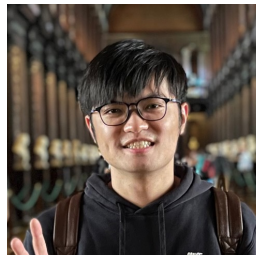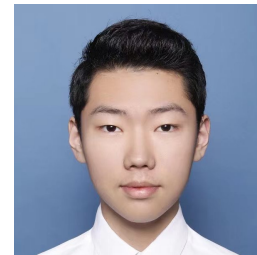# TAGPRIME: A Unified Framework for Relational Structure Extraction

I-Hung Hsu* Kuan-Hao Huang* Shuning Zhang Wenxin Cheng
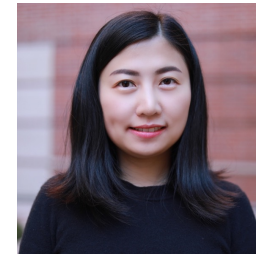
Prem Natarajan Kai-Wei Chang Nanyun Peng
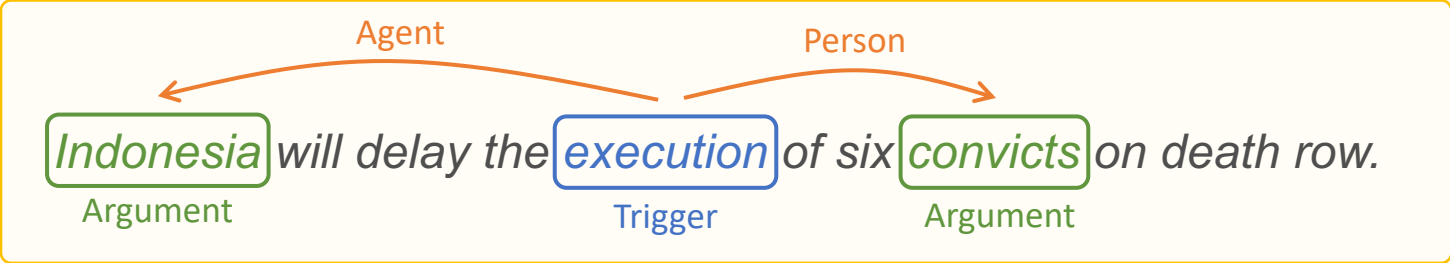
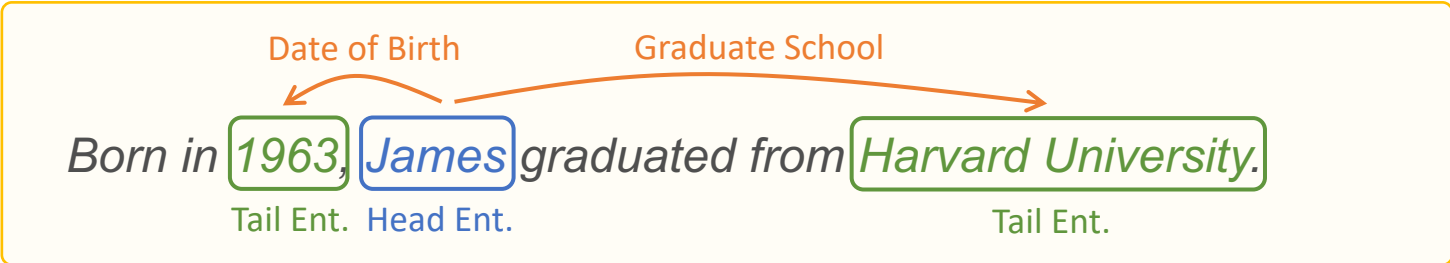# Relational Structure Extraction

- Extract relational structures from texts
  - Concepts in text and the relationships between concepts

Our Contributions

- Prior works[1-5]

  - Solve individual relational structure extraction task separately

  - Design a specific and complicated model for each task

- Our work

  - Take a unified view of relational structure extraction tasks

  - Propose TAGPRIME, a simple but effective model for all tasks, which can serve as a strong baseline for future works.

