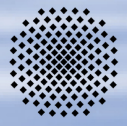

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Evaluating noise reduction strategies for terminology extraction

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Why do we need noise reduction strategies for terminology extraction?

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Standard part-of-speech-based extraction ...

... of N+PP results in:

- Bohrer mit Diamantspitze ✓ "drill with diamond bit"
- die *Oberfläche mit Leinölfirnis bedecken —

"cover the *surface with linseed oil varnish"

... of ADJ+N results in:

- sechskantige Schraube ✓ "hexagonal screw"
- elektromagnetisch *angetriebene Spritzpistole —

"electromagnetically *operated spray gun"

Why do we need noise reduction strategies for terminology extraction?

- Standard part-of-speech-based extraction results in
  - Geburtstagskuchen mit Kerzen – "birthday cake with candles"

  → for a technical domain this candidate is not relevant

- Such an expression is typically filtered out by using termhood measures
  - based on a comparison of the domain corpus and a general-language corpus

⇒ But: which termhood measures work well?

⇒ What are their (statistical) properties?

Overview

- Context and objectives
- A standard pipeline approach: components and evaluation
- Improving term extraction quality
  - filtering by syntactic constraints

    "cover the *surface with linseed oil varnish"
  - filtering out invalid embedded phrases

    "electromagnetically *operated spray gun"
  - ranking by termhood measures "birthday cake with candles"
- Conclusion and future work

Context and objectives

Context and objectives

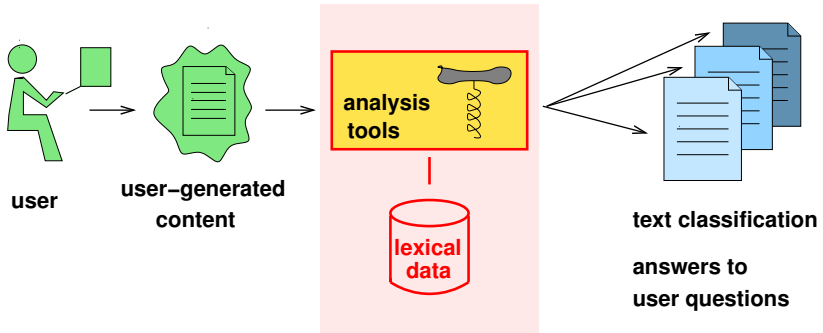
- Data:
  - Expert-produced texts from the DIY domain: manuals, handbooks, articles, ... EXP
  - Domain-specific user-generated content (mostly from the web): forums, discussion groups, etc. UGC
    - noisy data

    → requires robust tools

    → part-of-speech based approach better suited than parse-based

Context and objectives

- Need for professional text analysis:
  - Tools to analyze the UGC from a domain-related viewpoint: classification by topics, finding answers for (e.g. forum) questions, etc.

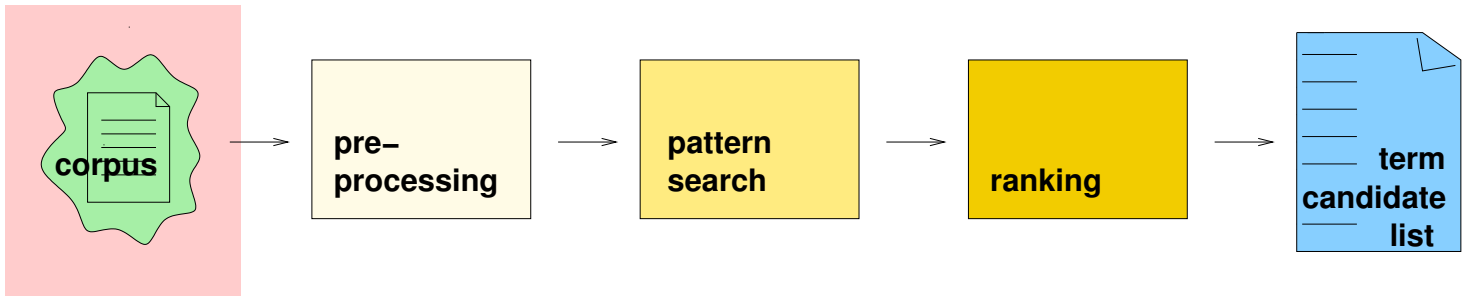


- Prerequisite: Lexical resources to feed the tools
  - term extraction as a first step

  $\Rightarrow$ **quality of extracted terms is important!**

A standard pipeline approach: components and evaluation

Data and gold standard



- Domain corpus:
  collection of texts from the do-it-yourself domain
  - different genres and text types
  - expert and user generated content
  - total number of tokens: 2.7 M

Data and gold standard

- Domain corpus:

