Adjudication Framework for Construction Disputes

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Abstract. Complexity existed in the civil engineering field, especially when considering the power and responsibility relationship among the contractors, subcontractors, owners and various stakeholders. Numerous engineering disputes are inevitably lead. Meanwhile, the judgement logic hidden in the adjudication of engineering disputes were quite similar. Therefore, the ontology theory and machine learning were introduced to predict the adjudication results. Sorting out and summarizing the judgment logic of dispute cases, a knowledge map was constructed with the ontology theory of power and responsibility, which could be the theoretical foundation for the application of machine learning.

Keywords: Construction Disputes; NLP; Adjudication; Contract Management.

1. Introduction

1.1 Research Background

Natural language processing (NLP) is a newly-developed technology which teaches computers to analyze human language. Recent years, it developed rapidly and is widely used in various fields. The methodology consists of traditional rule-based methods and statistical methods, and they tend to merge in recent years. To filter analysis results, scholars have proposed to merge the two methods through ontology framework or knowledge mapping [1].

This paper intended to propose a reasoning framework of construction dispute adjudications, and to lay a theoretical foundation for the application of machine learning in this field. The judgement and ruling logic on the court was sorted out through analyzing the adjudication documents about disputes during the construction period. Then the reasoning framework of disputes was formed. Summarized from real cases and judgments, the ontological framework could serve as learning reference data of the neural network. Therefore, applying the framework in actual disputes is feasible.

1.2 Research Overview

Dealing with disputes using NLP is commonly achieved by the prediction of judgement. Train the model with a large number of actual cases and test it with the remaining. Neural network technology has been widely developed and in-depth researched in the aspect of the automatic decision.

Tu hai et al. [2] established a question-and-answer neural network model GENQA, namely Genomics Quality Assessment, which could be applied in legal disputes. In their research, 80% of the 5,000 question-and-answer pairs were set as training sets, and the remaining 20% was set as test sets. With increased data set amount, its accuracy rate was continuously improved. Besides, comparing the results of GENQA model with that of other algorithms, it is concluded that the neural network algorithm model has better accuracy in the large-scale data sets of legal disputes. In addition to providing legal consultation to the disputes, the decision results of legal cases could also be predicted by applying the algorithm in the neural network.

Han jinbo [3] brought out a case decision interval prediction model Siamese-CNN, which was based on Siamese network and multi-core CNN model. Several aspects were designed and studied, including sample organization, model establishment, loss function definition and performance verification. The above model was verified by actual experiment and results proved that the accuracy rate of the Siamese-CNN model in the verdict of intentional homicide cases reaches 88.6%. Deng

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wenchao [4] intended to prejudge the crimes, sentencing and fines with a given case description. The word bag model, fast Text model and convolutional neural network model were involved and for the term of imprisonment and fines, the predicted transformation value and digital discretization were used in the comparison.

However, there are still a few relevant types of relevant researches on engineering dispute cases while the number of engineering dispute cases increases year by year. Therefore, it is of great research value to develop automatic judgment on engineering dispute cases using a neural network.

2. Adjudication Procedure

The text structure and hierarchy of the judgment proposed in this paper is based on 20 judgments which have been decided by the Supreme Court, China. The contents in the judgments which have a substantial influence on the judgment result were divided and the decision logic of the judge's penalty was simulated. Then the text content hierarchy is arranged in a routing logic. Extracting the text structure of a large number of adjudicated judgments as a database allows machines to learn the logic of real-world court decisions, making machines the 'brains' of judges. It is worth mentioning that the two important text structures that can be used to train automatic judgment of machine are the evidence of all parties in the case and the basis of a legal decision if used for subsequent machine learning. Figure 1 shows the adjudication logic framework.