  - Adapt priming techniques to boost performance

[1] Degree: A data-efficient generation-based event extraction model, NAACL 2022
[2] Text2event: Controllable sequence-to- structure generation for end-to-end event extraction, ACL 2021
[3] A frustratingly easy approach for entity and relation extraction, NAACL 2021
[4] A partition filter network for joint entity and relation extraction, EMNLP 2021
[5] MTOP: A comprehensive multilingual task-oriented semantic parsing benchmark, EACL 2021

A Unified View of Relational Structure Extraction Tasks

- Extract conditions
- Extract word spans and corresponding relationships based on conditions
  - Sequence tagging

Event Extraction

Condition

Trigger: execution
Type: Justice

Agent O O O O O O Person O O O

Indonesia will delay the execution of six convicts on death row.

Relation Extraction

Condition

Head Ent.
James

O O Birth O O O School School

Born in 1963, James graduated from Harvard University.

Task-Oriented Semantic Parsing

Condition

Intent
Create_Reminder

O O O O O To-do To-do O Time Time

Set up a reminder to message Mike at 7pm tonight.

3

Using Condition Information

- Prior works add learnable features for conditions[1,2]

Learnable Features

Agent O O O O O O *Person* O O O

Condition-Specific Representations

Text Representations

Condition

Trigger: execution Type: Justice

Language Model

Indonesia will delay the execution of six convicts on death row.
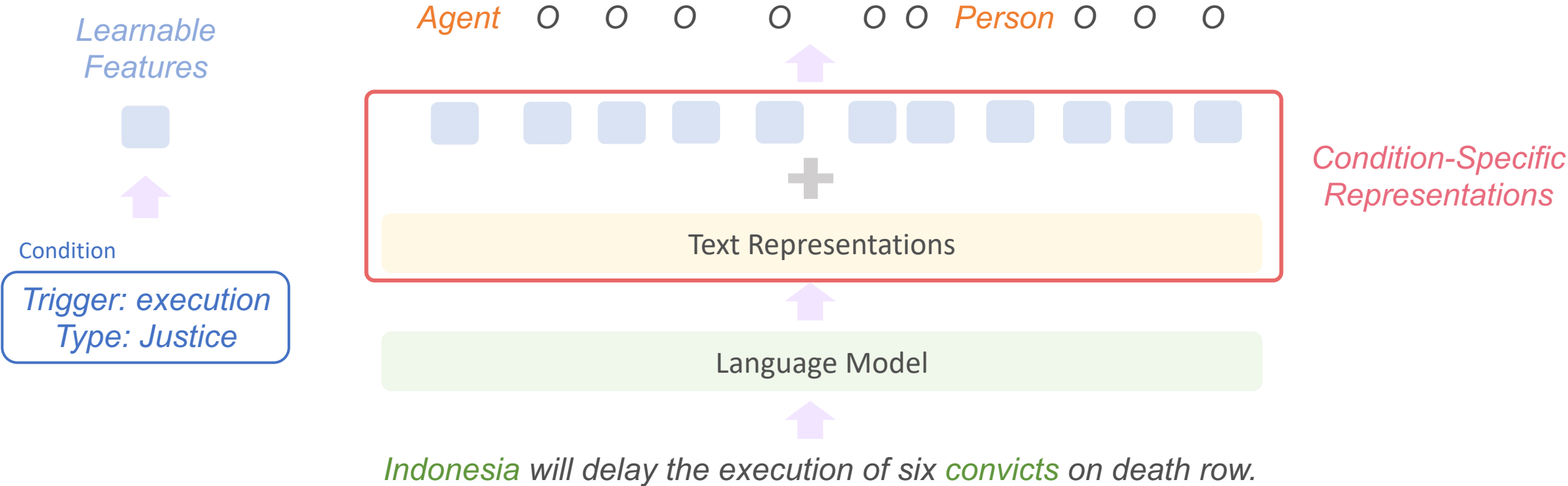
[1] Joint type inference on entities and relations via graph convolutional networks, ACL 2019
[2] Joint extraction of entities and relations based on a novel decomposition strategy, ECAI 2020