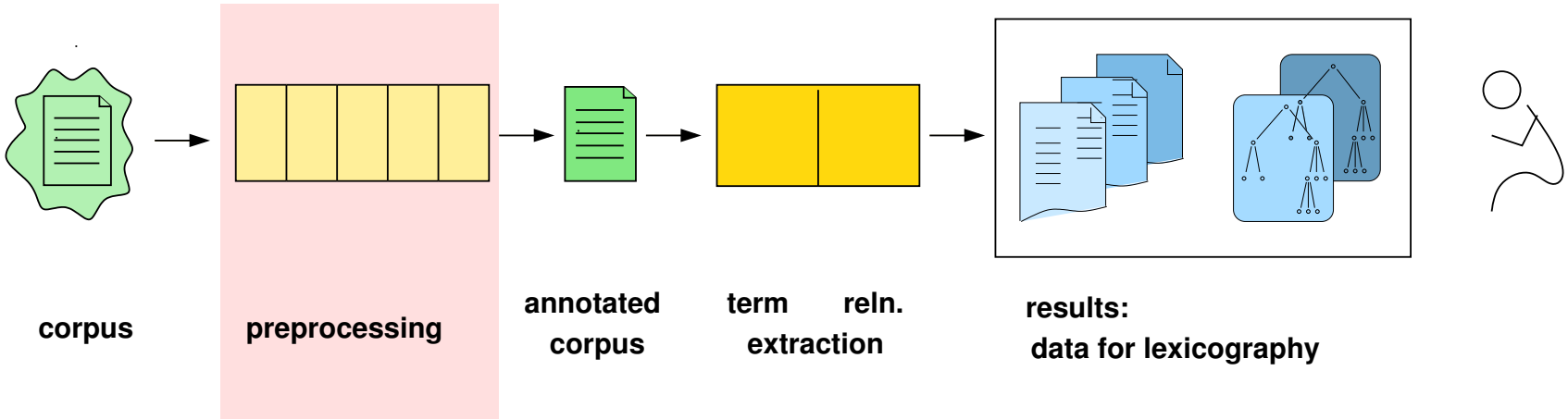
# tokens	text
62,131	do-it-yourself handbook
6,868	encyclopedia entries
5,150	list of FAQs with answers
15,104	tips and tricks for do-it-yourselfers
35,302	marketing texts
2,160,008	user generated project descriptions
444,381	user generated wiki content
2,728,944	total DIY corpus

- General-language corpus: SdeWaC Faaß and Eckart 2012
  - German web text
  - 880 M tokens

Data and gold standard

- Gold standard
  - 3 independent annotators
  - basic patterns only: `N`, `Adj+N`, `N+D+N`$_{Gen}$, `N+P+N`
  - decision: [+/– terminologically relevant]
  - we keep track of {3:0}-decisions (strict)
    and of {2:1}-decisions (liberal)
  - inter-annotator agreement:
    between moderate and substantial agreement
  - contains 4,238 SWTs (including compound nouns) and 826 MWTs

