or weaken legal concepts over time by right of their privileged or unprivileged level in the hierarchy [12].

Successful implementation of NLP-based IR, which we define as any system that incorporates NLP tools[2], has been elusive in open domain search. Lack of consistent, demonstrable benefit has led to statistical IR using simple, general features of text i.e. words, citations, and phrases. However we argue that NLP-based search may benefit

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[2]NLP techniques include part-of-speech (POS) tagging, chunking (grouping text into meaningful units, such as verb or noun phrases), sentence segmentation, named entity recognition (identifying entities such as people, organisations, locations in text) and dependency parsing (constructing a hierarchical tree that describes how words depend on each other in a sentence, e.g. an adjective depends on a noun).

case-based retrieval due to the nature of legal documents and the requirements of legal searchers.

Inference networks used in commercial legal IR can incorporate any number of document and query representations from simple terms to encoded knowledge about the syntax and semantics of text, temporal events and document structure. Although the details of commercial legal systems are carefully concealed, they do not appear to make full use of their potential. Turtle, who helped develop West's inference system, has written about manually assigned index terms, citation information and automatic keyword extraction (e.g. thesauri, term clustering), with advanced NLP referred to as possible future evidence [24]. We propose that given recent advances in NLP, this is an opportunity and inclusion of more sophisticated forms of language understanding such as combined named entity recognition, dependency parsing and SRL, should provide more detailed information about cases that may improve precision in case-based legal retrieval.

2.1. Related Work

Commercial legal 'natural language' search uses simple NLP output in an inference network [24, 26] that simulates Boolean retrieval with weighted indexing. This is achieved by reducing the rigidness associated with conditional probability estimates for Boolean operators *and, or* and *not*, plus operators for *phrase, synonym* and *related terms*, so that document ranking increasingly depends on the number of query constraints met. Such systems can incorporate many types of evidence, including citations, and potentially, more sophisticated NLP output.

Dick [13] suggested that NLP be used to derive concepts directly from a collection of case texts, instead of assigning cases to nodes in a pre-existing legal ontology. She gives a highly detailed case analysis based on Toulmin's argument theory.

Other forms of representation may also be possible following NLP, including tagged feature-value pairs, logical, symbolic, predicate or other structures. The FLEXICON system [14] generates headnotes, called *flexnotes* which are similar to the headnotes manually generated by printed publishers. Flexnotes are comprised of paragraphs excerpted from case opinions using automatic summarization and four text parameters: concepts, case citations, legislation and facts. These four search parameters were proposed as necessary and sufficient to achieve high performance in legal retrieval. Unfortunately, there is an absence of published work on the system post the mid-beta version [21].

There is little other NLP-related work specific to case-based retrieval. Biagioli et al. [5] view the classification of statute paragraphs according to their regulatory content as a preparatory step for indexing and retrieval of legal text, and use semantic role labeling (SRL)[3] to discriminate between types of regulatory content with promising results. The TREC legal track [23] focuses on search for electronic evidence (DESI), which differs from case-based IR in desired recall and data format. It also faces challenges of data noise, such as from scanned documents, and identification of social networks in email.

Although not law related, we can gain some insight into the possible benefits of NLP techniques from open domain question answering (QA)[4]. Narayanan and Harabagiu [18]

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[3]SRL identifies the semantic constituents of a sentence, such as the agent, theme, object etc.

[4]QA: An IR task in which natural language questions are translated into traditional IR queries, the top *n* sentences from the resulting search are ranked using the presence of query terms plus other factors, and an answer is retrieved using advanced NLP.

were the first to use SRL to improve precision and enable inference processes in complex QA. Their system based only on answer hierarchy (ontology) achieved 8% accuracy, whilst their system using all semantic structures achieved 52% accuracy.

2.2. Benefits and Drawbacks

In the past, open domain IR focused on using NLP in query analysis, partly because it makes no sense to invest a lot of effort processing large numbers of documents when NLP techniques are still developing rapidly and those documents will only need to be processed again [26]. This drawback still applies today, but to a lesser extent; NLP has come a long way in the last ten years.

In favour of probabilistic techniques used in NLP, when compared to manual indexing and case tagging, they are more efficient since they are designed to run on terabytes of data. There is no cost of human labour, and the only limitation is computing power. This is expected to continue to increase exponentially in the coming years, making widespread, deep NLP a viable possibility.

3. Legal IR as Question Answering

Of all the open domain IR tasks, in some ways legal IR most closely resembles QA. In open domain retrieval, QA is a testing ground for advanced semantic NLP techniques that must also be flexible enough to respond to different types of search. In law, the art of efficient questioning is also more flexible than that of 'correct argumentation', representing an additional conceptual tool with which to persuade a court.

