

New York University 2016 System for KBP Event Nugget: A Deep Learning Approach

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Event Nugget

- Three major subtasks:
 - ▶ Event Detection and Classification
 - ▶ Event Realis Classification
 - ▶ Event Coreference Resolution



Event Nugget: Input

Hundreds of people have been rescued after the eight-story building in Savar on the outskirts of the Bangladeshi capital Dhaka collapsed on Wednesday morning, leaving at least 83 people dead and over six hundred injured.

.....

Officials say nearly 700 people have been rushed to the hospitals. Doctors said the death toll could rise as some of those injured are in critical condition



Event Detection and Classification

Hundreds of people have been rescued after the eight-story building in Savar on the outskirts of the Bangladeshi capital Dhaka collapsed on Wednesday morning, leaving at least 83 people *dead* and over six hundred *injured*.

..... Life_Injure

Life_Die

Contact_Contact

Movement_Transport-Person

Officials *say* nearly 700 people have been *rushed* to the hospitals. Doctors said the death toll could rise as some of those *injured* are in critical condition

Life_Injure



Event Realis Classification (i.e, Actual, Generic or Other)

Hundreds of people have been rescued after the eight-story building in Savar on the outskirts of the Bangladeshi capital Dhaka collapsed on Wednesday morning, leaving at least 83 people dead and over six hundred injured.

.....

Life_Injure (Actual)

Life_Die (Actual)

Contact_Contact (Actual)

Movement_Transport-Person (Actual)

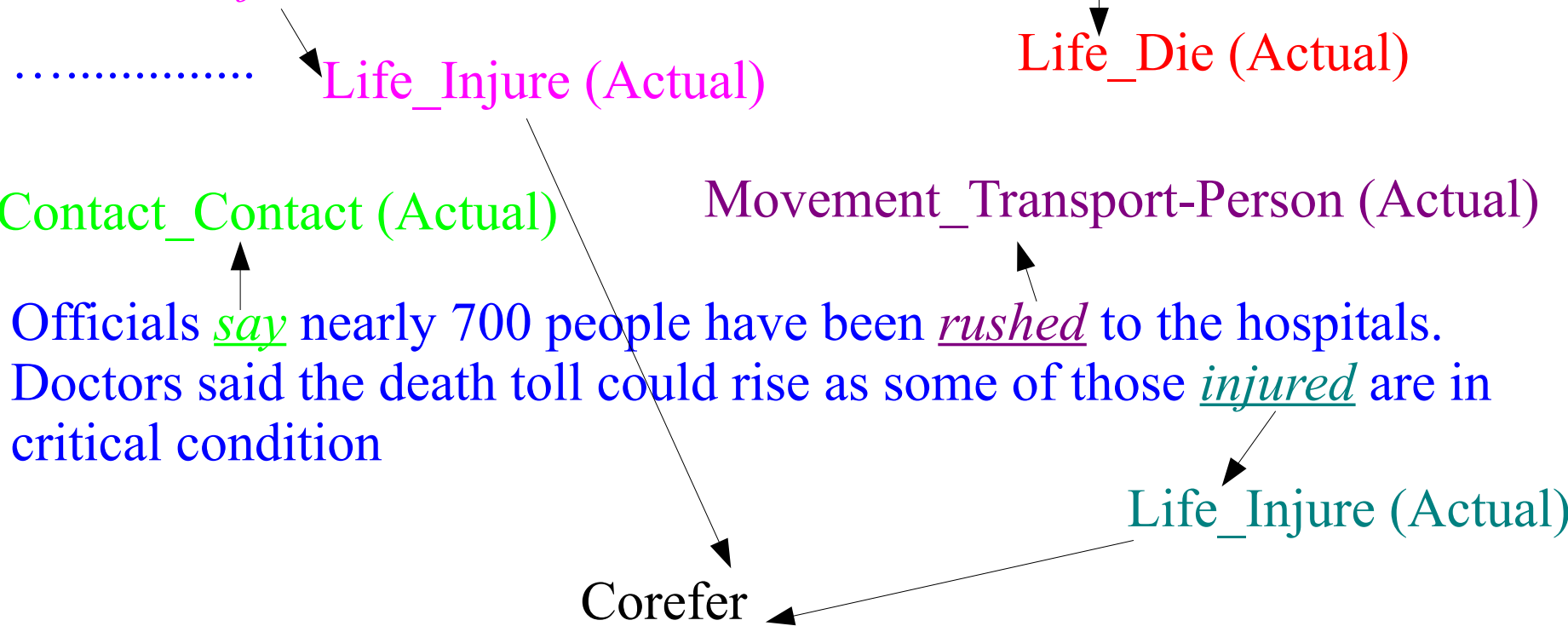
Officials say nearly 700 people have been rushed to the hospitals. Doctors said the death toll could rise as some of those injured are in critical condition

Life_Injure (Actual)

