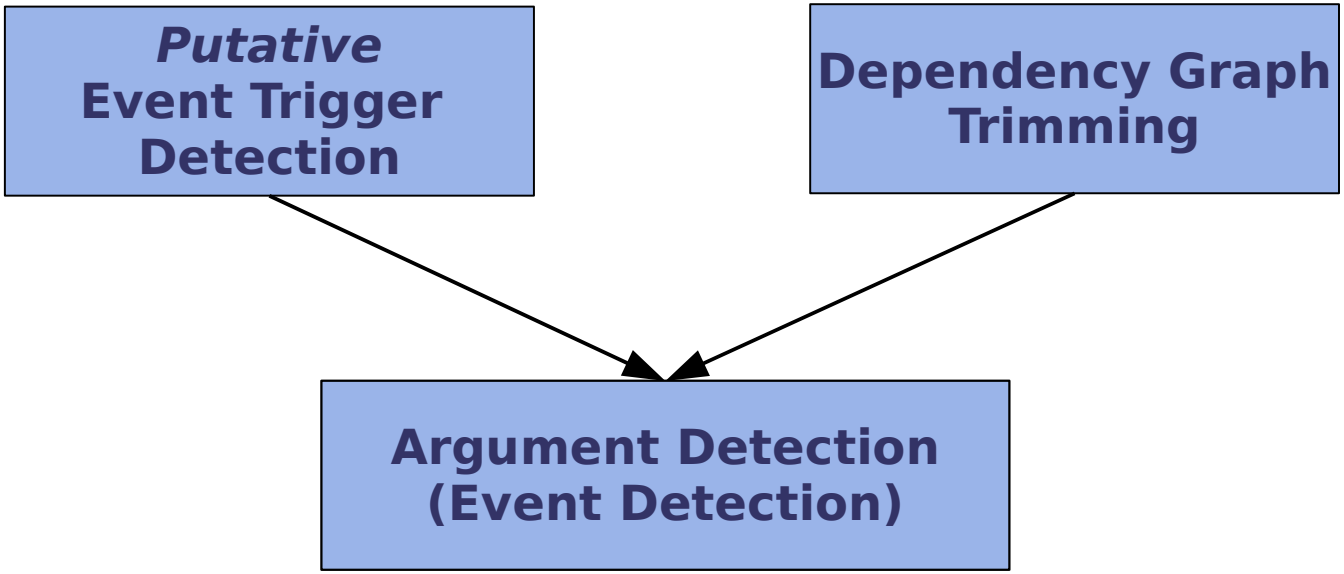
Event Extraction from Trimmed Dependency Graphs

Ekaterina Buyko, Erik Faessler,
Joachim Wermter and Udo Hahn

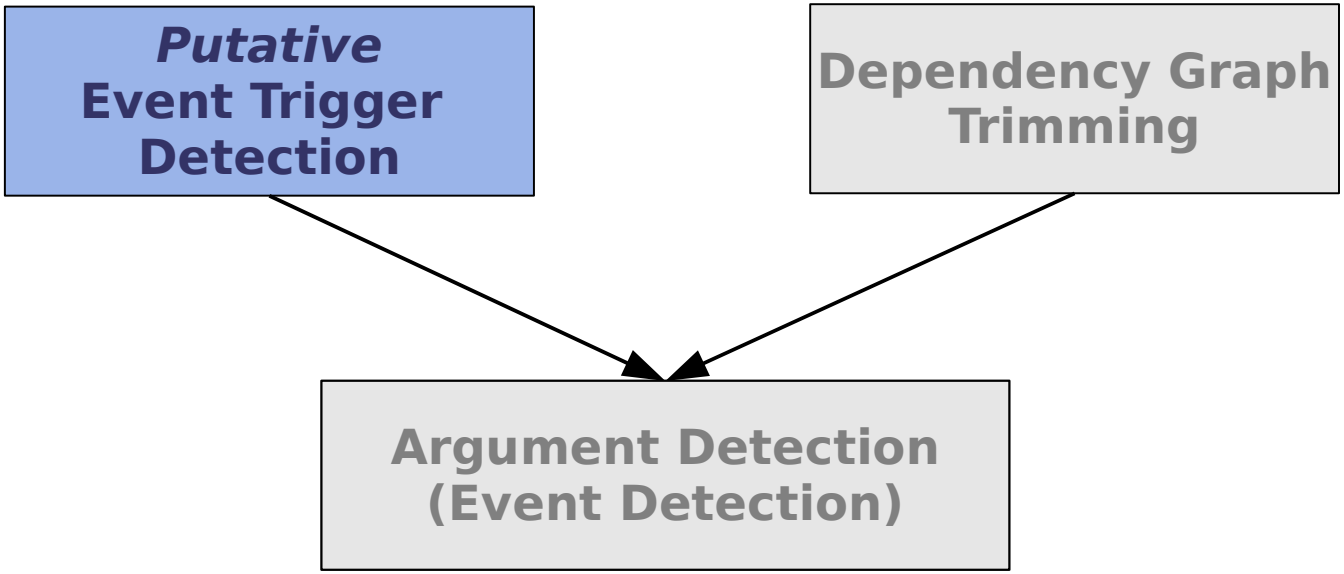
Jena University
Language and Information Engineering (JULIE) Lab
Germany

