

EA²E: Improving Consistency with Event Awareness for Document-Level Argument Extraction

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INTRODUCTION

Events are inter-related in documents. Motivated by the one-sense-per-discourse theory, we hypothesize that **a participant tends to play consistent roles across multiple events in the same document.**

For example, the *Attacker* in the *DetonateExplode* event is likely to be:

- the *IdentifiedRole* in the *IdentifyCategorize* event,
- the *Detainee* in the *ArrestJailDetain* event,
- as well as the *Defendant* in the *ChargeIndict* event.

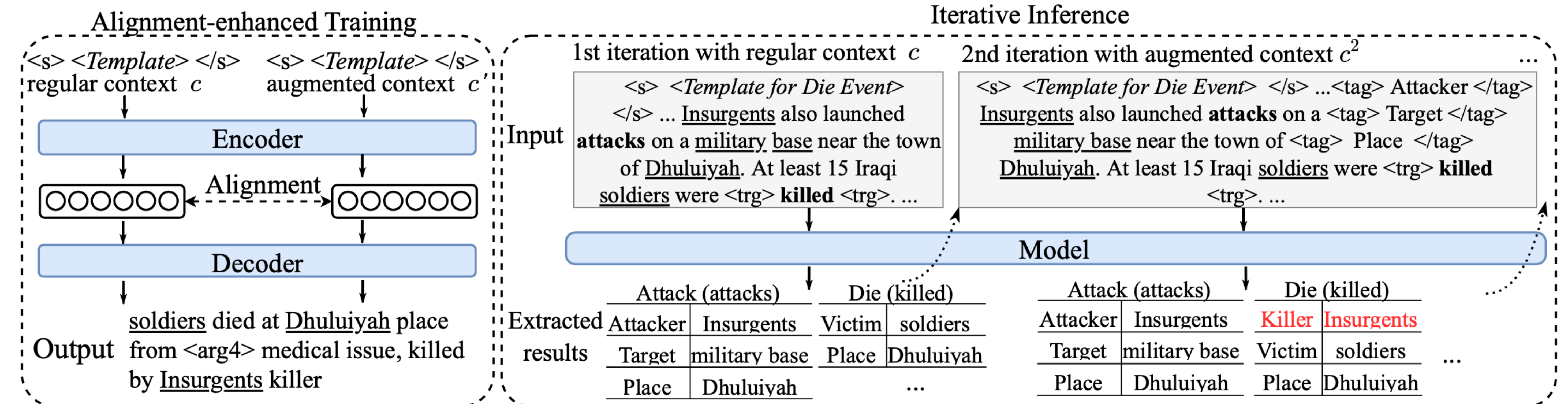
[S1]: The Saturday night's [bombing] in New York City wounded 29 people.	Event 1: DetonateExplode	
	Attacker	Ahmad Khan Rahami
[S2]: Prosecutors have [charged] 28-year-old Ahmad Khan Rahami with five counts of attempted murder stemming from the shootout that wounded two officers.	Place	New York City
	Event 2: IdentifyCategorize	
...	IdentifiedRole	Rahami
	IdentifiedObject	man
[S4]: Officers [recognized] the man as Rahami, who opened fire, wounding two policemen before he was injured.	Identifier	Officers
	Event 3: ArrestJailDetain	
...	Detainee	Ahmad Khan Rahami
	Jailer	officers
[S6] Police officers walk near the site where Ahmad Khan Rahami, sought in connection with a bombing in New York, was [taken into custody] in Linden, New Jersey, U.S., Sept. 19, 2016.	Place	Linden
	Event 4: ChargeIndict	
	Defendant	Ahmad Khan Rahami
	Prosecutor	Prosecutors

Recent work models each individual event in isolation and therefore causes inconsistency among extracted arguments across events.

To improve event argument consistency, we introduce the Event-Aware Argument Extraction (EA²E) model with augmented context for training and inference.

Experiment results on WIKIEVENTS and ACE2005 datasets demonstrate the effectiveness of EA²E compared to baseline methods.

METHOD



- Template: a pre-defined unfilled template for each type of event (eg. the template for Attack event is $\langle arg \rangle$ detonated or exploded $\langle arg \rangle$ explosive device using $\langle arg \rangle$ to attack $\langle arg \rangle$ target at $\langle arg \rangle$ place).
- Augmented context: tagging the argument labels of the other events

Alignment-enhanced Training

Pull close the argument representation distributions under regular context c and under augmented context c' .

