Natural dialect processing

NLP for non-standardized language varieties

Verena Blaschke & Barbara Plank
MaiNLP lab, LMU Munich

Quantitative approaches in dialectology
and variationist sociolinguistics
December 7, 2023

Natural Language Processing

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... but *which* languages?

NLP – but which “language(s)”?

- Many speakers, abundant data, standardization

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  Modern methods learn from massive amounts of data –
  how can we learn from sparse + heterogeneous data?

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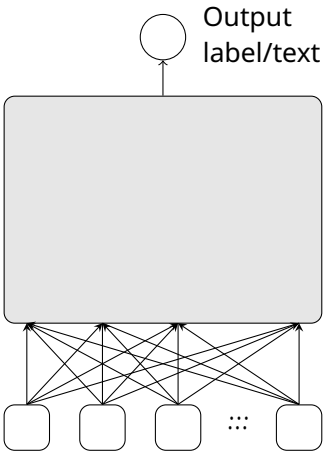
Overview of current challenges and approaches regarding NLP & dialects

Overview



Input text sequence goes here

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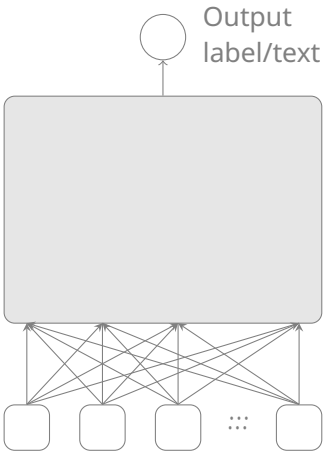

Input text sequence goes here

ż Available dialect data

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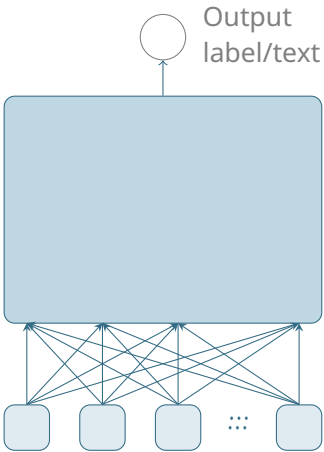

Input text sequence goes here

- Modelling non-standard data
- Available dialect data

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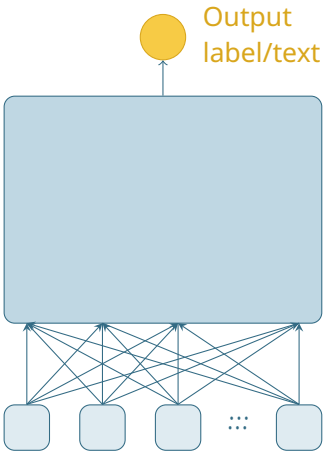

- Human-centric NLP (what tools and why?)
- Modelling non-standard data
- Available dialect data

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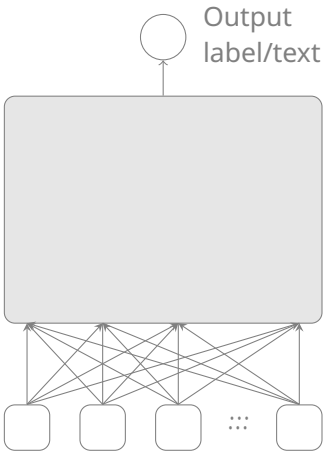

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(Lack of?) resources

Datasets for dialects and “small” languages

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- Two communities: variationists & NLP researchers

(Lack of?) resources

Datasets for dialects and “small” languages

- Two communities: variationists & NLP researchers
- Findable; licenses allowing re-use