Jena University Language & Information Engineering Lab

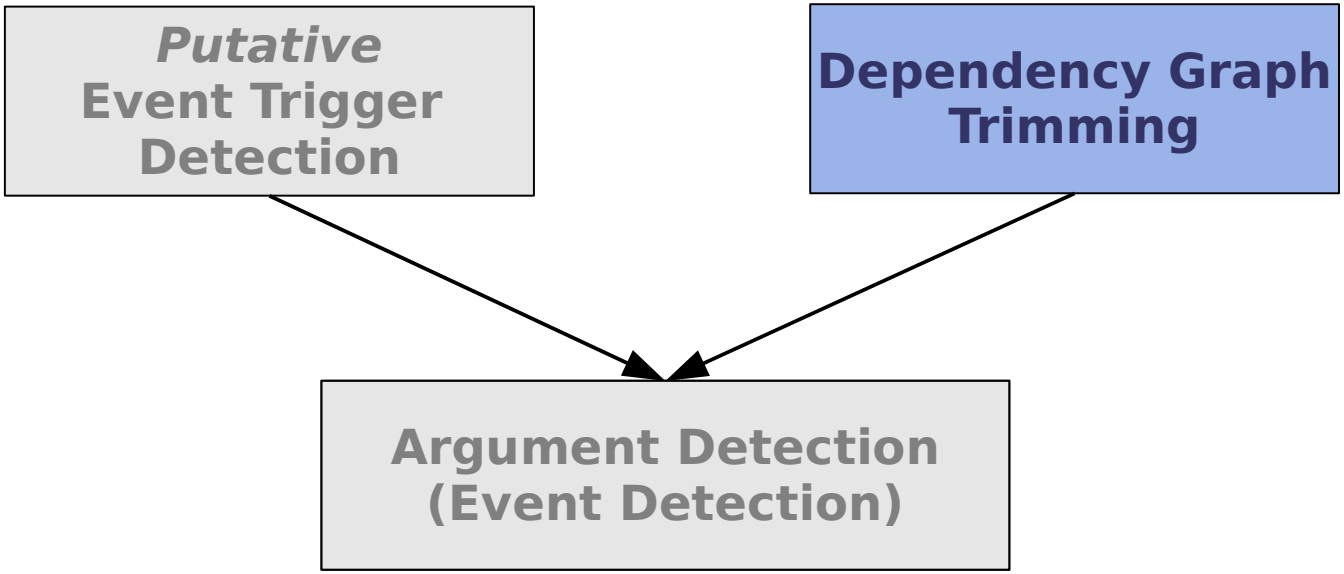
Event Extraction Solution



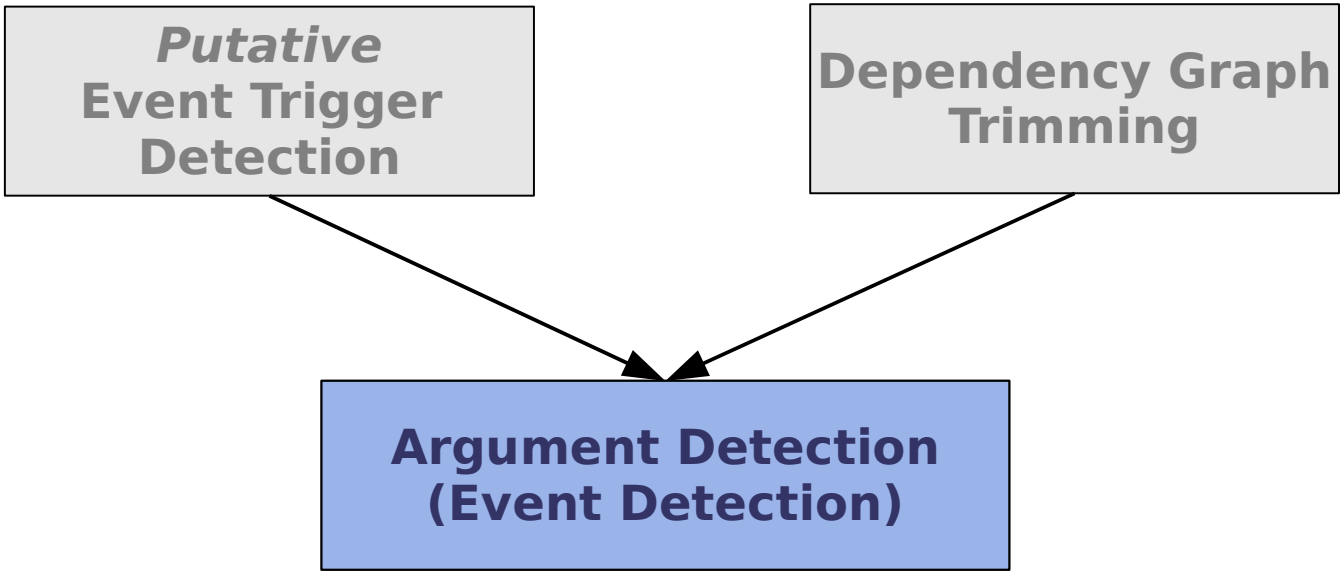
Event Extraction Solution



Event Extraction Solution



Event Extraction Solution



Jena University Language & Information Engineering Lab

Event Trigger Detection (1/3)

To be or not to be an Event Trigger

Event Trigger Detection (1/3)
To be or not to be an Event Trigger

- wide variety
  - 3,730 alternative morphological forms for `Positive regulation`

Jena University Language & Information Engineering Lab

Event Trigger Detection (1/3)
To be or not to be an Event Trigger

- wide variety
  - 3,730 alternative morphological forms for `Positive regulation`
- high ambiguity
  - 'induction' (`Positive regulation`, `Transcription`, `Gene expression`, not a trigger)

Jena University Language & Information Engineering Lab

Event Trigger Detection (2/3)

Curation of Dictionaries

Jena University Language & Information Engineering Lab

Event Trigger Detection (2/3)
Curation of Dictionaries

- important and discriminative

  'upregulate': `Positive regulation`

Event Trigger Detection (2/3)
Curation of Dictionaries

- important and discriminative

  'upregulate': `Positive regulation`

- important though not fully discriminative

  'cleavage': `Protein catabolism`

