LMU LUDWIG-MAXIMILIANS-UNIVERSITÄT MÜNCHEN

Developing a stemmer for German based on a comparative analysis of publicly available stemmers

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Outline

- Introduction to Stemming
- Overview of existing stemmers
- Objectives
- Gold standard development and evaluation methodology
- Evaluation results
- CISTEM development
- Final evaluation
- Conclusion

The Stemming Task

"In Information Retrieval, an important task is to not only return documents that contain the exact query string, but also ***documents containing semantically related words or different morphological forms*** *of the original query word"*

(Manning et al., 2008, p.57)

"A stemming algorithm is a computational procedure which ***reduces all words with the same root*** *(or, if prefixes are left untouched, the same stem)* ***to a common form****, usually by stripping each word of its derivational and inflectional suffixes"*

(Lovins, 1968)

Motivation

- Small choice of stemmers for German available
- Snowball is the most common in NLP toolkits
- No evaluation of different stemmer performances available

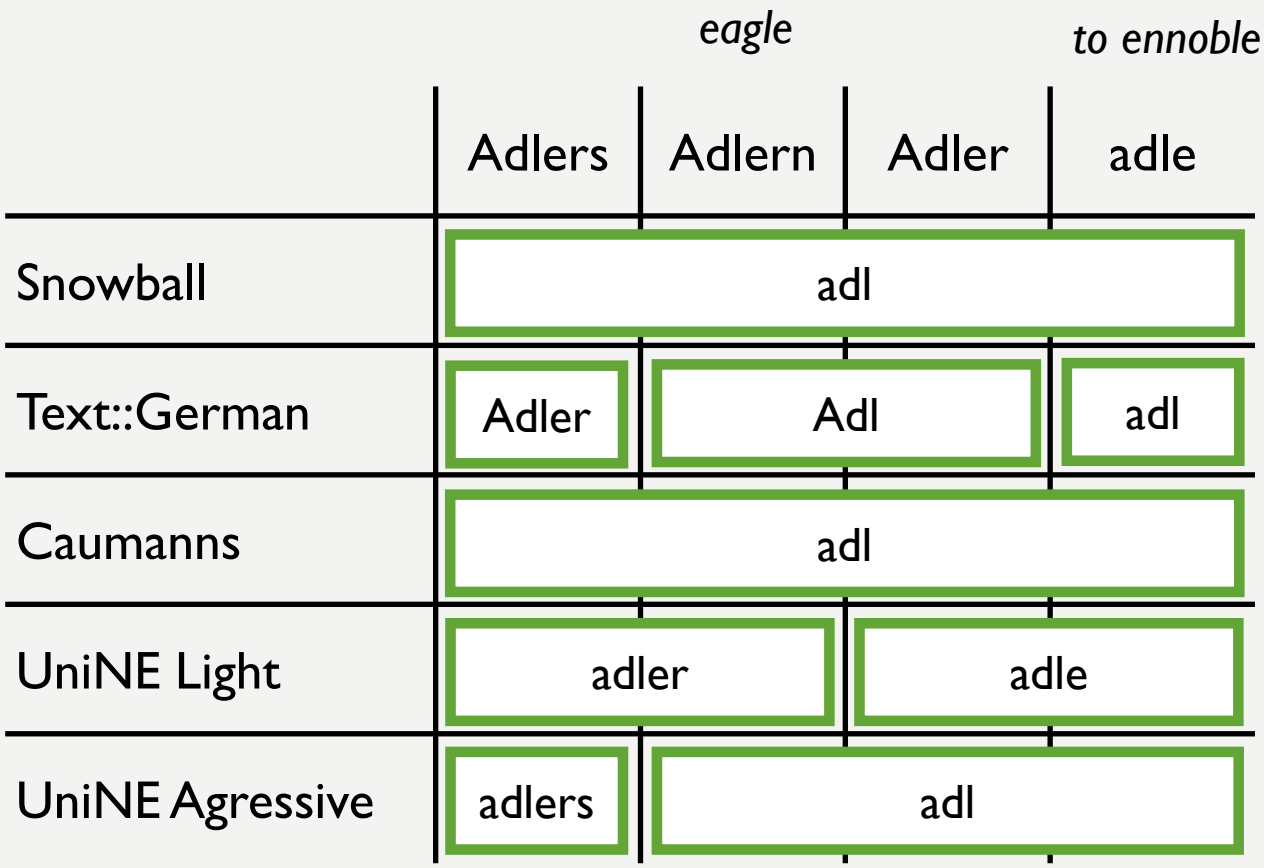
Existing Stemmers

- Snowball
- Text::German
- Caumanns
- UniNe (Light or Aggressive)

Objectives

- Present first comparative evaluation of existing stemmers for German
- Present new state-of-the-art stemmer based on evaluation results
- Make official implementations available in a range of programming languages

Comparison


eagle
to ennoble
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Snowball
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Text::German
Adler
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adl
Caumanns
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UniNE Light
adler
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UniNE Agressive
adlers
adl

Gold standard 1

Word	Belichtungsmesser					
Morphemes	be	licht	ung	s	mess	er
Shapes	x	A	x	x	V	x

light meter

Gold standard 1

Word	Belichtungsmesser					
Morphemes	be	licht	ung	s	mess	er
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light meter

