Karlsruhe Institute of Technology

Machine Translation from Standard German to Alemannic Dialects

SIGUL 2022

Louisa Lambrecht, Felix Schneider, Alexander Waibel

Motivation

Why dialect translation?

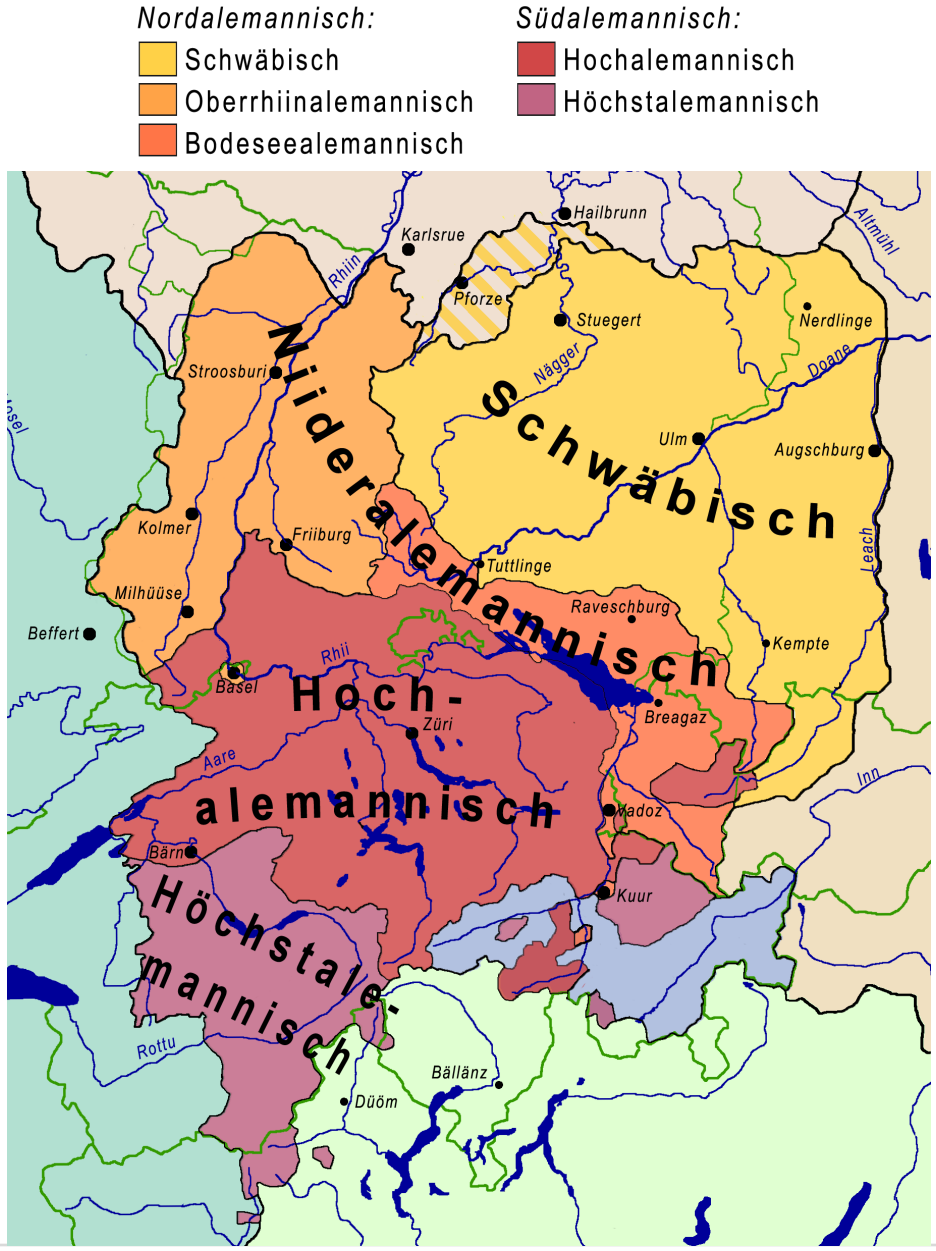
- Many people speak dialect only
- Cultural heritage