Jena University Language & Information Engineering Lab

Event Trigger Detection (2/3)
Curation of Dictionaries

- important and discriminative

  'upregulate': `Positive regulation`
- important though not fully discriminative

  'cleavage': `Protein catabolism`
- by and large non-discriminative

  'presence': `Localization, Gene expression`

Jena University Language & Information Engineering Lab

Event Trigger Detection (2/3)
Curation of Dictionaries

- important and discriminative

  'upregulate': `Positive regulation`
- important though not fully discriminative

  'cleavage': `Protein catabolism`
- by and large non-discriminative

  'presence': `Localization, Gene expression`
- absolutely non-discriminative

  'observe', 'demonstrate', 'function'

Jena University Language & Information Engineering Lab

Event Trigger Detection (2/3)
Curation of Dictionaries

- important and discriminative

  'upregulate': `Positive regulation`
- important though not fully discriminative

  'cleavage': `Protein catabolism`
- by and large non-discriminative

  'presence': `Localization, Gene expression`
- absolutely non-discriminative

  'observe', 'demonstrate', 'function'

Jena University Language & Information Engineering Lab

Event Trigger Detection (3/3)
Disambiguation of Event Triggers

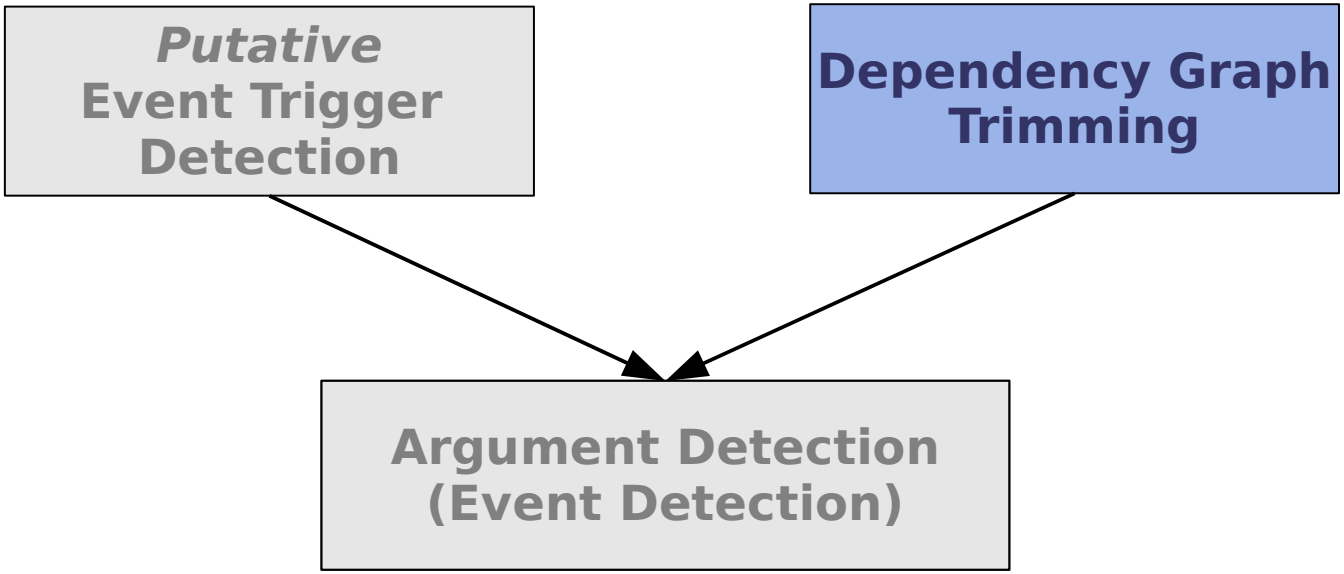
Importance of a trigger t_i for an event type e