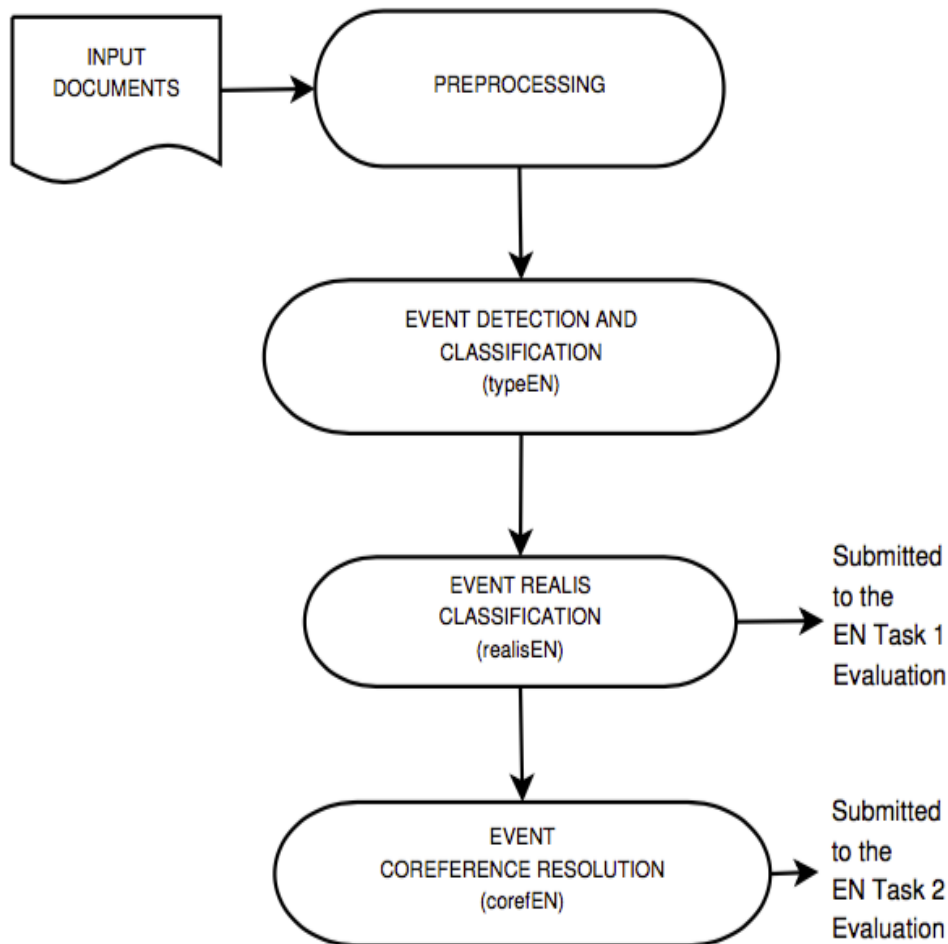


Event Coreference Resolution

Hundreds of people have been rescued after the eight-story building in Savar on the outskirts of the Bangladeshi capital Dhaka collapsed on Wednesday morning, leaving at least 83 people *dead* and over six hundred *injured*.