Alemannic

Alemannic variants:

- Low Alemannic
  - Upper Rhine Alemannic
  - Lake Constance Alemannic
- High Alemannic
- Highest Alemannic
- Swabian

→ fluent transitions



Louisa Lambrecht, Felix Schneider, Alexander Waibel
Machine Translation from Standard German to Alemannic dialects
Department of Informatics, Interactive Systems Labs (ISL), KIT

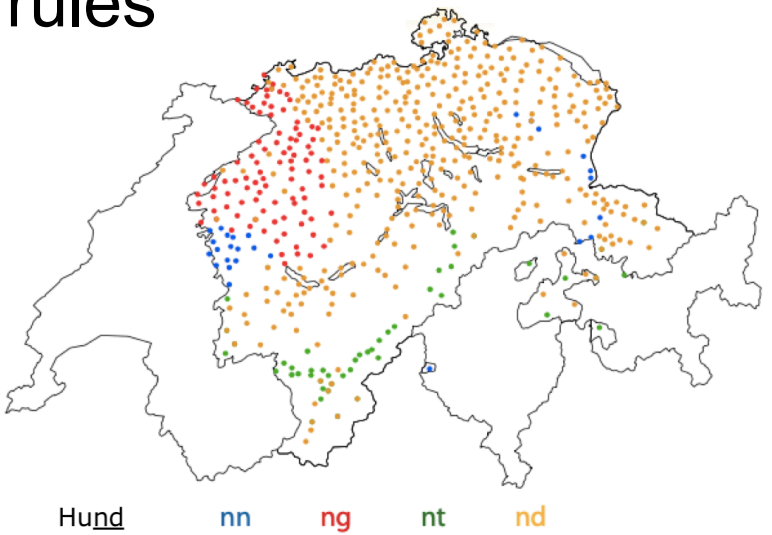
Alemannic

Language characteristics:

- K/ch-line: Sundgau-Bodensee-Schranke (isogloss)
  Kind vs. *Chind* (English: *child*)
- Vocabulary subset not shared with Standard German
  Kartoffel vs. *Erdapfel, Grundbirne, Gummel* (English: *potato*)
- Grammar: passive voice and perfect tense
  er entdeckte vs. *ist von ihm entdeckt worden* (English: *he discovered* vs. *has been discovered by him*)
- Grammar: avoiding genitive
  die Krone der Königin vs. *die Krone von der Königin* (English: *the queen's crown* vs. *the crown of the queen*)

Related Work

- Dialect translation mostly for Arabic
  - normalisation vs. translation
- Swiss German normalisation
- Only one work translating into Alemannic dialects (Scherrer, 2012)
- Rule-based system with handwritten transformation rules
  - phonetic rules
  - word translation rules
  - syntactic rules
- Rules are georeferenced with probability maps



Data: Alemannic Wikipedia

- Parallel and monolingual corpus
- derived from the Alemannic Wikipedia

Data: Alemannic Wikipedia

- Parallel and monolingual corpus
- derived from the Alemannic Wikipedia

- 33,597 articles in the Alemannic Wikipedia (as at June 15, 2021)
- 5,462 articles are tagged with an Alemannic variant
- 29 tags

Data: Alemannic Wikipedia

- Parallel and monolingual corpus
- derived from the Alemannic Wikipedia

- 33,597 articles in the Alemannic Wikipedia (as at June 15, 2021)
- 5,462 articles are tagged with an Alemannic variant
- 29 tags

→ use the dialect tags to split the corpora

Data: Challenges

- High diversity within the dialect

Data: Challenges

- High diversity within the dialect
  - e.g., use of accents
    Wia vìelmols mìt da Dialekta, düen d Üssproch un dr Wortschàtz vum Elsassischa schnall wachsla mìt dr Geographie.

→ normalisation of data

Data: Challenges

- High diversity within the dialect
  - e.g., use of accents
    Wia vìelmols mìt da Dialekta, düen d Üssproch un dr Wortschàtz vum Elsassischa schnall wachsla mìt dr Geographie.