(Lack of?) resources

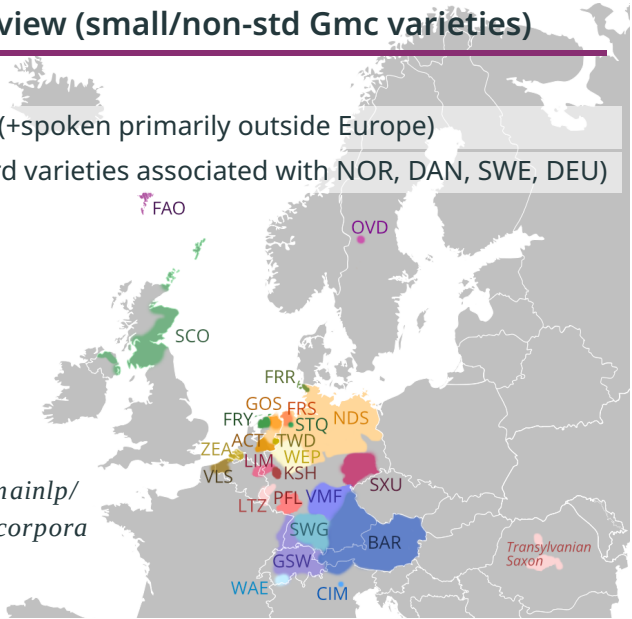
Datasets for dialects and “small” languages

- Two communities: variationists & NLP researchers
- Findable; licenses allowing re-use
- Long-term storage + accessibility

Corpus overview (small/non-std Gmc varieties)

(+spoken primarily outside Europe)

(+non-standard varieties associated with NOR, DAN, SWE, DEU)



! *github.com/mainlp/germanic-lrl-corpora*

Corpus overview (small/non-std Gmc varieties)

100+ (mostly written) corpora for 30 language varieties

Blaschke ea “A survey of corpora for Germanic low-resource languages and dialects” NoDaLiDa 2023

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- If annotated:
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  - Morphosyntax
  - Rarely: translations, content-related annotations

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Data exchange between research communities?

Blaschke ea "A survey of corpora for Germanic low-resource languages and dialects" NoDaLiDa 2023

Bavarian dependency treebank

Work under review

- Different dialects
  (location metadata)

Map based on Wiesinger (1983, map 47.4)

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- Different dialects
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- Different text genres

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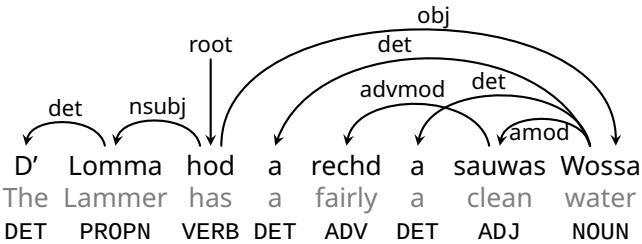
- Different dialects (location metadata)
- Different text genres
- Freely accessible, permissive license
- 11k words, 750 sentences

Map based on Wiesinger (1983, map 47.4)

Bavarian dependency treebank

Work under review

Universal Dependencies



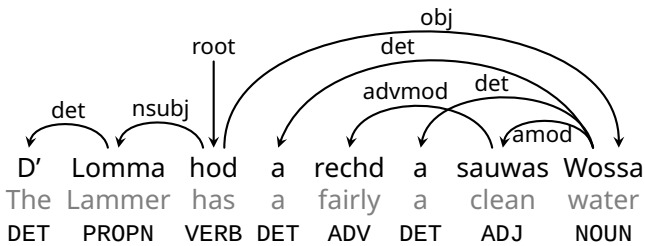
de Marneffe ea "Universal Dependencies" *Computational Linguistics* (2021)

Bavarian dependency treebank

Work under review

Universal Dependencies

- Cross-linguistic comparability (incl. DEU, GSW, NDS)



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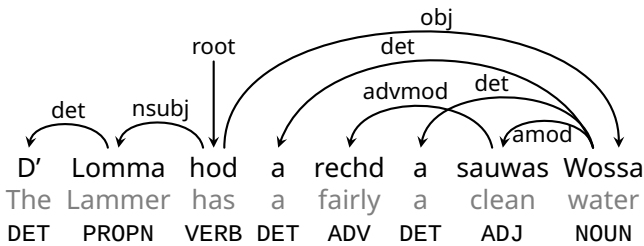
Bavarian dependency treebank

Work under review

Universal Dependencies

- Cross-linguistic comparability (incl. DEU, GSW, NDS)
- Established for automatic annotation tasks



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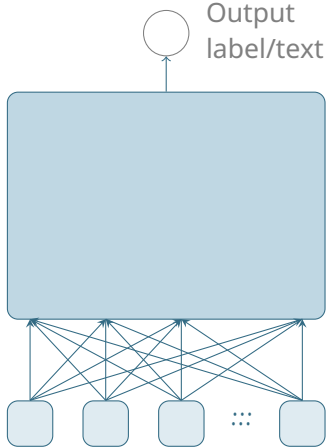

