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A full-process intelligent trial system for smart court

Key words: Intelligent trial system; Smart court; Evidence analysis; Dialogue summarization; Focus of controversy; Automatic questioning; Judgment prediction

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Motivation

1. During the pandemic of COVID-19, online trials based on the intelligent trial system have become ubiquitous. The smart court relies on Internet courts to turn offline litigation activities into online activities. However, how to implement a full-service online processing and build a comprehensive, multi-functional, and intensive online litigation platform for smart court is still a challenge.

2. In constructing a smart court, it is of paramount importance to bridge artificial intelligence and online trial for providing intelligent assistance to achieve more efficient, fair, and explainable trial proceedings for smart court.

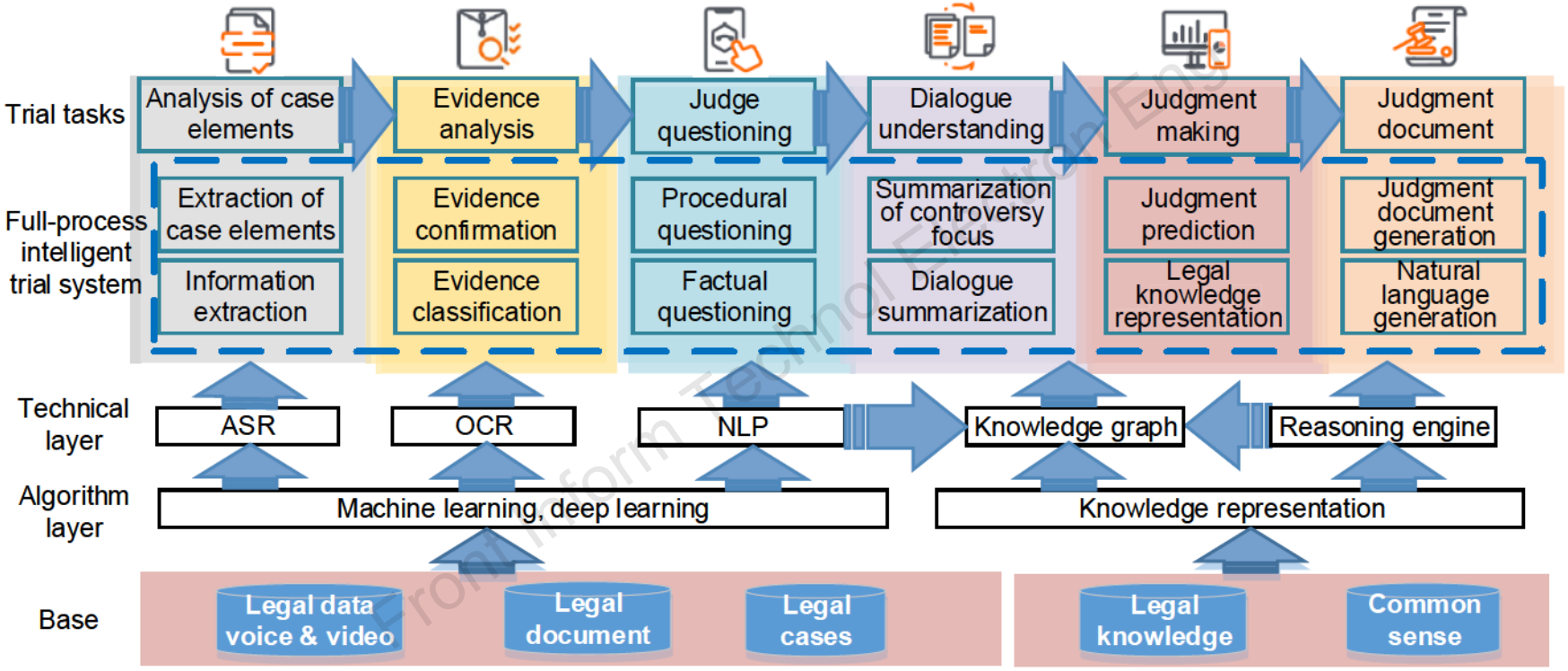
Main idea

1. In constructing a smart court, to provide intelligent assistance for achieving more efficient, fair, and explainable trial proceedings, we propose a full-process intelligent trial system (FITS).