  → normalisation of data

  - e.g., different spellings: *hät, het, hot* (English: *has*)

Data: splitting corpora

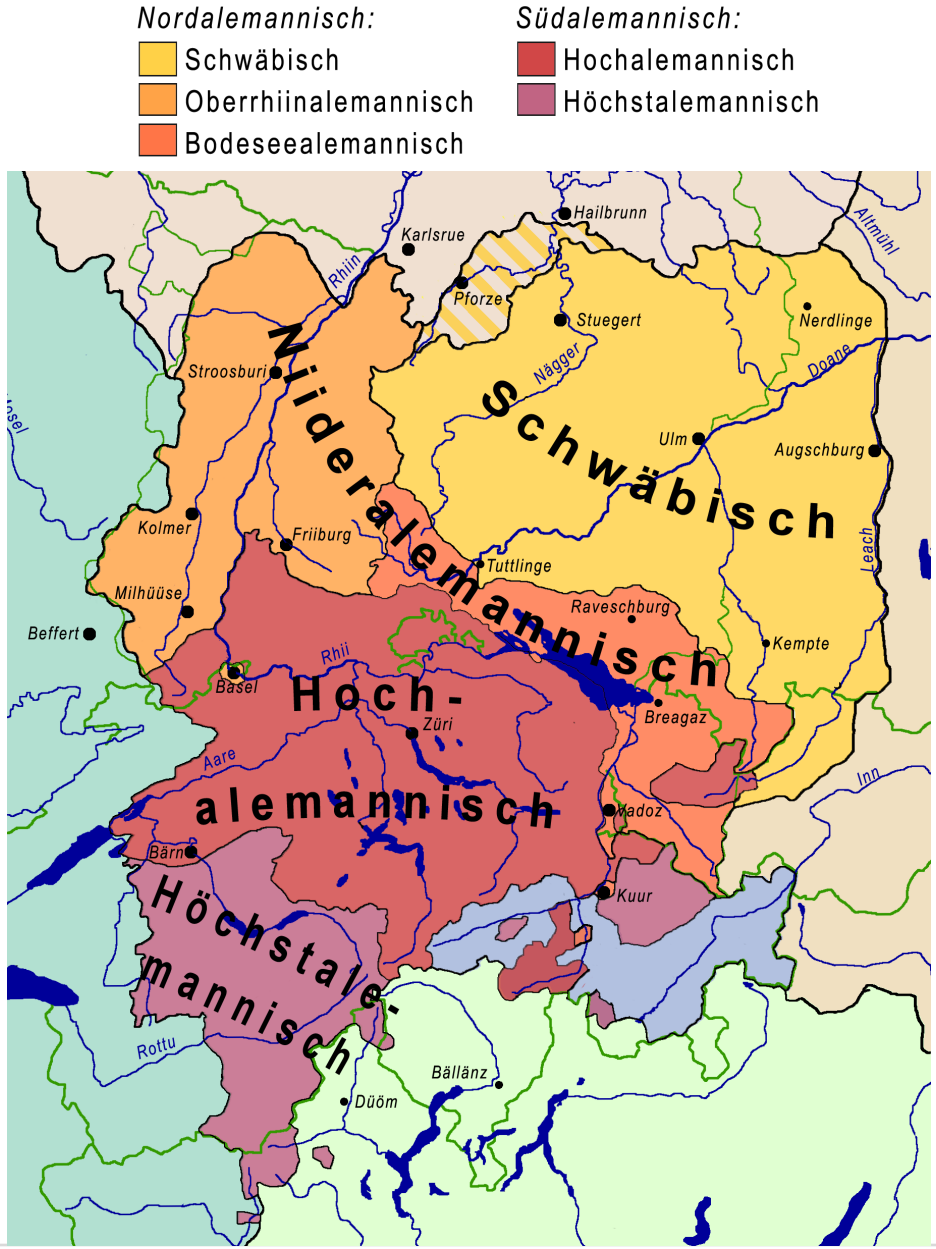
Data: splitting corpora

- Linguistic analysis

Alemannic dialect	gehören
Glarnerdeutsch	gchört
Walserdeutsch	gchöört, ghöört
Alagnadeutsch	
Senslerdeutsch	köört, ghöört, köre
Walliserdeutsch	khöört, kheert
Issimedeutsch	gheerd
Obwaldnerdeutsch	gheerd
Nidwaldnerdeutsch	gheerid
Hochalemannisch	gheert
Schwyzerdeutsch	ghöört
Aargauerdeutsch	ghööred, ghöört, ghört
