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An Embarrassingly Simple Model for Dialogue Relation Extraction

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What is Dialogue Relation Extraction (RE)?

Dialogue relation extraction (RE) is to predict the **relation type** of **two entities** mentioned in a **dialogue**. Each dialogue usually include **multiple entity pairs**.

An Example in DialogRE Dataset (Dialogue-level Relation Extraction)

S1: Hey Pheeb.

S2: Hey!

S1: Any sign of your **brother**?

S2: No, but he's always late.

S1: I thought you only met him once?

S2: Yeah, I did. I think it sounds y'know big sistery, y'know, '**Frank**'s always late.'

S1: Well relax, he'll be here..

Argument pair	Trigger	Relation type
R1 (Frank, S2)	brother	per:siblings
R2 (S2, Frank)	brother	per:siblings
R3 (S2, Pheeb)	none	per:alternate names
R4 (S1, Pheeb)	none	Unanswerab

Motivation

Among **multiple pairs of entities**, the relations mentioned in the same dialog often **interrelate with each other** to some extent.

For example, **Richard** and **Monica** in the first few utterances show two possible relations, i.e. **positive_impression** or **girl/boyfriend**. The last utterance indicates that **Monica** is girlfriend of S2; hence **Richard** and **Monica** can only be related by **positive_impression**.

S1: Where the hell have you been?!

S2: I was making a coconut phone with the professor.

S1: Richard told Monica he wants to marry her!

S2: What?!

S1: Yeah! Yeah, I've been trying to find ya to tell to stop messing with her and maybe I would have if these damn boat shoes wouldn't keep flying off!

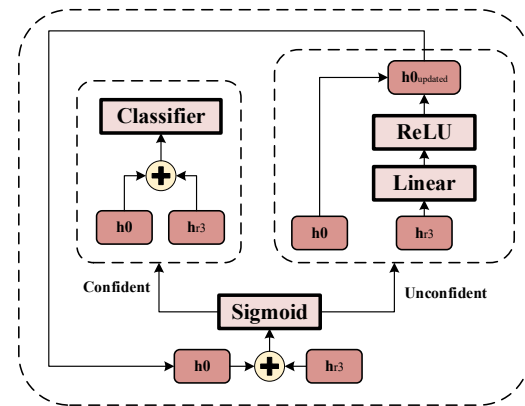
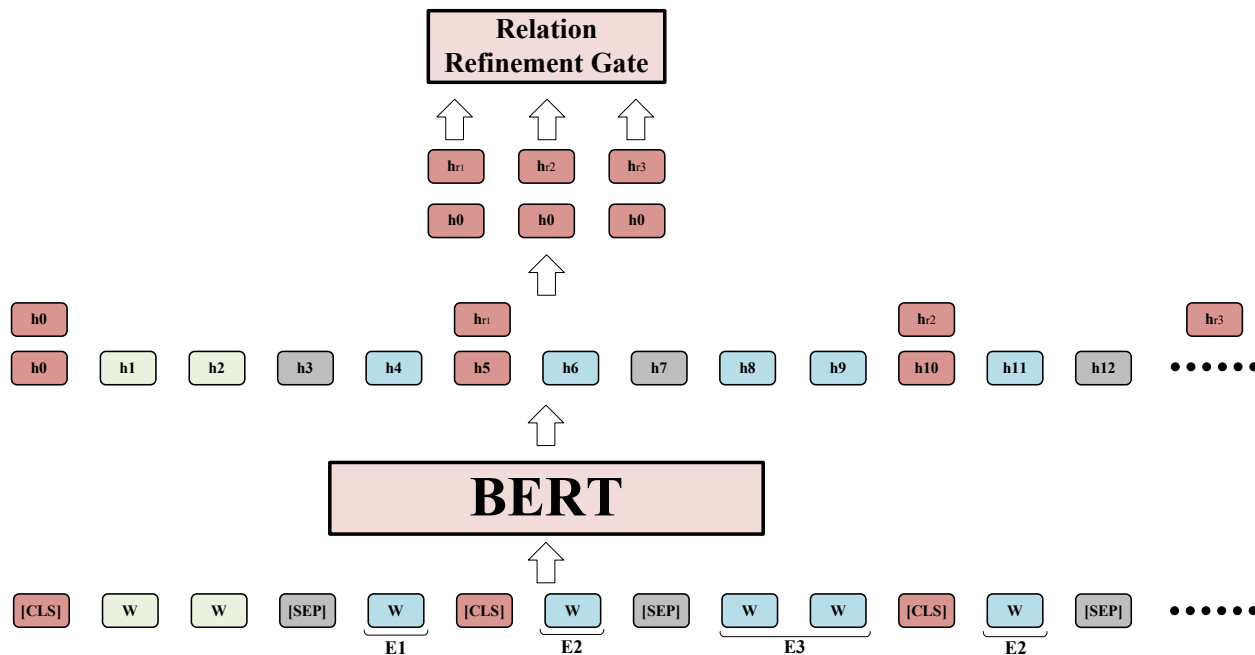
S2: My—Oh my God!