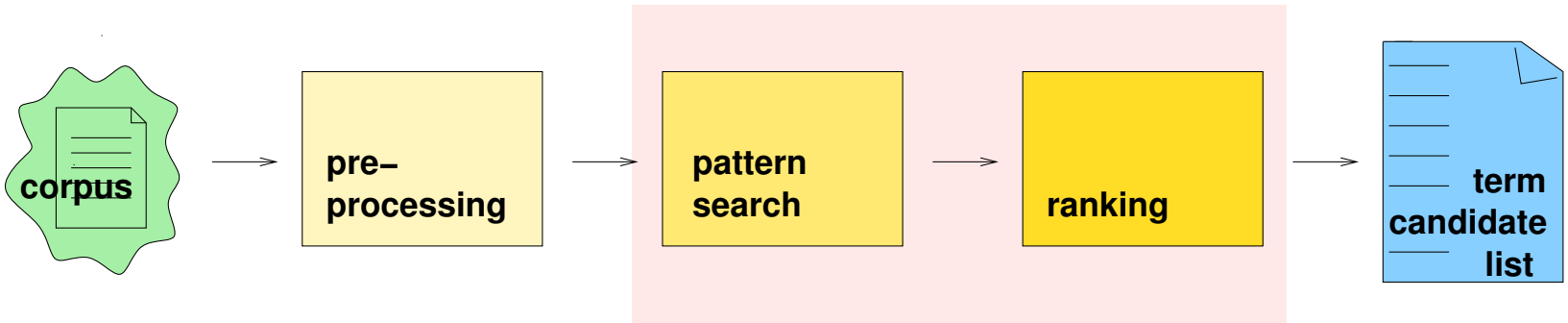
Technology



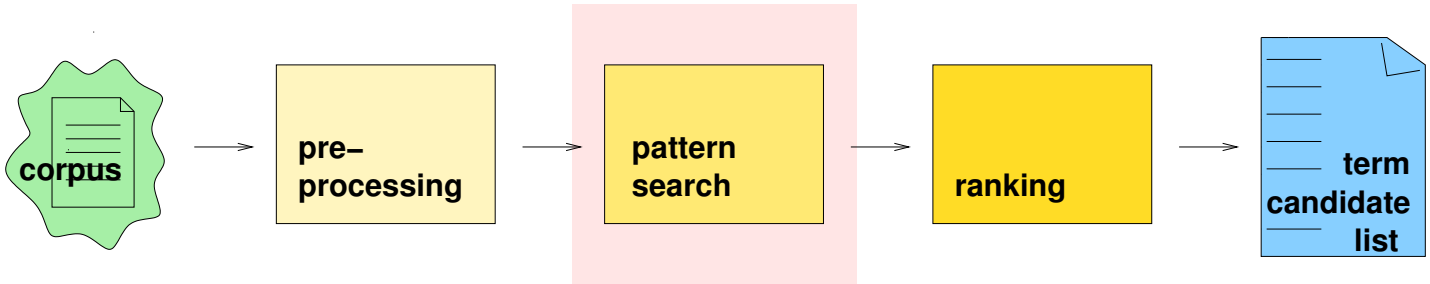
- Standard corpus technology for preprocessing
  - Tokenizing — Schmid 2000
  - Tagging, Lemmatization: RF-Tagger — Schmid/Laws 2008
  - Dependency parsing: mate — Bohnet 2010, Björkelund et al. 2010

Technology

- Standard term extraction procedures – two steps:
  1) extraction by patterns
  2) ranking of extracted candidates



Technology



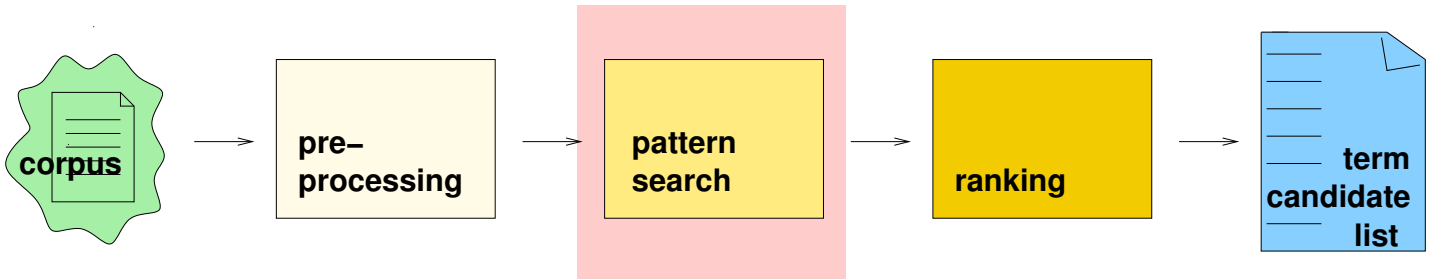
- Pattern-based search:
  - POS-shapes:
    - N — Kreissäge — “circular saw”
    - Adj + N — oszillierende Säge — “oscillating saw”
    - N + P + N — Bohrer mit Kabel — “drill with cord”
    - N + D + N_{gen} — Spitze des Bohrers — “bit of the drill”
- Allowing for optional determiners, adjectives or adverbs

```
- (Adv? Adj? Adj)? N
- (N D)? (Adv? Adj)? N P D? (Adv? Adj)? N
- (Adv? Adj)? N D (Adv? Adj)? N_gen
```

Improving term extraction quality

Filtering by syntactic constraints

Improving term extraction quality: filtering by syntactic constraints



- Part-of-speech pattern search has no syntactic knowledge
- Problem: candidates covering too long spans
  - typically occur when part of the extracted candidate is actually attached to the verbal phrase

*die *Schablone mit Farbe besprühen* — *"spray the *template with paint"*

*ein *Loch in die Wand bohren* — *"drill a *hole into the wall"*

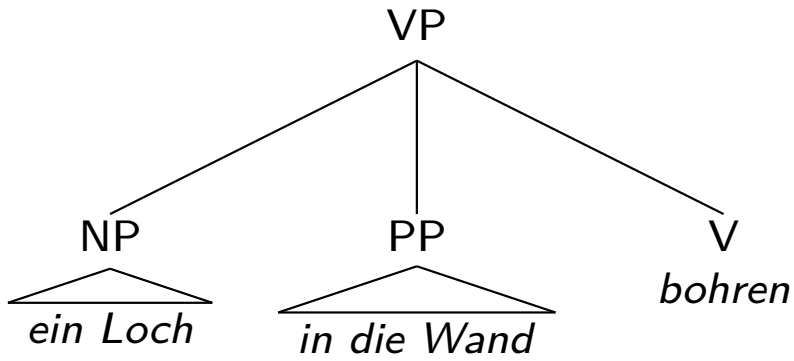
Improving term extraction quality: syntactic validity

Idea:

- Find start and end points of NPs using the dependency parser *mate* Bohnet 2010, Björkelund et al. 2010
- Filtering mechanism:
  - if the POS sequence goes beyond the end point of an NP: invalid
  - else: valid
- Soft filter: only filters out one particular occurrence
- Hard filter: filters out all occurrences of this lemma sequence completely

Improving term extraction quality: syntactic validity

- Terminologically invalid N+PP sequence:



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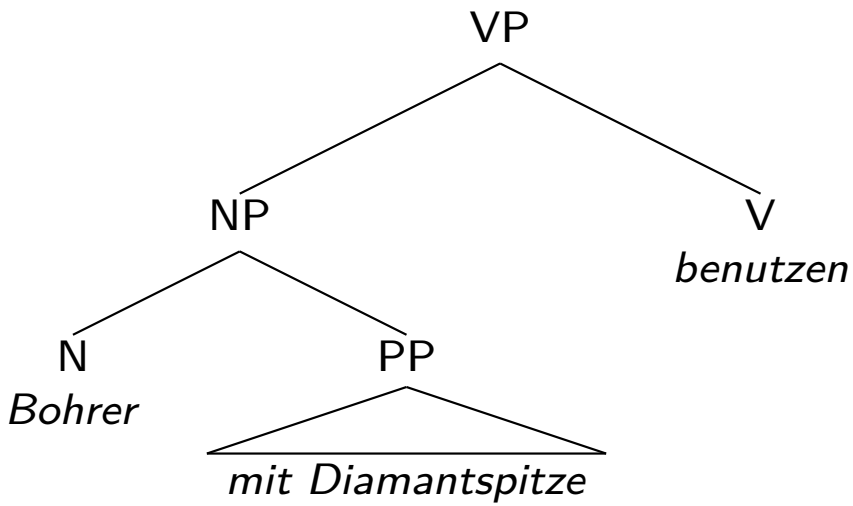
Improving term extraction quality: syntactic validity

- Terminologically valid N+PP sequence:

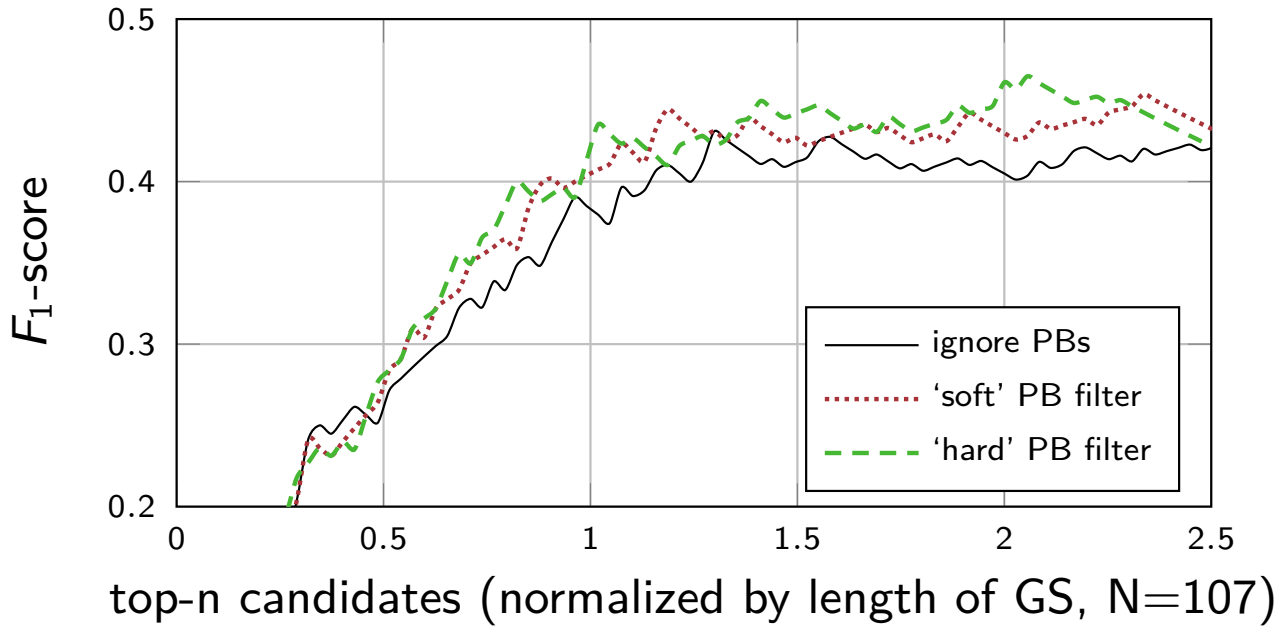


Bohrer mit Diamantspitze benutzen *"use drill with diamond bit"*

Improving term extraction quality: syntactic validity

First evaluation:

- 107 N+P+N terms in the gold standard
- Both the hard and the soft filter improve results
- F_1-score improvement in figure below
  (performance for ranking by termhood measure *CSmw*)



Improving term extraction quality: syntactic validity

Second evaluation:

- Filter affects more candidates than only N+P+N
  → also variants of this basic pattern
- 17.4 % of all NP+PP candidate occurrences affected
- Precision-based evaluation of top-n lists:
  83 % for the top 500 candidates

Top n	100	200	300	400	500
Precision	0.75	0.81	0.82	0.82	**0.83**

Top-n manual plausibility check for “hard” filter

Improving term extraction quality

Filtering out invalid embedded occurrences

Improving term extraction quality: invalid embedded occurrences

- Exhaustive part-of-speech pattern matching
  - not only extracts matches of maximum length
  - extracts matches for all possible patterns