Elsässisch	ghert, ghere, gheera
Liechtensteinerisch	ghörd, köört, ghört, khöört
Vorarlbergisch	kört, ghört, khört

Data: splitting corpora

- Linguistic analysis
- Categorisation of Alemannic

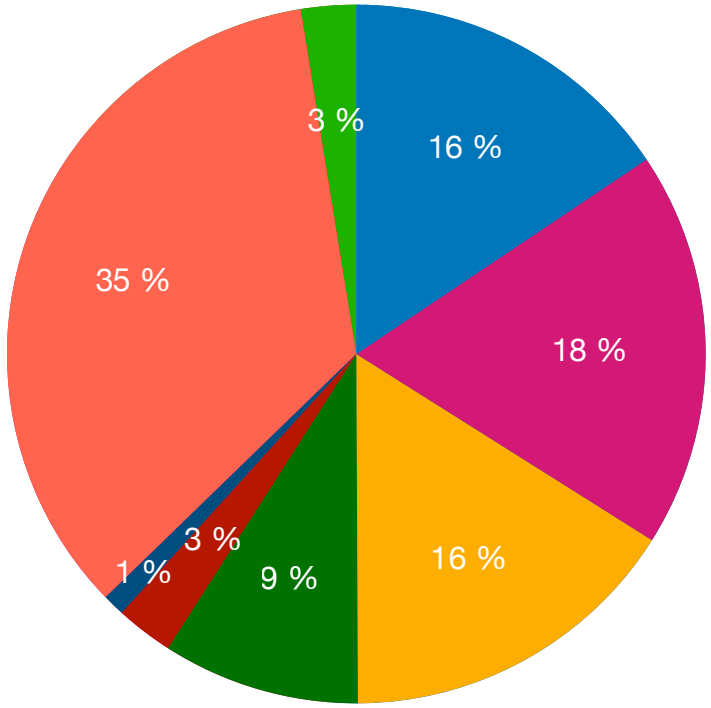


Louisa Lambrecht, Felix Schneider, Alexander Waibel
Machine Translation from Standard German to Alemannic dialects
Department of Informatics, Interactive Systems Labs (ISL), KIT

Data: splitting corpora

- Linguistic analysis
- Categorisation of Alemannic
- Distribution of tagged articles