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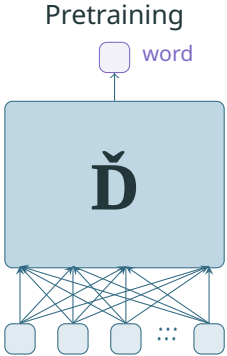
Pretrain – finetune – transfer



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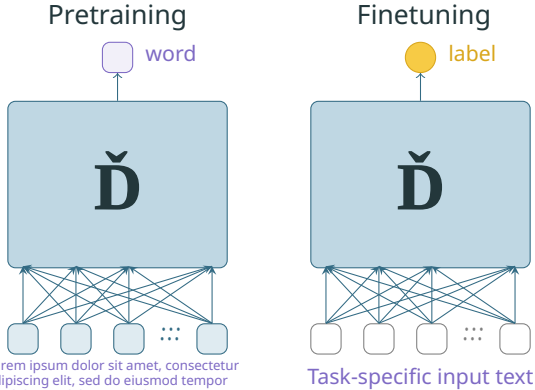

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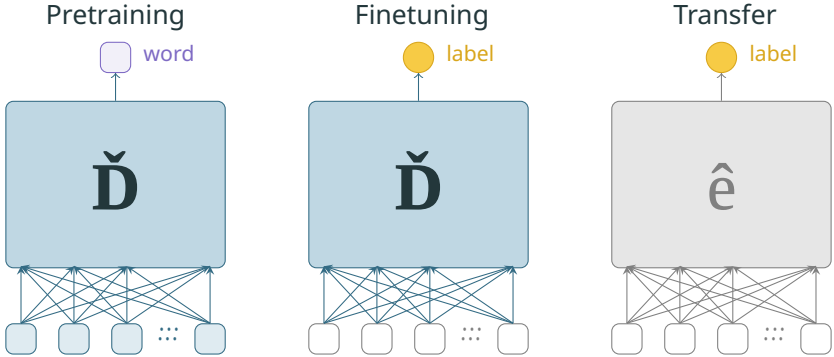

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Task-specific input text

Input text in another language

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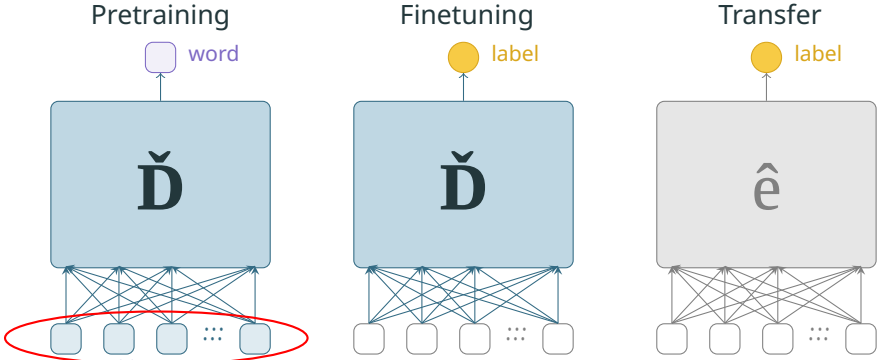

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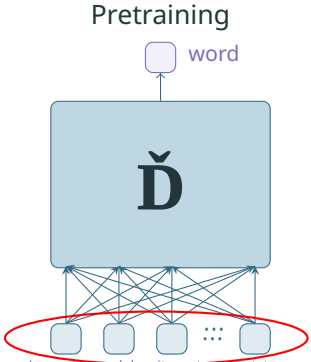

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Encoding input text

Map character sequences (“subword tokens”) to numeric representations

Non-standard orthographies + tokenization

Die	Lammer	hat	ein	recht		sauberes	Wasser
D’	Lomma	hod	a	rechd	a	sauwas	Wossa

Sentence via bar.wikipedia.org/wiki/L¬mma
Chan ea “German’s next language model” 2020

Non-standard orthographies + tokenization

Subword tokenization with GBERT

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Sidenote:
ChatGPT/GPT-4/etc also use such kinds of tokenization

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Solutions – ongoing work in the field

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Solutions – ongoing work in the field

- Move away from character-sequence-based representations altogether – requires training new models, experimental (overall performance might be worse)
- (How to) make existing models more robust to variation