Gold standard 1

Word	Belichtungsmesser
Stem	lichtmess

light meter

Gold standard 1

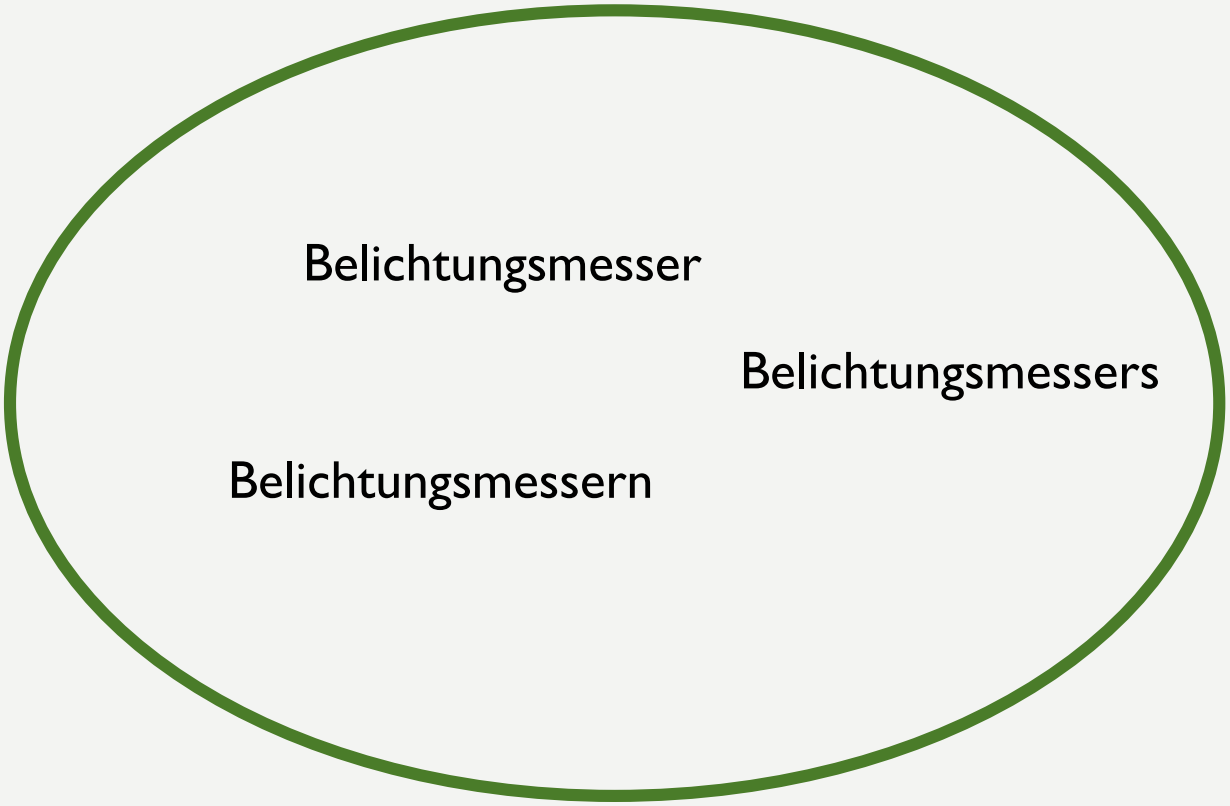
Word	Belichtungsmesser
Stem	lichtmess

Word	Belichtungsmessers
Stem	lichtmess

Word	Belichtungsmessern
Stem	lichtmess

light meter

Gold standard I

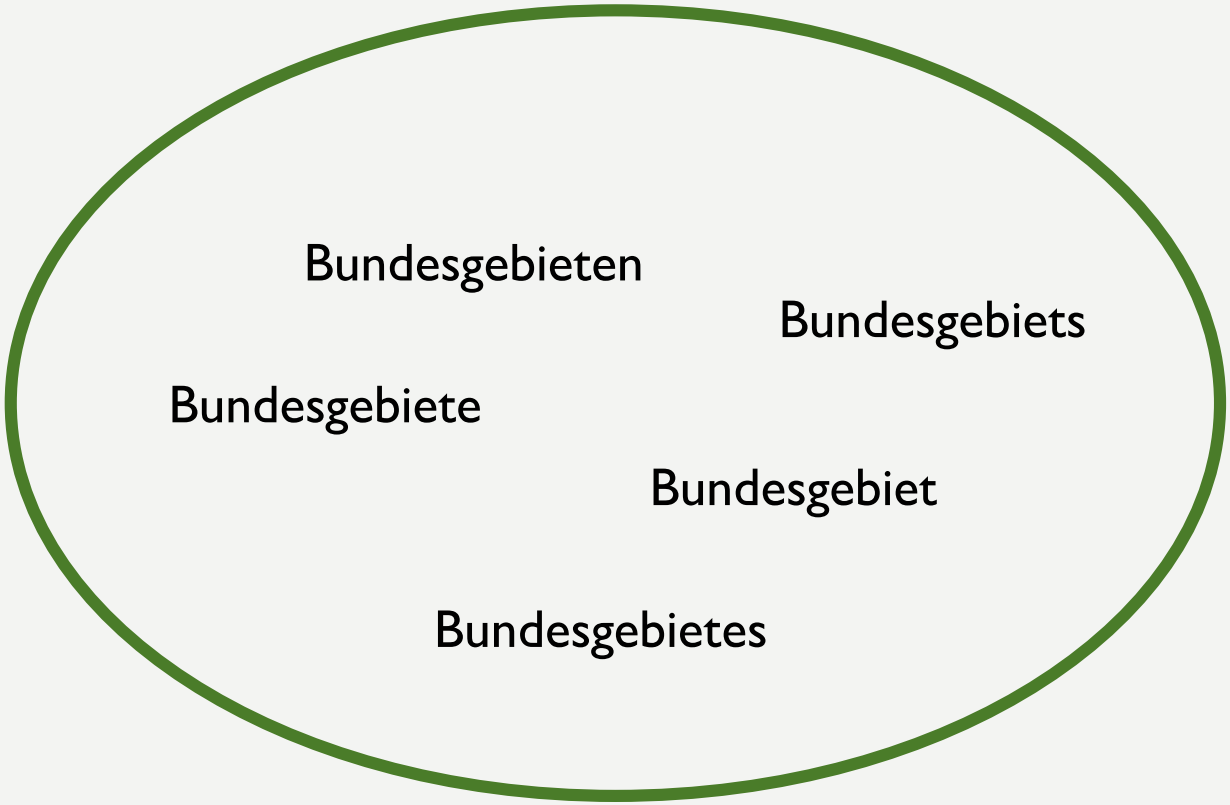


light meter

Gold standard 2

- Uses wordform – lemma information from the CELEX2 corpus
