The Assessment of Case Similarity Based upon Temporal Relations

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In legal reasoning systems, case-based reasoning (CBR), as well as rule-based reasoning (RBR), plays an important role. CBR can find the most similar precedent from a number of cases. Precedents are the important sources of the law like statute, custom, jurisprudential theories and so forth. In addition, they are increasing more and more, and we have a great number of precedents today. Therefore it is hoped that CBR can support the processing of them.

As the experts do not organize their knowledge as a rule, we must cope with many difficulties in consructing RBR systems. On the other hand, cases are easy to extracted from great experience of the experts. But there are other problems instead. In particular, similarity assessment is a fundamental issue in CBR.

Rules are expressed in terms of "open-textured word" that can be defined only within specific contexts in law. Because precedents illustrate the meanings of "open-textured word", it is important to determine the similarity between new legal situation and them. In legal reasoning systems, the similarity should be assessed by causal relations in key factors, and those causalities are strictly related to temporal relations. Because these temporal relations are determined objectively, they are easy to process with computer. This paper deals with the system assessing similarities using temporal relations among affairs. To accomplish this purpose, we focus on two issues:

1. Representing and indexing cases

We can pick up many affairs from legal cases. To represent these affairs, we propose a classification of affair types by their temporal features as: *State, Durative event*, and *Punctual event*. *State* is stative affair and holds for a time interval. *Durative event* is

active affair and keeps the state of achievement, *Punctual event* is also active one but does not keep it. The former event occurs over a time interval and the latter does at time point. In addition, these affairs are related by such predicates as: start, end, during, overlap and meet. They are defined in terms of Allen's logic.

Temporal relations among affairs are generated automatically by rules. Legal cases consist of these temporal relations.

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2. A framework of similarity assessment

To determine the degree of similarities and differences between two cases, we examine two match scores:

(1) the match score between two temporal relations

(2) the match score between two cases

On the basis of the classification of affairs and the relation between affairs, (1) is computed. Next we define the numerical evaluation function according to (1), and thus, (2) is determined.

From the match score between two cases, we assess case similarity in three steps:

First step Compute the whole match scores.

Second step Compute the partial match scores.

Third step Contrast the whole match scores and the partial one, and assess with hypothetical cases.

where the whole match scores mean the degree of the similarities for the whole of cases, the partial match scores mean that for the part of cases.

In first step, we compute the whole match scores to search the precedent which has a high match score. It narrows a number of cases to several candidates for the most similar precedent. Next, in Second step, cases are divided into several parts. And then, we compute the partial match scores. Finally, in third step, we contrast two match scores and assess with hypothetical cases. The resulting differences have important information to assess case similarity.

This strategy is called *divide and assessment*.

We illustrate the system with precedents about complicity in crime. In criminal law, there are three situations of criminality as: preparation, attempt and consummation. We regard these classifications as *State* and examine how they are related temporally with affairs that construct the legal case.

We assume new legal situation, and assess similarities against 21 precedents. In many legal reasoning systems, it creates hypotheticals by modifying new case, and they are used

for a variety of purposes in argumentation. We also use hypotheticals, but create them by modifying precedents. As a result, we can find the knowledge that does not exist in the precedent database. This kind of knowledge might be a issue of legal.

We compared this system with HYPO that is legal reasoning system. HYPO has a set of "dimensions" representing factors that can affect the relative strength of cases. It corresponds to temporal relations in this system. Besides this, there are several things in common. Because HYPO is one of the most sophisticated CBR system, it is supported by these correspondence that the approach of this system is effective. Moreover, we point out the differences between two systems, and we can clear the merit of similarity assessment in this system.

This system is implemented with $\mathcal{Quixote}$(a deductive object-oriented database language) that has abductive inference mechanism to complement lacking information. Because most of the legal data and knowledge are incomplete, this mechanism is very useful in legal reasoning.