Brittleness towards uncommon structures

Work under review

D’	Lomma	hod	a	rechd	a	sauwas	Wossa
The	Lammer	has	a	fairly	a	clean	water
DET	PROPN	VERB	DET	ADV	DET	ADJ	NOUN

Sentence via bar.wikipedia.org/wiki/L¬mma

Brittleness towards uncommon structures

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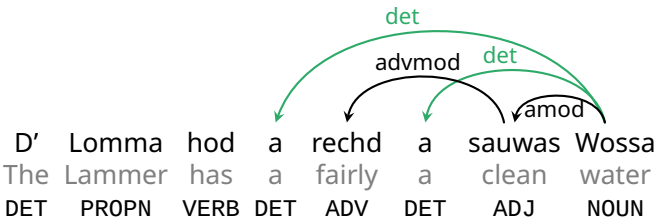

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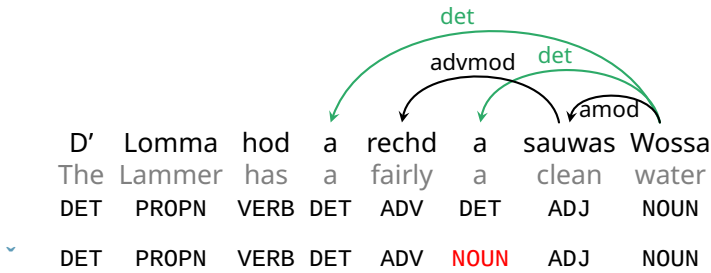

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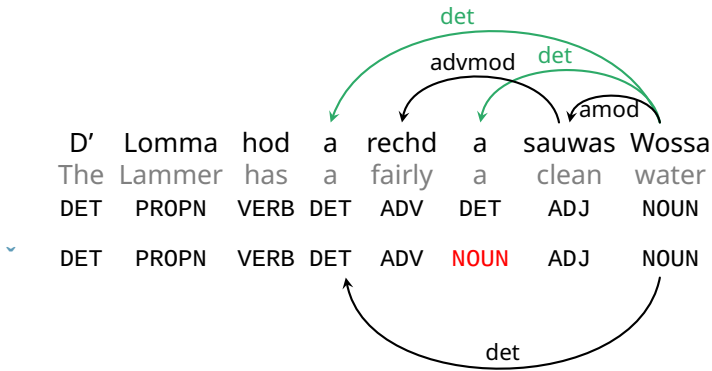

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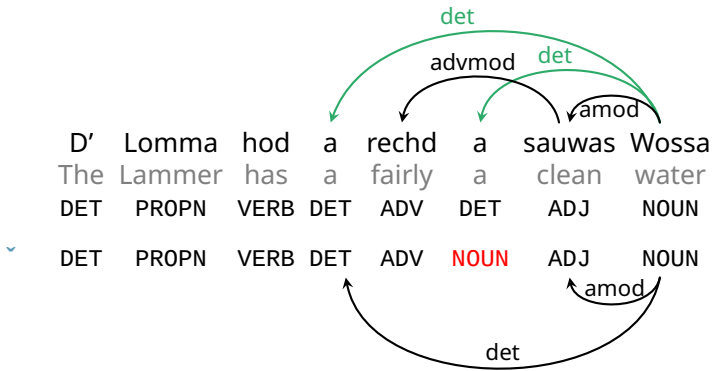

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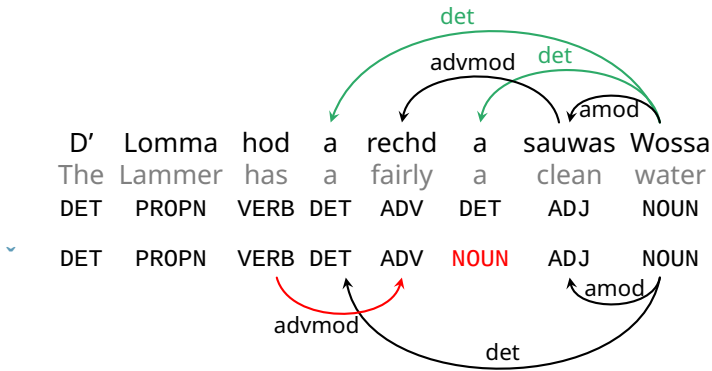