Lawyers are skilled in asking questions and believe in the power of asking questions to elucidate the truth [19]. Examination of witnesses is the most iconic example of the use of questions by lawyers to retrieve information, but interviewing a client is of equal consequence. Further, the importance of questions has been recognised recently, to a limited extent, by argumentation-oriented researchers in legal AI, most prominently by Walton and Gordon, who address the concept of the "critical question" [27].

We posit that combining state-of-the-art NLP techniques applied in QA with existing inference network legal IR may reap the benefits of NLP whilst preserving KE's proximity to core legal skills and cognitive schemata.

In the next section we bring these ideas together: first, that legal IR should reflect the cognitive model of lawyers and address their specific search needs; second, that NLP-based techniques, as exemplified in QA, offer a promising avenue for future legal IR research. We do this whilst bearing in mind the current explosion of electronic legal information and the requirements this places on retrieval in terms of precision and recall.

4. Precision and Recall

The concepts of precision and recall are fundamental to research in open domain IR, where it is widely acknowledged that a trade-off exists between the two. However, both are judged in relation to *relevance*, assuming that *relevance* is equivalent to *topicality*. This is acceptable and convenient in open domain IR; topicality is far easier to empirically measure than relevance, and it enables open domain retrieval systems to be com-
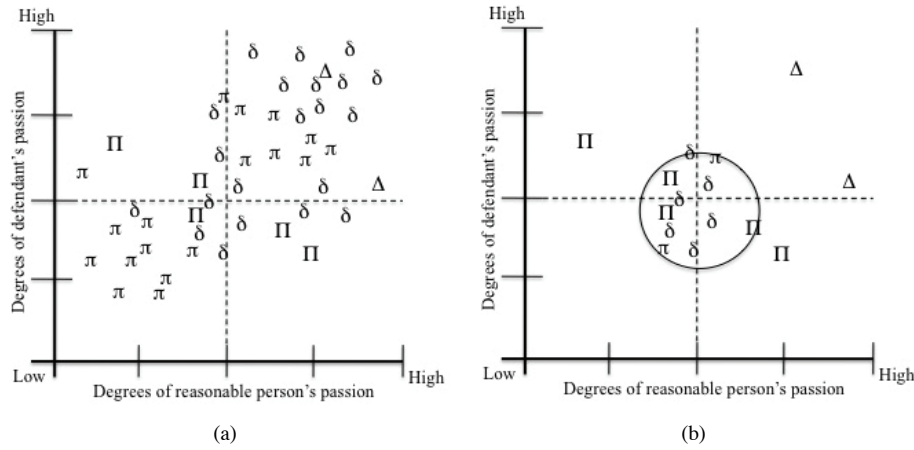
Figure 1. The case population following total recall search (a); and a high recall search within the context of precision (b). Figures adapted from [22].

pared statistically, but it creates problems in legal IR. The partisan nature of legal disputes means that any IR system that only looks for cases that are objectively the *best*, or most *on-topic*, will be unsuited for at least one party.

Dabney [10, 11] and Berring [2, 3] argue that advocates require nothing less than recall of every relevant case in a database. Lawyers are liable for not being fully informed, so from a given perspective this statement is plainly true. On the other hand, it has been argued that the most pressing task in online legal research is quickly and easily finding a few on-point cases from which other cases can be traced by traditional means [3, 15]. If precision is indeed more important than recall in legal IR, then this is particularly problematic for current database systems: the larger the document collection the harder it becomes for Boolean techniques to perform adequately.

We take the view that whilst many lawyers say they want *total recall*, they may actually prefer full *conceptual* or *contextual* recall within the framework of a precise search. Let us illustrate the practical consequences using graphical representations of a lawyer's hypothetical mental model of case precedent.

4.1. Thinking Like a Lawyer

Figure 1a shows a graph adapted from Sutton [22], mapping hypothetical cases of murder in the heat of passion. This graph represents a lawyer's mental model if he were fully informed of all on-topic cases to do with this subject (total recall). Here, δ indicates a case decided for the defendant, and π indicates a case decided for the prosecution. Δ and Π are the principal cases for the defence and prosecution respectively.

We conceive this conceptual map as a plot of cases where contextual similarity of facts is represented by proximity in event space, and decisive factors - the "legally operative facts" - determine the labels on the plot axes, in this case, *degrees of reasonable person's passion* and *degrees of defendant's passion*. In support of this interpretation, we assert that in legal IR both facts and legal concepts must be considered. Legal concepts can only be interpreted in light of the facts. Further, KE issues, concepts and factors arise

from reasoning about facts. For this reason, several researchers have attested to the importance of considering facts in legal IR [13, 14, 16]. In the example that follows, we assume that concepts are KE-derived and context is extracted using NLP.

