An Education Method for Legal Creativity by Using Logic Programming

Seiichiro SAKURAI
Graduate School of
Information Science and Engineering
Tokyo Institute of Technology
Tokyo, Japan

Hajime YOSHINO

Faculty of Law
Meijigakuin University
Tokyo, Japan

Abstract

This paper describes a new education method for legal creativity by using logic programming (LP). A logic program, which consists of if-then rules, can be used for representing legal knowledge and it has been used for knowledge base of legal expert systems. In order to use LP as a tool for legal education, a lawyer's cognitive process are modeled by using LP. Based on the analysis of a lawyer's cognitive process, an education method with LP, which is combined with E-learning system, is proposed.

1 Introduction

Creativity is one of the most important abilities of lawyers in order to solve the deficits of legal rules. In order to develop an education method, the lawyers' cognitive process must be analyzed by using logic programming (LP). One of the objectives of research of legal expert systems is to clarify lawyers' knowledge. In the field of Artificial Intelligence, LP has been considered as a useful knowledge representation. By adopting LP, lawyer's knowledge can be represented as a logic program.

While creation of a legal rule may be one of most creative activities of lawyers, automatic creation of a legal rule is very hard task for computers because of vague creation criteria. However, human beings can create a legal rule based on their criteria. To make use of ability of the creation of rules, a new education method is proposed. The new method is based on the presentation of world by the instructor and construction of rules by students.

2 Knowledge Representation by using LP

A logic program consists of rules as follows:

$$A \leftarrow B_1, B_2, B_3, \cdots, B_n.$$

where A and B_i are literals which represent relations among objects. The above rule denotes that if all of B_i hold then A also holds. For example, Article 23[1] CISG (United Nations Convention on Contracts for the International Sale of Goods) can be represented as (a) of Figure 1.

(a) $contract\_is\_concluded(T) \leftarrow$
    $accpetance\_of\_offer\_become\_effective(T).$
(b) $contract\_is\_concluded(A, O, T) \leftarrow$
    $offer\_is\_effective(O, T),$
    $accpetance\_become\_effective(A, O, T).$

Figure 1: Example Rules of Article 23

The rule (a) of Figure 1 can be read as "a contract is concluded at the moment, T, when an acceptance of an offer becomes effective." where "T" is a logical variable. While the rule (a) of Figure 1 the rule only focuses on the time of the conclusion of a contract, the rule (b) is considered as the definition of formation of a contract. In the rule (b), "A" denotes an acceptance and "O" denotes an offer, respectively. The predicate $offer\_is\_effective$ is invented as an abstract concept of revocation, withdrawal and termination.

---

[1] A contract is concluded at the moment when an acceptance of an offer becomes effective in accordance with the provisions of this Convention

Since an offer may become ineffective according to Article 15, 16 and 17, $offer\_is\_effective$ is inserted as an additional condition. The invention of predicate such as $offer\_is\_effective$ is a very creative work of lawyer.

If all of provisions have represented by such rules, any of legal effects can be concluded as a logical consequence of rules. Since a LP system is a machine which computes logical consequences of a logic program, it can realize a legal expert system partially. In order to fill the gap between a LP system and a human lawyer, the lawyer's reasoning process must be modeled.
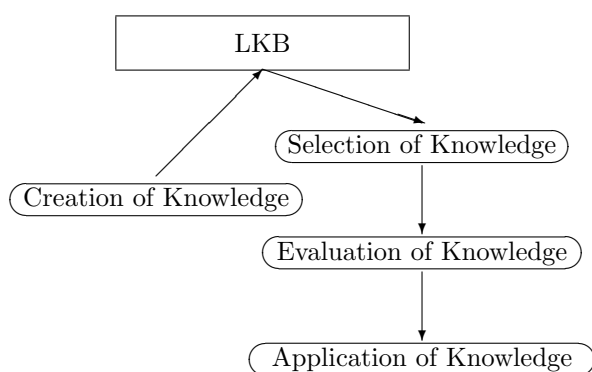

Figure 2: A Lawyer's Cognitive Process

In Figure 2, a naive cognitive process of a lawyer is shown where LKB denotes a legal knowledge base. As shown in Figure 2, lawyer's cognitive process is assumed to be divided into four subprocesses, 1) creation of knowledge, 2) selection of knowledge 3) evaluation of knowledge and 4) application of knowledge. The creation of knowledge is obviously a creative process, and the other three subprocesses may be also creative processes. This paper focuses on the creation of knowledge and the selection of knowledge.

Even if the creation of knowledge is not performed, the selection of knowledge still may be considered as a creative process. That is interpretation may be a creative work. The interpretation process is realized by selecting a consistent subset of LKB, which is called a view.

The role of a view is not only to obtain a consistent subset but also to allow multiple rules for a provision as shown in Figure 1. As shown above, each provision may have multiple interpretations. One of the essences of creativity are considered to be hidden in to imagine a variety of interpretations. Such a variation of interpretations is allowed in our formalization of legal reasoning because each interpretation is realized by selecting a view.

3 Traditional Methods and a Legal Education Method with LP

In many law schools, traditional lecture method is oriented to the acquisition of the definitions of concepts and the relations of concepts and it is effective to transplant knowledge from teachers to students. Traditional Socratic method or traditional discussion method can be used to speed up the acquisition through rectification of students' errors. After the knowledge acquisition, law students use the acquired knowledge to solve legal problems. In usual, creativity of lawyers' activity may be considered to be emerged in legal problem solving. However, creativity also exists in the process of knowledge acquisition.

Provided the network structure of concepts, students can solve legal problems by using the network structure. Namely, the process of solving legal problems is considered to mapping from provisions to the network structure of concepts. Obviously, since the mapping is strongly guided by the lectures, it is hard for law students to consider provisions from another point of view. Consider a chance to think a view for law students. More haste, less speed. To acquire creative thinking manner is not so effective because of trial and error.