Hartmetallbohrer für faserverstärkte Kunststoffe

"carbide drill for fiber-reinforced plastics"

Hartmetallbohrer *"carbide drill"*

faserverstärkte Kunststoffe *"fiber-reinforced plastics"*

Kunststoffe *"plastics"*

Improving term extraction quality: invalid embedded occurrences

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Hartmetallbohrer *"carbide drill"*

faserverstärkte Kunststoffe *"fiber-reinforced plastics"*

Kunststoffe *"plastics"*

- Problem: candidates covering too short spans

elektromagnetisch angetriebene Spritzpistole

"electromagnetically operated spray gun"

Spritzpistole *"spray gun"*

**angetriebene Spritzpistole* *"*operated spray gun"*

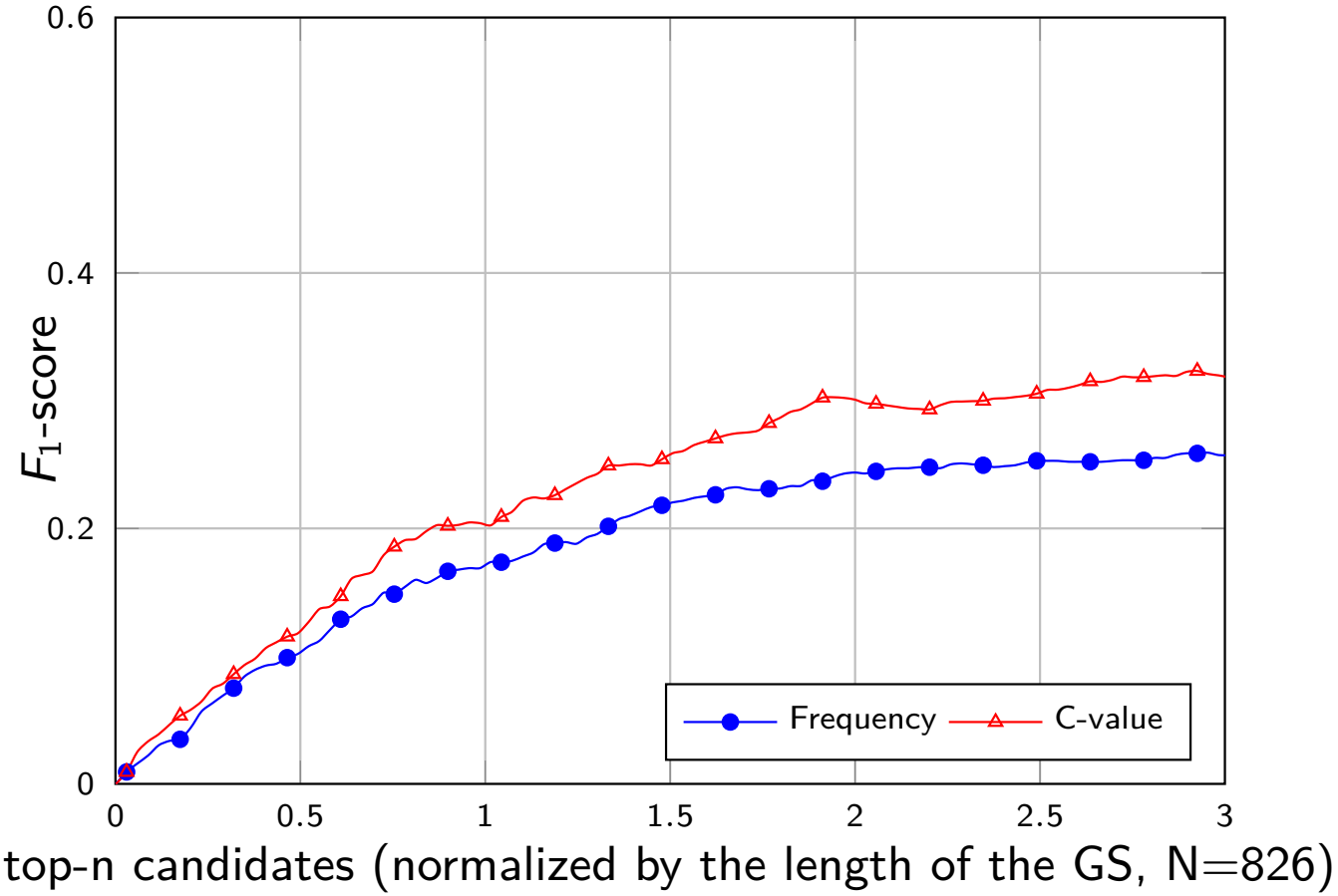
Improving term extraction quality: invalid embedded occurrences

