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Fine-Grained Legal Argument-Pair Extraction via Coarse-Grained Pre-training

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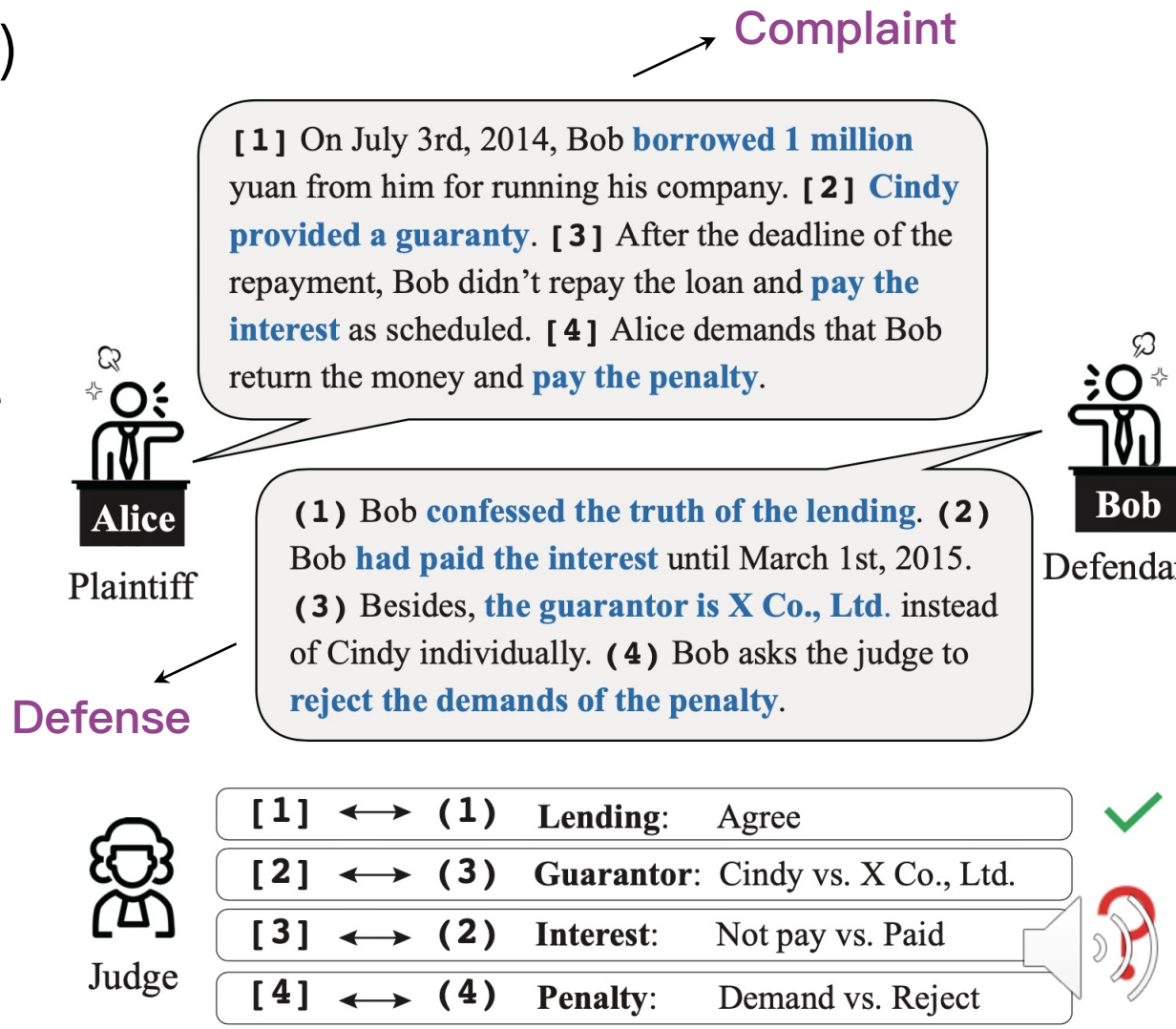
Background

- Legal Argument–Pair Extraction (LAE)
  - Identify the interactive arguments with the same topic from the statements of the plaintiff and the defendant
- Highlight the key factual disputes for further investigation