Iterative Inference

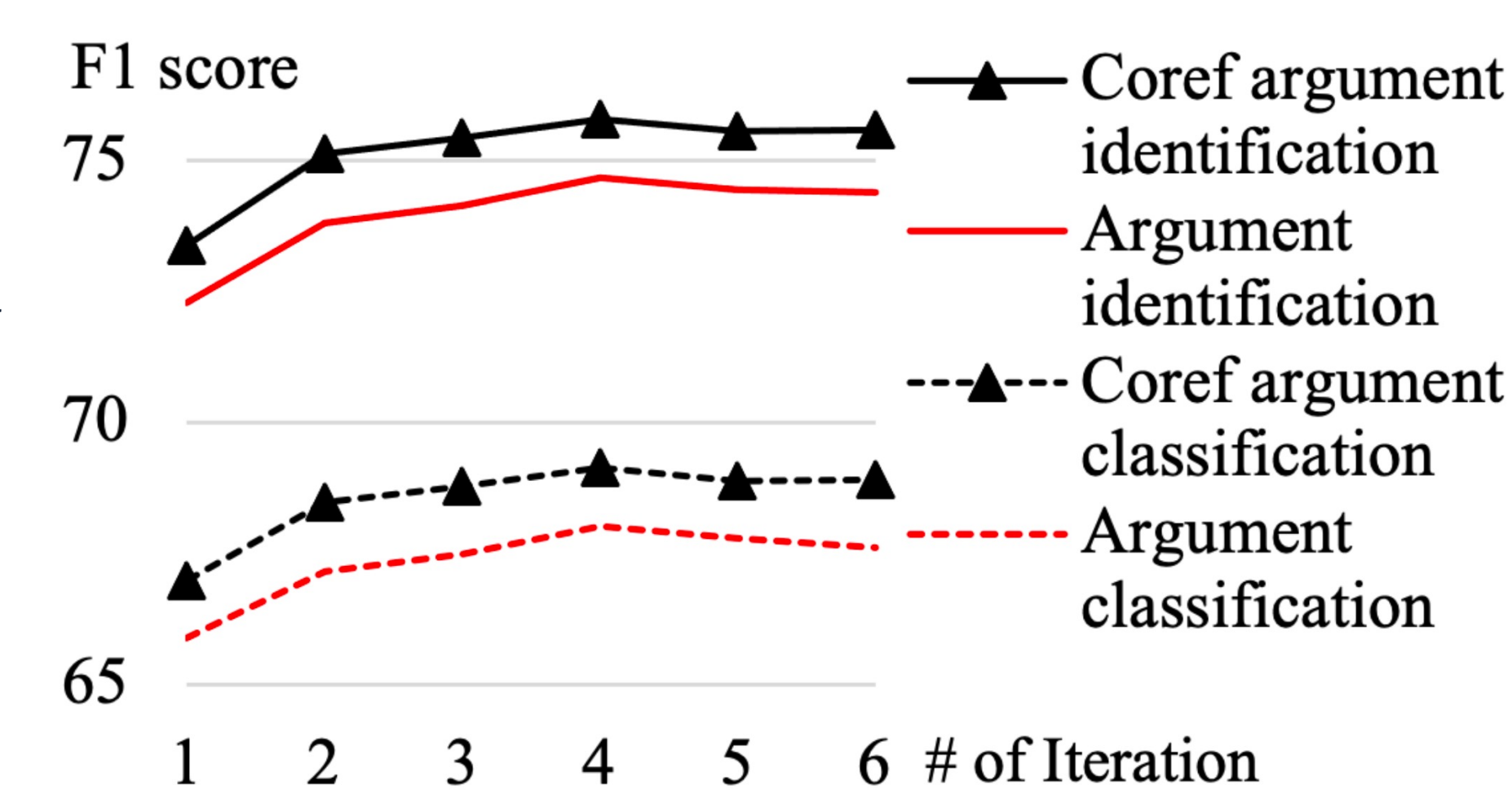
Explicitly introduces event awareness by utilizing extracted results in multiple inference iterations.

RESULTS & ANALYSIS

Model	Argument Identification						Argument Classification					
	Head Match			Coref Match			Head Match			Coref Match		
	P	R	F1	P	R	F1	P	R	F1	P	R	F1
BERT-CRF	72.66	53.82	61.84	74.58	55.24	63.47	61.87	45.83	52.65	63.79	47.25	54.29
ONEIE	68.16	56.66	61.88	70.09	58.26	63.63	63.46	52.75	57.61	65.17	54.17	59.17
BART-Gen	70.43	71.94	71.18	71.83	73.36	72.58	65.39	66.79	66.08	66.78	68.21	67.49
EA ² E	76.51	72.82	74.62	77.69	73.95	75.77	70.35	66.96	68.61	71.47	68.03	69.70
EA ² E w/o AT	77.26	71.23	74.12	78.61	72.47	75.42	71.10	65.54	68.21	72.25	66.61	69.32
EA ² E w/o II	75.96	72.29	74.07	77.13	73.42	75.22	69.61	66.25	67.89	70.72	67.32	68.97

The upper table shows that EA²E performs better than strong baseline methods.

- Alignment-enhanced training brings a significant improvement but comes with higher training costs.
- Iterative inference brings unstable improvement. The right figure shows that more iterations brings higher performance only to a certain range.



CONCLUSIONS

We introduce Event-Aware Argument Extraction (EA²E) model to improve self-contained consistency in document-level event argument extraction. We conclude that iterative inference brings higher performance only to a certain range of iterations and alignment-enhanced training brings significant improvement with costs.