

Backgrounds

Confusing charge prediction is a **subset** of charge prediction, specifically addressing difficult cases. Most methods utilize legal knowledge to assist the model, but they are not sufficient to distinguish between confusing charges.

Charge	Fact description
Snatch	Defendant XX forcibly pulled off the gold necklace on Mousmou's neck while the victim Mousmou was not prepared , and the market value of the robbed gold necklace was RMB 63,202.
Robbery	The defendant XX beat the victim Mousmou and robbed the victim of a gold necklace. The market value of the robbed gold necklace was RMB 1,060.91.
Fraud	Defendant XX in the name of communication, after gaining trust , defendant XX fabricated various reasons to defraud victim Mousmou of an Apple computer, whose market value is RMB 5,450
Theft	The defendant XX stole an Apple computer of the victim Mousmou. The market value of the Apple computer is RMB 5,000.

all charges share some charges share unique words of each charge

➤ Confusing charges in real legal cases.

The key to distinguishing charges is unique features, for example:

- Theft is characterized by non-violence,
- Snatch involves violence against property,
- Robbery entails violence against individuals,
- Fraud includes descriptions related to trust.

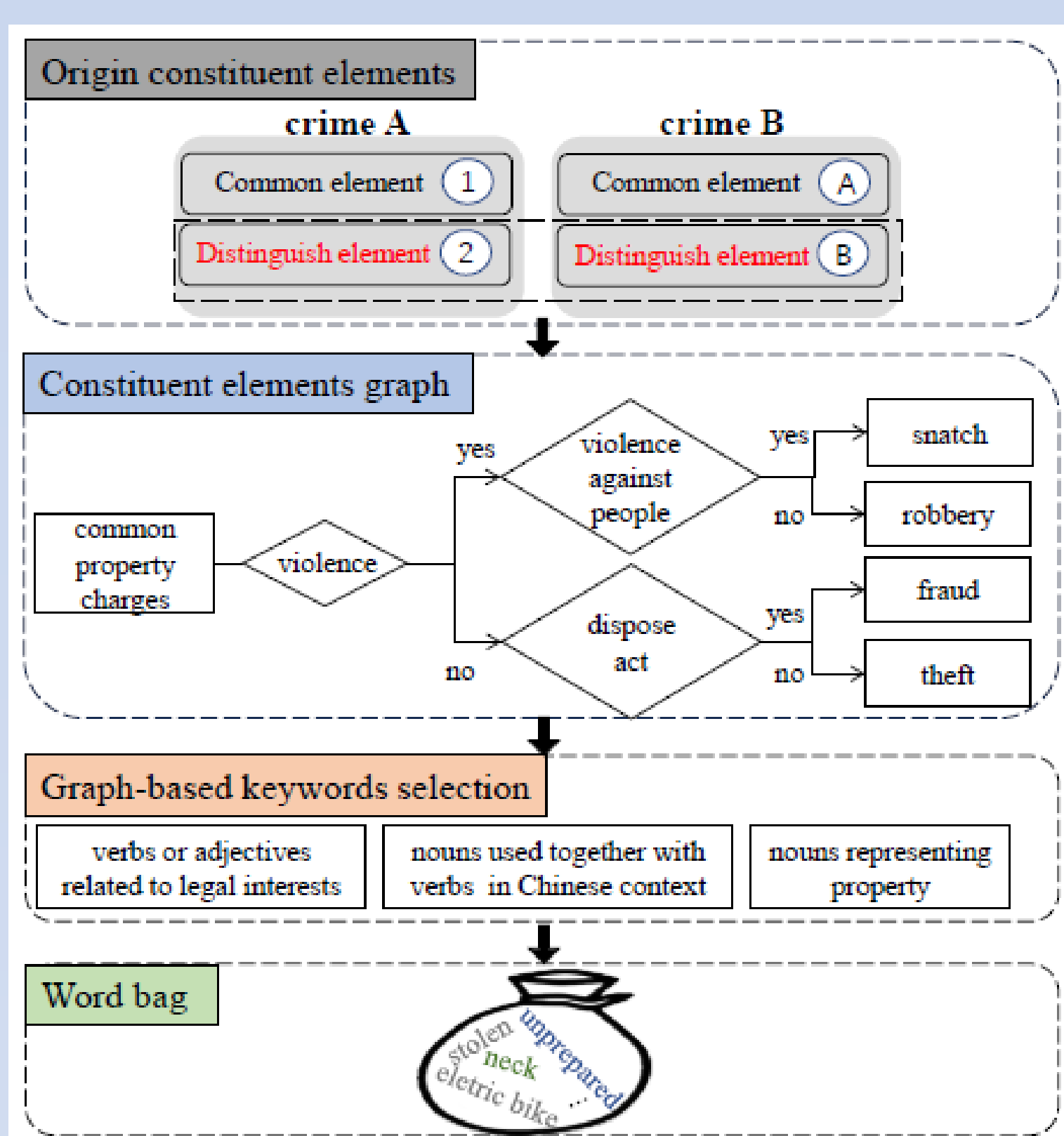
In the legal domain, unique features are called **constituent elements**, which refer to the behaviors that serve as the basis for punishment.