- C-value handles such nested multi-words Frantzi et al. 2000
  - Includes term length as number of words
  - Idea: term length including number of elements of compound nouns

candidate term	freq	C-value
Spritzpistole "spray gun"	49	80.00
*angetriebene Spritzpistole "*operated spray gun"	2	0.00
elektromagnetisch angetriebene Spritzpistole "electromagnetically operated spray gun"	2	8.00

Improving term extraction quality: invalid embedded occurrences

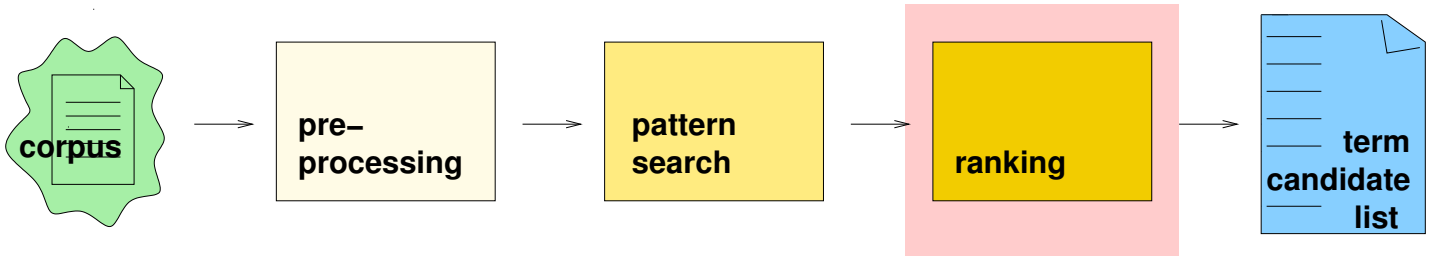
Extraction of MWTs:



Improving term extraction quality

Comparing different termhood measures

Improving term extraction quality: termhood measures



- Extracted candidates can be irrelevant for the domain
- Rankings by mere frequency or C-value not satisfactory (F_1-score 0.25 and 0.3 respectively)

$\Rightarrow$ Further filtering: top-n of rankings by termhood measures

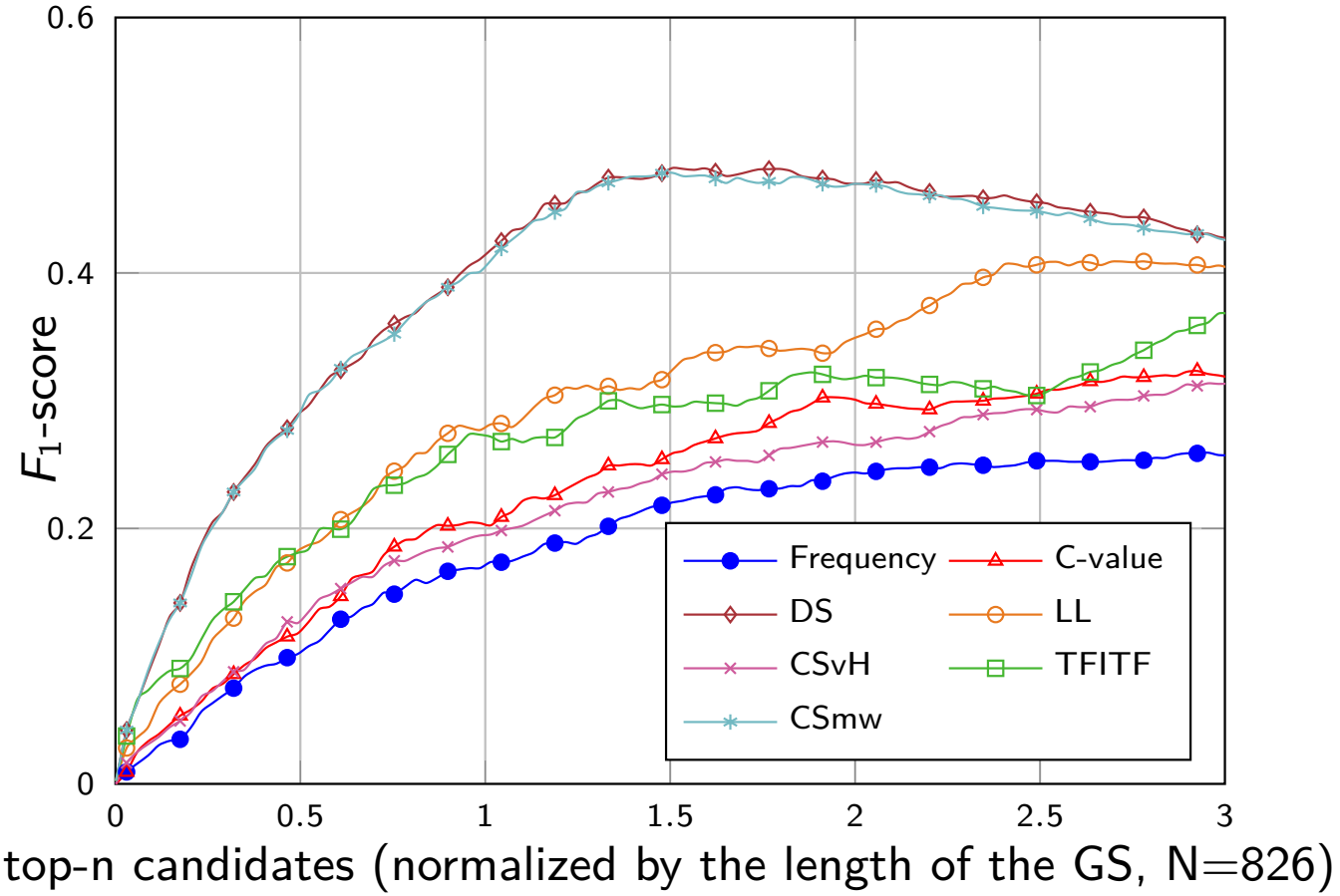
  - based on a comparison of the term frequency in the domain corpus and a general-language corpus