Priming Techniques

- Append priming string about condition information[1]
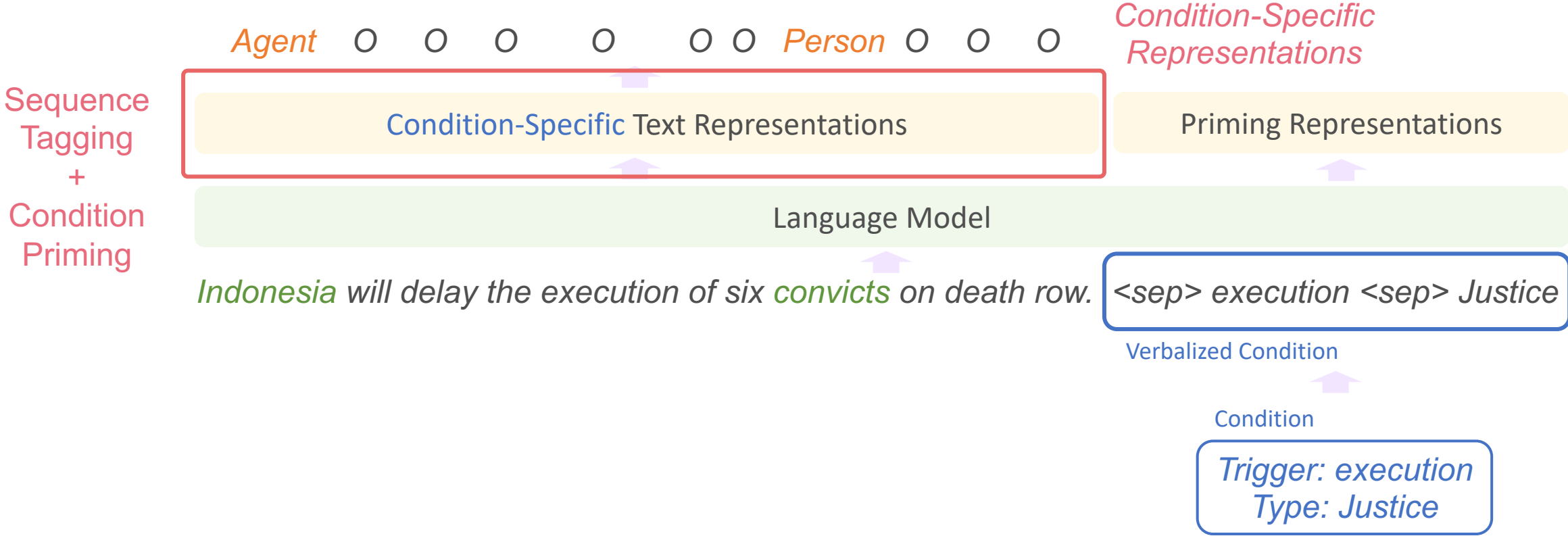
[1] Language model priming for cross-lingual event extraction, AAAI 2022

Relationship Priming

Experiments

- 3 tasks
  - Event extraction, relation extraction, task-oriented semantic parsing
- 5 languages
  - English, Chinese, Spanish, French, German