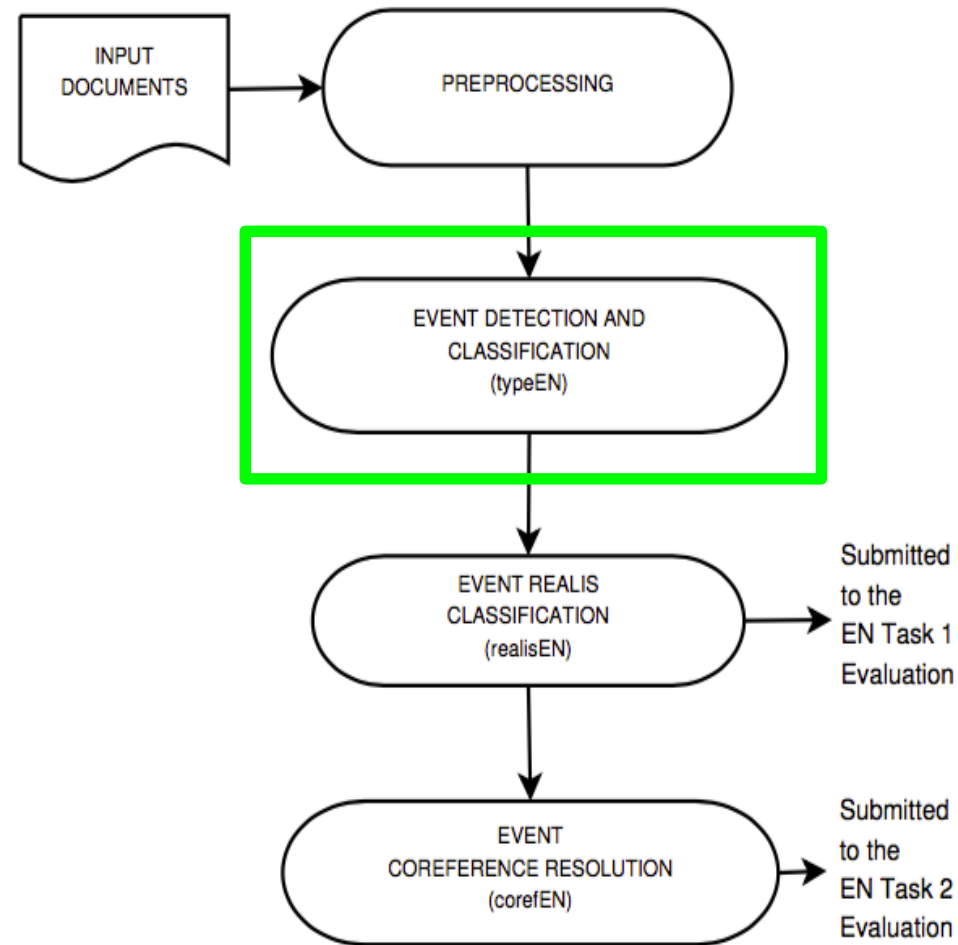
NYU 2016 Event Nugget System



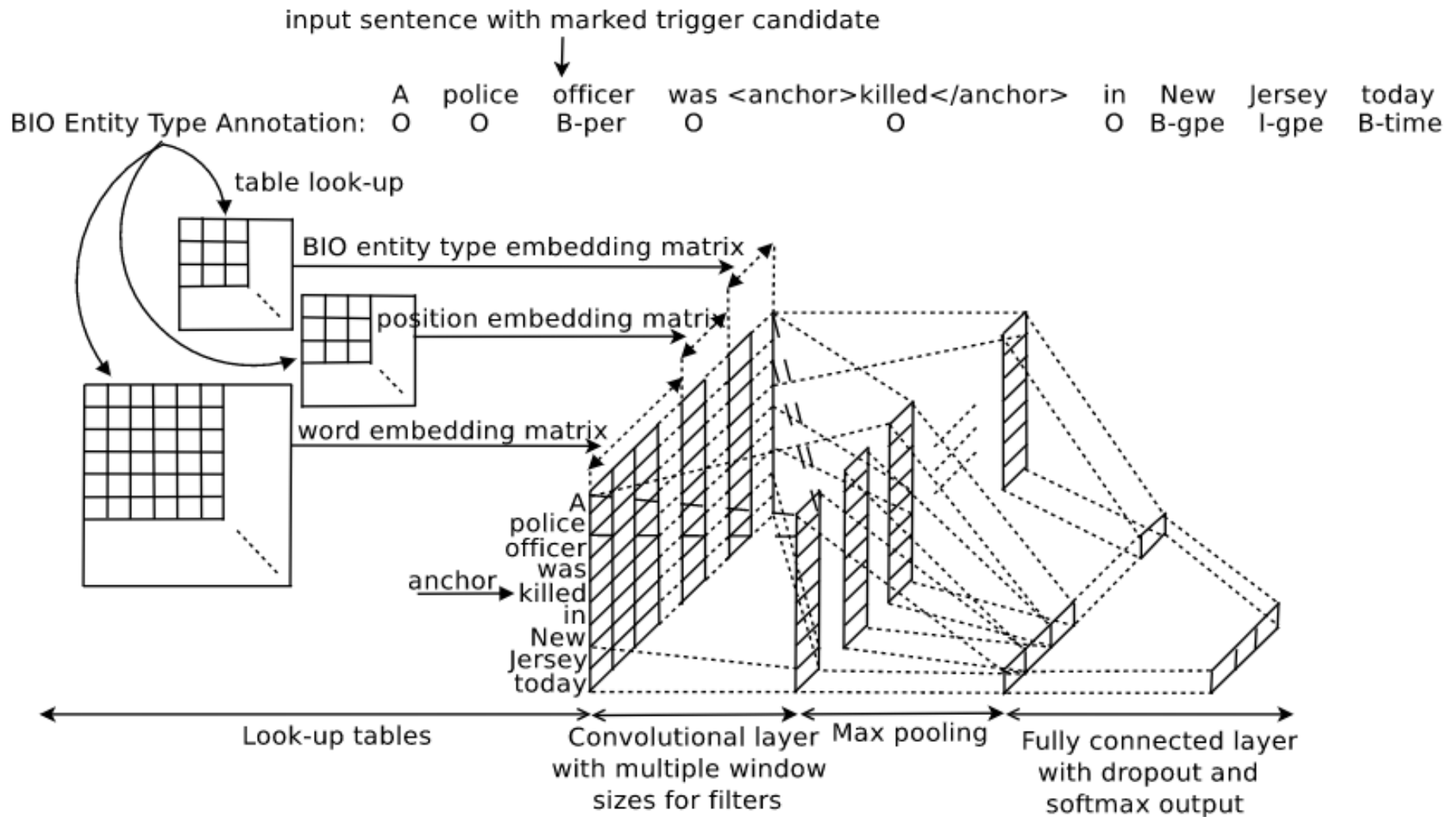
- Preprocessing includes: sentence detection, tokenization, dependency parsing
- All modules are based on neural network models