Improving term extraction quality: termhood measures

- Weirdness ratio for domain specificity (DS) Ahmad et al. 1999
- Corpora-comparing log-likelihood (LL) Rayson and Garside 2000
- Contrastive Selection via Heads (CSvH) Basili et al. 2001
- Term Frequency Inverse Term Frequency (TFITF) Bonin et al. 2010
- Contrastive Selection of multi-word terms (CSmw) Bonin et al. 2010

Improving term extraction quality: termhood measures

Extraction of MWTs:



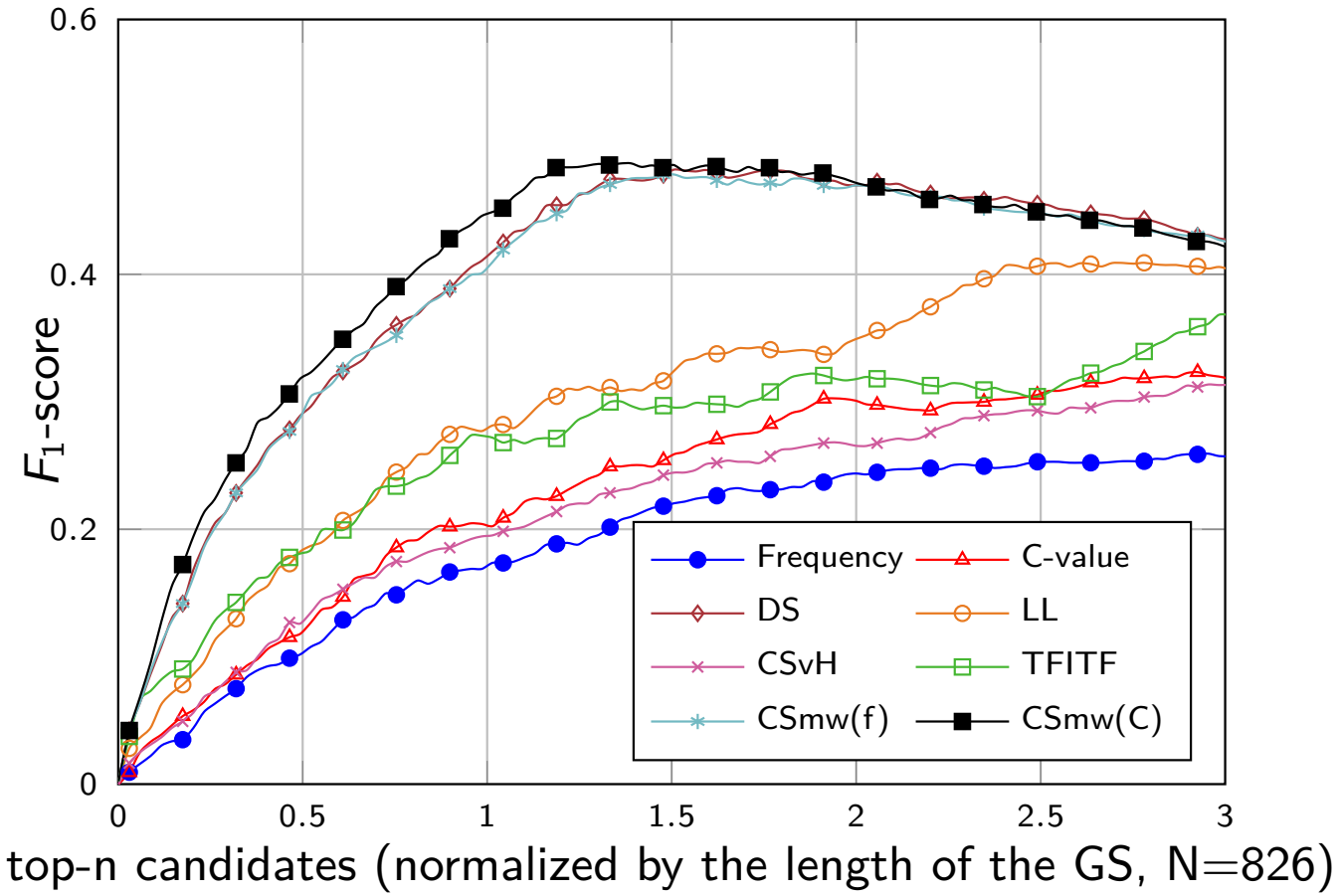
Improving term extraction quality: termhood measures