Background

- Existing methods formalize argument–pair extraction as a **supervised** sentence pair classification problem
- Rely heavily on substantial human–annotated data
  - Time–consuming and labor–intensive

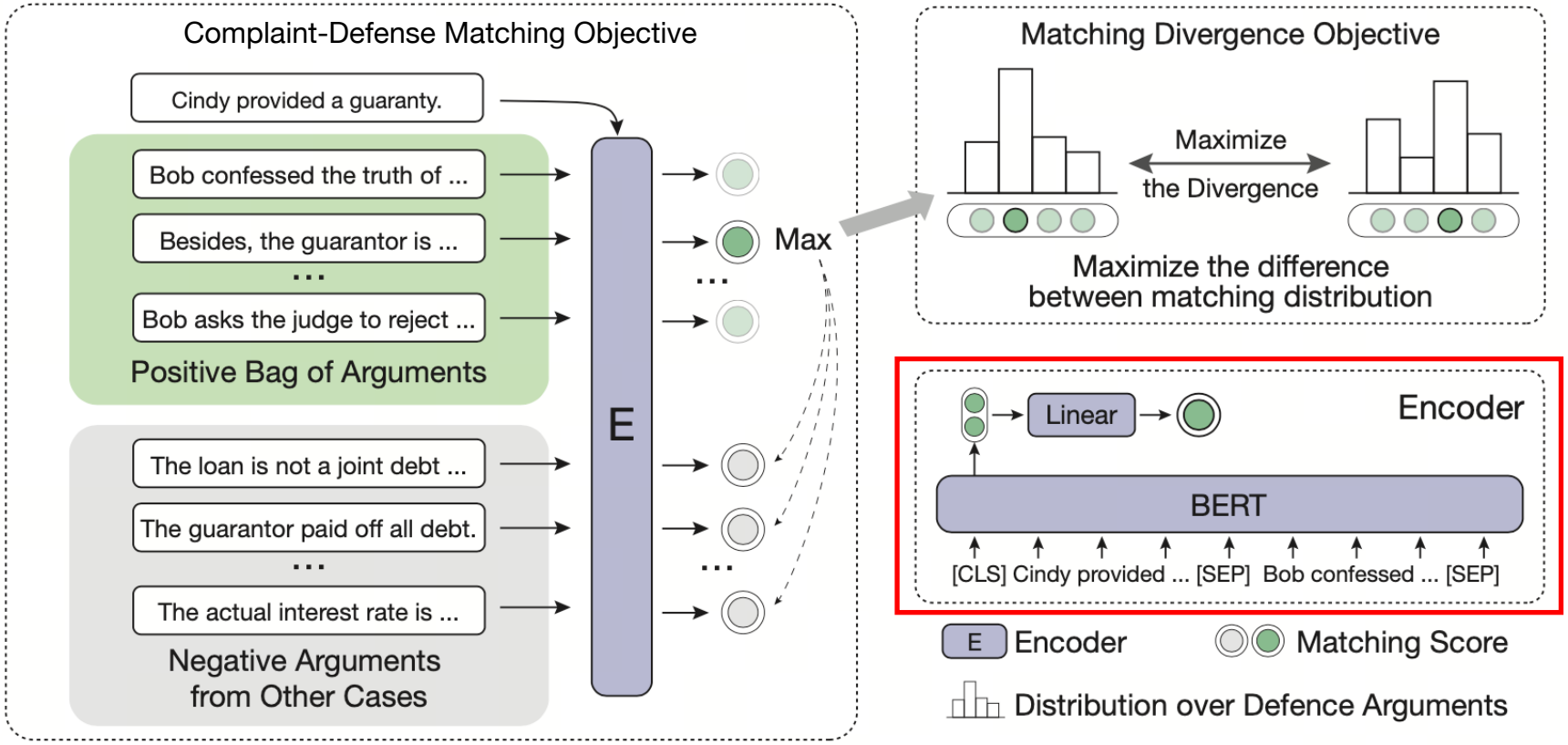
- Goal: Designing an argument–oriented pre–training framework to utilize large–scale **unlabeled complaint–defense pairs**

Methodology

- Motivated by two observation:
- (1) For most complaint arguments, there typically exists **at least one** corresponding defense argument that addresses them
- (2) Different complaint arguments are usually addressed by **different** defense arguments