$$Imp_e(t_i) := \frac{freq_e(t_i)}{\sum_j freq_e(t_j)}$$

$$type(t_i) = argmax(Imp_e(t_i))$$

Jena University Language & Information Engineering Lab

Event Extraction Solution



Dependency Graph Trimming (1/3)

Introduction

Dependency Graph Trimming (1/3)
Introduction

- syntactic pruning
  - elimination of irrelevant nodes and relations
  - propagation of relations

Dependency Graph Trimming (1/3)
Introduction

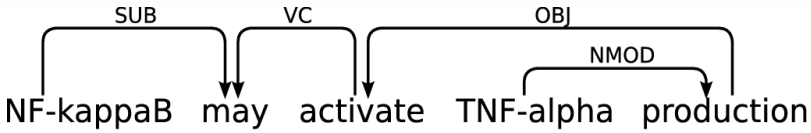
- syntactic pruning
  - elimination of irrelevant nodes and relations
  - propagation of relations

- conceptual overlaying
  - normalization of nodes
  - semantic decoration of nodes

Jena University Language & Information Engineering Lab

Dependency Graph Trimming (2/3)

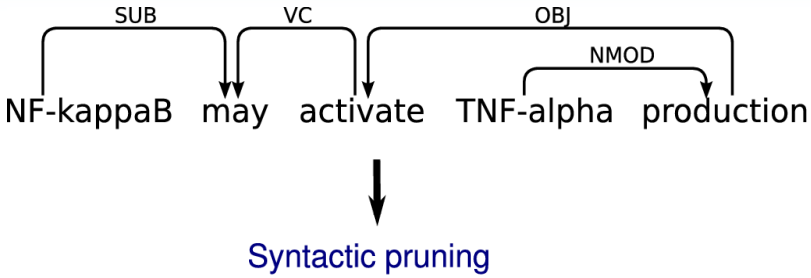
Example



Jena University Language & Information Engineering Lab

Dependency Graph Trimming (2/3)

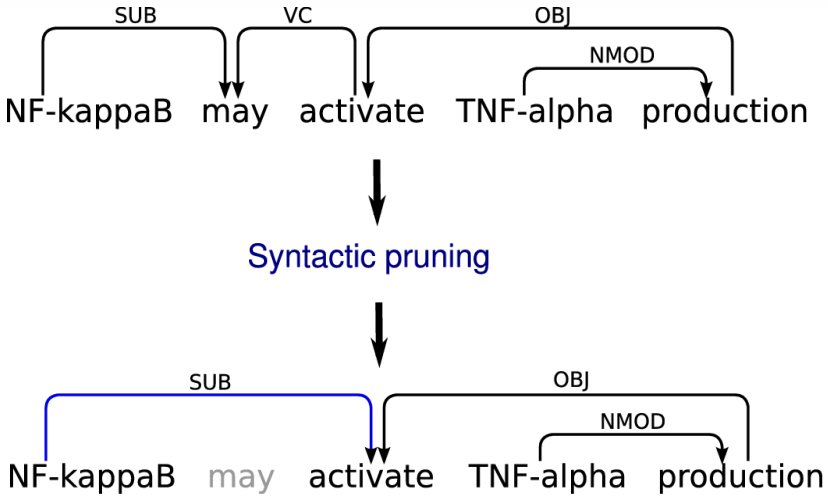
Example



Jena University Language & Information Engineering Lab

Dependency Graph Trimming (2/3)