- Groups wordforms with the same lemma
- More conservative that gold standard 2

Gold standard 2



federal territory

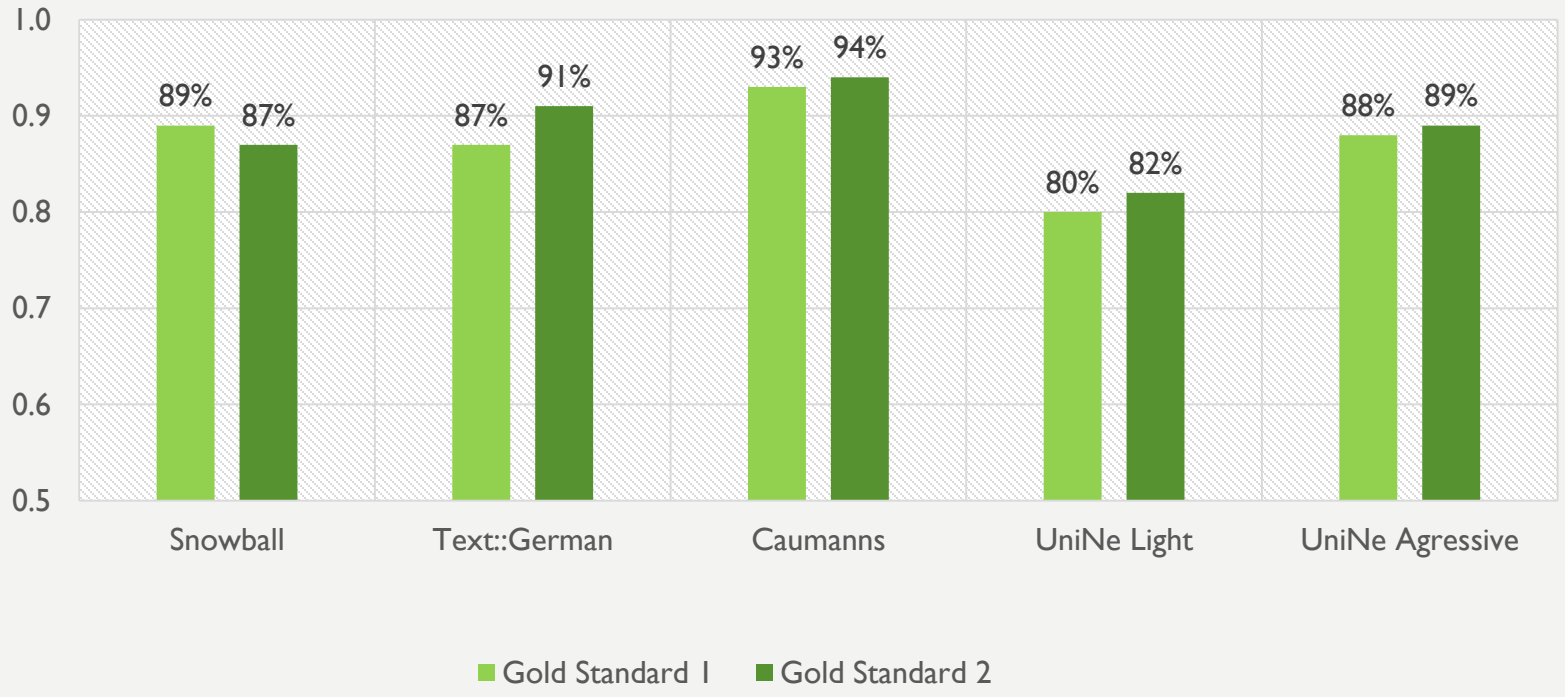
Goldstandard 1 vs 2

Goldstandard 1		Goldstandard 2
relativem Relatives … …	relative	relativieret releativiertest …
Relativität Relativitäten … …	the theory of relativity	Relativität Relativitäten
relativistischerer …	an idea in philosophy	Relativismus relativistischen …