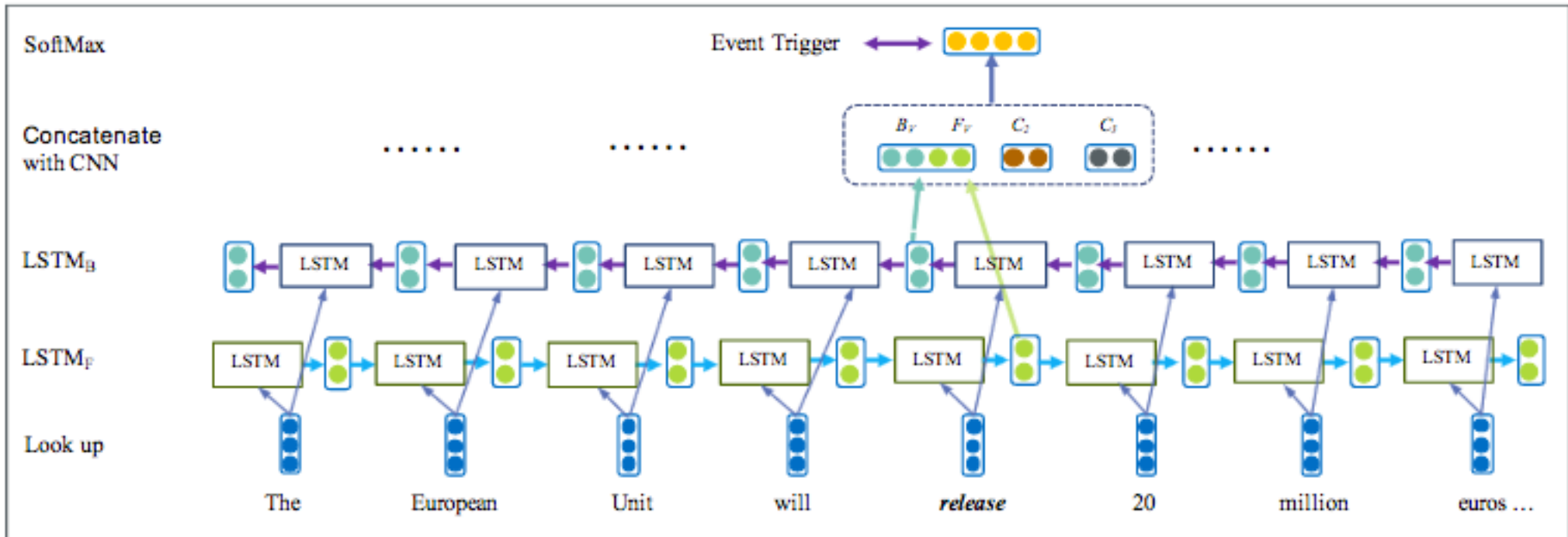
Event Detection with Neural Network



Previous Work on Event Detection with Neural Network



Previous Work on Event Detection with Neural Network



Combination of convolution neural networks and bidirectional recurrent neural networks (CNN+BRNN) (Feng et al., 2016)



Issue of the traditional CNN

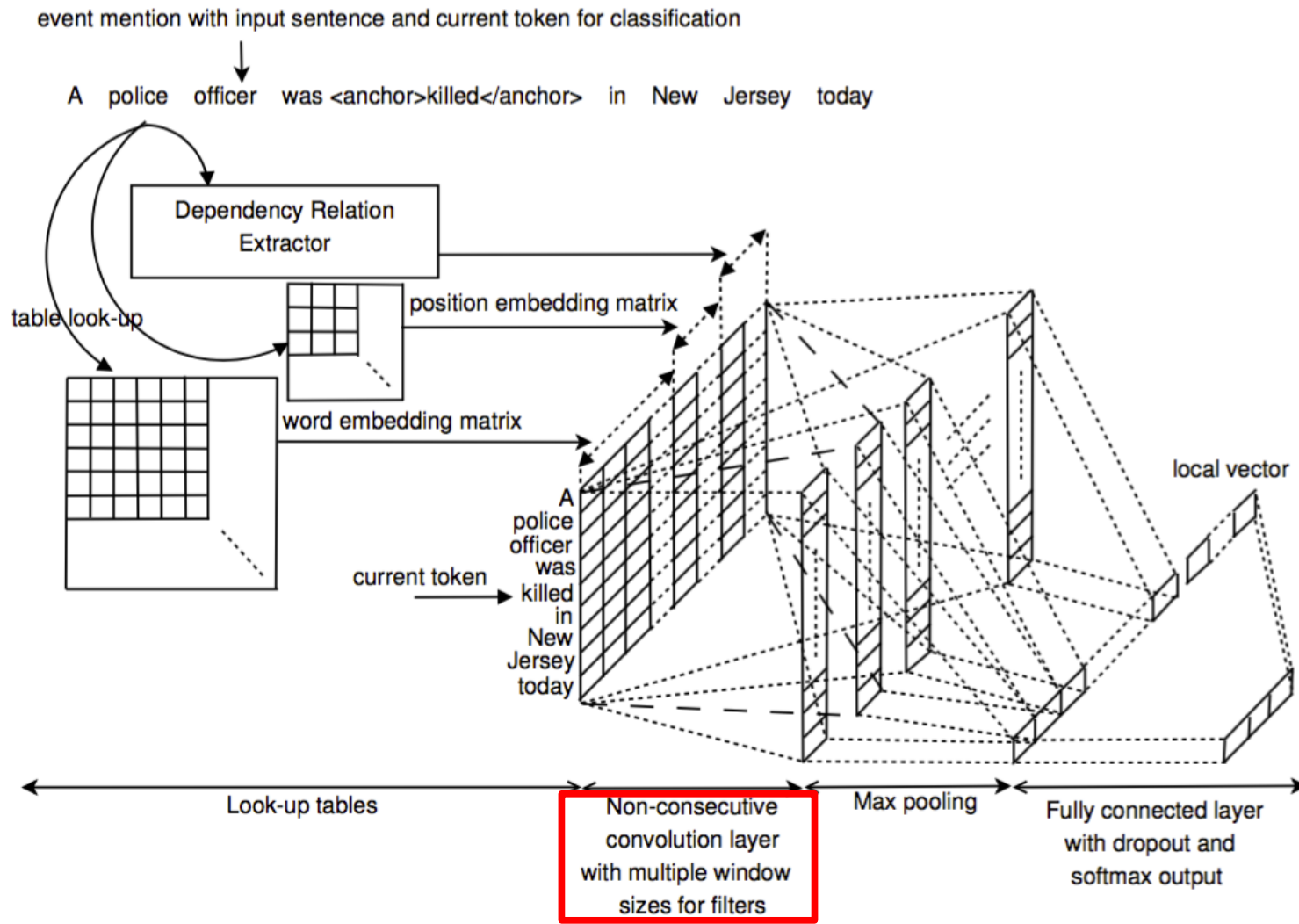
• Non-consecutive Patterns:

The mystery is that she took the job in the first place or didn't leave earlier.

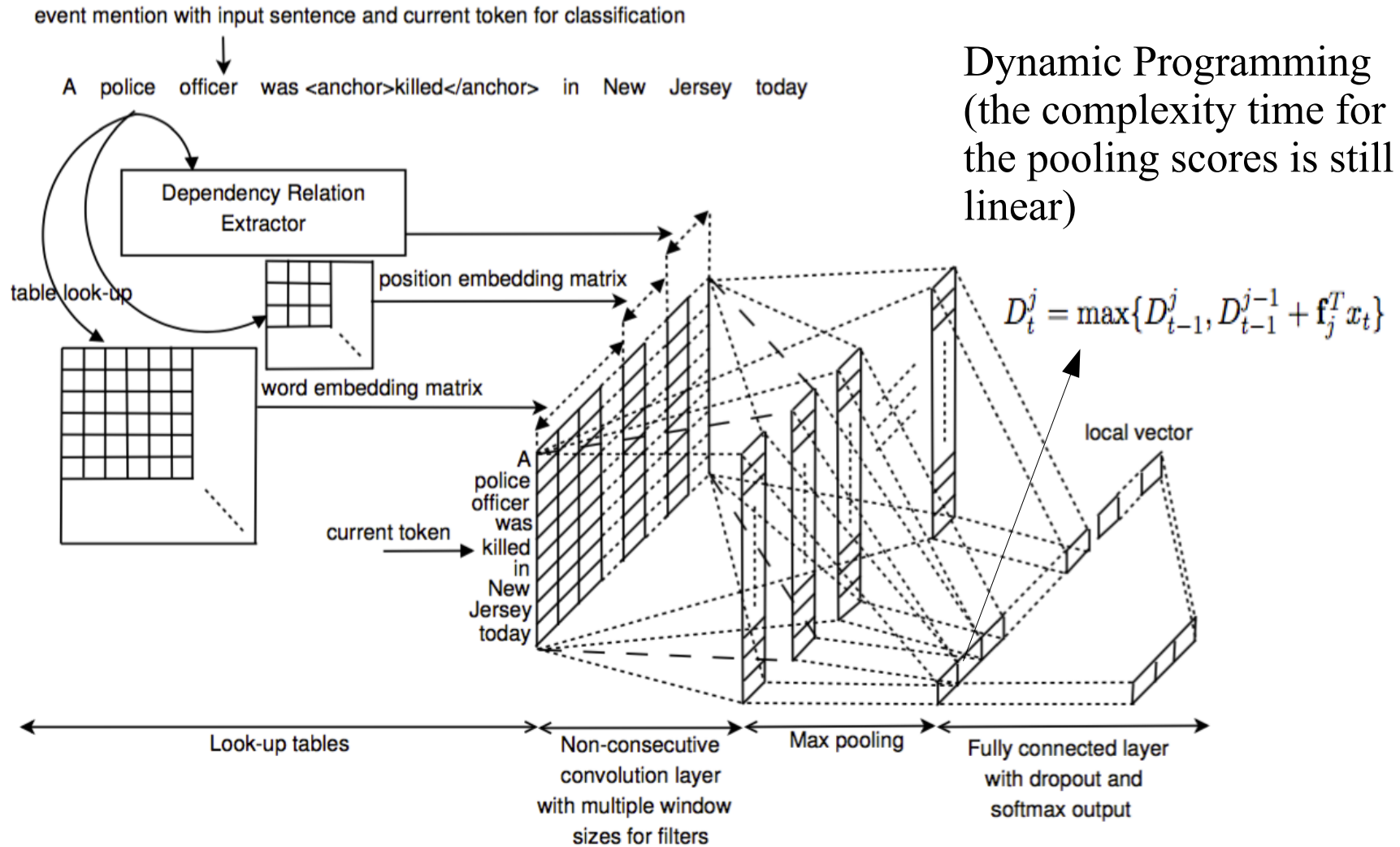
→ *non-consecutive convolutional neural networks (NCNN)*



