Construction of Artificial Intelligence Model of Legal Reasoning Based on Judicial Precedents

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Abstract: AI and law are emerging research fields born in the early 1980s. The main goal of AI and law research is to construct good legal applications and generate models that can be implemented in computer programs. The calculation model of legal reasoning refers to the computer program used to implement the process of human legal reasoning, and the calculation model of legal argument refers to the computer program used to implementation the process of legal argument. When constructing the artificial intelligence model of legal reasoning, the research methods of legal semantic interpretation and logical interpretation are mainly used. Text analysis of judicial cases in the database is fundamental for artificial intelligence model construction. The first step is to extract core key concepts from the text. Second, process targeted texts with legal reasoning logic methods. Third, seek to construct a calculation model for legal argumentation and prediction of legal results. The study based on the analysis of judicial precedent texts has important theoretical and practical value.

1. Introduction

The reasoning procedure when human beings deal with legal problems includes reasoning about legal rules. Case based reasoning, reasoning to predict legal results. The core of the value of judicial cases lies in the normative and exemplary functions of the law and the function of "guidance", which is not only reflected in the level of legal methods (how to apply the law), but also in the level of guidance of social values and the concept of rule of law. Researchers have developed calculation models of legal reasoning and calculation models of legal argumentation. These models are used to implement computer programs of human legal reasoning and argumentation process. They can perform legal reasoning, legal interpretation, legal argumentation, legal prediction and other intelligent tasks like legal professionals. The artificial intelligence and legal research have developed rapidly. However, there is still a bottleneck in the field of legal practice, and the legal knowledge used in the calculation model of reasoning and legal argument must be manually extracted from the legal source. Historically, AI and law focused more on argumentation and reasoning than on empirical and corpus based legal methods. However, in the age of big data, the rapid development of new data centric technologies has opened the door to algorithms for solving and analyzing legal problems.[1] Recent developments in large-scale storage capabilities and related advances in legal data analysis have created unprecedented tools for identifying large legal databases. The rapid development of legal

text analysis technology will profoundly change legal practice, legal education and legal research. The ontology and type system are used to represent legal concepts, which is the basic idea of constructing a legal reasoning artificial model based on judicial precedents. It is more intelligent for the legal information retrieval system to apply machine learning to legal texts, extract information from the texts of laws and regulations, and extract information related to argumentation from judicial precedents.

2. Legal Argumentation and Legal Text Analysis are the Research Basis of Legal AI

Artificial intelligence and law has been a research field since 1980s. The research team from question-and-answer information extraction and text argumentation mining developed programs such as Watson and Debater from IBM. Procedures such as Watson and Debater do not engage in legal reasoning. They can only answer legal questions superficially, and cannot explain their answers or make legal arguments. Legal AI needs to transform simple legal information retrieval into new conceptual information retrieval: argumentation retrieval. Computer models developed by AI and legal researchers will perform legal reasoning. The newly extracted information related to argumentation directly connects the computer model of legal reasoning and argumentation with the legal text. These models can produce specific results that support and oppose text input problems, and interpret the results. A new type of legal application program, which can implement cognitive computing, is a collaborative activity between people and computers.[2]

The goal of most AI and legal research is to develop computer model for legal reasoning. These models can be used to make legal arguments and predict the results of legal issues. The computer model of legal reasoning is a computer program, which implements the process of proving the characteristics of human legal reasoning. It includes analyzing the situation, answering legal questions, predicting the results of disputes, and making legal arguments. It is called the computer model of legal argumentation.

The computer model of legal reasoning and the computer model of legal argumentation write a set of computational steps and algorithms for the complex human intelligence process. This model specifies the input mode of a problem and the type of legal result output. The row creator constructs a computer system for applying domain knowledge to perform these steps and the transformation of input and output. To develop these models, we need to solve the following problems. At present, the entity legal knowledge used in many legal AI computing models must be manually extracted from the source. That is, it is extracted from cases, legal rules, regulations, contracts and other texts used by legal professionals. That is to say, the calculation model of legal reasoning cannot be directly and automatically connected to the legal text. This limits the application of legal AI programs to legal information retrieval, forecasting and decision-making. Legal text analysis can obtain meaningful retrieval from legal text data. Connect the calculation model of legal reasoning and legal argumentation with the text analysis tool. To construct new legal applications.[3]Specifically, the legal reasoning and legal argumentation calculation model developed in the field of artificial intelligence and law will use the information automatically extracted from the legal texts of case decisions and laws and regulations to help people answer legal questions, predict the results of cases to provide analysis and interpretation, and more effectively demonstrate support and opposition to legal conclusions than existing technologies.