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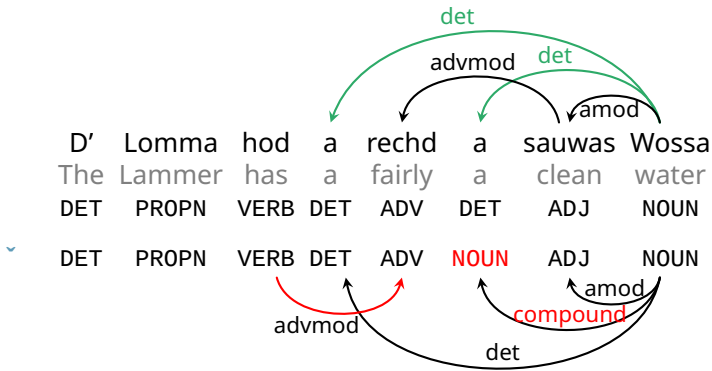

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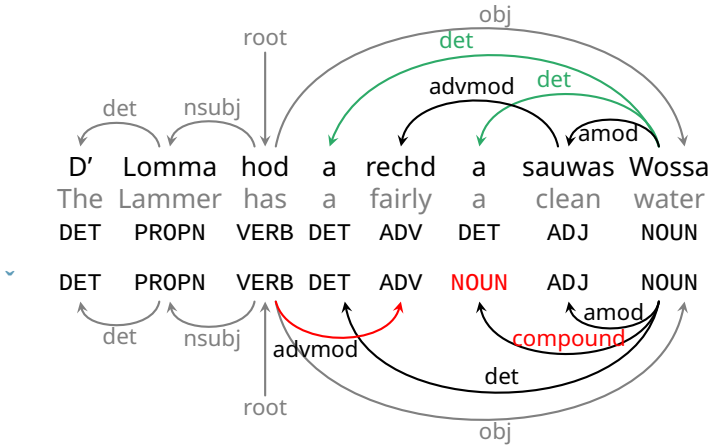

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Brittleness towards uncommon structures

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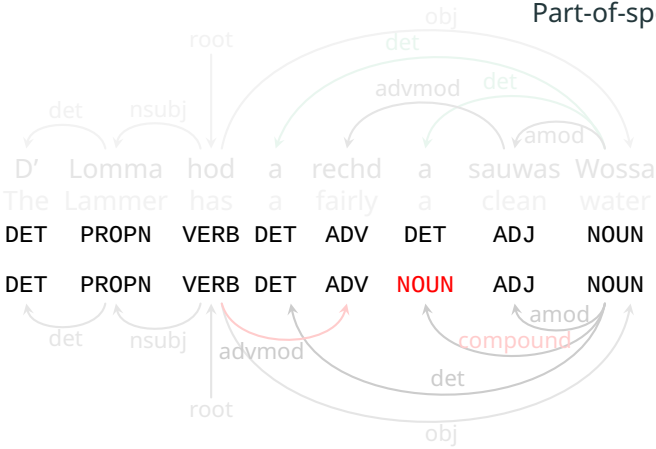
Part-of-speech tags:
Accuracy



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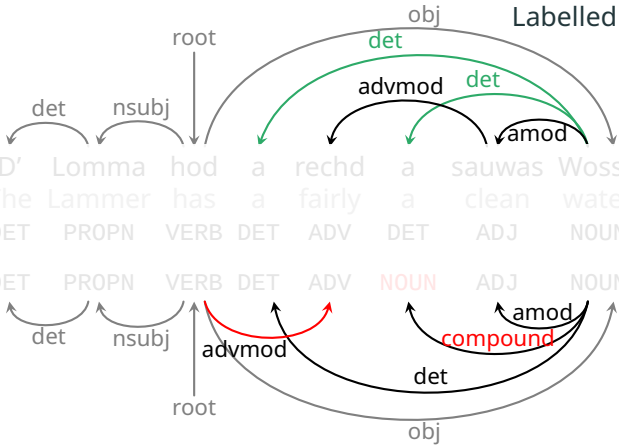
Brittleness towards uncommon structures

Work under review

Dependencies: Labelled attachment score



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Automatic tagging/parsing

Work under review

Train on German data (there is no Bavarian training data!), test on German vs. Bavarian