We propose a novel From Graph to Word Bag (FGWB) approach:

- A knowledge graph that encompasses constituent elements.
- A graph-based keyword selection method, which transforms graph to word bag.
- A multi-attention supervision method, which obtains independent attention supervision for each charge.

Methodology

Word Bag former



Knowledge graph

We use a set of charges as nodes and employ the constituent elements as the connections between nodes.

we downplay unnecessary elements in the graph.

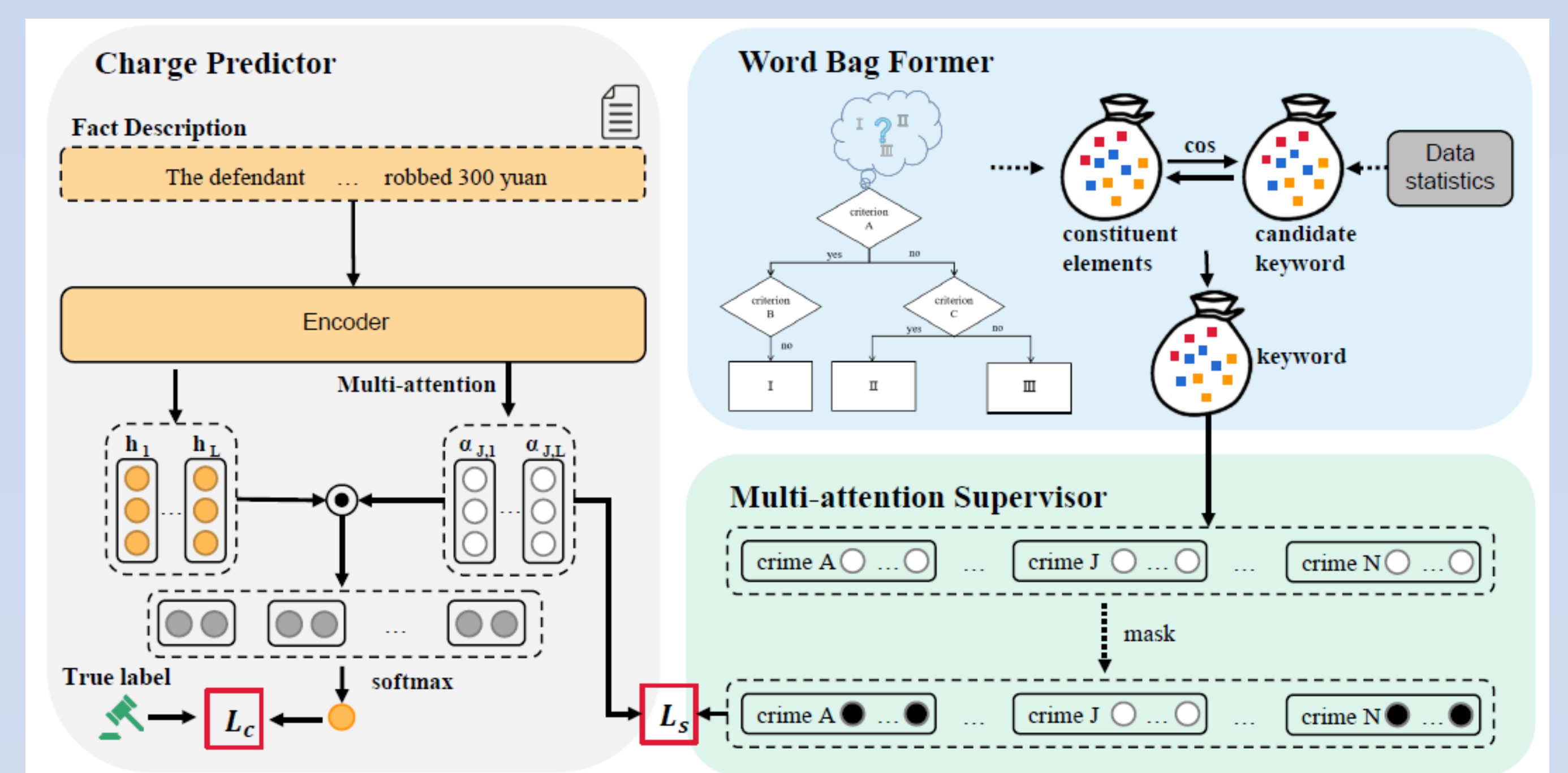
Graph-based Keyword Selection

Given charge i , use High-frequency statistics to filter out candidate keyword set C'_i , constituent elements set R_i from graph, legal pretrained model f_θ , the similarity threshold η

$$\frac{\sum_{w \in C'_i, r \in R_i} \text{sim}(f_\theta(w), f_\theta(r))}{|R_i|} > \eta \rightarrow w \in C_i$$

➤ Construction and utilization of expert knowledge graphs

FGWB method



➤ Structure of Our Model

Multi-attention & predictor

$$\alpha_{i,n} = \frac{\exp(\tanh(W h_i + b)^T u_n)}{\sum_i \exp(\tanh(W h_i + b)^T u_n)}$$

$$s = \sum_i \sum_n \alpha_{i,n} h_i$$

$$y = \text{softmax}(W s + b)$$

Multi-attention Supervisor