3. Research Methods of Legal Concept Analysis and Legal Text Analysis

Clarifying the logical relationship between legal concepts and judicial cases is the premise of legal text analysis. Because legal rules adopt vague terms and concepts with open structure, the calculation model of case-based reasoning will help determine the meaning of legal concepts. The court interprets

the meaning of legal terms and concepts by analogy with cases that explain how a term or concept has been applied in the past. There are three methods to construct the legal artificial intelligence model based on judicial precedents [4] the first is prototype and variant, which focuses on how to determine the interpretation of legal concepts by constructing theories based on past cases. The second method is dimensionality and legal factors, which use stereotypical facts to strengthen or weaken the argument of a party about legal claims or concepts. The third method is based on the example interpretation, which determines the interpretation of legal concepts in specific situations according to the previous court's interpretation of the reasons for the application or non-application of a concept. The construction of these models is to be able to compare specific cases with the judicial precedents of existing judgments, select cases with similar situations, and generate legal arguments that support and oppose the conclusions of a new case through analogy.[5]

How do computer programs reflect the dialectical relationship between legal concepts and relevant cases? How does the computer program express the facts of the case and the reasoning of the court? What are prototypes and variants, dimensions and factors, and interpretations based on judicial cases? What aspects of court decisions should computer program models capture? What are semantic networks and standards? How to measure the legal relevance between the case and the question to be retrieved through calculation? How do computer programs select relevant cases? How to compare judicial cases based on similarity? How to compare them with other cases and distinguish them from factual situations and other cases? How to evaluate what the reasoning for the purpose of such procedures is based on experience? What role does teleological reasoning play in the analogy of legal cases? How do computer programs represent the value behind rules? How does a computer program incorporate value into the selection of relevant cases?

The computer model of case-based legal reasoning simulates the interaction between legal concepts and cases. Legal concepts correspond to terms with open structure in constitutional laws or legal rules created by courts.[6]To some extent, cases play a role in clarifying the meaning of legal concepts with an open structure and regulating the changes in those rules and meanings.[7]Although China's legal system belongs to the continental law system, it is different from the case law of the common law system. However, there are two guiding cases stipulated in the Organic Law of the Court of China, of which Article 18 stipulates that "the Supreme People's Court may interpret issues that are specific to the application of law in judicial work. The Supreme People's Court may issue guiding cases". The Organic Law of the Court is a law formulated by the National People's Congress. In the Organic Law of the Court, it is stipulated that the Supreme People's Court has the right to issue guiding cases, which indicates that the issuance of guiding cases is legal, that is, guiding cases are supported by legal authority. When the Standing Committee of the National People's Congress revised the Organic Law of the Court in 2018, it amended Article 18, which is a kind of ex post legislative recognition of the case guidance system established by the former Supreme People's Court, so that the guiding cases have a legal basis without interpretation. After that, the guiding case is no longer the self-talk of the Supreme People's Court, but issued according to the authority expressly stipulated by the law. As a written law, the Organic Law of the Court is authoritative and serious. It stipulates that the Supreme People's Court has the right to issue guiding cases, and thus guiding cases have an authoritative and legal status.

If the law is regarded as a "mobile classification type", the legal concept is a classifier. In this process, it is necessary to decide whether the result of the precedent rule is applicable to the new case. By comparing the facts of the new case with the facts of the precedent, it may be necessary to clarify the meaning of the legal concept of the rule when determining whether the new case is similar to or different from the precedent.[8]

The legal concept is meaningful, and to some extent supports the deductive reasoning about whether the concept is applicable to new cases. To some extent, legal procedures are guided by rules,

but this is not just the application of rules to new situations. The main role of the legal concept is to pay attention to the similarities of specific legal rules. The legal concept is a label, and he has confirmed these similarities in a series of cases. The court reasoned according to the similarity when deciding new cases. For the law, the problem is that although they are similar cases, when is it fair to treat them differently? An effective legal system must be willing to pick out the key similarities and derive justice applicable to common classification. In the process of deciding whether certain cases are similar or different, legal rules and their concepts will change. In a new case, the court decides whether a concept will expand or contract. As the social environment and values change, the assessment of relevant or irrelevant specific similarities may change. Therefore, the previous analogy became suspicious and led to the judgment that is now considered unfair. When the facts of the case expanded the concept, it is easy to believe that the court can replace it with a new concept in the rules that can be restated. The existing legal rules and the arguments in the previous cases make the concept limited or expanded. The reasoning process supports this dynamism by using rule concepts and cases.