S1: I know! They suck!!

S2: He's not supposed to ask my girlfriend to marry him! I'm supposed to do that!

	Argument pair	Relation type
R1	(Monica, S2)	girl/boyfriend
R2	(Richard, Monica)	positive_impression

SimpleRE: Overview



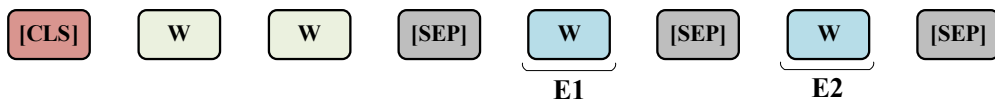
Relation Refinement Gate

SimpleRE: BERT Relation Token Sequence

BERT Relation Token Sequence

- Given a sequence X , which contains a set of subject entities $E_s = \{E_s^1, E_s^2, \dots, E_s^n\}$ and a set of object entities $E_o = \{E_o^1, E_o^2, \dots, E_o^n\}$, we form a BRS as input to BERT: $BRS = \langle [CLS], X, [SEP], E_s^1, [CLS], E_o^1, [SEP], E_s^n, [CLS], E_o^n, [SEP] \rangle$

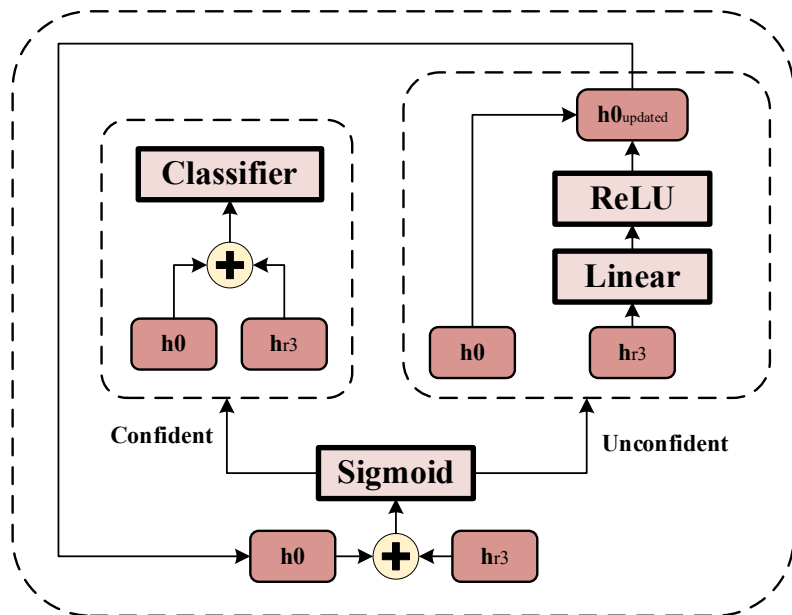
Baseline



BERT Relation Token Sequence



SimpleRE: Relational Refinement Gate



Relation Refinement Gate

Why: We propose a Relation Refinement Gate (RRG) to refine the semantic representation of each relation for target relation prediction in an adaptive manner.

