HeidelTime:
High Quality Rule-based Extraction and Normalization of Temporal Expressions

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Temporal Expressions (TEs)

Different types

- Date: On May 22, 1995, Farkas was ...
- Time: ... in Brownsville around 7:15 p.m.
- Duration: He spent six days abroad ...
- Set: ... for liver transplants each year ...

Different occurrences in documents

- explicit easy to normalize
- implicit knowledge is needed
- relative reference time is needed (& additional information)

Annotation scheme

- TimeML: ISO standard for temporal annotation (Timex3) [2]

Main Challenges

Disambiguation of:

- the reference time of relative TEs
- underspecified relative TEs
- relations between underspecified TEs and reference time (which Thursday?)

Document Creation Time: 1990-08-15
Also today, King Hussein of Jordan arrived in Washington ... he had rejected in peace talks following the August 1988 cease-fire ... which had condemned Iraq 's invasion of Kuwait on Aug. 2 ... The monarch will meet Bush on Thursday ... Independence Day 1989 ...

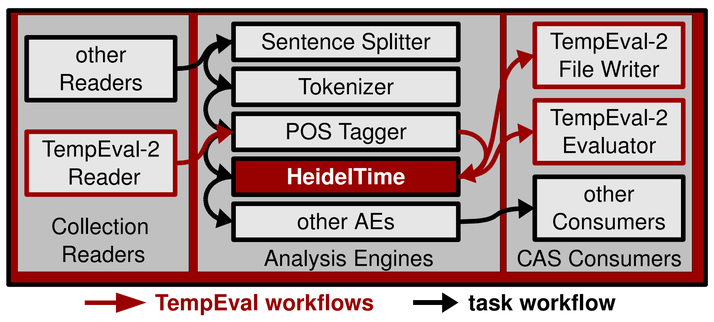
Task Description

- Identify extents of TEs
- Assign type information to TEs
- Normalize values according to Timex3

HeidelTime - Overview

- Rule-based system
- Realized as UIMA component [1]
- Methods for Extraction: regular expressions & NLP features
- Methods for Normalization: knowledge resources & linguistic clues
- Two rule sets: high precision (HeidelTime-1) and high recall (HeidelTime-2)