4. Construct a Model of Legal Concepts and Judicial Cases

Case based legal reasoning modeling requires techniques for representing case facts and evaluating legally relevant similarities. Since the model must decide whether to deal with cases in the same way from a legal perspective, it must express the similarities and differences in the form that procedures can handle, analyze, and manipulate. Generally, first, decompose the problem text to find clues and determine the core key concepts. It involves identifying part of speech, sentence structure, logical relations between sentences, etc., such as subject, predicate and object. Secondly, using the method of concept retrieval and ranking, we can find the core concepts and their related concepts, such as the upper concept and the lower concept. Finally, we use the relationship extraction method to find the semantic relationship between concepts.[9]
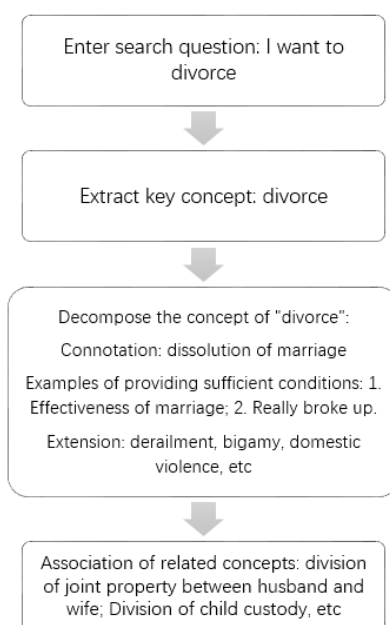

Figure 1: Schematic Diagram of Concept Decomposition

First, the legal concept is divided into three components (as shown in Figure 1): one is an invariant component of a necessary condition, that is, the connotation of the concept; the second part provides a series of examples of sufficient conditions; the third part is composed of other influencing factors. Conceptual legal information retrieval is a legal information retrieval that automatically retrieves

relevant texts for concepts and roles needed to solve users' legal problems, based on matching concepts and their roles in documents.[10]The connotation of a concept refers to the essential or unique attributes of the object reflected in the concept; The extension of a concept refers to the object with the essential or unique attributes reflected by the concept, that is, the scope of application of the concept. Fourth, directly associate related concepts. Different from ordinary legal information retrieval, conceptual legal information retrieval focuses on simulating the needs of human users for the information they seek in order to solve problems. For example, in the legal argumentation users try to make, and in the process of solving problems, the concept and its role.

Second, through the extraction of key legal concepts in the case facts, the judicial precedents are searched. If the input problem is called the current factual situation, the retrieved legal sources will be treated as judicial precedents at three levels. (1) Argument by analogy between the current factual situation and the case supporting the plaintiff. (2) Differentiate the argument of the cited case from the current factual situation, which represents the defendant and cites counterexamples in support of the defendant. (3) Distinguish the rebuttal of counterexample cases from the current factual situation and the hypothetical proposed facts, and suggest that the facts strengthen the plaintiff's argument in the current factual situation when possible. (As shown in Figure 2)
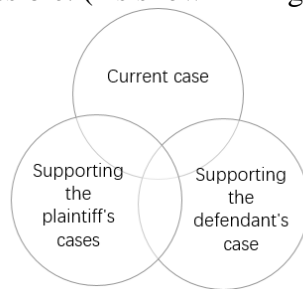

Figure 2: Relationship of relevant cases

Analogizing the current factual situation and cited cases means explaining the legally relevant similarities. These similarities lead to the reason why decisions should be made in the same way? It represents the common legal factors of the current factual situation and the cited cases. If at least one of these legal factors supports the party making the argument, the case can be determined as the potential reason for supporting that party's argument. This argument assigns the same result to the current factual situation.[11]