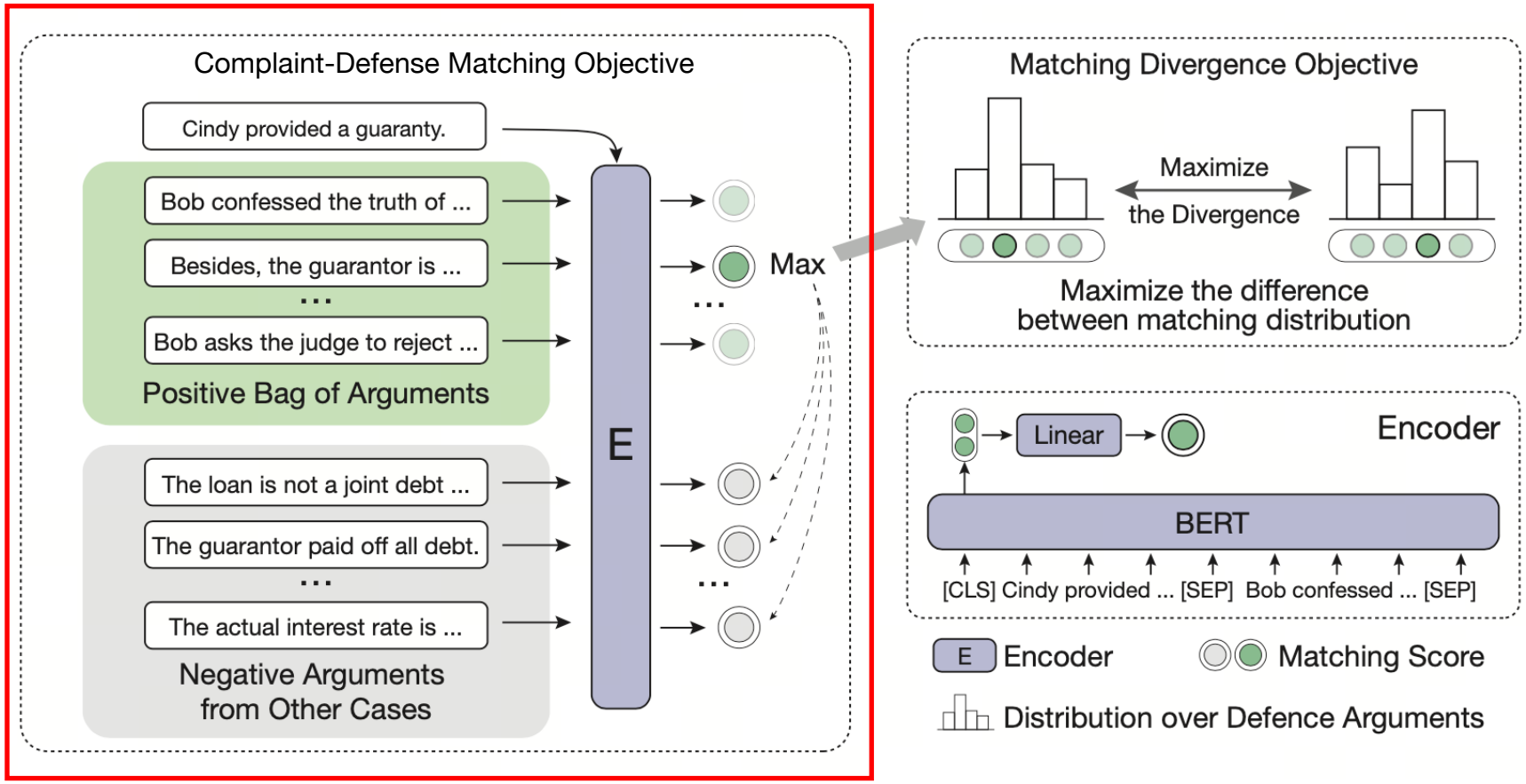
Methodology

- Argument–pair matching score: we employ BERT as the encoder



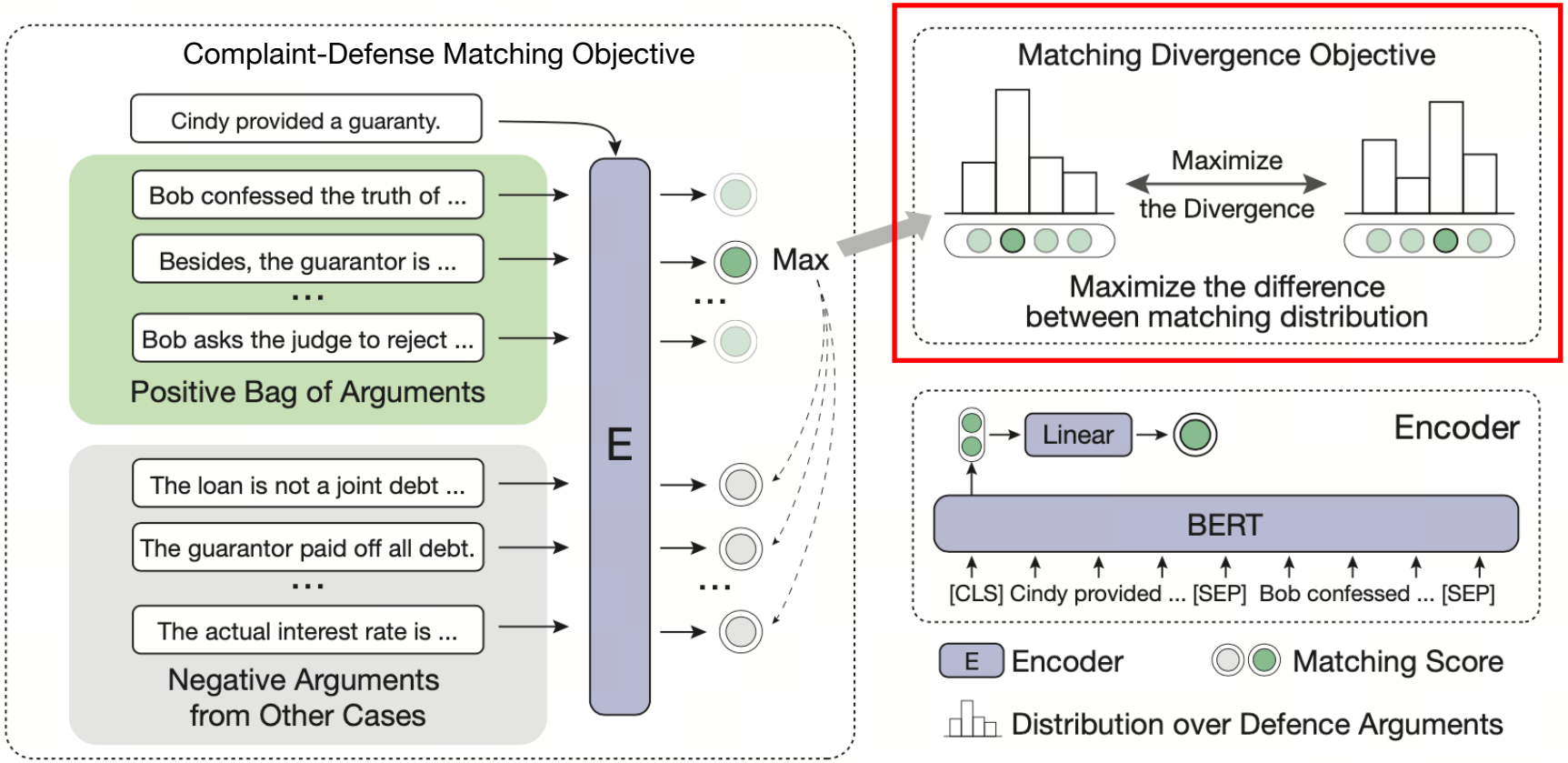
Methodology

- Complaint–defense matching objective: we employ a contrastive learning strategy



Methodology

- Matching divergence objective: we maximum the JS divergence between the matching distribution of different complaint arguments



Experiments

- Dataset Construction: two–step annotation
  - Annotators: in a law–related profession or pursuing a law degree
  - Step 1: each case is required to be annotated twice independently
  - Step 2: an experienced annotator to give the final results for cases with different annotations in the first step
- Quality evaluation
  - 95.26% precision; 91.70% recall