- C-value corrects term frequency with consideration of embeddings in longer terms
- Termhood measures focusing on domain-specificity are mainly based on frequency

$\Rightarrow$ Idea: Use C-value instead of frequency as input for these measures

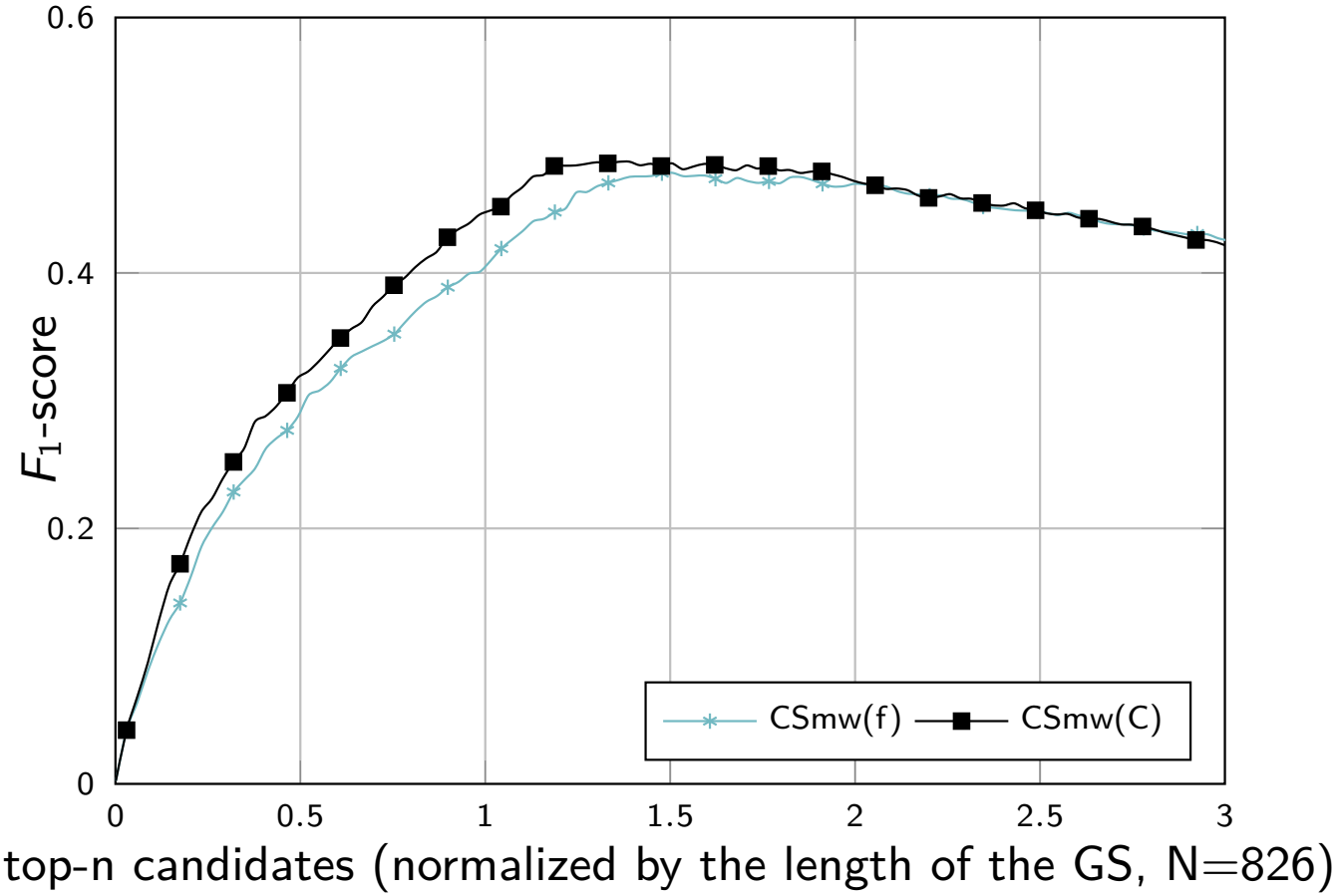
Improving term extraction quality: termhood measures

Extraction of MWTs:



Improving term extraction quality: termhood measures

Extraction of MWTs:



Conclusion

Conclusion

Has been shown:

- Part-of-speech based approaches are suitable for term extraction when combined with a set of noise reduction strategies
- Ensuring syntactic validity helps
- Filtering out invalid, embedded occurrences improves results
- Different termhood measures have different statistical properties
  $\Rightarrow$ important to make an informed decision
  $\Rightarrow$ in our domain and language: DS and CSmw work best

Future work

Next steps:

- New domain: do measures behave similarly?
- English data: are our results transferable?
- Combination of termhood measures