2. In the proposed FITS, we introduce essential tasks for constructing a smart court, including information extraction, evidence classification, question generation, dialogue summarization, judgment prediction, and judgment document generation.

3. FITS has played an essential role in financial lending and private lending cases, which moves the trial procedures of the court to the network platform, supports judicial trials in a highly informative manner, and assists judges in making judicial decisions.

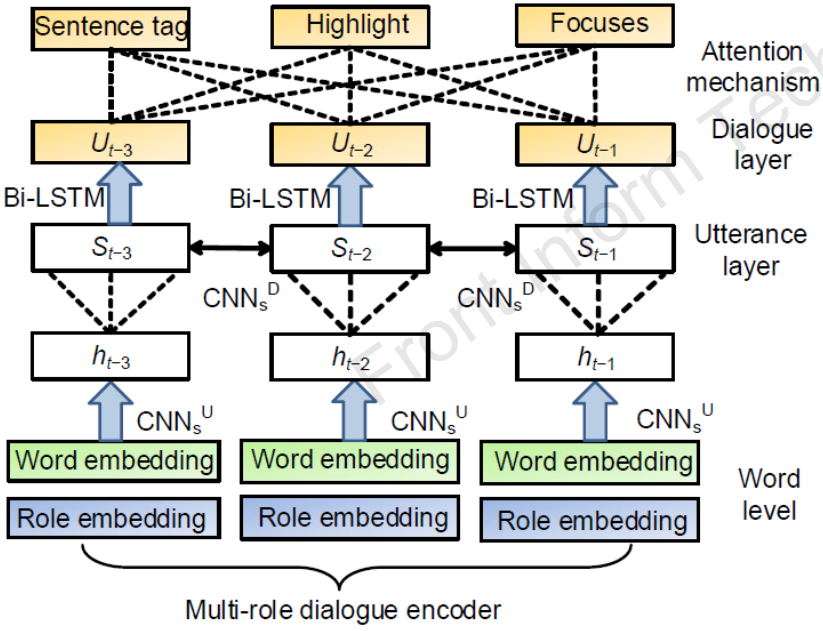
Framework



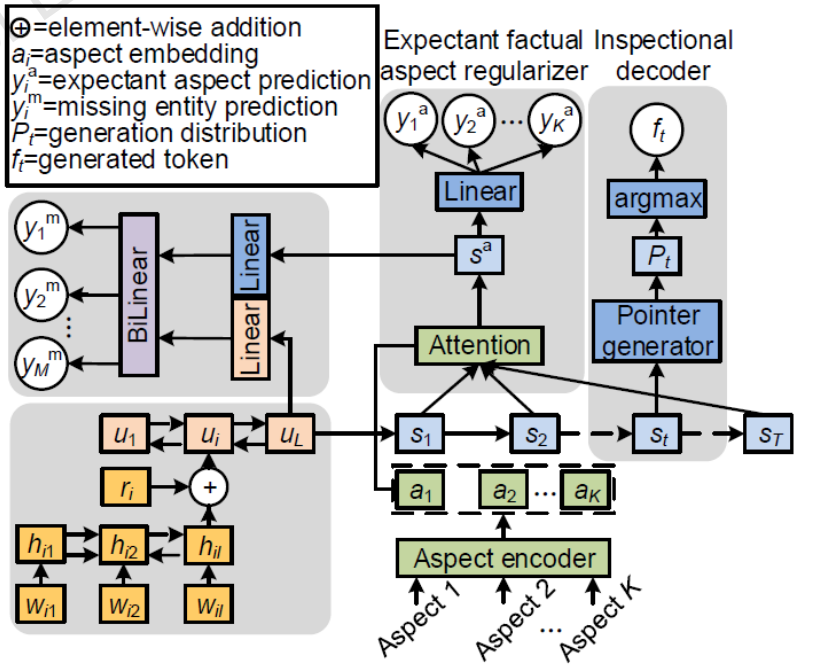
Overview of the full-process intelligent trial system (FITS) (ASR: automatic speech recognition; OCR: optical character recognition; NLP: natural language processing)

Method

1. Trial summarization consists of two tasks. The first task is to summarize the court debate transcript during the trial stage. The other task is to summarize the controversial focuses of the dialogue in the trial.