→ 8 Alemannic dialects



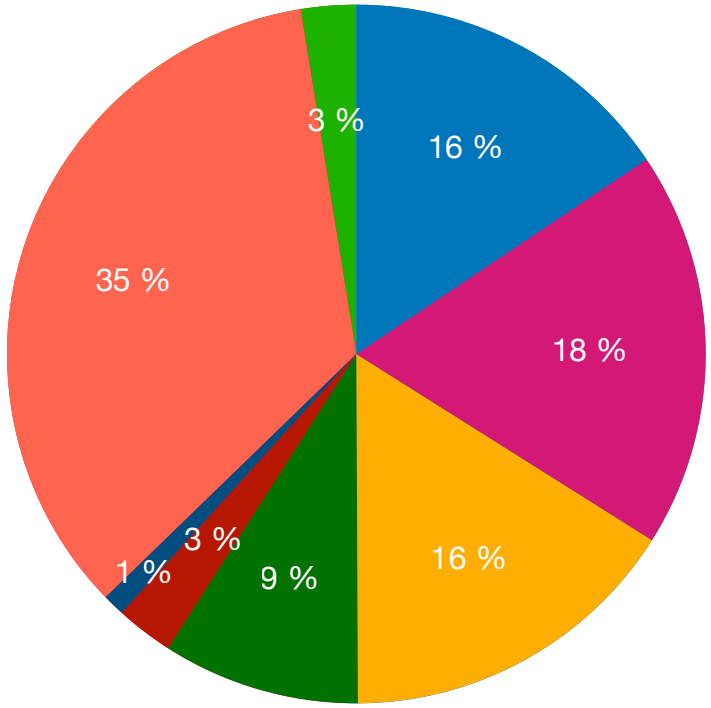
(a) tagged articles

mg bd sw ha na hoe els so

Data: splitting corpora

→ 8 Alemannic dialects

- Margravian (mg)
- Basel German (bd)
- Swabian (sw)
- High Alemannic (ha)
- Low Alemannic (na)
- Highest Alemannic (hoe)
- Alsatian (els)
- others (so)