Task 1: Event Extraction

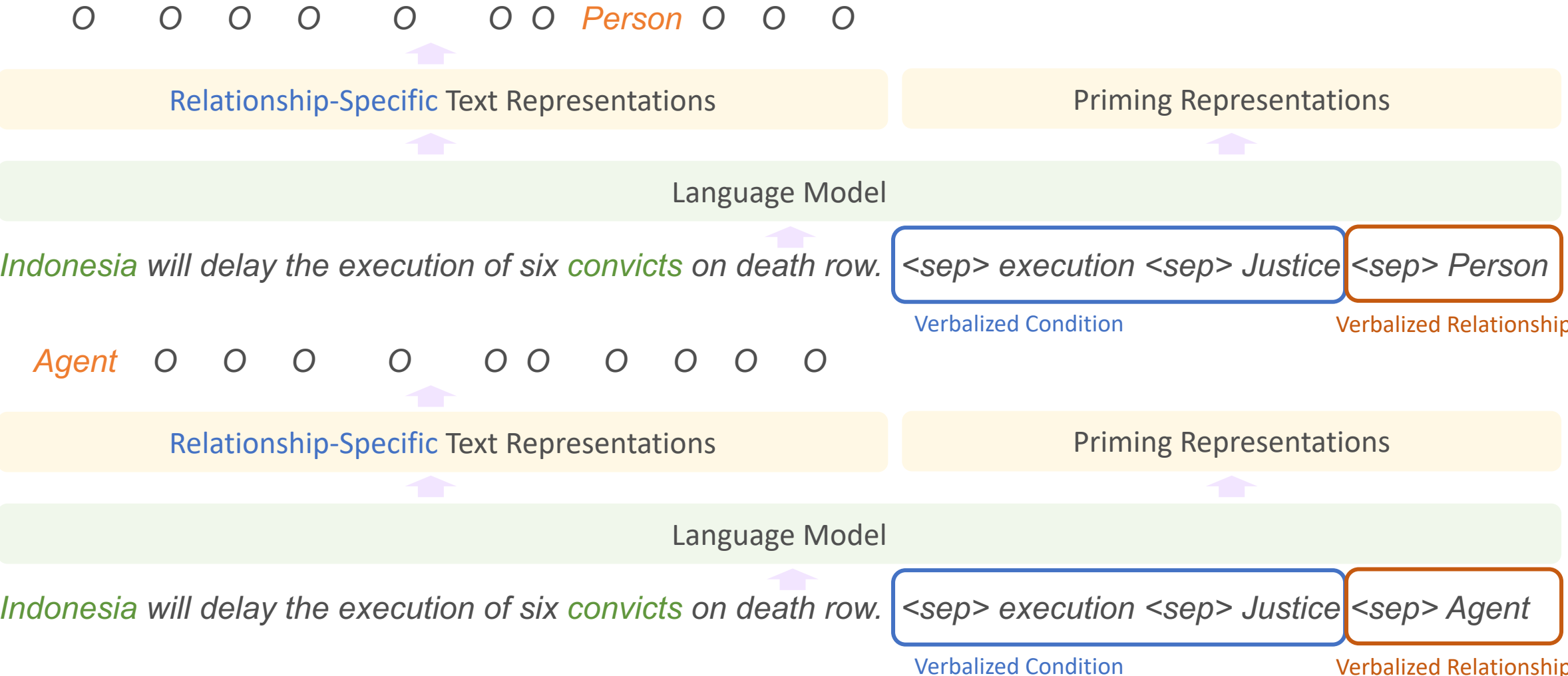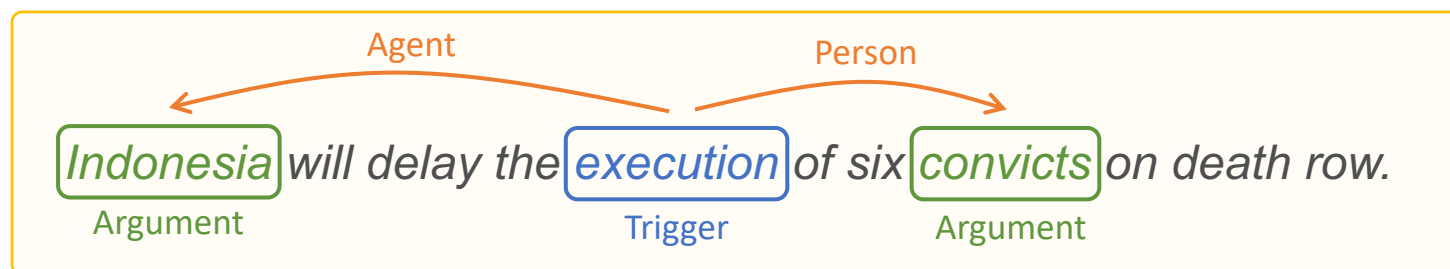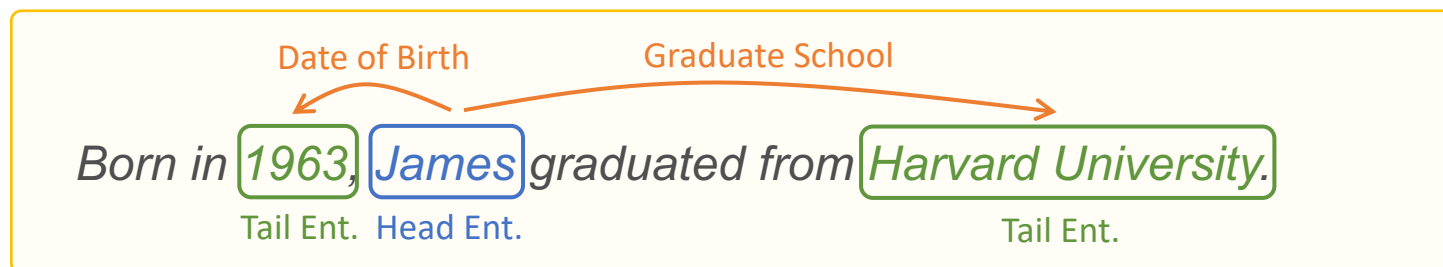| Model	ACE05-E (en)			ACE05-E (zh)			ERE (en)			ERE (es)		
	Tri-C	Arg-I	Arg-C	Tri-C	Arg-I	Arg-C	Tri-C	Arg-I	Arg-C	Tri-C	Arg-I	Arg-C
DyGIE++* (Wadden et al., 2019)	69.7	53.0	48.8	72.3	63.0	59.3	58.0	51.4	48.0	65.8	49.2	46.6
TANL (Paolini et al., 2021)	68.4	50.1	47.6	-	-	-	54.7	46.6	43.2	-	-	-
Text2Event (Lu et al., 2021)	71.9	-	53.8	-	-	-	59.4	-	48.3	-	-	-
OneIE* (Lin et al., 2020)	74.7	59.2	56.8	73.3	63.4	60.5	57.0	50.1	46.5	66.5	54.5	52.2
DEGREE (Hsu et al., 2022b)	73.3	-	55.8	-	-	-	57.1	-	49.6	-	-	-
TagPrime w/ Cond. Priming	74.6	**60.0**	56.8	71.9	63.2	60.5	57.3	52.1	49.3	66.3	**55.2**	52.6
TagPrime w/ Cond. & Rela. Priming	74.6	59.8	**58.3**	71.9	**64.7**	**62.4**	57.3	**52.4**	**49.9**	66.3	55.1	**53.6**