$$\mathcal{L}_s = - \sum_{i=1}^L [\hat{a}_i \log(a_i) + (1 - \hat{a}_i) \log(1 - a_i)]$$

$$a_i = \text{MASK}(n)(a_{1,1}, \dots, a_{i,n}, \dots, a_{L,N}) = a_{i,n}$$

$$\mathcal{L}_c = -y \ln y$$

$$\mathcal{L} = \mathcal{L}_c + \lambda \cdot \mathcal{L}_s$$

The Experiment Results

Experiment results for property charges and drug charges

Method	Property Set					Drug Set				
	Ma-P	Ma-R	Ma-F	Acc	Ma-F*	Ma-P	Ma-R	Ma-F	Acc	Ma-F*
TextRNN	0.789	0.784	0.769	0.783	0.769	0.913	0.910	0.909	0.909	0.895
LSTM	0.857	0.815	0.808	0.814	0.798	0.914	0.901	0.909	0.924	0.914
TextCNN	0.846	0.799	0.776	0.800	0.743	0.903	0.880	0.878	0.884	0.908
DPCNN	0.882	0.864	0.856	0.865	0.896	0.931	0.934	0.927	0.937	0.947
C3VG	0.882	0.862	0.860	0.868	0.985	0.920	0.920	0.920	0.914	0.939
Electra	0.903	0.889	0.881	0.888	0.892	0.936	0.930	0.928	0.928	0.943
Topjudge	0.891	0.877	0.874	0.878	0.886	0.926	0.923	0.922	0.917	0.940
LADAN	0.905	0.893	0.892	0.895	0.908	0.933	0.930	0.929	0.940	0.966
NeurJudge	0.907	0.897	0.902	0.905	0.917	0.939	0.940	0.935	0.950	0.968
R-Former	0.905	0.895	0.894	0.901	0.918	0.931	0.948	0.941	0.951	0.970
FGWB (LSTM)	0.888	0.880	0.876	0.880	0.880	0.934	0.933	0.930	0.929	0.942
FGWB (Electra)	0.923	0.925	0.924	0.925	0.928	0.957	0.955	0.956	0.955	0.979