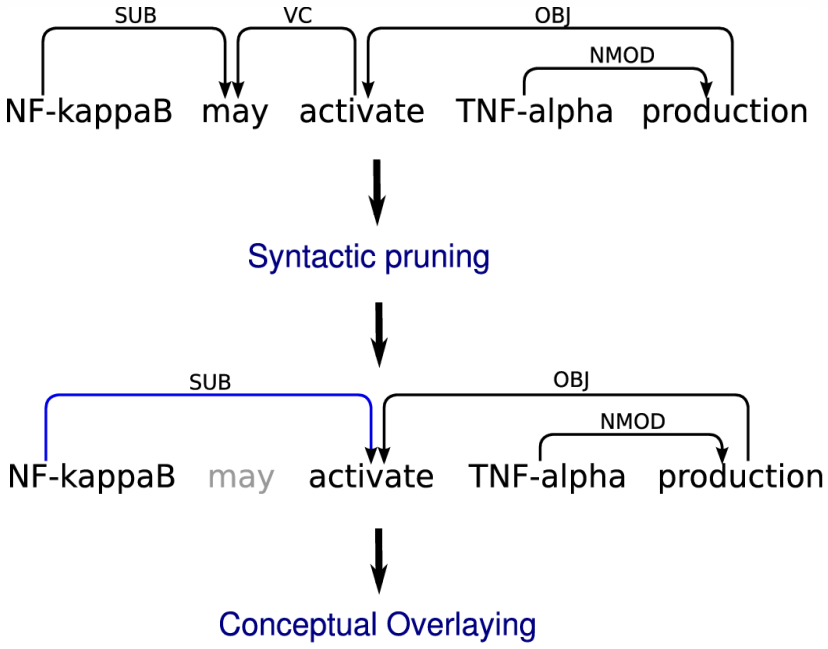
Example



Jena University Language & Information Engineering Lab

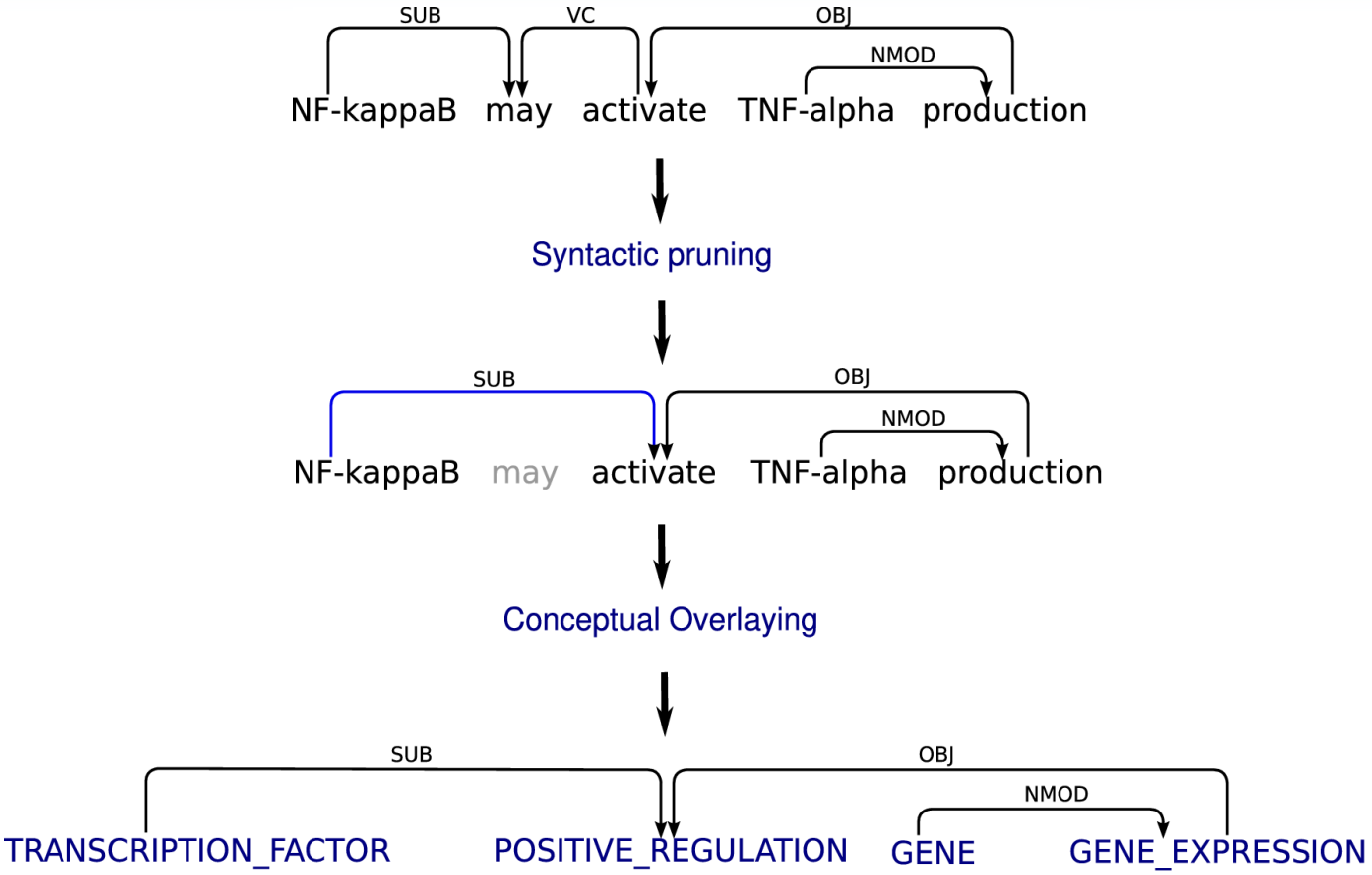
Dependency Graph Trimming (2/3)