Task 2: Relation Extraction

Date of Birth   Graduate School

Born in 1963*,* James *graduated from* Harvard University*.*

Tail Ent. Head Ent.   Tail Ent.

Model	ACE05-R			ACE04-R		
	Ent	Rel	Rel+	Ent	Rel	Rel+
Table-Sequence (Wang and Lu, 2020)	89.5	67.6	64.3	88.6	63.3	59.6
PFN (Yan et al., 2021)	89.0	-	66.8	89.3	-	62.5
Cascade-SRN (late fusion) (Wang et al., 2022)	89.4	-	65.9	-	-	-
Cascade-SRN (early fusion) (Wang et al., 2022)	89.8	-	67.1	-	-	-
PURE (Zhong and Chen, 2021)	89.7	69.0	65.6	88.8	64.7	60.2
PURE◇ (Zhong and Chen, 2021)	90.9	69.4	67.0	90.3	66.1	62.2
UniRE◇ (Wang et al., 2021)	90.2	-	66.0	89.5	-	**63.0**
TAGPRIME w/ Cond. Priming	89.6	69.7	67.3	89.0	65.2	61.6
TAGPRIME w/ Cond. & Rela. Priming	89.6	**70.4**	**68.1**	89.0	**66.2**	62.3

Task 3: Task-Oriented Semantic Parsing

Model	MTOP (en)			MTOP (es)			MTOP (fr)			MTOP (de)		
	Intent	Slot-I	Slot-C	Intent	Slot-I	Slot-C	Intent	Slot-I	Slot-C	Intent	Slot-I	Slot-C
JointBERT (Li et al., 2021)	96.7	-	92.8	95.2	-	89.9	94.8	-	88.3	95.7	-	88.0
JointBERT (reproduced)	97.1	94.2	92.7	96.6	91.6	89.5	95.8	90.2	87.7	96.5	89.2	87.6
TAGPRIME + Cond. Priming	97.1	**94.8**	93.4	96.6	91.6	90.3	95.8	**90.6**	88.6	96.5	**89.6**	87.9
TAGPRIME + Cond. & Rela. Priming	97.1	94.7	**93.5**	96.6	**91.8**	**90.7**	95.8	**90.6**	**89.1**	96.5	89.5	**88.1**

Ablation Studies

Case	Cond. Feat.	Cond. Prim.	Rela. Feat.	Rela. Prim.	ACE05-E (en) Arg-I	Arg-C	ACE05-E (zh) Arg-I	Arg-C	MTOP (es) Slot-I	Slot-C	MTOP (fr) Slot-I	Slot-C	ACE05-R (en) Rel	Rel+	ACE04-R (en) Rel	Rel+	Average
1	✗	✗	✗	✗	57.8	54.2	60.2	57.2	91.8	90.2	90.5	88.4	67.8	65.5	62.2	58.9	69.1
2	✓	✗	✗	✗	58.1	55.3	60.4	58.1	**92.0**	90.4	90.6	88.6	67.5	65.2	61.8	58.4	69.4
3	✗	✓	✗	✗	59.6	56.7	62.0	59.7	91.8	90.4	**90.7**	88.8	69.6	67.2	64.7	60.7	70.6
4	✓	✓	✗	✗	**60.0**	56.8	63.2	60.5	91.6	90.3	90.6	88.7	69.7	67.3	65.2	61.6	70.9
5	✓	✗	✓	✗	57.3	55.3	61.4	59.4	91.7	90.5	90.2	88.5	68.0	65.6	61.6	58.3	69.6
6	✗	✓	✗	✓	59.3	57.6	63.0	61.2	91.7	90.5	90.5	88.9	**70.6**	**68.2**	66.0	62.2	71.4
7	✓	✓	✗	✓	59.8	**58.3**	**64.7**	**62.4**	91.8	**90.7**	90.6	**89.1**	70.4	68.1	**66.2**	**62.3**	**71.8**
8	✓	✓	✓	✓	59.7	58.0	64.3	**62.4**	91.5	90.4	90.6	**89.1**	70.5	68.1	65.8	62.2	71.7