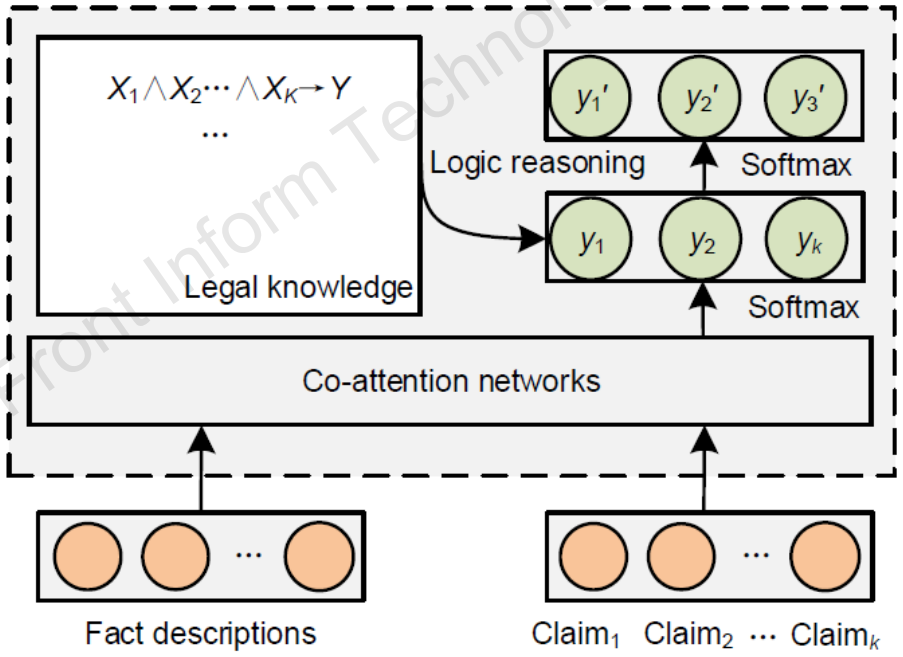
The process of trial summarization



The process of dialogue summarization

Method

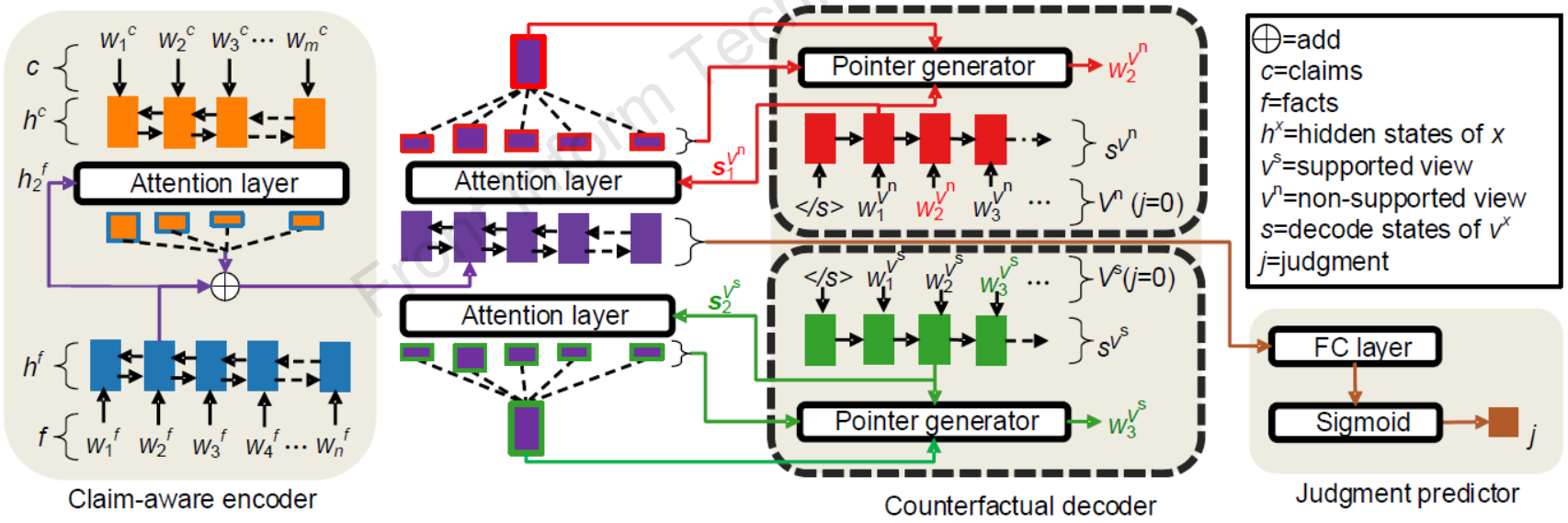
2. To improve the interpretability of judgement prediction, we propose to combine deep neural networks (DNNs) with a symbolic legal knowledge module, in which legal knowledge is expressed as a set of first-order logic (FOL) rules.