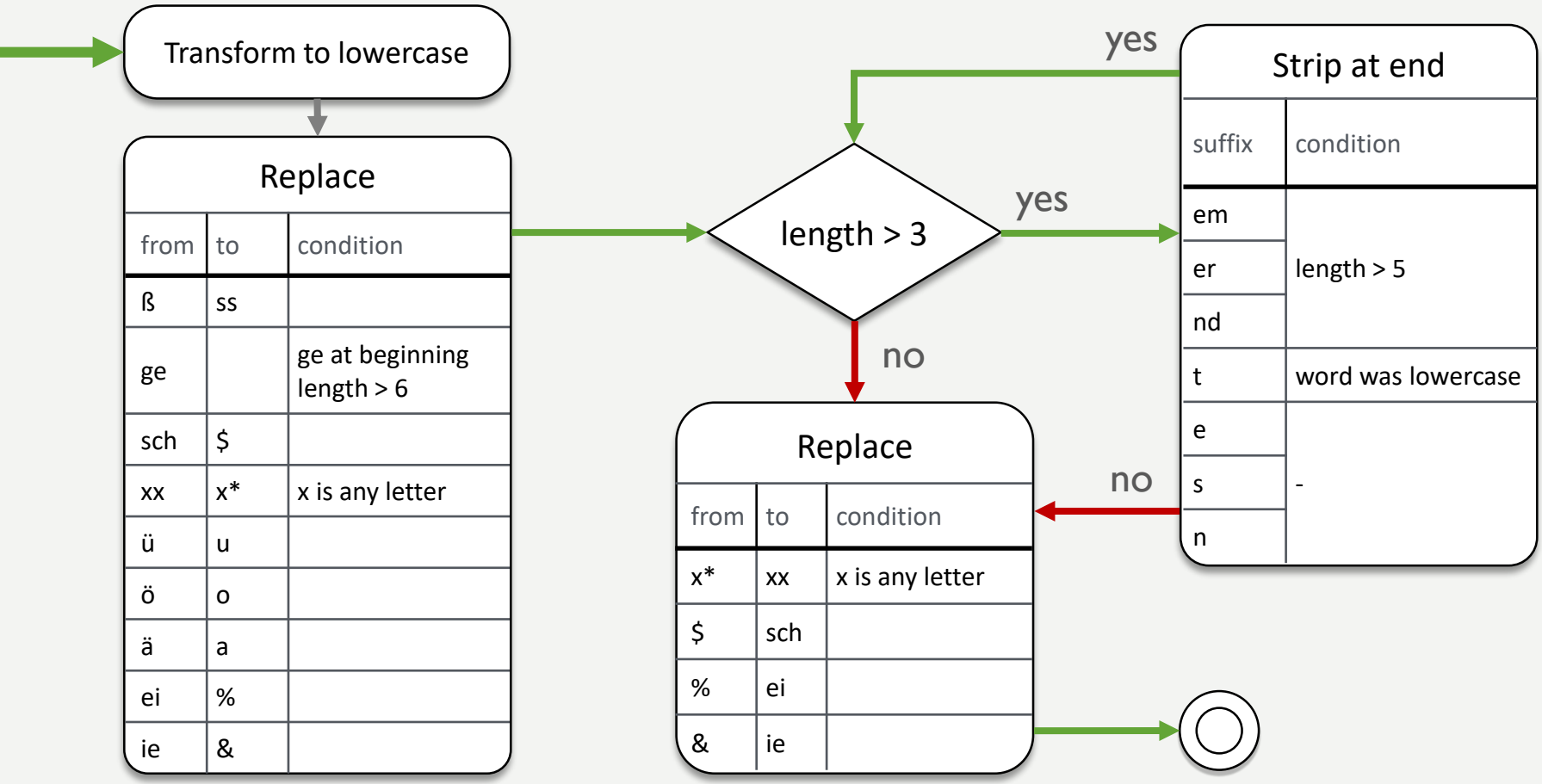
Evaluation Methods

- Stem the CELEX2 Corpus
- For each stem/cluster/line in each gold standard, compute precision and recall by finding the stem in the stemmed corpus that best matches it
- Compute average precision and recall for each gold standard + f1 measure