➤ FGWB significantly and consistently outperforms all the baselines.

Case Study

Model	LSTM-attn	FGWB (SV)	FGWB (MSV)
Attention distribution	At about 02:02 on June 18, 2019, when the defendant Zhao Mousmou went to the toilet in Tuqiao Village, Guandu District, Kunming City, he saw the victim Li Mousmou put a red OPPO R17 mobile phone at his feet when he went to the toilet. Defendant Zhao XX took advantage of the victim Li XX's unpreparedness and snatched away the mobile phone that was at his feet. The value of the OPPO R17 mobile phone identified as involved in the case was 2190 yuan and has been returned to the victim.	At about 02:02 on June 18, 2019, when the defendant Zhao Mousmou went to the toilet in Tuqiao Village, Guandu District, Kunming City, he saw the victim Li Mousmou put a red OPPO R17 mobile phone at his feet when he went to the toilet. Defendant Zhao XX took advantage of the victim Li XX's unpreparedness and snatched away the mobile phone that was at his feet. The value of the OPPO R17 mobile phone identified as involved in the case was 2190 yuan and has been returned to the victim.	At about 02:02 on June 18, 2019, when the defendant Zhao Mousmou went to the toilet in Tuqiao Village, Guandu District, Kunming City, he saw the victim Li Mousmou put a red OPPO R17 mobile phone at his feet when he went to the toilet. Defendant Zhao XX took advantage of the victim Li XX's unpreparedness and snatched away the mobile phone that was at his feet. The value of the OPPO R17 mobile phone identified as involved in the case was 2190 yuan and has been returned to the victim.
prediction	Theft	Theft	Snatch

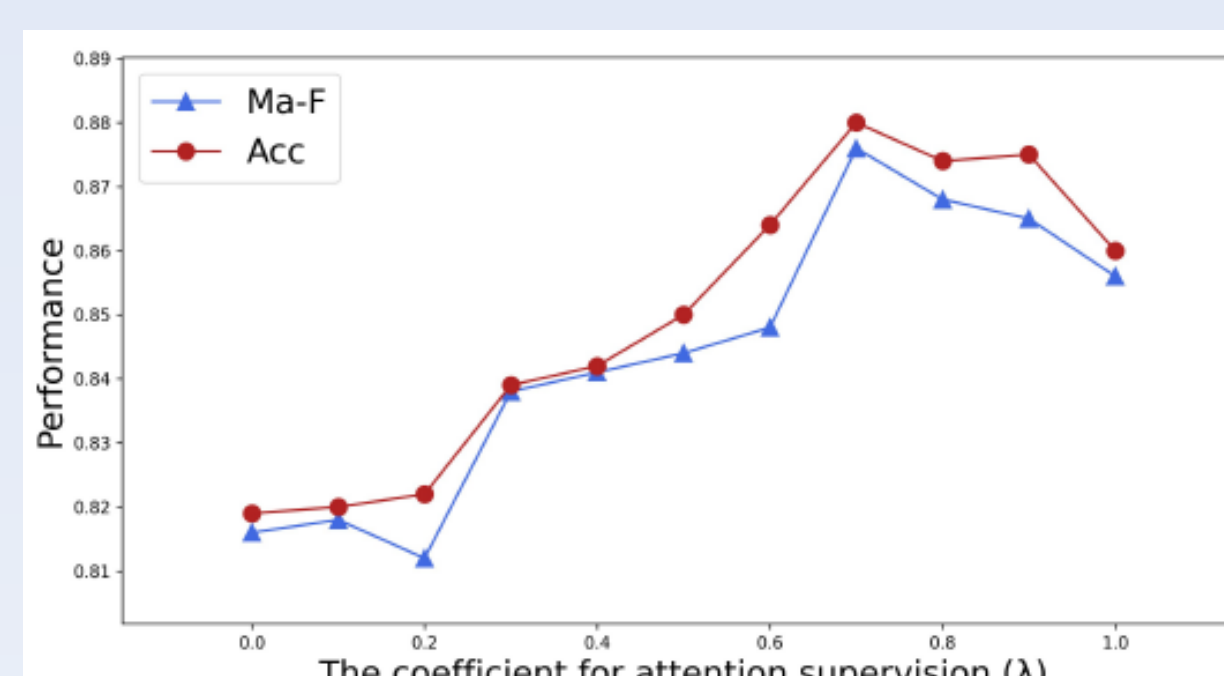
➤ Attention distribution from different models for a Snatch case. FGWB places emphasis on *unpreparedness*. It predicts Snatch.

