EventPlus: A Temporal Event Understanding Pipeline

Mingyu Derek Ma*, Jiao Sun*, Mu Yang, Kung-Hsiang Huang, Nuan Wen, Shikhar Singh, Rujun Han, Nanyun Peng

Introduction

- Event understanding is a core problem for Natural Language Understanding
- Existing NLP analysis tools are mostly in token and sentence-level
- Semantic understanding of events and their temporal information is under-explored

Contributions:
- The first event pipeline system providing comprehensive event understanding capabilities
- Each component in EventPlus has comparable performance to the state-of-the-art

Example of event understanding result

Components and Pipeline Design

Component 1: Multi-task Learning of Event Trigger and Temporal Relation Extraction
- BERT embedding + BiLSTM layer (Han et al., 2019)
- SOTA on both tasks

Component 2: Event Trigger Extraction on ACE Ontology
- Raw text → semantic rich information of events
- Trained with ACE2005
- Multi-task learning with shared BERT encoder
- Inference constraints to keep valid predictions
  - Entity-Argument, Entity-Trigger, Valid Trigger-Argument constraints

Component 3: Event Duration Detection
- Model 1: Fine-tuned BERT
- Model 2: ELMo embeddings followed by attention layers (Vashishtha et al., 2019)
- Dataset 1: UDS-T (Vashishtha et al., 2019) over 11 duration categories (instant, ..., centuries)
- Dataset 2: Typical-Duration (Pan et al., 2006) over 7 duration categories (seconds, minutes, hours, days, weeks, months, years)
- Dataset 3: ACE-Duration (new) over 7 duration categories
- SOTA on event duration detection

Component 4: Negation and Speculation Cue Detection and Scope Resolution

- The United States is **not** considering sending troops to Mozambique
- The United States **might** send troops to Mozambique

- Identifies speculation and negation events and mark with special labels
- BERT-based models trained on SFU Review dataset (Khandelwal and Sawant, 2020)

- 0.92 F1 score for cue detection model
- 0.88 F1 score for token-level scope resolution

Extension to Biomedical Domain

- Two approaches to extend event extraction to biomedical domain
- Multi-domain training with GENIA
- Replace current component with an in-domain event extraction component: SciBERT-FT (Huang et al., 2020)

Experiments show multi-domain training improves the performance, though SciBERT-FT is still the best

Try live demo at:
kairos-event isi.edu

Code available at:
github.com/pluslabnlp/eventplus

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Example of event understanding result

- EventPlus
- George Pataki (Artifact) toured
- five counties that have been declared under a state of emergency.

Performance of event trigger extraction

- Raw text
- A powerful ice storm continues to maintain its grip. Yesterday New York governor George Pataki toured five counties that have been declared under a state of emergency.

Performance of temporal relation extraction

- Trigger Extraction
  - ice storm continues to maintain its grip ... toured five counties that have been ...

- Event Duration Detection
  - ice storm continues (Months) to maintain (Hours) ... toured (Days) five counties ...

- Temporal Relation Extraction
  - EventPlus Interface