

On Modeling Cognitive and Affective Factors in Legal Decision-making

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Abstract. In recent years, many empirical studies of legal decision-making process have shown that it incorporates many cognitive, affective, and supra-legal factors. Our goal is to design artificial intelligence systems that model these aspects of legal decision-making. Our vision is to implement a kind of legal assistant that can be used by lawyers and judges to run through different scenarios and produce arguments for different, and possibly contradictory, decisions. We propose a multi-agent blackboard architecture for such an assistive system, employing some insights from our previous work on a context-aware recommender system.

Keywords. Affective factors, blackboard system, cognitive factors, generating legal arguments, legal recommendation system, supra-legal factors

1. Introduction and motivation

In recent years, there have been many empirical studies to show how various supra-legal principles like the intent of the lawmakers, prevailing social norms, common-sense moral principles, cognitive biases, and so on, significantly affect legal decision-making by judges and juries. However, there are not many artificial intelligence systems that try to model these factors, or incorporate them in generating legal arguments (see [5,4,1] for some recent work.)

Our research is aimed to fill this lacuna. Our approach is to use the blackboard architecture, which allows a number of independently acting agents (experts) to compete and cooperate together to generate different arguments. To this end, we plan to use our recent experience in implementing a blackboard-based architecture for a poetry-generating system that incorporates an emotional personality [2].

We also plan to employ our insights from adapting some features of this architecture to develop a context-aware recommender system (CARE) that provides detailed textual explanations to support the user in the decision-making process [3]. CARE incorporates a hierarchical structure, in which independent modules embodying different aspects of the context compete and cooperate together to generate recommendations for the user with accompanying rationales. In a standard recommendation task, the goal is to support the user in the decision-making process by suggesting a set of items that are the most relevant according to the user's past preferences or actions and other information such as the context or demographic data. If we treat possible verdicts as the set of items that may be selected by the user, then the legal decision-making process can also be seen as generating recommendations based on precedents, statutes, various supra-legal factors, and so

on. We will consider here some examples of supra-legal principles affecting legal decisions, and then present an architecture for incorporating these factors in a computational system.

2. Cognitive factors and supra-legal principles in legal decision-making

How cognitive biases affect judges' decisions is starkly illustrated by a relatively recent infamous case of a Dutch nurse Lucia de Berk, who was given life imprisonment for four murders and three attempted ones in 2003. The verdict relied on incorrect, but cognitively compelling, statistical reasoning. The case was reopened in 2008, and Lucia de Berk was exonerated in 2010. Several other examples of psychological biases have been mentioned in the literature. In another landmark study, Danziger and his colleague have shown that even routine and mundane events like food breaks can have a significant influence on judicial decisions.

Of course, these are examples of subconscious biases or cognitive illusions, but many a time judges explicitly evoke some principle that is not explicitly encoded in any legal statute. For instance, consider the *fairness* principle. Judge Alex Kozinski, in 2010, dissented in *Pineta-Moreno* case, which involved the legality of attaching a GPS tracking device to the vehicle of the defendant, who lived in a trailer home so had to park his car in a public place. Judge Kozinski considered this attachment of the GPS device illegal, and wrote in his dissent, "I don't think that most people in the United States would agree with the panel that someone who leaves his car parked in his driveway outside the door of his home invites people to crawl under it and attach a device... There is something creepy and un-American about such clandestine ... behavior. To those of us who have lived under a totalitarian regime there is an eerie feeling of déjà vu."

This essentially appealed to the fairness principle: laws should be uniformly applied to the rich as well as to the poor. Though Judge Kozinski was in minority then, two years later, in 2012, US Supreme Court unanimously ruled in *U.S. v. Jones* that attaching a GPS device to an individual's vehicle requires a search warrant. The fairness doctrine was also evoked during Judge Alvin Hellerstein's settlement of the 9/11 tort cases, and judge Jack Weinstein's settlement of the Agent Orange cases from the Vietnam war.

In our earlier research focusing on the US tax laws in the 1980s, we found a number of supra-legal principles evoked by judges in rendering their judgements. For instance: a) tax deductions are a matter of grace and not a right; b) tax deductions ought to be fair, and so on.

Another interesting example is provided by the painstakingly detailed research by Healy on the evolution of Oliver Wendell Holmes's famous dissent in *Abrams v. United States*, where he forcefully put forth his arguments that the First Amendment is there to promote 'free trade in ideas', and there has to be 'clear and immediate danger' before any ideas can be suppressed. This was in stark contrast to the views he held a little over a year earlier, when he argued for the "sacred right to kill the other fellow when he disagrees." This historical research by Healy shows how various factors such as personal experiences, opinions of the colleagues, political events of that time, and so on, influence legal decisions — it is not simply a matter of reading and interpreting the laws.