Dataset & parameter

Type	Property Set	Drug Set
# Train set	34169	8903
# Valid set	3796	989
# Test set	4000	2000
Avg. # Tokens in Fact	339	347

Property Set	Number	Drug Set	Number
Theft	28535	DS	5435
Fraud	8426	PVFDU	4789
Robbery	3648	IPOD	1668
Snatch	1356	DT	855

Imbalanced distribution



➤ When optimal, $\lambda = 0.7$

Confusing Matrices

NeurJudge	Robbery	Snatch	Theft	Fraud
Robbery	709	7	0	2
Snatch	48	836	1	2
Theft	108	41	989	6
Fraud	2	10	10	992

Electra	Robbery	Snatch	Theft	Fraud
Robbery	888	244	1	0
Snatch	4	355	2	0
Theft	101	376	982	10
Fraud	7	25	15	990

FGWB (SV)	Robbery	Snatch	Theft	Fraud
Robbery	872	71	0	0
Snatch	68	862	2	0
Theft	35	34	997	6
Fraud	25	33	1	994

FGWB (MSV)	Robbery	Snatch	Theft	Fraud
Robbery	902	29	0	0
Snatch	181	942	1	0
Theft	45	98	996	3
Fraud	5	37	3	995

➤ With FGWB, model improves.

Ablation Experiment Results

Method	property charges					drug charges				
	Ma-P	Ma-R	Ma-F	Acc	Ma-F*	Ma-P	Ma-R	Ma-F	Acc	Ma-F*
FGWB (LSTM)	0.888	0.880	0.876	0.880	0.880	0.934	0.933	0.930	0.929	0.942
w/o SV	0.862	0.839	0.857	0.848	0.872	0.914	0.897	0.911	0.904	0.924
w/o Multi-Attn	0.866	0.842	0.861	0.854	0.862	0.918	0.908	0.917	0.921	0.931
w/o KG	0.874	0.869	0.863	0.865	0.872	0.930	0.923	0.921	0.919	0.943
FGWB (Electra)	0.923	0.925	0.924	0.925	0.938	0.957	0.955	0.956	0.955	0.979
w/o SV	0.901	0.892	0.907	0.897	0.905	0.942	0.904	0.920	0.919	0.957
w/o Multi-Attn	0.907	0.897	0.917	0.902	0.911	0.948	0.927	0.934	0.959	0.965
w/o KG	0.912	0.902	0.910	0.895	0.919	0.950	0.948	0.935	0.948	0.977

➤ Ablation settings perform worse than FGWB in all metrics.