Model	Test lang	Acc (%)	LAS (%)
Stanza	DEU	95.9	83.7
GBERT	DEU	96.8	83.1
UDPipe	DEU	96.5	84.9

Acc = accuracy (part-of-speech tags); LAS = labelled attachment score

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Model	Test lang	Acc (%)	LAS (%)
Stanza	DEU	95.9	83.7
GBERT	DEU	96.8	83.1
UDPipe	DEU	96.5	84.9
Stanza	BAR	40.9	23.1
GBERT	BAR	57.4	30.1
UDPipe	BAR	80.5	67.3

Acc = accuracy (part-of-speech tags); LAS = labelled attachment score

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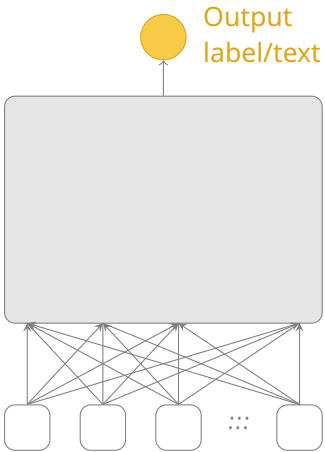
Model	Test lang	Acc (%)	LAS (%)	Input representation
Stanza	DEU	95.9	83.7	
GBERT	DEU	96.8	83.1	
UDPipe	DEU	96.5	84.9	
Stanza	BAR	40.9	23.1	Full words
GBERT	BAR	57.4	30.1	Subword tokens
UDPipe	BAR	80.5	67.3	Subword tok. + characters

Acc = accuracy (part-of-speech tags); LAS = labelled attachment score

Overview



Input text sequence goes here

- Human-centric NLP (what tools and why?)
- Modelling non-standard data
- Available dialect data

What NLP tools and why?

Computational linguistics & machine learning research

- Quantitative patterns
- How to learn from sparse + heterogeneous data?

Blokland ea “Language documentation meets language technology” *Septentrio conference series* (2015)

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NLP tools for linguists – also require dialogue between the communities!

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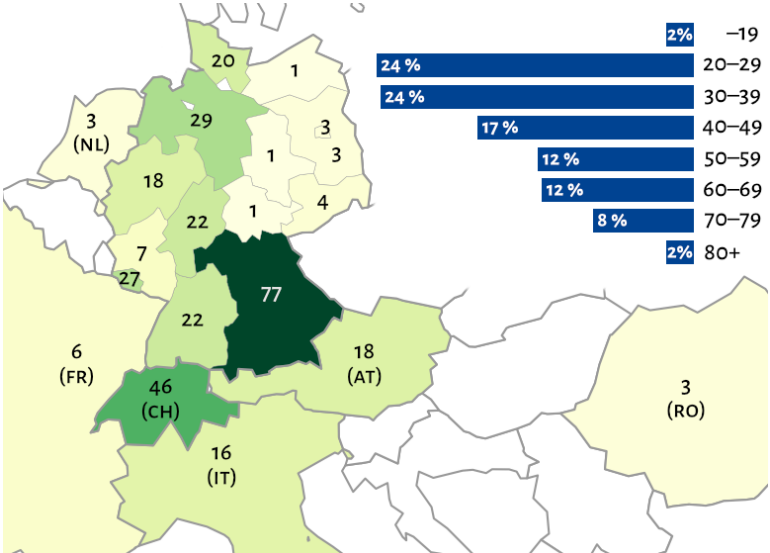
Language technology for dialect speakers

Work under review



Language technology for dialect speakers

Work under review

Self-identified dialect speakers

- How often / in what contexts do people speak/write their dialects?
- What do they think about various language-related technologies for their dialects? (e.g., spellcheckers, machine translation, digital assistants...)

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Results

- Dialect input > dialect output

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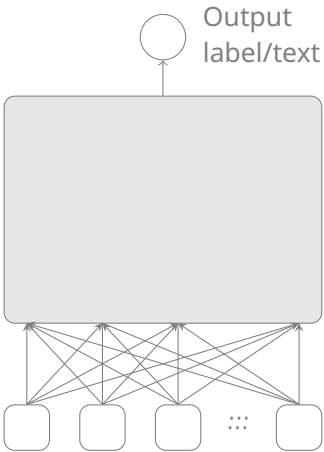
Summary



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- Data availability

! *github.com/mainlp/germanic-lrl-corpora*

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