UIMA Text Mining Pipeline



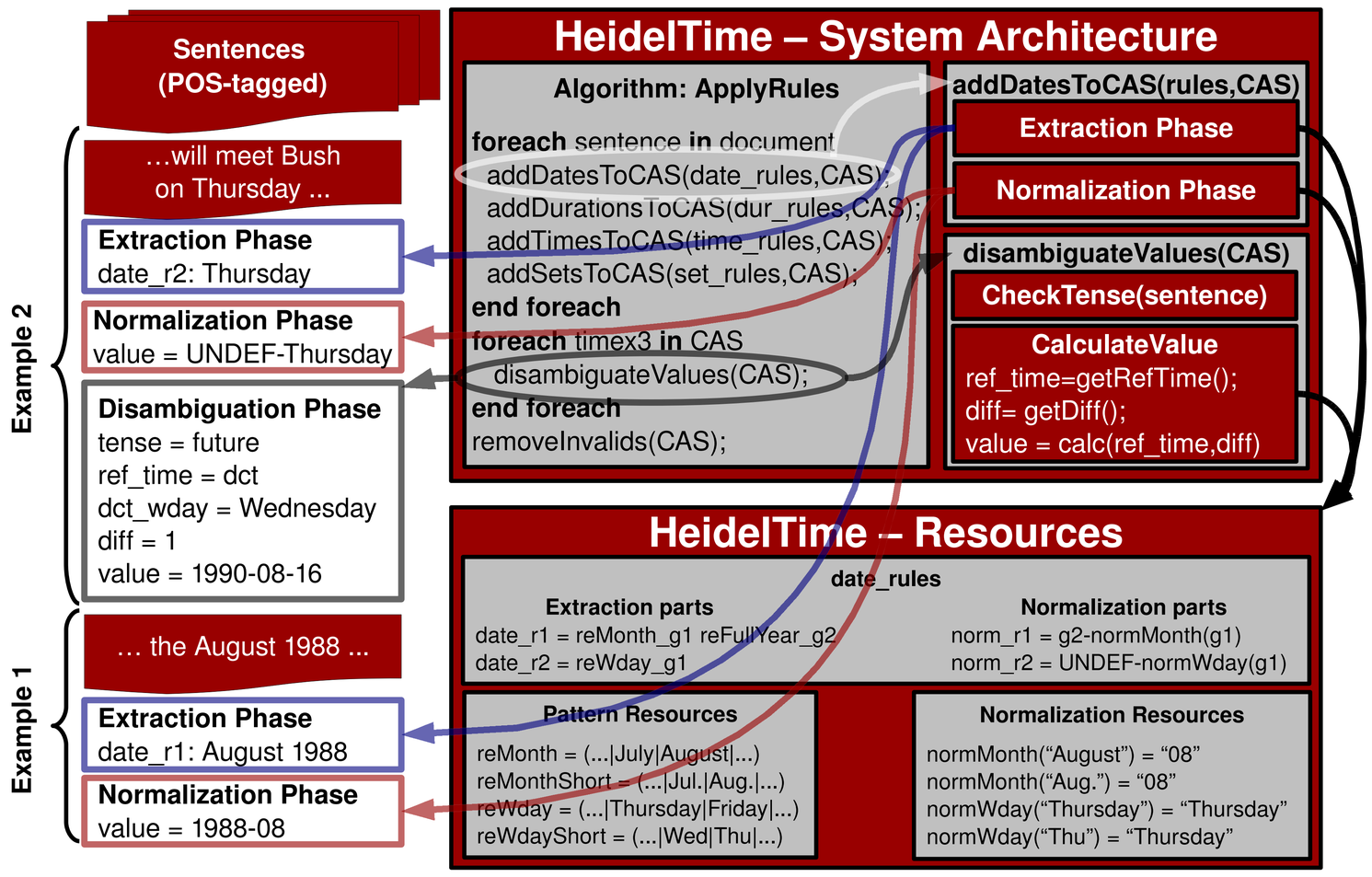
Iterative Rule Development Process

- Training data (sentence, token, Timex annotations → gold standard)
- Evaluator compares gold standard with HeidelTime Timex annotations
  Evaluator creates lists with FN, FP, TP
- These lists are used to improve rules

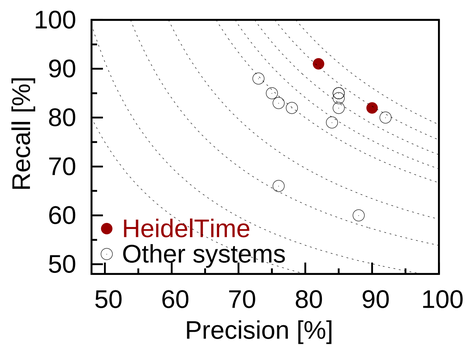
Evaluation Process

- Test data (sentence, token annotations)
- Files for evaluation are created

HeidelTime – System Architecture

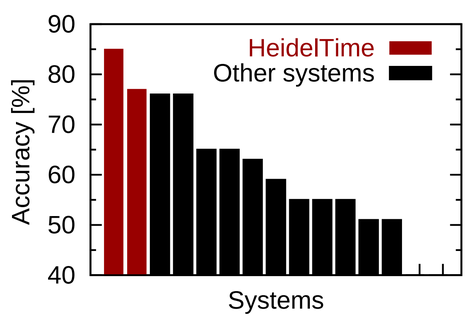


Extraction Results



	Precision	Recall	F-score
HeidelTime-1	90 %	82 %	86 %
HeidelTime-2	82 %	91 %	86 %

Normalization Results



	Value Acc.	Type Acc.
HeidelTime-1	85 %	96 %
HeidelTime-2	77 %	92 %

Ongoing Work

Other languages

- new pattern resources (e.g., names of months, weekdays, ...)
- new normalization resources
- new rules

Other types of corpora

- TempEval-2 corpus: news documents
- adaptations for and evaluation on other types of corpora

References

[1] UIMA, http://uima.apache.org/

[2] James Pustejovsky and Marc Verhagen: SemEval 2010 Task 13: Evaluating Events, Time Expressions, and Temporal Relations. In *SEW-2009*, pages 112-116, 2009.

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