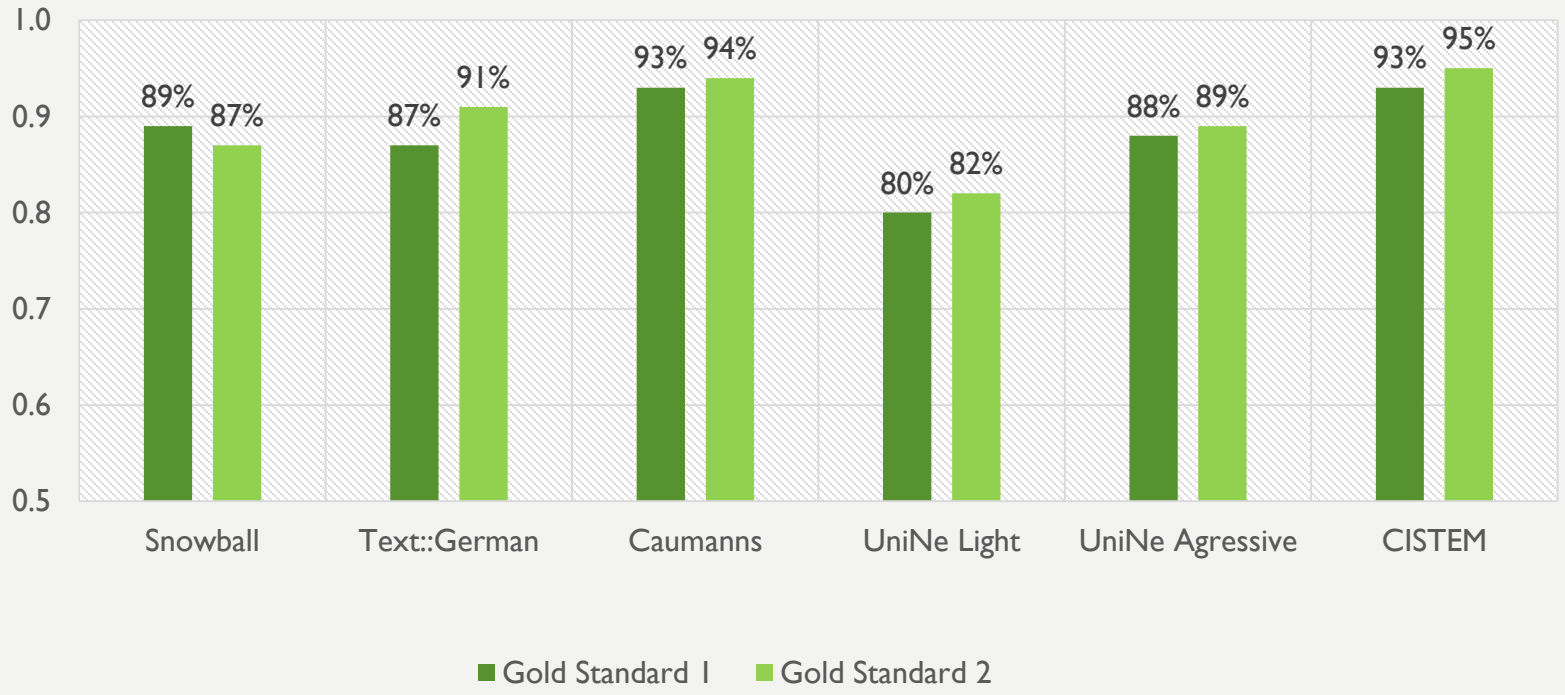
F1 Scores


1.0
0.9
0.8
0.7
0.6
0.5
89%
87%
87%
91%
93%
94%
80%
82%
88%
89%
Snowball
Text::German
Caumanns
UniNe Light
UniNe Agressive
Gold Standard 1
Gold Standard 2