Dataset	pre-train	train	valid	test
		Lending		
# Case	20k	1.2k	400	400
# Argument	194k	11.7k	3.9k	3.9k
# Arg-Pair	–	11.9k	4.4k	4.8k
		Contract		
# Case	20k	1.2k	400	400
# Argument	201k	12.4k	4.2k	4.1k
# Arg-Pair	–	11.3k	4.5k	4.8k

Experiments

- Our method can achieve superior performance for both unsupervised and supervised setting

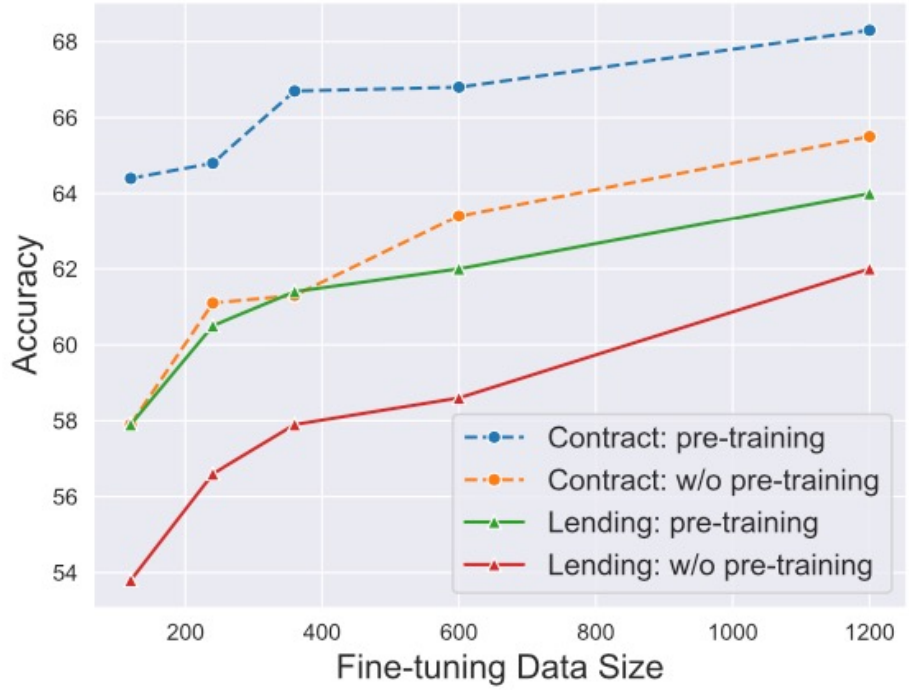
Model	Lending valid	Lending test	Contract valid	Contract test
Unsupervised Setting				
AvgEmb	36.7	36.5	43.1	43.3
IS-BERT	40.9	41.0	51.8	52.6
SimCSE	42.9	41.7	51.8	51.9
Ours	**48.4**	**46.4**	**53.4**	**54.6**
Supervised Setting				
SBERT	54.6	54.0	60.6	59.8
$\text{SimCSE}_{\text{Sup}}$	57.5	58.0	61.2	61.1
BERT-Pair	62.0	62.0	65.3	65.5
DARL	58.4	57.6	65.8	65.2
Ours_{Sup}	**65.6**	**64.0**	**68.0**	**68.3**

- Both two training objectives contribute to the final superior performance

Model	Lending valid	Lending test	Contract valid	Contract test
Unsupervised Setting				
Ours	**48.4**	**46.4**	**53.4**	**54.6**
w/o divergence	48.1	45.4	52.1	52.4
Supervised Setting				
Ours_{Sup}	**65.6**	**64.0**	**68.0**	**68.3**
w/o divergence	65.3	63.6	67.8	67.5
w/o pre-training	62.0	62.0	65.3	65.5
w/ MLM	62.5	62.3	65.2	65.0

Experiments

- Our method can reach superior accuracy with only half manually annotated data



Summary

- Legal argument–pair extraction can help legal professionals highlight the key factual disputes
- We design an argument–oriented pre–training framework for LAE
- Our proposed method can achieve superior performance for both unsupervised and supervised setting with limited human–annotated data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Thanks

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