Speed Issue and Acceleration

- Need one inference for each condition (relationship) type
  - Inference becomes slow
- Approximation and acceleration
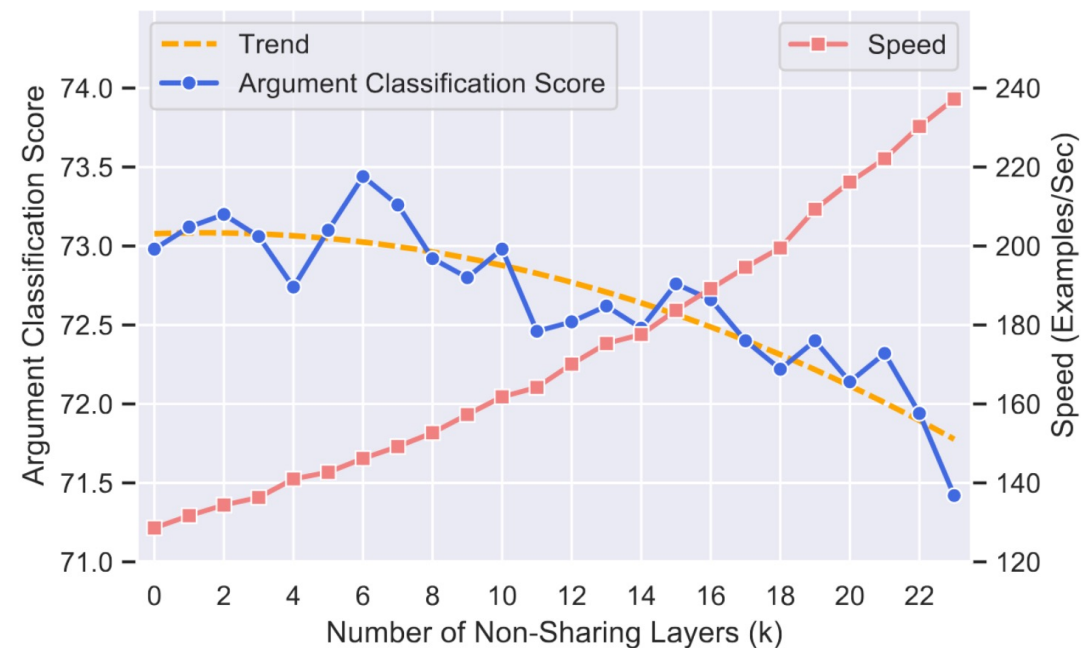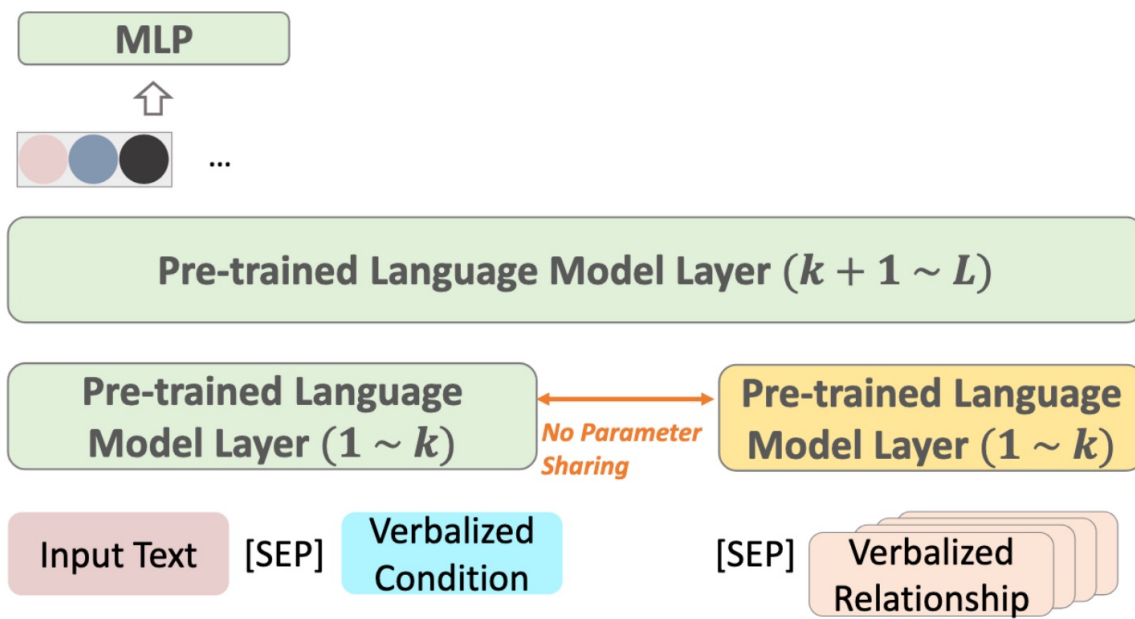
Conclusion

- We take a unified view of relational structure extraction tasks
- We propose TAGPRIME, a simple but effective model
  - Condition priming
  - Relationship priming
- TAGPRIME achieves promising performance

Code will be available at https://github.com/PlusLabNLP/TagPrime