CISTEM Development



F1 Scores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95%
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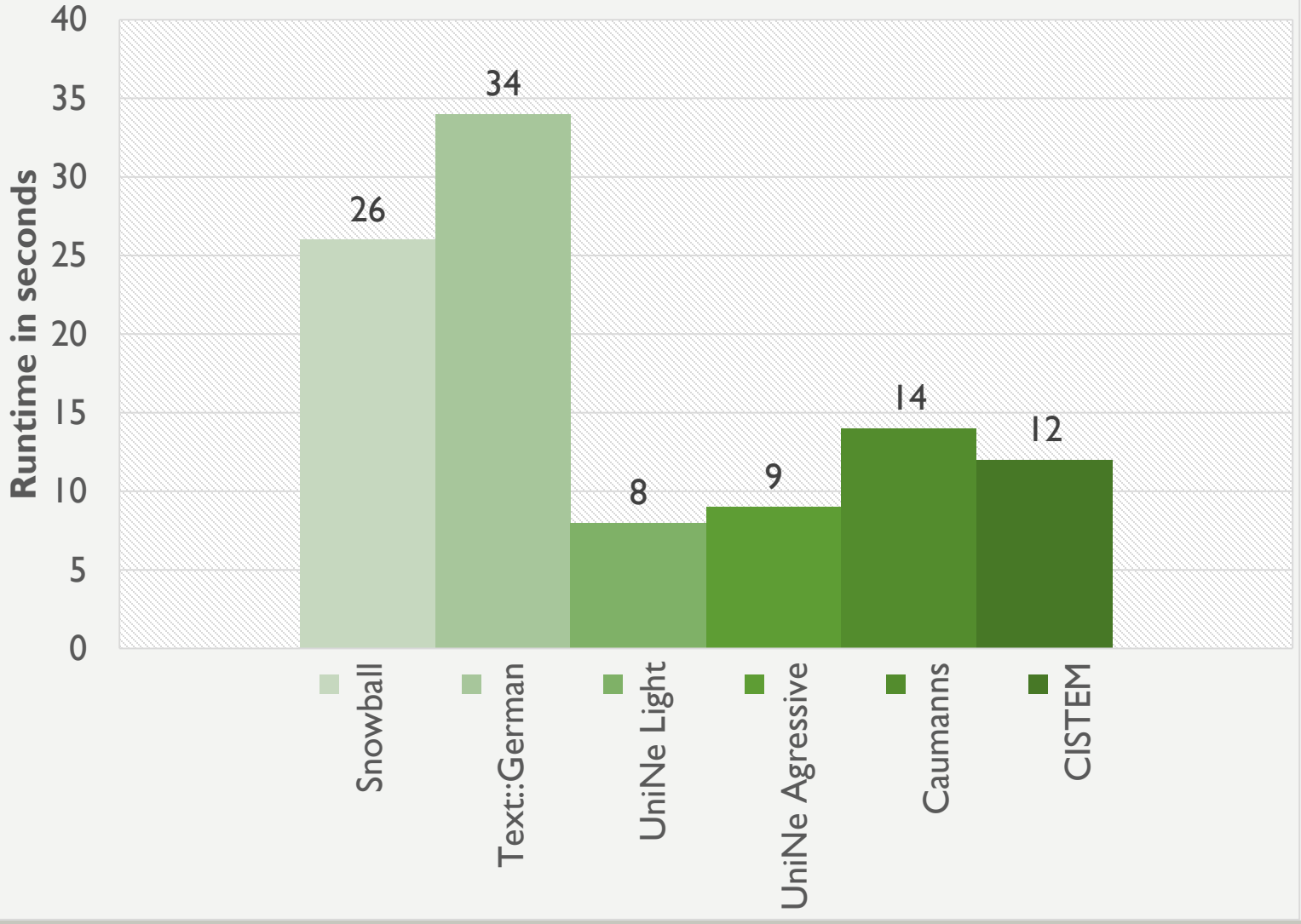
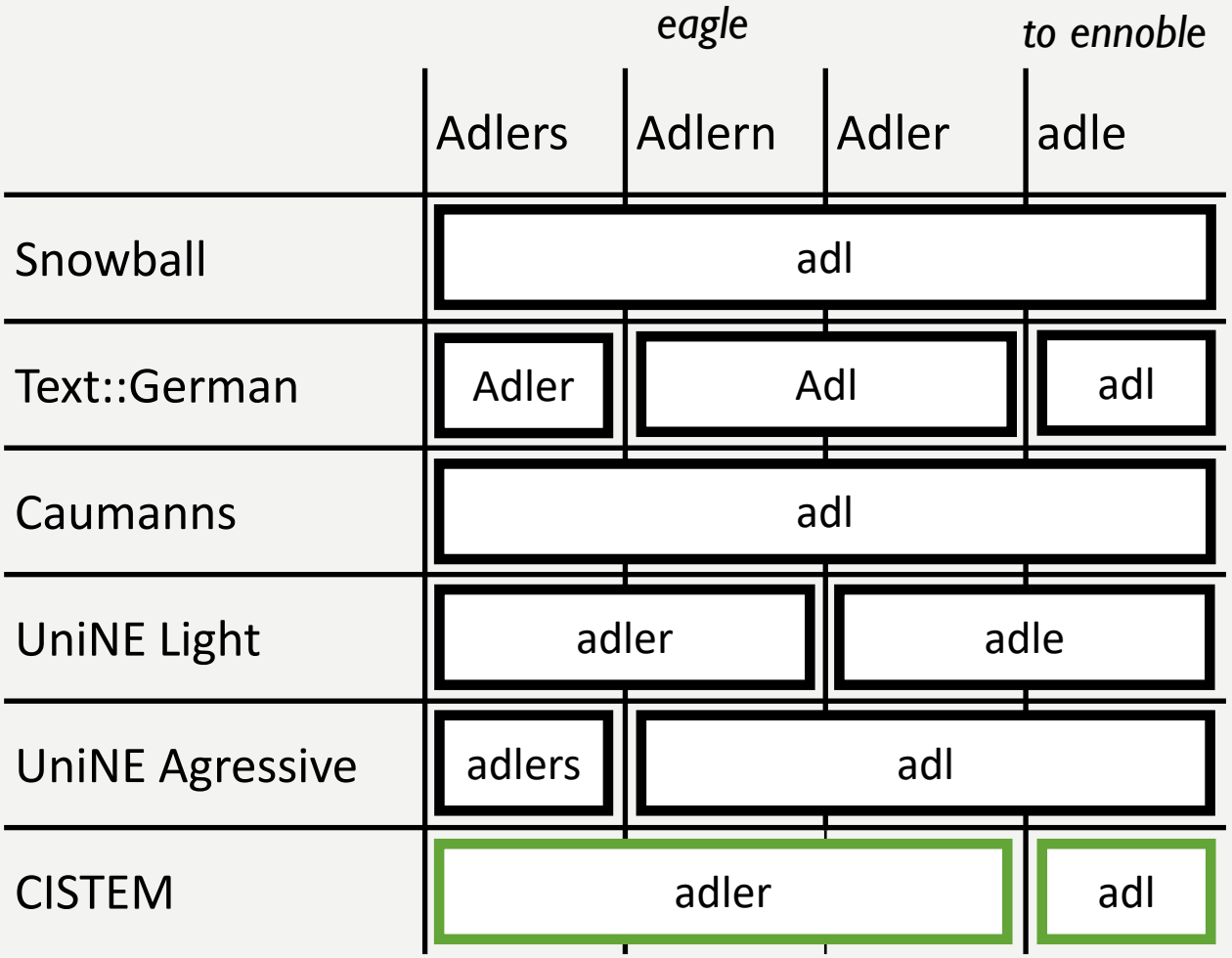
CISTEM
Gold Standard 1
Gold Standard 2