These are just a few examples, but they illustrate the prevalence of affective and supra-legal factors in legal decision making as it is practiced.

3. An architecture for incorporating supra-legal principles in legal reasoning

Our architecture is inspired by the following vision of John Wisdom: “...The process of argument is not a chain of demonstrative reasoning. It is a presenting and re-presenting of those features of the case which severally cooperate in favor of the conclusion, in favour of saying what the reasoner wishes said, in favor of calling the situation by the name which he wishes to call it. *The reasons are like the legs of a chair, not the links of a chain.*’ Wisdom, 1944 (Quoted by Twining and Miers, emphasis added by Twining and Miers.)

In order to generate these multipronged arguments, we chose to use the blackboard architecture, in which a number of diverse agents (experts) interact together through a common database (blackboard). The blackboard architecture was originally developed for a speech-understanding system around 1980, but since then has been successfully applied to a number of diverse areas

There are many advantages of using a blackboard architecture for realising our vision for an assistive system for legal decision-making. The main factor is that it allows a number of heterogeneous agents — each agent can use a different internal representation and a different processing strategy — to interact together. The only thing that needs to be homogenised is the interface between an agent and the blackboard. This makes it particularly suitable to incorporate different kinds of supra-legal principles as well as statutory knowledge, case-based knowledge, world-knowledge, statistical knowledge, psychological knowledge, and so on. Blackboard system also makes it natural to have a combination of top-down and bottom-up processing, and allows multiple constraints to be satisfied in different ways.

We have recently used the blackboard architecture as a basis for a poetry-generating system [2]. We also incorporated some its key features in a context-aware recommender system [3], so we would like to use our experience with those systems to build an assistive system for legal decision-making.

A block schematic of the blackboard architecture for legal decision-making is shown below in Fig. 1. The blackboard has multiple levels, though we show only three in the figure.

The key features of this blackboard architecture are as follows:

- The blackboard is hierarchically organized into multiple abstraction levels. At the bottom level are the facts of the current case, and at the top level is a decision for this case in terms of statutory concepts. The middle layers have intermediate concepts that mediate between and connect statutory concepts with the facts of the case. Such information may include retrieved similar cases and analogies between them, semantically related concepts, relevant law statutes and so on.
- Statutory knowledge, precedents, supra-legal principles, statistical knowledge, commonsense knowledge, etc. are all represented as independent experts (agents) that operate on different levels of the blackboard. Each type of agent can access the relevant knowledge base. So, a precedent expert has access to the library of past cases.
- Each agent is implemented as a condition-action pair. The condition part identifies the situation on the blackboard that triggers that agent, and the action part specifies how the agent processes the information on the blackboard, and where

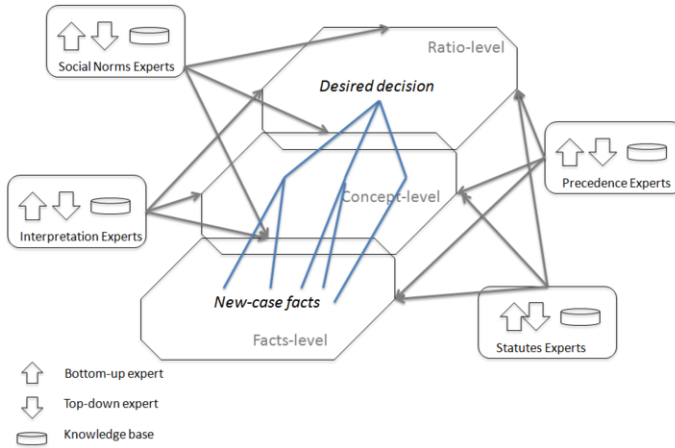


Figure 1. Blackboard architecture for legal decision-making.

it posts the output on the blackboard. The condition and action parts can be at different levels of abstraction.

- There can be three types of agents: top-down, bottom-up and intra-level as all three modes of reasoning occur in legal decision-making.
- A controller determines the order in which the activated agents are executed.

4. Conclusions and future research

We emphasized here that many affective and supra-legal factors play a crucial role in legal decision-making, and they should be incorporated in any computational model. Our goal is to develop an assistive system that incorporates these factors so that the stakeholders (lawyers, judges, etc.) can examine a given case from multiple points of views, and consider various arguments favoring different decisions. We proposed a blackboard architecture for such a system. Our design incorporates insights from our recent implementations of a context-aware recommender and a poetry-generation system. We believe that the process of generating legal arguments is somewhat similar to coming up with contextual recommendations, and we plan to implement our system along those lines.

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