An experienced lawyer will be able to estimate his chances of winning before searching a database. Let us assume a scenario in which lawyer X can safely assume there are powerful precedents supporting his case, whilst lawyer Y knows he faces an uphill struggle. X's main interest in this scenario is to identify an outline of principal cases in the area. This might be obtained from a senior counsel or a compiled law report, but for the 'Google generation', this is likely to be a precision-focused research task: return all and only the few top cases that have high *conceptual relevance* (legally operative facts), possibly low *contextual relevance* (eventualities), and high *juristic value* for a query in which the concept is given. In other words, find important cases for which certain legal concepts (the legal dimensions under consideration) are influential, and which lie anywhere in the event space. Concurring decisions by lower courts, even if more *contextually* relevant, can be safely ignored. Indeed, using precedents sparingly is seen as an indication of quality of a legal argument, and only beginners in this situation would cite all decisions in their favour.

In graphical form, the desired results of X's search correspond to the cases indicated by Δ and Π in Figure 1b: a few cases bounding areas where cases are more frequently decided for the plaintiff or the defendant, plus the landmark precedent. Notice now, if we use eventualities and legally operative facts as the basis of retrieval, then it is sensible that the former might be extracted from text using NLP whilst the latter are provided by KE. By this, of course, we intend to suggest that NLP techniques will have a key role to play in legal IR, and hybrid systems will offer a strong solution for legal case-based retrieval.

For lawyer Y, the situation is different but the search system is the same. Ex hypothesis, there is no obvious governing precedent from a high ranking court in Y's favour, and as a result, the overwhelming majority of on-point lower court decisions are bound to be against him as well. At this point, Y has two options. He can try to convince his client to settle, or he can pursue the case regardless. In the latter situation, Y's only hope is to find the most relevant decision in his favour, even though superficially it may be less on-point or from a lower court; he needs some basis for his legal argument that the court should ignore or set aside decisions cited by the opposition. A bold analogy to another field of law (and, inevitably, decisions that use a very different vocabulary), or an overlooked dissenting opinion, may be a way for lawyer Y to convince the court that, given the facts, his perspective is more just, accurate or acceptable than his opponent's. As a result, the database is for him more like a hostile witness under cross examination. His questions have to circumvent unwanted answers to elicit small and perhaps overlooked morsels of information that allow him to construct a counter argument. The better the IR system is in identifying the most conceptually *on topic* cases, the less Y will be able to find the cases he needs, as in a one-size-fits-all definition of topicality, they will be weak.

We argue that both X and Y need near perfect search recall *within the context of precision*. This point is crucially important and is illustrated in Figure 1b. Total recall would simply swamp both lawyers in material that for their purposes is irrelevant, as shown in Figure 1a. Instead, X desires full recall from a precise search for cases of high conceptual relevance and juristic value. Y would do well with X's search plus full recall from a precise search for cases with similar eventualities to the current case. He might

also investigate the event space immediately surrounding precedents likely to be cited by X, to check whether any conflicting opinions can be leveraged for his client. Through iterative search, more in-depth coverage of the event space can be achieved.

This flexible, tailored search process stays close to the reasoning process of lawyers, who traditionally use citation search to gain deeper awareness of a specific area of law. Citation search tools already are provided by commercial legal IR systems, but each citation must be clicked through manually. The advantage of automation is that retrieved cases are not constrained by any legal expert's conception of the law, ontological structuring of a database, or the particular set of citations for a given case. Further, more precise retrieval saves the lawyer time and money.

Conclusion

Two broad approaches to legal information retrieval are presented, based on manual knowledge engineering (KE) and NLP. A review of each approach suggests that retrieval based solely on KE is not sustainable in the long term. Superficially, NLP-based models of IR may appear to be removed from the skill set that lawyers bring to their task, but we prepare an argument that this need not be true. By linking NLP-based IR to the concept of questioning, and the mental models lawyers maintain of the law, we can now see a possibility to align NLP to core skills of the legal profession in a way which is also scalable to the vast quantities of electronic legal text rapidly becoming available.

We address the implications of increasing amounts of legal information with respect to search recall and precision. In the long term, if legal databases are swamped with lower quality opinions (those that in the past would remain unpublished), it may not be desirable for recall to be weighted heavily over precision. High recall will increase costs of human time and effort incurred in sorting through cases. We propose a way of conceiving hybrid NLP-based search that is compatible with near perfect search recall within the context of precision, and aim to report on ongoing research into incorporation of NLP-based representations in due course.

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