Non-consecutive convolutional neural networks (NCNN)



Non-consecutive convolutional neural networks (NCNN)



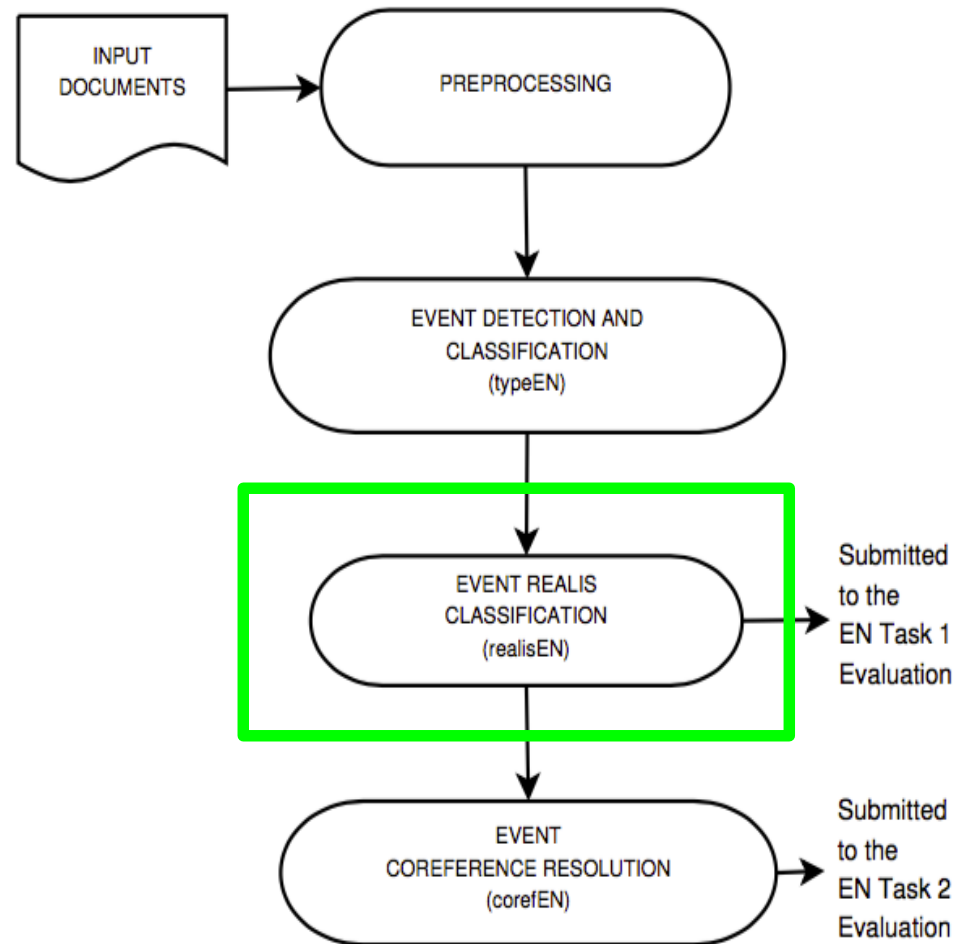
Non-consecutive convolutional neural networks (NCNN)

Methods	F
<i>Sentence-level</i> in Hong et al (2011)	59.7
<i>MaxEnt</i> (Li et al., 2013)	65.9
<i>Joint+Local</i> (Li et al., 2013)	65.7
<i>Joint+Local+Global</i> (Li et al., 2013)	67.5
<i>Cross-entity</i> in Hong et al. (2011) †	68.3
<i>Probabilistic soft logic</i> (Liu et al., 2016) †	69.4
<i>CNN</i> (Nguyen and Grishman, 2015b)	69.0
<i>DM-CNN</i> (Chen et al., 2015)	69.1
<i>B-RNN</i> (Nguyen et al., 2016a)	69.3
<i>NC-CNN</i>	71.3