Example



Dependency Graph Trimming (2/3)

Example

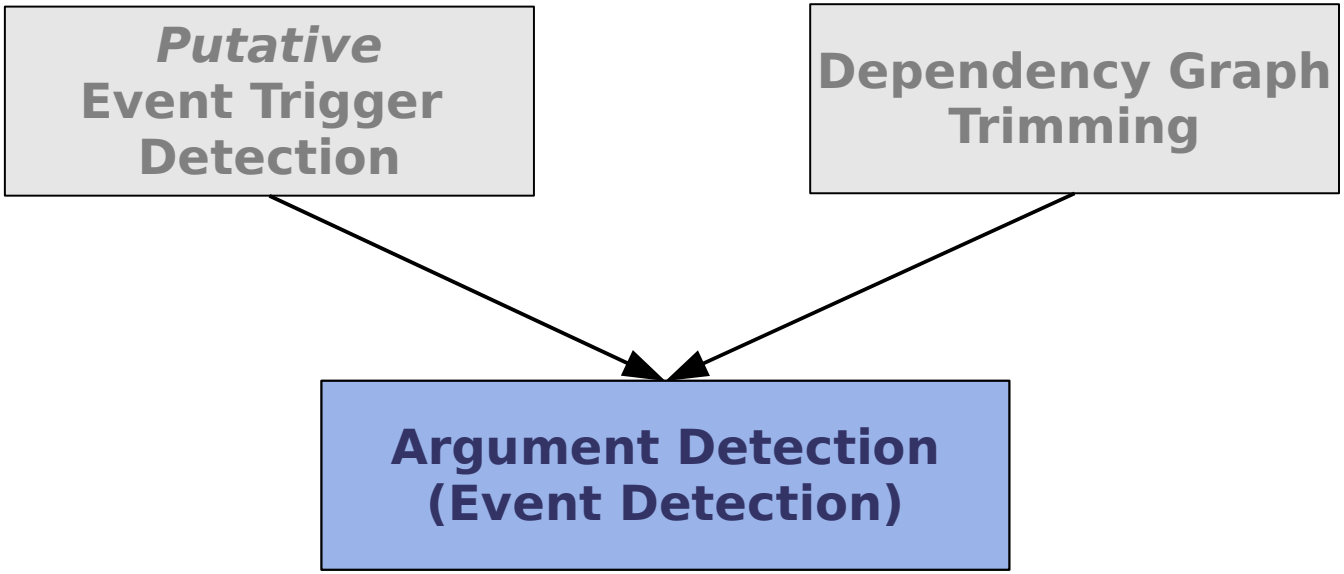


Jena University Language & Information Engineering Lab

Dependency Graph Trimming (3/3)
Conceptual Overlaying

- specific semantic hierarchy
  - transcription factor, binding site, promoter
  - MeSH terms (except chemical and drugs brunch)
  - gene/protein
- Gene Ontology annotations (GOA)
  - event-specific categories of GO terms
  - mapping of genes via UniProt to GOA
- experimental methods (taken from GENIA)

Event Extraction Solution



Jena University Language & Information Engineering Lab

Argument Identification (1/3)
Annotation of Shared Task Data

- addition of putative event triggers: training data (17,542 triggers (6,607 original triggers))