(a) tagged articles

mg bd sw ha na hoe els so

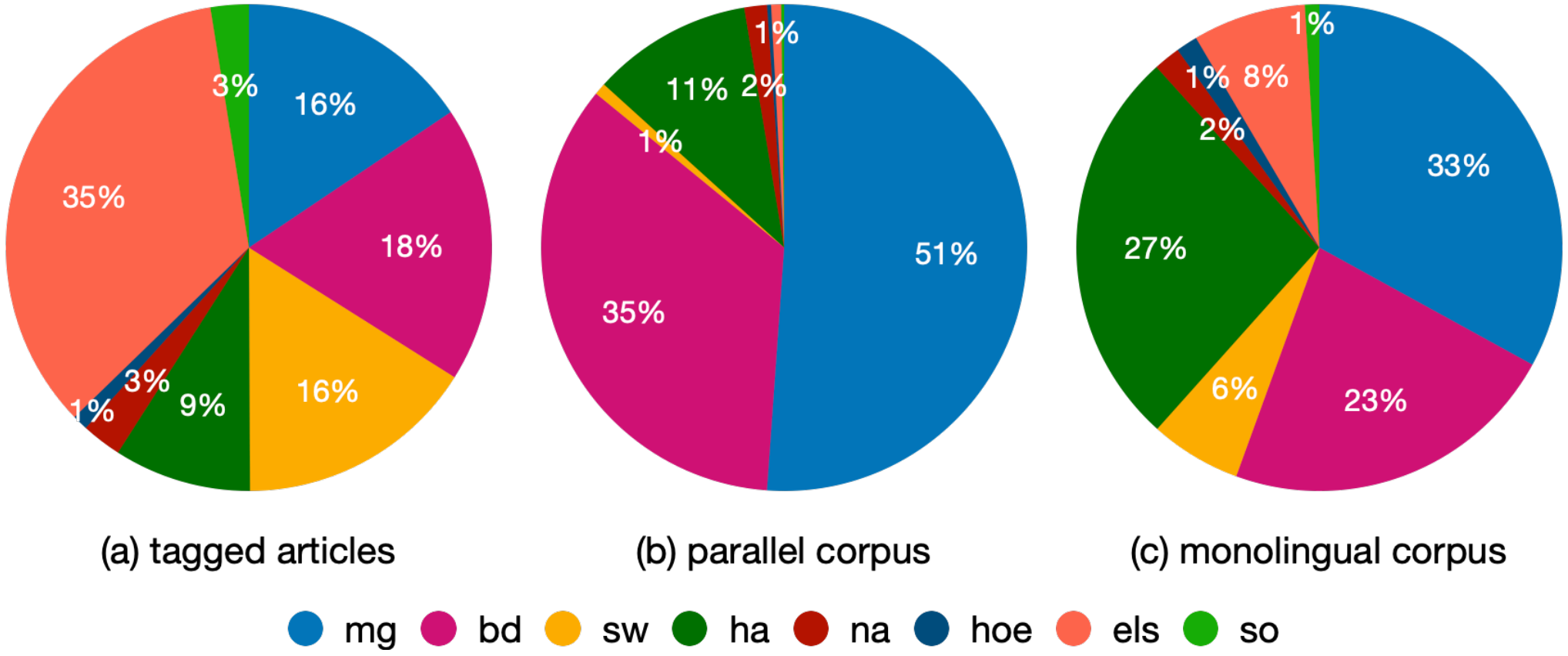
Data: splitting corpora

- Train a classifier to identify the Alemannic dialect in which a Wikipedia article was written
- Divide articles into paragraphs of 6 sentences
- 22,277 data points
- 97.80% accuracy

→ apply to the parallel and monolingual corpus

→ filter monolingual corpus for the parallel

Data: splitting corpora



Louisa Lambrecht, Felix Schneider, Alexander Waibel

Department of Informatics, Interactive Systems Labs (ISL), KIT

Data: back-translation

- Make use of the monolingual corpus
- Train
  - a back-translation model
  - and a German language model (on the German Wikipedia)
- BLEU: 55.31 with the LM weighted at 0.52

Data: back-translation

- Make use of the monolingual corpus
- Train
  - a back-translation model
  - and a German language model (on the German Wikipedia)
- BLEU: 55.31 with the LM weighted at 0.52

Data availability:

- Parallel corpus: 16,438 sentences
- Monolingual corpus: 390,561 sentences

Experiments

Baseline

- 10% test data that reflects the distribution of Alemannic variants
- Transformer architecture
  - default architecture but only 2 attention heads
  - high dropout rates: 0.3, 0.1 (attention), 0.3 (activation), 0.3 (decoder layers)
- BLEU: 37.29

	mg	bd	sw	ha	na	hoe	els	so	**total**
Baseline	43.43	32.80	13.04	28.25	25.06	4.97	27.10	3.80	**37.29**

1. E2e training on back-translated data

- Use back-translated monolingual data
- Transformer model
- 390k sentences instead of 16k

→ mediocre results

1. E2e training on back-translated data

- Use back-translated monolingual data
- Transformer model
- 390k sentences instead of 16k

→ mediocre results

- Fine-tune on the parallel training data

→ strong improvements

2. E2e training for selected Alemannic variants

- Alemannic dialects: Margravian, Basel German, Swabian

2. E2e training for selected Alemannic variants

- Alemannic dialects: Margravian, Basel German, Swabian

- Train a model for each Alemannic variant
- Train on back-translated monolingual data, fine-tune on parallel data
- Evaluation on the dialect-specific test set

2. E2e training for selected Alemannic variants

- Alemannic dialects: Margravian, Basel German, Swabian

- Train a model for each Alemannic variant
- Train on back-translated monolingual data, fine-tune on parallel data
- Evaluation on the dialect-specific test set

- Problem: Swabian test set contains only 15 sentences

3. Multi-dialectal translation

- Use all Alemannic variants except for Low Alemannic, Highest Alemannic and „others“
  → small data sets and heterogenous data

3. Multi-dialectal translation

- Use all Alemannic variants except for Low Alemannic, Highest Alemannic and „others“
  → small data sets and heterogenous data

- Train a multi-lingual transformer
  - one encoder for Standard German input
  - one decoder *each* for the Alemannic variants

3. Multi-dialectal translation

- Use all Alemannic variants except for Low Alemannic, Highest Alemannic and „others“
  → small data sets and heterogenous data

- Train a multi-lingual transformer
  - one encoder for Standard German input
  - one decoder *each* for the Alemannic variants