Event Detection Performance on ACE



Event Realis Classification

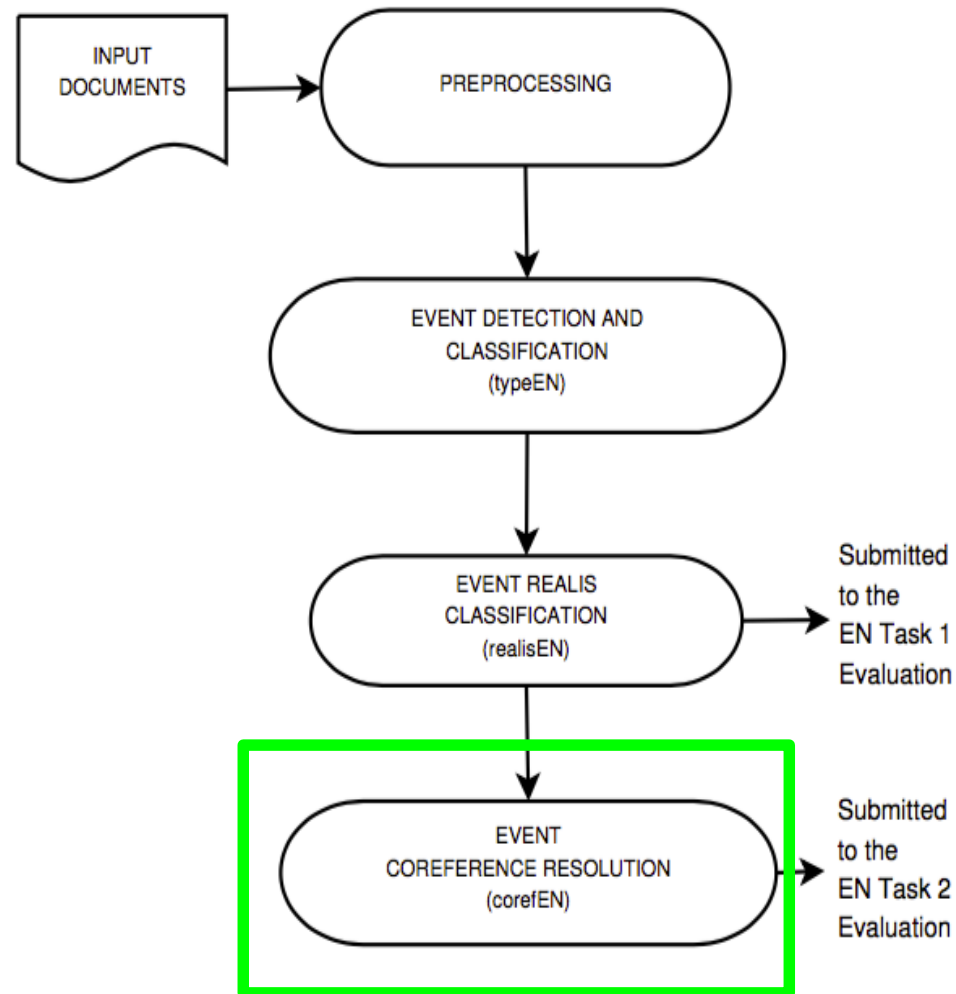


Event Realis Classification

- Training the same NCNN model to classify for 3 Realis types (i.e, GENERIC, ACTUAL and OTHER)
- Examining some in-house modality features for event realis extracted from the GLARF semantic parser, i.e:
 - ▶ Scope of operator words, including **quantifier** (i.e, *every*, *some* etc.), **verbs licensing belief contexts** (i.e, *believe*, *assume* etc.), **epistemic adverbs, adjectives** (i.e, *possibly*, *maybe* etc.), **negation words** (i.e, *not*, *no*, *deny*, *refuse* etc.) etc
 - ▶ Morphological features
 - ▶ Attribution
 - ▶ Manual rules (to predict a more fine-grained set of realis-like distinctions like ACE)



