Event Coreference Resolution using Convolutional Neural Networks

Nirbhay Modhe Parag Bansal

[1]Department of Computer Science
Indian Institute of Technology Kanpur

Outline

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What is Coreference Resolution?

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- Two or more expressions in a text are **coreferent** if they refer to the same entity.

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Parag broke his arm when he fell down the stairs. It was Nirbhay who pushed him.

- Two or more expressions in a text are **coreferent** if they refer to the same entity.
- The task of identifying coreferent expressions is called **Entity Coreference Resolution**

What is an Event?

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  In Baghdad, a cameraman <u>died</u> when an American tank <u>fired</u> on the Palestine Hotel.

- What does the event **Die** consist of?
  - Trigger Word(s) - "**died**"
  - Victim - "**cameraman**"
  - Instrument - "**American Tank**"
  - Place - "**Baghdad**"

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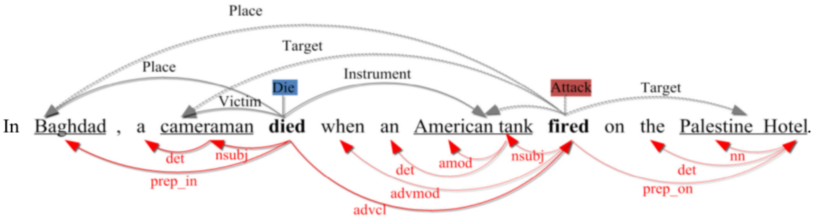
Identifying an Event



- Upper side: Event mentions **Die** and **Attack**
- Lower size: A subset of dependency parse tags

Source: Chen et. al. in "*Event Extraction via Dynamic Multi-Pooling Convolutional Neural Networks*"

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  E1: *Donald Trump beats Clinton.*
  E2: *Muhammad Ali beats his opponent.*

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  E1: *Donald Trump <u>beats</u> Clinton.*
  E2: *Muhammad Ali <u>beats</u> his opponent.*

- Trigger words are not discriminatory enough!

Event Extraction

A Machine Learning Approach

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  - Syntactic features such as POS, dependency tags.
  - Semantic information, estimated using word vectors.
- Learning features automatically using deep learning.

Related Work

Event Extraction using CNNs

- Recently Chen et. al. proposed a convolutional neural network approach for event extraction.
- Incorporated multiple event sentences by using a dynamic multi-pooling framework.

Chen's CNN Architecture

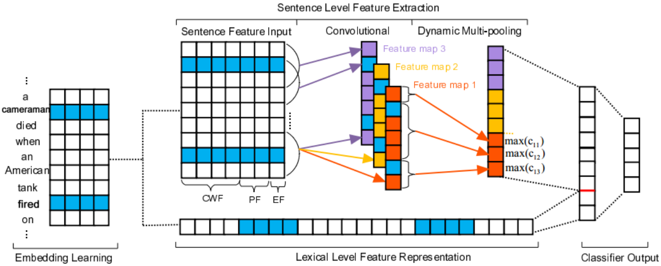

Figure 2: The architecture for the stage of argument classification in the event extraction. It illustrates the processing of one instance with the predict trigger *fired* and the candidate argument *cameraman*.

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- Classifying event pairs as coreferent or not - simple binary classification?
- Best performance (a coreference metric related to F-score) until 2015 was around 60 for the ACE 2005 dataset.
- We aim to empirically analyse the performance of a CNN approach for feature extraction.

Our CNN Architecture

- Features of the two events taken by the CNN are:
  - Word vectors of event trigger context window
  - Position feature embeddings of event triggers
- A single convolutional layer with multiple convolution filter sizes, followed by a dynamic max-pooling layer
- Three FC (fully connected) layers followed by softmax over the three predicted classes:
  - 1 - First event is true or false
  - 2 - Second event is true or false
  - 3 - The two events are coreferent or not

Conclusion

- Our joint CNN architecture is the first such approach for Coreference Resolution and Event Extraction
- We hope to test whether sequence learning methods (RNNs) can provide better features for coreference resolution.

Thank You