Our new method is to construct an ideal abstract world incrementally by writing rules of provisions incrementally. Since a provision of laws is described in abstract level, a provision of laws can be considered as a description of abstract world. Thus to understand the provisions of laws is to imagine abstract world. If a law student uses a textbook, he/she may borrow the image of abstract world described in the textbook. Since the textbook is too helpful to construct an abstract world, no textbook is used in our method. Only provisions are presented to law students as a knowledge source. Actual instructions are shown in Fig-

ure 3.

1. An instructor gives the first instruction to write a rule of a provision.

2. The instructor gives the second instruction to modify the rule by considering another provision which is related the first provision.

3. If the rule is not satisfied by an instructor, repeat the modification of rule.

Figure 3: Legal Education Method with LP

To alleviate the burden of a law student, the utilization of Web technology will be described in the next section.

4 Combination with E-learning

4.1 E-learning

E-learning is a new trend of computer aided instructions. Since E-learning borrows Web technology, only Web browser is required for client students. Furthermore, E-learning can utilize not only static contents but also dynamic contents. The advantage of dynamic contents is beneficial to legal education method with LP. For example, the query evaluation of a legal issue can be realized by CGI or other server side programming techniques. From the view point of dynamic contents server, there exists a web application server called Zope[1]. In Zope, since all contents are designed as objects, it is very easy to combine with other applications. By combining with a LP system like Prolog, the consequences of a view can be computed dynamically.

4.2 Selecting View

Since construction of rules is hard task for law students when the requirement part of a rule is complicated. While a LP system can find a consistent subset of LKB, it cannot decide the effectiveness of a view. Thus the effectiveness of a view must be decided by human beings. To evaluate the effectiveness of a view, the ordering of a view should be given by a supervisor. Suppose a rules of Article

23 shown in Figure 1 be given. The first instruction is as follows:

> An acceptance of an offer becomes effective at T. Select a view to decide whether a contract is concluded or not.

If only the rule (a) of Figure 1 is selected, then the following instructions are presented.

> If an acceptance is withdrawn, is the acceptance effective? Consider the question according to Article 15 (2). What view is desirable?

In this way, the selection of view will be learned.

4.3 Constructing Rules

Although LP is a powerful knowledge representation tool, it is not so easy to write a rule of a provision. To alleviate the task of law students, Web interface is utilized. A law student constructs a rule by selecting terms. For example, to construct a rule of Article 23, the vocabulary[2] is restricted to the followings:

- a contract is concluded.

- an acceptance of the offer becomes effective.

- the offer is not withdrawn.

- the offer is not revoked.

- the offer is not terminated.

Suppose the first instruction be to write a rule of CISG Article 23. Most of law students will write rule as follows:

$contract\_is\_concluded(A, O, T) \leftarrow$
$\quad accpetance\_become\_effective(A, O, T).$

The above rule is constructed automatically by selecting "an acceptance of the offer becomes effective." as a requirement and "a contract is concluded." as legal effect respectively. However, the

---

[2]The vocabulary also includes the arities of predicates and argument types.

above rule only works unless the offer is ineffective. The incorrectness can be confirmed by the compute whether the consequence,

$$contract\_is\_conlucded(A, O, T)$$

holds or not. Then the system present the next instruction as follows:

> When the offer is withdrawn, is the contract is concluded? Consider the question according to Article 15(2).

If the student select the additional requirement, "the offer is not withdrawn.", the first rule will be modified as follows:

$contract\_is\_concluded(A, O, T) \leftarrow$
    $not(offer\_is\_withdrawn(O, T)),$
    $accpetance\_become\_effective(A, O, T).$

where "not" denotes the logical negation. From these instructions, the legal state transition as shown in Figure 4 is learned.
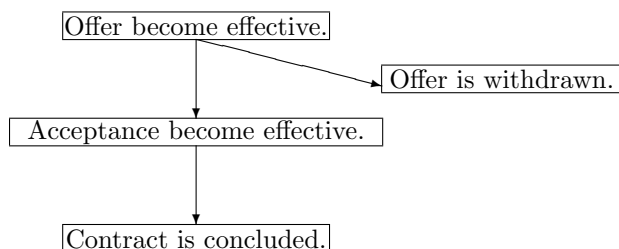

Figure 4: Legal Sate Transition

Note that the knowledge can be learned by combining Article 23 and 15(2). The role of the instructor is to guide the related provisions.

In this way, the rules of Article 23 will be constructed as shown in Figure 5.

After constructing the rules in Figure 5, prompt the user as follows:

> Do you want to define new term to represent abstract notion?

If the student answers yes, the rule (b) of Figure 1 will be constructed. Thus the incremental construction of rules is considered as a help of a predicate invention.

(a) $contract\_is\_concluded(A, O, T) \leftarrow$
    $not(offer\_is\_withdrawn(O, T)),$
    $accpetance\_become\_effective(A, O, T).$
(b) $contract\_is\_concluded(A, O, T) \leftarrow$
    $not(offer\_is\_revoked(O, T)),$
    $accpetance\_become\_effective(A, O, T).$
(c) $contract\_is\_concluded(A, O, T) \leftarrow$
    $not(offer\_is\_terminate(O, T)),$
    $accpetance\_become\_effective(A, O, T).$

Figure 5: Examples of Constructed Rules

5   Conclusion

A new education method oriented to legal creativity is proposed. While our method uses LP as a tool for the derivation of logical consequences, the evaluation of the validity of the result is delegated to the client users. Guiding students to the correct evaluation is a teacher's role. Currently, a learning system based on our method are being built. The evaluation of the learning system is our future work.

References

[1] Zope Community, http://www.zope.org