Event Realis Classification

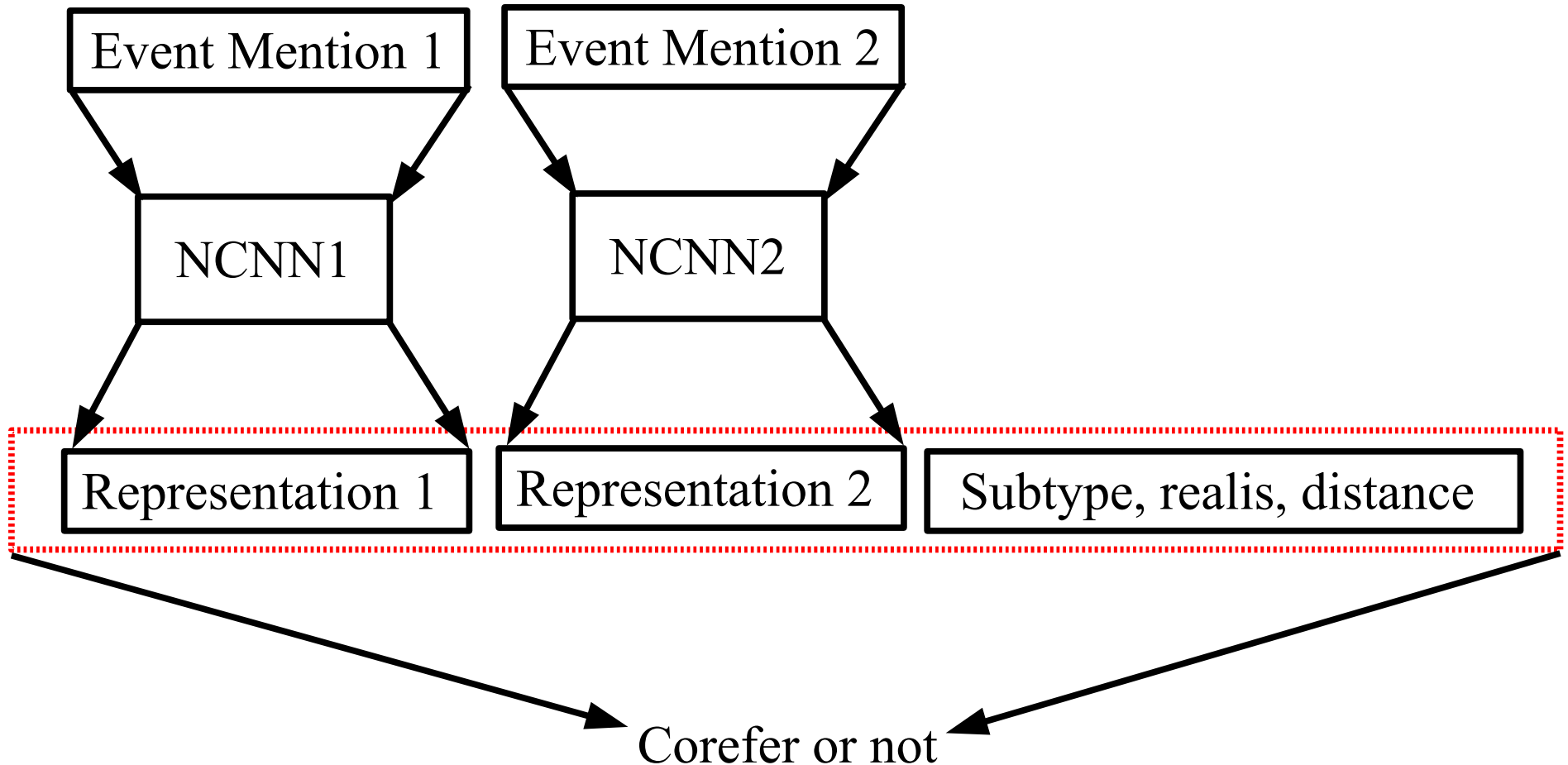


Event Coreference Resolution

- A binary classification task for every event mention pair in a document (i.e, whether two event mentions in a document corefer or not)
- Two event mentions corefer if their contexts are similar, and their subtypes and realis match



Event Coreference Resolution



NYU Event Nugget Submissions

Runs	Components		
	<i>typeEN</i>	<i>realisEN</i>	<i>corefEN</i>
NYU1	NCNN	NCNN	NCNN
NYU2	NCNN	NCNN + Modality Features	NCNN
NYU3	NCNN+BRNN	NCNN+BRNN	NCNN+BRNN

Table 1: Models and features for different runs of NYU.



Experiments

- Training data for official submissions
 - ▶ The training data for the Event Nugget 2015 evaluation
 - ▶ The DEFT Rich ERE English Training Annotation Dataset
 - ▶ Half of the evaluation data for the Event Nugget 2015 evaluation (102 documents)
- Development data:
 - ▶ The remaining documents in the 2015 evaluation data (100 documents)



Experiment Results

System	Plain	Type	Realis	Type & Realis	Coref score
NYU1	71.07	62.72	56.12	49.70	43.14
NYU2	71.16	62.65	57.41	50.43	43.40
NYU3	70.03	62.38	55.62	49.86	43.94

Table 2: Performance of NYU1, NYU2 and NYU3 on the development data.



Experiment Results

System	Plain	Type	Realis	Type & Realis	Coreference
NYU1	53.84	44.37	42.68	35.24	27.07
NYU2	52.39	44.12	41.73	35.22	26.28
NYU3	54.07	44.38	41.19	33.60	26.94
Top site	54.59	46.99	39.78	33.58	30.08

Performance of NYU1, NYU2 and NYU3 on the 2016 official evaluation data for English



Experiment Results

System	Plain	Type	Realis	Type & Realis	Coref score
NYU1	67.77	59.74	53.82	47.26	40.11
Top 1 in 2015	60.77	57.18	40.35	38.06	39.12
Top 2 in 2015	62.13	57.41	47.85	43.73	37.23
Top 3 in 2015	64.56	57.45	45.21	39.67	32.36

Table 4: Performance comparison of NYU1 and the best systems in the 2015 event nugget evaluation.



Conclusions

- Develop an Event Nugget system based on neural networks for the three subtasks: event detection and classification, event realis classification and event coreference resolution
- Automatically extracts features from inputs
- Although the system is pretty simple, it works pretty well



THANK YOU!



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