Argument Identification (1/3)
Annotation of Shared Task Data

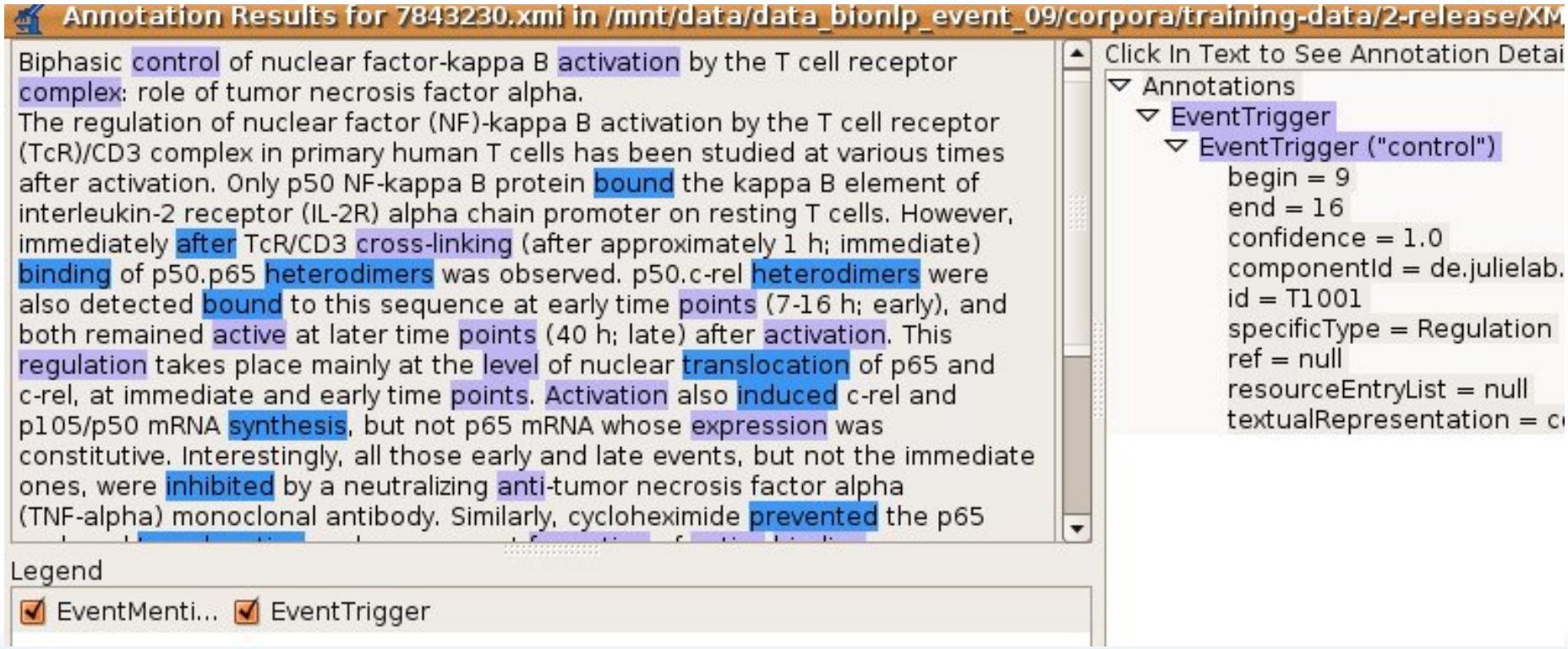
- addition of putative event triggers: training data (17,542 triggers (6,607 original triggers))

→ increase of negative event examples for learning

Argument Identification (1/3)
Annotation of Shared Task Data

- addition of putative event triggers: training data (17,542 triggers (6,607 original triggers))

→ increase of negative event examples for learning



Argument Identification (2/3)
Approaches

- feature-based
  - lexical features
  - shallow parsing features
  - dependency parsing features
- graph kernel-based (Airola et al., BioNLP 2008)
  - only shortest path information
  - modified representation of dependency relations

Argument Identification (3/3)
Event-specific classification

- graph kernel classifier
  - Phosphorylation
  - Localization
  - Protein catabolism
- feature based classifier
  - Regulation
  - Positive regulation, Negative regulation
- ensemble of feature and graph kernel classifiers
  - Binding
  - Gene expression & Transcription