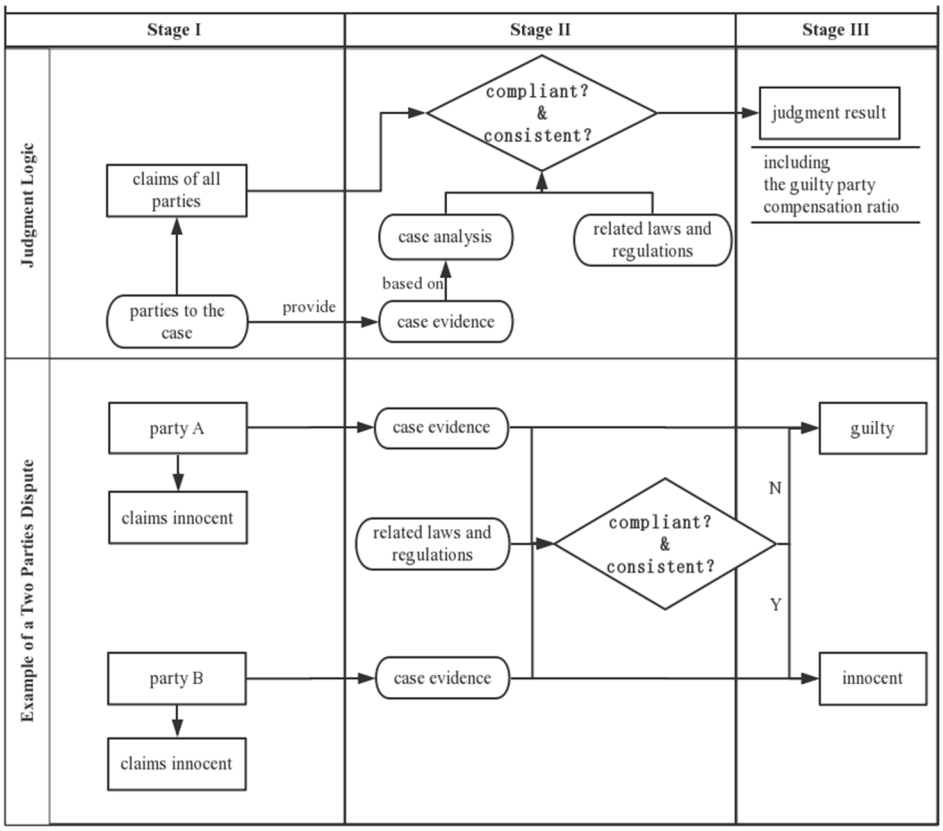

Fig. 1 Adjudication Logic Framework

The following six points are the text structure of the verdict, namely parties involved in the case, claims of the parties involved, evidence of all parties, relevant laws and regulations concerning the case involved, the results of the court's ruling, and the basis of the court's ruling.

2.1 Parties Involved in the Case

The case participants, usually the plaintiff and defendant, are the foundation of other structure layers. Thus, the participants should be presented as the text structure layer of the foundation alone.

2.2 Claims of the Parties Involved

Set the text structure advocated by each party, extract the claims in the judgment from a large number of legal judgments that have been decided. The court's decision on the appellant is limited to the appellant's claim and does not question the facts of other cases. The automatic decision would also be based on their claims. So, it is clear that the claims of the parties about the case are the basis for the subsequent efficient and correct reference to the legal regulations.

2.3 Evidence of All Parties

For the judges in reality, after clarifying the parties involved and their claims, he would generally read the evidence of each party about the case. For the most time, he cannot empirically obtain the development of the case like the client, who experienced the past time and the whole event. Moreover, the evidence and witness testimony are the only channels through which he can understand the case from a third-party perspective, and the authenticity of the two is an important factor affecting the judge's ruling. Setting the textual structure of the proof of the parties in the case is the step of simulating the judge's reading of the evidence from the parties.

2.4 Relevant Laws and Regulations

After clarifying the parties' claims and listing the evidence of the parties, the judge will enter the ruling process, and the legal basis for the judge's ruling is the corresponding laws and regulations and legal provisions. For the human brain, it is almost impossible to fully memorize the legal provisions, but for computers, a memory stick can realize the memory of legal provisions. Therefore, the text structure of the relevant laws and regulations is set up, and the facts formed by the evidence of authenticity in the previous step are used to decide the responsible party in accordance with the corresponding laws and regulations.

2.5 Court Decision Result

For the machine, in order to get a ruling result, it must combine the corresponding content in the 4 and 6 processes to identify the faulty party of the case and the party responsible for the loss of compensation. But if there is no court ruling result, then there is no output for a machine learning program to form a training function used to give the result of the judgment. A text structure, leaving only 4 or 6 text structures as the material for machine learning rulings, then our machine learning loses the learning of the resulting output, such machine learning will be meaningless.

2.6 Basis of Court Decision

When a judge makes a final result ruling, he often explains the basis of the ruling in his logical thinking. The text of this part is to let the machine learn to 'pick' an important part of the useful evidence, and how to discriminate the evidence for the evidence of the parties. Authenticity and compliance are a core step in the ruling.

3. Summary

This paper applies NLP, Natural Language Processing to the judgment of engineering disputes. Prior to this, although there have been researches using NLP for prediction, it was rarely combined with engineering practice. By analyzing the actual engineering case and simulating the judge's decision-making logic, this paper constructed a ruling model for various types of disputes arising in the construction projects. In the six steps of the model, the participants are the foundation and represent the subject of the adjudication. Participant claims are the content, as well as a foothold, of judgment. The evidence provided by the plaintiff and the defendant is the basis for discrimination and is used for comparison. Another subject of comparison is the relevant laws and regulations. Referring to the results of past legal decisions, the accuracy of the prediction can be improved. In order to learn the language processing method better for the machine, reading the decisive statement in the judgment is also a crucial step. Through such repeated learning, the judgments of China's

engineering circles that apply the legal provisions can also refer to the results of past judgments, saving unnecessary manpower and material resources.

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