Runtime


Runtime in seconds
0
5
10
15
20
25
30
35
40
26
34
8
9
14
12
Snowball
Text::German
UniNe Light
UniNe Agressive
Caumanns
CISTEM

Comparison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adle
UniNE Agressive
adlers
adl
CISTEM
adler
adl

Conclusion

CISTEM…

- ... scores highest in F1 measure
- ... is one of the quickest stemmers (when implemented in Perl)
- ... is easy to use and understand
- ... has a case insensitive version
- ... has official implementations available in Python, Java, Perl and C with more to come

Future Work

- Release official CISTEM implementations in as many programming languages as possible
- Try to merge the two gold standards into one definitive gold standard
- Implement rule-learning system for learning the optimal stemmer (would require definitive gold standard)
- Test if testing the gold standards yield the same results as testing stemmers in an IR system

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Thanks for your attention!
github.com/LeonieWeissweiler/CISTEM

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erc

Health in my Language

HimL

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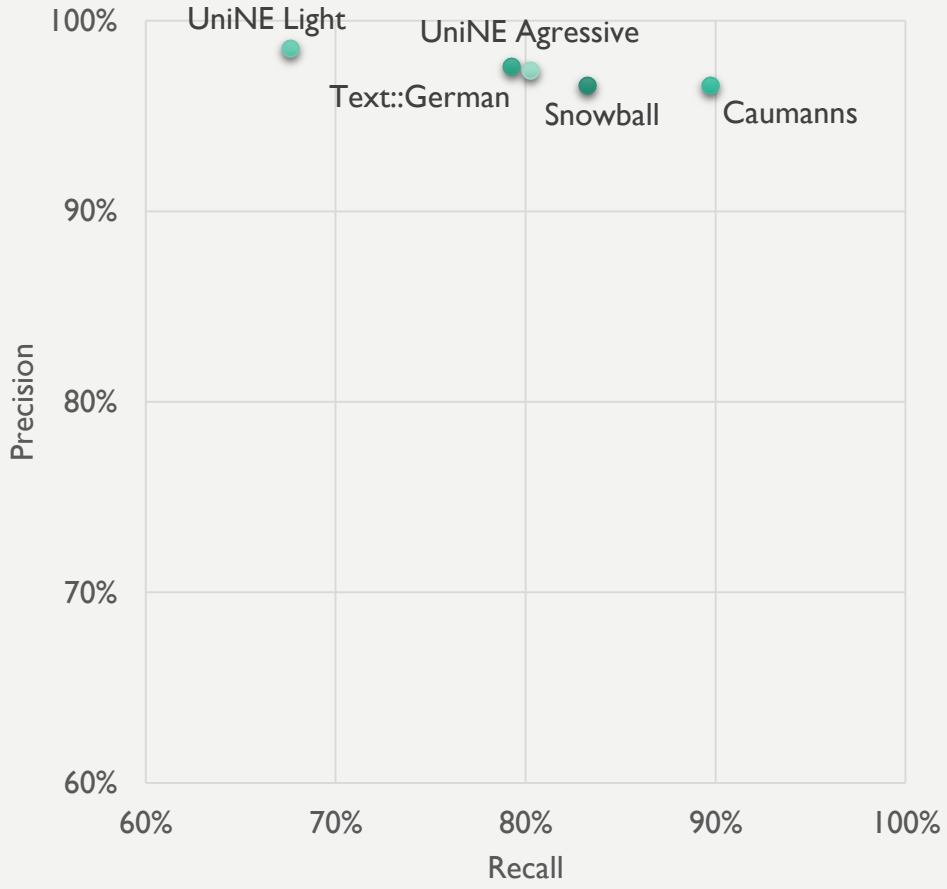
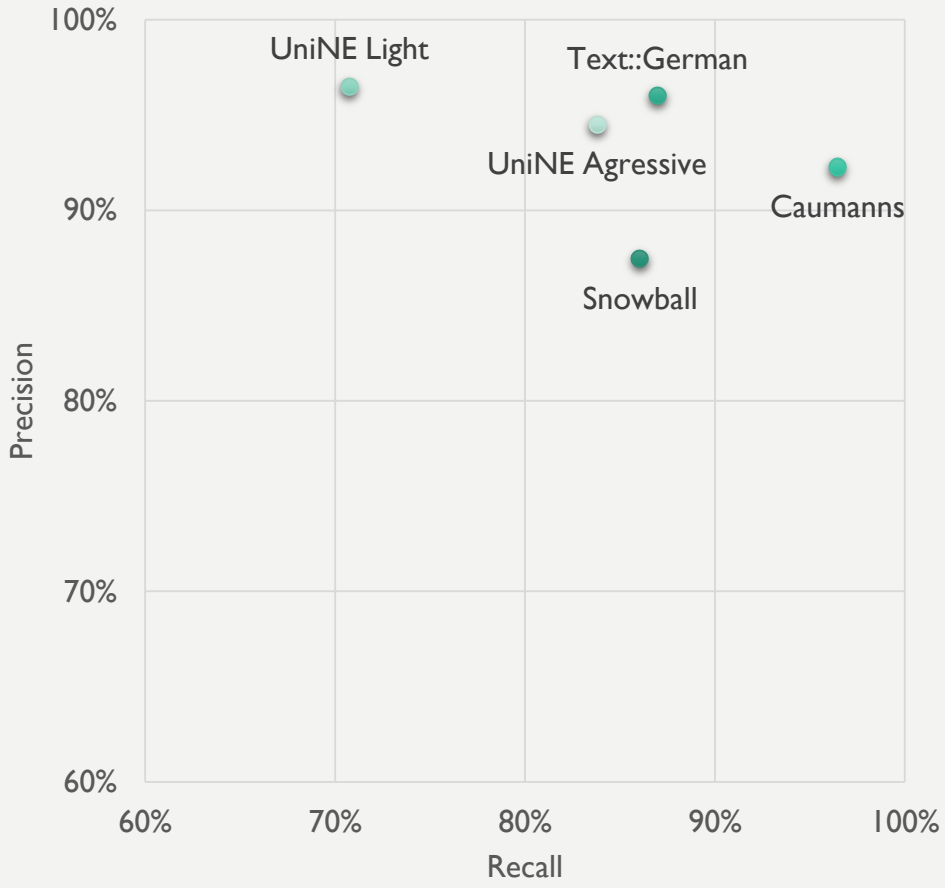
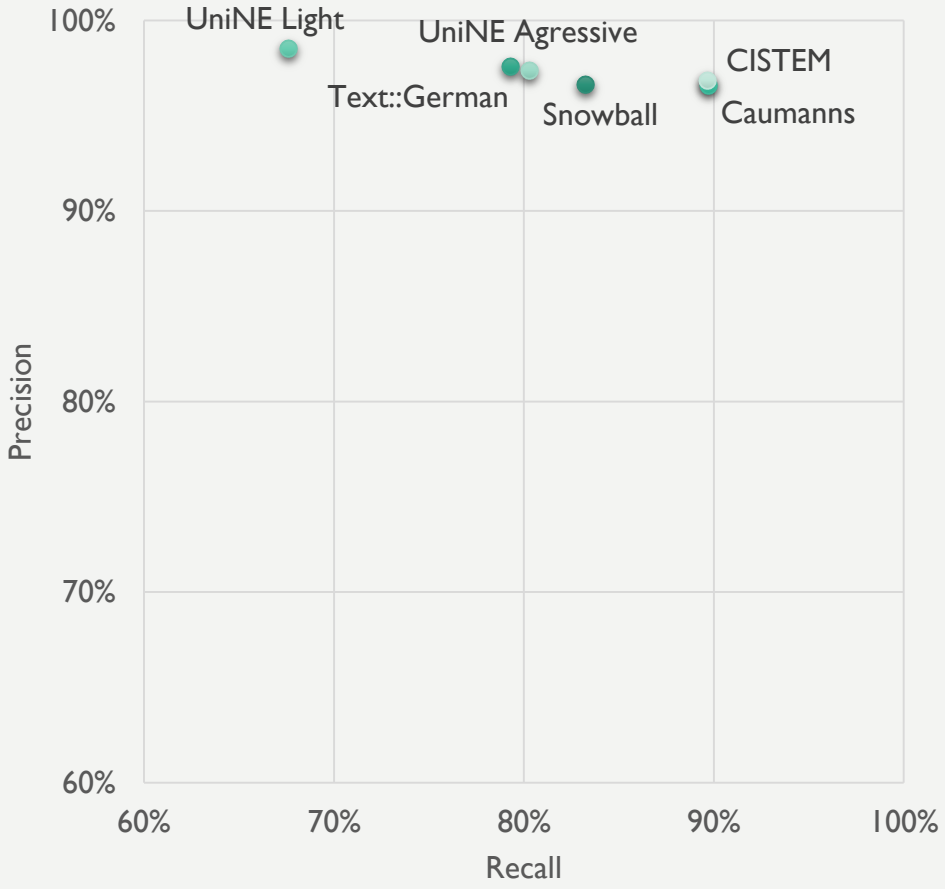
Precision & Recall Gold standard I



Precision & Recall Gold standard 2



Precision & Recall Gold Standard I



Precision & Recall Gold Standard 2