Jena University Language & Information Engineering Lab

Evaluation (1/3)
Baseline

shortest dependency path (SP) between putative argument and trigger

If

- no directional change
- no intervening event triggers

then

- argument is assigned the `Theme` role

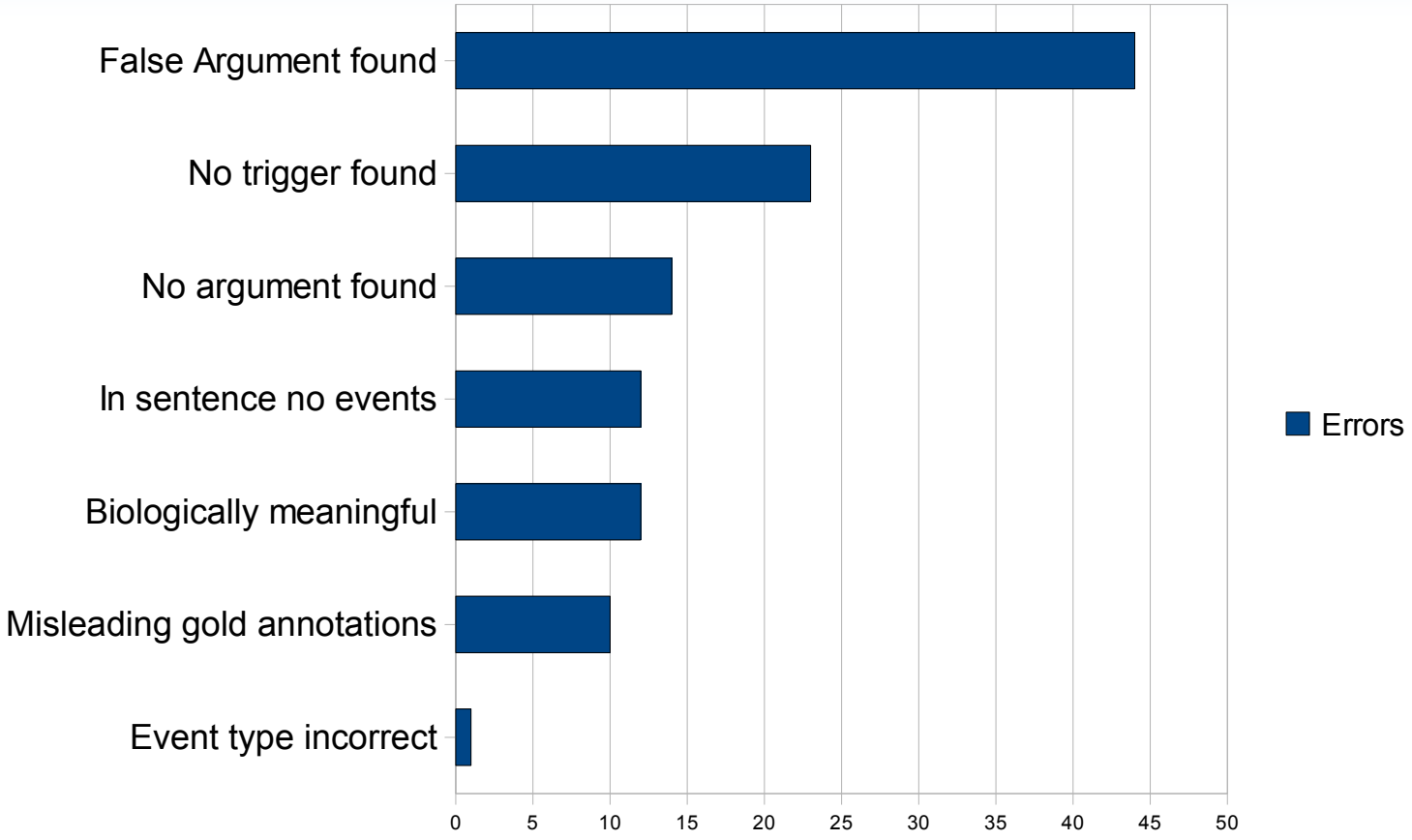
Jena University Language & Information Engineering Lab

Evaluation (2/3)
Results

		Baseline			Official run		
Event Class	**gold**	**recall**	**prec.**	**F-score**	**recall**	**prec.**	**F-score**
Localization	174	42.53	44.85	43.66	43.68	77.55	55.88
Binding	347	32.28	37.09	34.51	49.57	35.25	41.20
Gene expression	722	61.36	80.55	**69.65**	64.82	80.27	**71.72**
Transcription	137	39.42	35.06	37.11	35.77	62.03	45.37
Protein catabolism	14	71.43	66.67	68.97	78.57	84.62	81.48
Phosphorylation	135	65.93	90.82	**76.39**	76.30	91.15	**83.06**
EVT-TOTAL	1529	51.14	60.90	55.60	57.49	63.97	60.56
Regulation	291	9.62	11.72	10.57	31.27	30.13	30.69
Positive regulation	983	10.38	11.33	10.83	34.08	37.18	35.56
Negative regulation	379	14.25	19.22	16.36	40.37	31.16	35.17
REG-TOTAL	1653	11.13	12.96	11.98	35.03	34.18	34.60
ALL-TOTAL	3182	30.36	35.7	**32.82**	45.82	47.52	**46.66**

Table 1: Approximate Span Matching/Approximate Recursive Matching.

Evaluation (3/3)
Error Discussion



Jena University Language & Information Engineering Lab

Summary

- 2nd rank in Shared Task with an f-score of 46.7%
- manual curation of dictionaries
- disambiguation of triggers
- trimming of dependency graphs
- enrichment of training data with negative examples
- event-specific configurations

Jena University Language & Information Engineering Lab

Acknowledgements

SPONSORED BY THE