Third, use the semantic web for legal reasoning. The Semantic Web is a graph containing nodes, which represents concepts. And arcs representing relationships between concepts. The semantic web can be used to express the court's interpretation of the case results according to the standard facts. The court held that important facts supported its conclusion, that is, whether the specific legal concept was satisfied from the regulations.[12](As shown in Figure 3)
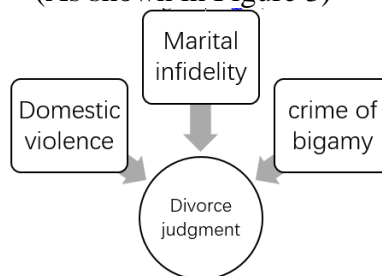

Figure 3: Interpretation of case results according to standard implementation

Fourth, construct a theory constructor. The constructor should include relevant cases, relevant legal rules, preferences from cases, and rules from value preferences in the Amway library. Through these

value preferences, we can use theory to make legal arguments and predict the results of new cases. (As shown in figure 4)
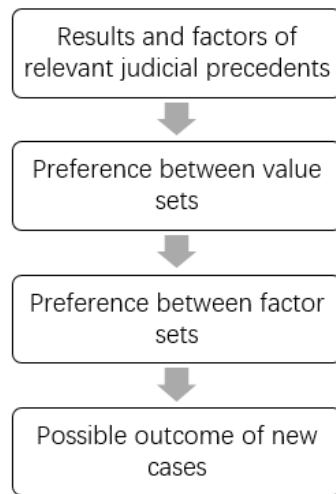

Figure 4: Theoretical construction demonstration from factors and value preference

Fourth, construct a theory constructor. The constructor should include relevant cases, relevant legal rules, preferences from cases, and rules from value preferences in the Amway library. Through these value preferences, we can use theory to make legal arguments and predict the results of new cases.

In the process of constructing the above calculation model, attention should be paid to the following aspects: First, the use of legal rules and concepts to construct reasoning models requires the construction of arguments that support and oppose the application of rules to factual situations. Second, Amway plays an important role in modeling whether the concept of a legal rule is applicable to a series of facts. Demonstrate the difference of the correlation similarity between focus and keystrokes and factual situations. Third, the role of teleological considerations, including the purpose and value behind the rules, in defining the legally relevant similarities and differences between justifications. Fourthly, in order to be a useful tool, the computer evaluation of case similarity needs to define the standard of legal similarity that can be actually calculated by the program. The computer model of case-based legal reasoning about legal concepts introduced by the author defines the criteria for measuring case similarity and demonstration model. These criteria may help to retrieve cases, have supported human problem-solving, and highlight how these cases were used in the past. It is quite limited, but the potential purpose and value of these standards are considered when evaluating similarity.[13]Fifthly, the usefulness of case-based models for cognitive computing depends largely on their knowledge representation. To what extent can the technology be directly connected to the case text using the text parsing technology.

Computer programs can use case databases represented as feature and result sets to predict possible decisions for new problems. They are usually implemented through case-based reasoning models or machine learning algorithms, sometimes combining the two. The prediction technology uses different types of features expressed in previous cases to capture the similarities with the current case from various legal factors, such as the historical trend of the judgment and the stereotyped fact model that strengthens a claim or defense, and use these features to predict the outcome of judicial decisions. Machine learning technology uses feature frequency information to learn information statistically to learn the corresponding relationship between features and target results. The technology for cases focuses more on case comparison and interpretation prediction. They make predictions based on the advantages of competing legal arguments. New technologies explain their predictions in different ways. Their feature representations are compatible with cognitive computing, and their degree of

compatibility with cognitive computing is also different. Their feature tables and their feature representations are also different in their compatibility with cognitive computing.

