Grammatical Profiling for Semantic Change Detection

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Motivation

- Semantics, morphology and syntax are strongly interdependent
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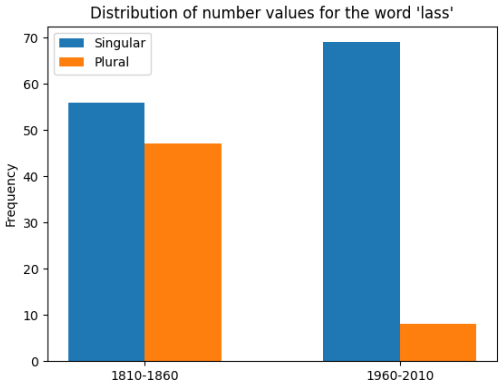
English noun '*Lass*':

1. Older times: 'YOUNG WOMAN' sense more dominant ('*lasses are dancing*')
2. 20th century: 'SWEETHEART' sense more dominant ('*the young hero and his lass*')

A sharp decrease in plural usages!

Are there systematic correlations between diachronic semantic change and morphosyntactic changes?



(English corpora of SemEval 2020)

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Task definition

- Data:
  - A *corpus* compiled of documents from at least two time periods
  - A list of *target words*
- Task:
  - *Rank target words* according a degree of semantic shift
  - in an *unsupervised* way, using only corpus.

Example: SemEval dataset

Changed			Not-changed		
beatus	1	1.870	hostis	0	1.890
poena	1	1.800	dubius	0	1.851
senatus	1	1.490	imperator	0	1.638
civitas	1	1.437	sapientia	0	1.433
voluntas	1	1.407	simplex	0	1.428
sacramentum	1	1.131	scriptura	0	1.427
humanitas	1	1.119	nobilitas	0	1.270
sanctus	1	1.110	honor	0	1.144
dolus	1	0.975	fidelis	0	1.137
nepos	1	0.880	jus	0	1.115
virtus	1	0.863	acerbus	0	0.817
necessarius	1	0.816	adsumo	0	0.720
regnum	1	0.668	dux	0	0.561
itero	1	0.667	potestas	0	0.548
salus	1	0.553	credo	0	0.519
licet	1	0.509	cohors	0	0.250
oportet	1	0.496	ancilla	0	0.143
pontifex	1	0.492	consul	0	0.128
sensus	1	0.402	titulus	0	0.126
templum	1	0.295			
consilium	1	0.160			

Semantic change detection tasks

Standard subtasks

- Subtask 2: ranking (graded change detection)
- Subtask 1: binary classification (any senses gained or lost?)

1. *SemEval* dataset: both subtasks, English, German, Latin, Swedish [Schlechtweg et al., 2020]
2. *EvaLita* dataset: Subtask 1 only, Italian [Basile et al., 2020]
3. *RuShiftEval* dataset: Subtask 2 only, Russian [Kutuzov and Pivovarova, 2021]

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In total, 274 manually annotated words from 3 Indo-European language groups: Italic, Germanic and Slavic.

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- **It is theoretically plausible that diachronic word meaning change is reflected in a change of profiles**
- However, the majority of previous methods for semantic change detection rely on distributional word embeddings
- The recent exception is [Ryzhova et al., 2021]: case and number frequency distributions to reveal diachronic change in Russian nouns

Our findings in short

- Tracing changes in the morphosyntactic categories does outperform count-based distributional models.
- Morphological and syntactic categories are complementary.
- Useful categories are language-dependent.
- Predictions are interpretable.

https://aclanthology.org/2021.conll-1.33/

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Morphosyntax methods for semantic change detection

Basic procedure 1/2

- Target historical corpora are tagged and parsed with *UDPipe*
- *A profile* is a dictionary of frequencies of morphosyntactic categories for each target word
- A dictionary is treated as a vector of values and semantic change estimated as *cosine distance* between feature vectors in two time periods
- **Basic procedure:**

`Tense=Pres|VerbForm=Part`	50
`Mood=Ind|Tense=Past|VerbForm=Fin`	24
`Tense=Past|VerbForm=Part|Voice=Pass`	17
`VerbForm=Inf`	9
`Mood=Ind|Tense=Pres|VerbForm=Fin`	1
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Feature vectors are actually time-dependent grammatical profiles.