Injecting legal knowledge into DNNs for judgement prediction

Method

3. To address the data imbalance in court's view generation task, we propose the attentional and counterfactual natural language generation (AC-NLG) method by jointly optimizing a claim-aware encoder, a pair of counterfactual decoders to generate judgment-discriminative court views (both supportive and non-supportive), and a synergistic judgment predictive model.



Architecture of the attentional and counterfactual natural language generation (AC-NLG) method

Major results

Table 1 Final results of all methods on the civil loan test dataset (Wu et al., 2020)

Method	Reject			Partially support			Support			Average			
	P	*R*	F1	*P*	*R*	F1	*P*	*R*	F1	Mac.P	Mac.R	Mac.F1	Mic.F1
TF-IDF+SVM	0.751	0.494	0.596	0.581	0.454	0.510	0.848	0.922	0.884	**0.805**	0.663	0.624	0.727
TextCNN	0.756	0.434	0.551	0.665	0.417	0.513	0.830	**0.945**	0.884	0.750	0.599	0.649	0.807
BiLSTM+ATT	0.722	0.528	0.609	0.645	0.512	0.571	0.858	0.926	0.890	0.741	0.655	0.690	0.818
HARNN	**0.758**	0.521	0.617	0.633	0.505	0.562	0.855	0.923	0.889	0.749	0.650	0.689	0.816
BERT	0.723	0.608	0.667	0.645	0.579	0.610	0.876	0.913	0.894	0.748	0.700	0.722	0.827
CoATT	0.705	**0.728**	0.716	**0.727**	0.690	0.708	0.914	0.923	0.918	0.782	0.780	0.781	0.864
CoATT+LK	0.750	0.695	**0.721**	0.718	**0.753**	**0.735**	**0.926**	0.921	**0.923**	0.798	**0.789**	**0.793**	**0.872**

The best results are in bold

Conclusions

1. In constructing a smart court, this paper presents a full-process intelligent trial system (FITS) to provide intelligent assistance for achieving more efficient, fair, and explainable trial proceedings. FITS explores in-depth applications of big data, modern logic, and artificial intelligence in the full trial process.

2. In FITS, we introduce essential tasks for constructing a smart court, including information extraction, evidence classification, question generation, dialogue summarization, judgment prediction, and judgment document generation.

Bin WEI received the PhD degree in logic from Sun Yat-sen University, China in 2013. From 2011 to 2012, he was a visiting scholar with Prof. Henry Prakken's Group at University of Groningen, the Netherlands. He conducted a postdoctoral research in jurisprudence in Southwest University of Political Science and Law, China. Currently he is a professor of Hundred Talents Program in Guanghua School of Law, Zhejiang University, China. His main research interests include artificial intelligence (AI) & law, legal logic, and jurisprudence.

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