

Multilingual Generative Language Models for Zero-Shot Cross-Lingual Event Argument Extraction

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Event Argument Extraction

- Goal: extract the participants for an event described in a sentence
- Input: sentence, event trigger
- Output: (role, argument) pairs
- Challenge:
 - Dependency
 - Event structure

Agent	coalition
Victim	civilians, woman
Instrument	missile
Place	houses

Five Iraqi civilians, including a woman, were killed Monday when their houses were hit by a missile fired by the US - led coalition warplanes, witnesses said.

Trigger for a Life:Die event

Zero-Shot Cross-Lingual Event Argument Extraction

- Training examples come from source languages
- Testing examples come from target languages
- Challenge:
 - Discrepancy between language properties
 - Different vocabularies, different word order and grammar, etc.

Agent	coalition
Victim	civilians, woman
Instrument	missile
Place	houses

Agent	以军
Victim	青年
Instrument	催泪弹, 子弹, 实弹
Place	None

Five Iraqi civilians, including a woman, were killed Monday when their houses were hit by a missile fired by the US - led coalition warplanes, witnesses said.

巴勒斯坦人持续以石块攻击以色列的部队，以军则是还以催泪弹、橡皮子弹甚至是实弹，结果又造成两名巴勒斯坦青年丧生，10多人受伤。

Previous Approaches

- Most previous approaches are classification-based models
 - GATE [Ahmad+ 2021] and CL-GCN [Subburathinam+ 2019]
- Recently, several works have shown that generation-based models perform better than classification-based models
 - DEGREE [Hsu+ 2022], BART-Gen [Li+ 2021], and TANL [Paolini+ 2021]
 - Strong performance, but specific to the monolingual setting

Agent	coalition
Victim	civilians, woman
Instrument	missile
Place	houses

Language-dependent!

Autoregressive generation considers dependency

The coalition led civilians and woman died by using missile in their houses.

Generative Language Model

Prompts provide event structure

Five Iraqi civilians, including a woman, were killed Monday when their houses were hit by a missile fired by the US - led coalition warplanes, witnesses said.

Trigger is killed. Somebody led some victim died by using some way in somewhere.

Our Goal

- We aim to explore the possibility of applying generation-based models for zero-shot cross-lingual event argument extraction
 - Output design
 - Prompt design

Proposed Method: X-Gear - Language-Agnostic Output Format

Agent	coalition
Victim	civilians, woman
Instrument	missile
Place	houses

Easy to decode the final predictions

They are special tokens and don't belong to any language

Language-agnostic format for language discrepancy

<Agent> coalition </Agent> <Victim> civilians [and] woman </Victim> <Instrument> missile </Instrument> <Place> houses </Place>

Multilingual Generative Model

Five Iraqi civilians, including a woman, were killed Monday when their houses were hit by a missile fired by the US - led coalition warplanes, witnesses said.

Prompt

Proposed Method: X-Gear - Prompt Design and Copy Mechanism

Agent	coalition
Victim	civilians, woman
Instrument	missile
Place	houses

<Agent> coalition </Agent> <Victim> civilians [and] woman </Victim> <Instrument> missile </Instrument> <Place> houses </Place>

Provide event structure and control signal

Multilingual Generative Model

Five Iraqi civilians, including a woman, were killed Monday when their houses were hit by a missile fired by the US - led coalition warplanes, witnesses said.

<Trigger> killed <Template> <Agent> [None] </Agent> <Victim> [None] </Victim> <Instrument> [None] </Instrument> <Place> [None] </Place>

Main Experiments

- Argument Classification F1 on ACE-2005

Model	# of parameters	en	en	en	ar	ar	ar	zh	zh	zh	avg
		↓	↓	↓	↓	↓	↓	↓	↓	↓	
		en	zh	ar	en	zh	en	zh	en	ar	
OneIE (XLM-R-large) (Lin et al., 2020)	~570M	63.6	42.5	37.5	57.8	27.5	31.2	69.6	51.5	31.1	45.8
CL-GCN (XLM-R-large) (Subburathinam et al., 2019)	~570M	59.8	29.4	25.0	47.5	25.4	19.4	62.2	40.8	23.3	37.0
GATE (XLM-R-large) (Ahmad et al., 2021)	~590M	67.0	49.2	44.5	59.6	27.6	26.3	70.6	46.7	37.3	47.6
GATE (mBART-50-large)	~630M	65.5	43.0	38.9	58.5	27.5	26.1	65.9	45.3	30.2	44.5
GATE (mT5-base)	~590M	59.8	47.7	32.6	45.4	20.7	21.0	64.0	35.3	22.8	38.8
TANL (mT5-base) (Paolini et al., 2021)	~580M	59.1	38.6	29.7	50.1	18.3	16.9	65.2	33.3	18.3	36.6
X-GEAR (mBART-50-large)	~610M	68.3	48.9	37.8	59.8	30.5	29.2	63.6	45.9	32.3	46.2
X-GEAR (mT5-base)	~580M	67.9	53.1	42.0	66.2	27.6	30.5	69.4	52.8	32.0	49.1
X-GEAR (mT5-large)	~1230M	71.2	54.0	44.8	68.9	32.1	33.3	68.9	55.8	33.1	51.3

- Ablation Study on Copy Mechanism

Model	en	ar	zh	xx	xx	xx	avg
	↓	↓	↓	↓	↓	↓	
	xx	xx	xx	en	ar	zh	
mBART-50-large - w/o copy	51.6	39.8	47.2	48.2	43.2	47.2	46.2
mT5-base - w/o copy	54.3	41.4	51.4	49.4	46.7	51.0	49.1
mT5-large - w/o copy	55.1	45.0	51.5	52.0	46.3	53.2	50.5

- Including event type in prompts

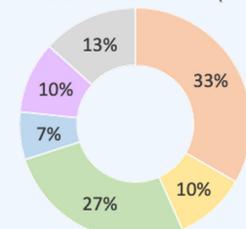
Five Iraqi civilians, including a woman, were killed Monday when their houses were hit by a missile fired by the US - led coalition warplanes, witnesses said.

<Type> Event-type <Trigger> killed <Template> <Agent> [None] </Agent> <Victim> [None] </Victim> <Instrument> [None] </Instrument>

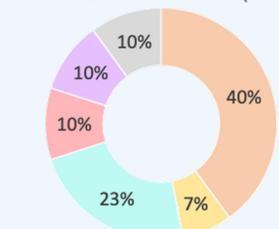
Model	en	ar	zh	xx	xx	xx	avg
	↓	↓	↓	↓	↓	↓	
	xx	xx	xx	en	ar	zh	
X-GEAR (mT5-base) w/ English Tokens	54.3	41.4	51.4	49.4	46.7	51.0	49.1
w/ Translated Tokens	51.7	40.4	52.2	49.8	45.6	48.8	48.1
w/ Special Tokens	52.3	39.7	51.8	49.0	45.4	49.3	47.9

Error Analysis

Error Distribution for X-GEAR (ar ⇒ en)



Error Distribution for X-GEAR (zh ⇒ en)



Conclusion

- We propose X-Gear, a generation-based model for zero-shot cross-lingual event argument extraction
 - Inherit the benefits of generation-based models
 - Language-agnostic templates
 - Copy mechanism
- Significant improvements over previous baselines

Code is available at

<https://github.com/PlusLabNLP/X-Gear>
<https://github.com/PlusLabNLP/TextEE>

X-Gear



TextEE