How: Following Shallow-Deep Networks, we use compute confidence score s_c to decide whether we further refine h_0 for a more task-specific representation.

Experiments: Dialogue-level Relation Extraction

- Dataset
 - **DialogRE** is the first human-annotated dialogue-level RE dataset.
- Baseline Models and Experimental Setup
 - **GDPNet**: a recent BERT-based model, and it achieves best performance on dialogue Relation Extraction.
 - **BERTs**: speaker-aware modification of BERT
 - We also include popular baseline models: **CNN, LSTM, BiLSTM and BERT** models.
 - We use the **same input format and hyperparameter settings** as in BERTs and GDPNet.

Experiments: Dialogue-level Relation Extraction

➤ Results on DialogRE v1

Model	$F1 \pm \delta$
CNN [1]	48.0±1.5
LSTM [1]	47.4±0.6
BiLSTM [1]	48.6±1.0
AGGCN [11]	46.2
LSR [12]	44.4
DHGAT [3]	56.1
BERT [4]	58.5±2.0
BERTs [1]	61.2±0.9
GDPNet [2]	64.9±1.1
SimpleRE (Ours)	66.3±0.7

SimpleRE achieves **the best performance** on DialogRE v1.

Experiments: Dialogue-level Relation Extraction

➤ Results on DialogRE v2

Model	English V2 ($F1 \pm \delta$)	Chinese ($F1 \pm \delta$)
BERT [4]	60.6±0.5	61.6±0.4
BERTs [1]	61.8±0.6	63.8±0.6
GDPNet [2]	64.3±1.1	62.2±0.9
SimpleRE (Ours)	66.7±0.7	65.2±1.1

SimpleRE achieves **the best performance** on DialogRE English v2 and DialogRE Chinese.

Experiments: Dialogue-level Relation Extraction

- Average training time per epoch

Model	Average Time (mins)
BERT [4]	4.7
BERTs [1]	4.7
GDPNet [2]	12.6
SimpleRE (Ours)	0.9

SimpleRE is the fastest BERT-based model

Experiments: Dialogue-level Relation Extraction

➤ Ablation Study

Model	$F1 \pm \sigma$
SimpleRE	66.3 \pm 0.7
SimpleRE w/o BRS	60.4 \pm 0.9
SimpleRE w/ BRS-v2	62.8 \pm 1.1
SimpleRE w/ BRS-v3	63.5 \pm 0.8
SimpleRE w/o RRG	65.5 \pm 0.7

Ablation study shows the effectiveness of the two main components in SimpleRE, i.e., **BERT Token Sequence** and **Relational Refinement Gate**.

Experiments: Sentence-level Relation Extraction

➤ Dataset

- **TACRED** is a widely used large-scale sentence-level relation extraction dataset.
- **TACREV** dataset, released recently, corrects the wrong labels in the development and test sets of TACRED.

➤ Baseline Models and Experimental Setup

- **GDPNet** is the best performing sentence-level Relation Extraction model without incorporating any external knowledge and parser.
- We also include **RNN- and graph-based models**.
- We use the **same input format and hyperparameter settings** as in GDPNet.

Experiments: Sentence-level Relation Extraction

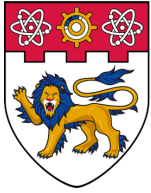
➤ Results on TACRED and TACREV

Model	TACRED	TACREV
LSTM [14]	62.7	70.6
PA-LSTM [14]	65.1	74.3
C-AGGCN [11]	68.2	75.5
LST-AGCN [15]	68.8	-
SpanBERT [16]	70.8	78.0
GDPNet [2]	70.5	80.2
SimpleRE (Ours)	71.7	80.7
KnowBERT [17]	71.5	79.3

Without external resources, SimpleRE achieves best performance on both TACRED and TACREV

Conclusion

- We propose SimpleRE, a simple yet effective model for dialogue relation extraction.
- SimpleRE achieves the best performance on DialogRE v1, DialogRE v2 and DialogRE Chinese.
- SimpleRE can also be easily adapted to sentence-level relation extraction.



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