Through the given classifier and training data set. That decision tree learns a group of problems. Each problem of the prediction classifier is a test. If the weight of a specific feature is less than the threshold, it will be divided into one branch, otherwise it will be divided into other branches. For example, if Party A and Party B fight and Party B is injured, establish a decision tree to predict whether Party A has reached the level of intentional injury crime? Or just public security detention? (As shown in Table 1)

Table 1: Schematic Diagram of Decision Tree

case	physical injury	Weapon	Criminal record	Result
1	No	No	Yes	Yes
2	Serious injury	Yes	Yes	Yes
3	No	Yes	No	Yes
4	Serious injury	No	No	Yes
5	Minor injury	No	No	No
6	No	Yes	Yes	No

Because of such false reasons as coincidence and sometimes data contain features and biased selection, these features are just related to the case results in a specific set. Obviously, rules derived from machines may lead to accurate predictions, but they do not involve human expertise. And it may not be as easy to understand as the rules manually constructed by experts. Because the rules introduced by machine learning algorithms do not necessarily reflect clear legal knowledge and professional knowledge, they may not meet the rationality standards of human experts.[14]For a decision tree algorithm, one goal is to determine the theoretical standard of the most effective problem sequence used to divide the training strength into a group of positive instances and a group of negative instances, which is the feature that the algorithm can select the most effective case division. The use of criteria minimizes the expected number of required problems by ranking problems, and selects the most discriminating threshold when the number of problems is involved, separating positive instances from negative instances.

Relevant studies in the United States have learned and constructed prediction functions to predict the behavior of the Supreme Court, which can be used to evaluate future cases and predict their results, either affirming or overturning. The system uses the vote prediction of a single judge to predict the overall decision of the court. The case input to the system is the case of the Supreme Court, which is represented as a list of characteristic values, and then it is described. The system outputs binary classification: will the judge or the whole court overturn the decision of the lower court? This method only imitates how Supreme Court experts make predictions or foresee the observable previous data matrix of the system based on the Supreme Court database and relevant sources. Such predictions are based on all judgements of the Lord Chancellor, the Court and all previous cases. The Supreme Court database records the characteristics of case representatives and trends.[15]All predictions are based on these characteristics. The case information includes the circuit jurisdiction where the case originated, the type of law, the objection of the lower court, the problem area and the jurisdictional criteria. The background information of the Chief Justice and the Court includes the Chief Justice, the gender of the Chief Justice, and the party that appointed the President. This includes the current and overall historical decisions of the Supreme Court, the trend of lower courts, the trend of individual justices of the Supreme Court and the differences in trends.[16]In general, the working principle of this prediction method is as follows: the data from the given value to the final case decided before the target case. This method applies the latest instance of extreme random tree set, that is, for each judge, he transmits the characteristics of the current case of the judge and all levels of courts through a group

of tests in the latest group of extreme random trees, and outputs a prediction for each judge. Then the algorithm uses majority rules to combine the group of predictions at the judge level into a case level prediction.

5. Conclusion

This paper mainly studies that computer programs can use case databases expressed as features and result sets to predict the results of new problems. They usually use case-based reasoning models or machine learning algorithms to achieve the purpose of legal reasoning. The artificial intelligence technology of legal reasoning based on case analysis makes use of different types of features expressed in judicial precedents. The trend of extracting judgments and strengthening a stereotyped factual model of advocacy or defense excavate all legal factors, extract these legal factors, compare and explain cases, and finally make predictions based on the advantages of competing legal arguments. Prediction is an important task in the legal field, and may become an important part of cognitive computing in the research and development of legal argumentation. It should be noted that, to the extent that machine learning and case-based reasoning have been applied to legal prediction tasks, these calculation methods are not intended to find features that affect the results, but to judge the weight of these features. The calculation model of prediction and demonstration can be directly applied to the legal text by automatically annotating the case text and other political related information with the characteristics reflecting the legal characteristics of a case. People can retrieve case decisions from the legal retrieval system to automatically process basically identified characteristics related to argumentation, as well as participants and behaviors, and use this information to more effectively rank cases, make more clear predictions, and implement computer programs to help people solve legal problems. Artificial intelligence and legal researchers and technical experts actively participate in extracting new question and answer information and demonstrating mining technology. The process of solving problems in the legal field shows us the potential of simulating the theoretical change of legal reasoning and the integrated prediction of computing technology. If these technologies can be developed, they can be used for legal reasoning and case decision prediction. Artificial intelligence and legal tools have produced the elements of legal texts that new text processing technologies should target and the legal tasks that can be completed. Apply cognitive computing technology to legal reasoning. He can identify the elements related to the problem in the vast sea of legal sources and judicial precedents. We will sort the legal logic reasoning together and present the knowledge of solution selection, which will greatly improve the efficiency of legal consultation and have a huge commercial application prospect.

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