

## A Detail of Syntax Structure Induction

Here we unfold the induction of Eq. (2) for the structure induction. Based on the rule  $\Gamma_C$  we have:

$$p(o_i^d > o_k^c) = \sigma(o_i^d > o_k^c).$$

Then, the probability that the  $l$ -th ( $l < i$ ) token is inside  $C_{[l,r]}$  is equal to the probability that  $o_i^d$  is larger than the maximum  $o_k^c$  between  $l$  and  $i$ :

$$p(l \in C_{[l,r]}) = p(o_i^d > \text{Max}(o_{i-1}^c, \dots, o_l^c)) = \sigma(o_i^d - \text{Max}_{k \in [l,i]}(o_k^c)).$$

Thus, the conditional probabilistic of  $p(w_l|w_i)$  becomes:

$$p(w_l|w_i) = \sigma(o_i^d - \text{Max}_{k \in [l,i]}(o_k^c)) - \sigma(o_i^d - \text{Max}_{k \in [l,i]}(o_k^c)).$$

Similarly, for  $p(w_r|w_i)$ :

$$p(w_r|w_i) = \sigma(o_i^d - \text{Max}_{k \in [i,r]}(o_k^c)) - \sigma(o_i^d - \text{Max}_{k \in [i,r]}(o_k^c)).$$

And finally, we can derive the probability of phrasal span  $C_{[l,r]}$ :

$$\begin{aligned} p_c(c_k|w_i) &= p(w_l|w_i) \cdot p(w_r|w_i) \\ &= [\sigma(o_i^d - \text{Max}_{k \in [l,i]}(o_k^c)) - \sigma(o_i^d - \text{Max}_{k \in [l,i]}(o_k^c))] \cdot [\sigma(o_i^d - \text{Max}_{k \in [i,r]}(o_k^c)) - \sigma(o_i^d - \text{Max}_{k \in [i,r]}(o_k^c))]. \end{aligned}$$

## B Baseline Specification

In our experiments we take the current SoTA methods as the separate IE comparisons on each specific task and data. Here Table 3 shows the specifications of these baseline models. Parts of the results are directly copied from their raw papers, where the Large version LM or GLM is used, while part of the results are from our reimplementations.

Table 3: SoTA baseline systems for different IE tasks.

Task	Dataset	Model	LM Type	Result Source
NER	CoNLL03	Wang et al. [70]	RoBERTa-Large	Raw paper
	ACE04/05	Yan et al. [80]	BART-Large	Raw paper
	OntoNote	Li et al. [35]	BERT-Large	Reimplementation
RE	CoNLL04	Wang and Lu [69]	ALBERT-large	Raw paper
	NYT	Zheng et al. [86]	BERT-Large	Raw paper
	ACE05	Zhong and Chen [87]	ALBERT-XXLarge	Raw paper
AOP	Res14	Wu et al. [77]	BERT-Large	Reimplementation
ASTE	Res14	Zhang et al. [84]	BERT-Large	Reimplementation
ORL	MPQA	Wu et al. [78]	BERT-Large	Reimplementation
SRL	CoNLL12	Fei et al. [17]	RoBERTa-Large	Reimplementation
EE	ACE05	Lin et al. [40]	BERT-Large	Reimplementation

## C Task Label Prompts

Each task with each dataset will come with different task label, including the *span attribute labels* and *relation type labels*, which will be used as the label prompts in input. Table 4 summarizes all the label prompts of each dataset. Also we note that, instead of directly taking the raw label abbreviations as label prompts, we use the full names of labels in natural languages, such that we can fully utilize their semantic representations in GLM.

Table 4: The span attribute labels and relation type labels of different tasks and datasets for building the task labels prompts. We note that we replace the raw label abbreviations with their full names in natural languages, so as to fully utilize their semantic representations in GLM.

Task	Dataset	Span attribute labels	Relation type labels
NER	CoNLL03	location, organization, person, miscellaneous	/
	OntoNote	person, nationality, facility, organization, geographical political, location, product, event, work of art, law, language, time, date, percent, money, quantity, ordinal, cardinal	/
	ACE04	person, organization, location, facility, geographical political, vehicle, weapon	/
	ACE05	person, organization, location, facility, geographical political, vehicle, weapon	/
RE	CoNLL04	location, organization, people, other	kill, live in, located in, organization in, work for administrative divisions, advisors, capital, children, company, contains, country, ethnicity, founders, geographic, distribution, industry, location, major shareholder of, major shareholders, nationality, neighborhood of, people, place founded, place lived, place of birth, place of death, profession, religion, teams agent artifact, general affiliation, organization affiliation, part whole, personal social, physical
	NYT	location, organization, person	
	ACE05	person, organization, location, facility, geographical political, vehicle, weapon	
AOP	Res14	aspect, opinion	default relation
ASTE	Res14	aspect, opinion	positive, neutral, negative
ORL	MPQA	opinion, role	holder, target
SRL	CoNLL12	default argument, default predicate	agent (ARG0), patient (ARG1), instrument and end state (ARG2), starting point and benefactive and attribute (ARG3), ending point (ARG4), direction (DIR), location (LOC), manner (MNR), extent (EXT), reciprocals (REC), secondary predication (PRD), purpose (PNC), cause (CAU), discourse and connectives (DIS), adverbial and general purpose (ADV), modal verb (MOD), negation (NEG), time (TMP)
EE	ACE05	default argument, acquit, appeal, arrest jail, attack, born, charge indict, convict, declare bankruptcy, demonstrate, die, divorce, elect, end organization, end, position, execute, extradite, fine, injure, marry, meet, merge organization, nominate, pardon, phone write, release parole, sentence, start organization, start position, sue, transfer money, transfer, ownership, transport, trial hearing	person, agent, victim, instrument, attacker, target, instrument, time, place, artifact, vehicle, price, origin, destination, time, buyer, seller, beneficiary, giver, recipient, beneficiary, org, money, entity, position, crime, defendant, prosecutor, adjudicator, plaintiff, sentence