- Evaluation on the dialect-specific test sets

BLEU scores

	mg	bd	sw	ha	na	hoe	els	so	total
Baseline	**43.43**	**32.80**	**13.04**	28.25	25.06	4.97	27.10	3.80	**37.29**
+back-translation	48.56	38.01	12.85	26.53	23.48	4.62	45.82	5.39	**41.84**
separate dialects (mg)	**50.87**	18.77	10.72	20.89	25.36	4.58	29.17	3.11	35.54
separate dialects (bd)	19.93	**42.95**	13.17	25.17	16.20	4.81	22.05	5.96	29.27
separate dialects (sw)	12.68	10.98	**23.63**	12.08	10.11	6.06	17.00	8.93	12.11
multilingual (mg)	**44.82**	16.68	11.39	19.99	22.73	6.27	29.85	3.16	31.51
multilingual (bd)	18.08	**39.30**	10.44	22.35	13.18	6.55	19.05	5.96	26.57
multilingual (sw)	9.12	8.81	**31.25**	9.50	9.03	4.38	13.85	3.67	9.29

BLEU scores

- Splitting into Alemannic variants shows great improvements

	mg	bd	sw	ha	na	hoe	els	so	total
Baseline	**43.43**	**32.80**	**13.04**	28.25	25.06	4.97	27.10	3.80	**37.29**
+back-translation	48.56	38.01	12.85	26.53	23.48	4.62	45.82	5.39	**41.84**
separate dialects (mg)	**50.87**	18.77	10.72	20.89	25.36	4.58	29.17	3.11	35.54
separate dialects (bd)	19.93	**42.95**	13.17	25.17	16.20	4.81	22.05	5.96	29.27
separate dialects (sw)	12.68	10.98	**23.63**	12.08	10.11	6.06	17.00	8.93	12.11
multilingual (mg)	**44.82**	16.68	11.39	19.99	22.73	6.27	29.85	3.16	31.51
multilingual (bd)	18.08	**39.30**	10.44	22.35	13.18	6.55	19.05	5.96	26.57
multilingual (sw)	9.12	8.81	**31.25**	9.50	9.03	4.38	13.85	3.67	9.29

BLEU scores

- Splitting into Alemannic variants shows great improvements
- E2e training using back-translated data works best for Alemannic as a whole

	mg	bd	sw	ha	na	hoe	els	so	total
Baseline	**43.43**	**32.80**	**13.04**	28.25	25.06	4.97	27.10	3.80	**37.29**
+back-translation	48.56	38.01	12.85	26.53	23.48	4.62	45.82	5.39	**41.84**
separate dialects (mg)	**50.87**	18.77	10.72	20.89	25.36	4.58	29.17	3.11	35.54
separate dialects (bd)	19.93	**42.95**	13.17	25.17	16.20	4.81	22.05	5.96	29.27
separate dialects (sw)	12.68	10.98	**23.63**	12.08	10.11	6.06	17.00	8.93	12.11
multilingual (mg)	**44.82**	16.68	11.39	19.99	22.73	6.27	29.85	3.16	31.51
multilingual (bd)	18.08	**39.30**	10.44	22.35	13.18	6.55	19.05	5.96	26.57
multilingual (sw)	9.12	8.81	**31.25**	9.50	9.03	4.38	13.85	3.67	9.29

BLEU scores

- Splitting into Alemannic variants shows great improvements
- E2e training using back-translated data works best for Alemannic as a whole
- Several test sets are too small to produce reliable results (sw, na, hoe, els, so)

	mg	bd	sw	ha	na	hoe	els	so	total
Baseline	**43.43**	**32.80**	**13.04**	28.25	25.06	4.97	27.10	3.80	**37.29**
+back-translation	48.56	38.01	12.85	26.53	23.48	4.62	45.82	5.39	**41.84**
separate dialects (mg)	**50.87**	18.77	10.72	20.89	25.36	4.58	29.17	3.11	35.54
separate dialects (bd)	19.93	**42.95**	13.17	25.17	16.20	4.81	22.05	5.96	29.27
separate dialects (sw)	12.68	10.98	**23.63**	12.08	10.11	6.06	17.00	8.93	12.11
multilingual (mg)	**44.82**	16.68	11.39	19.99	22.73	6.27	29.85	3.16	31.51
multilingual (bd)	18.08	**39.30**	10.44	22.35	13.18	6.55	19.05	5.96	26.57
multilingual (sw)	9.12	8.81	**31.25**	9.50	9.03	4.38	13.85	3.67	9.29

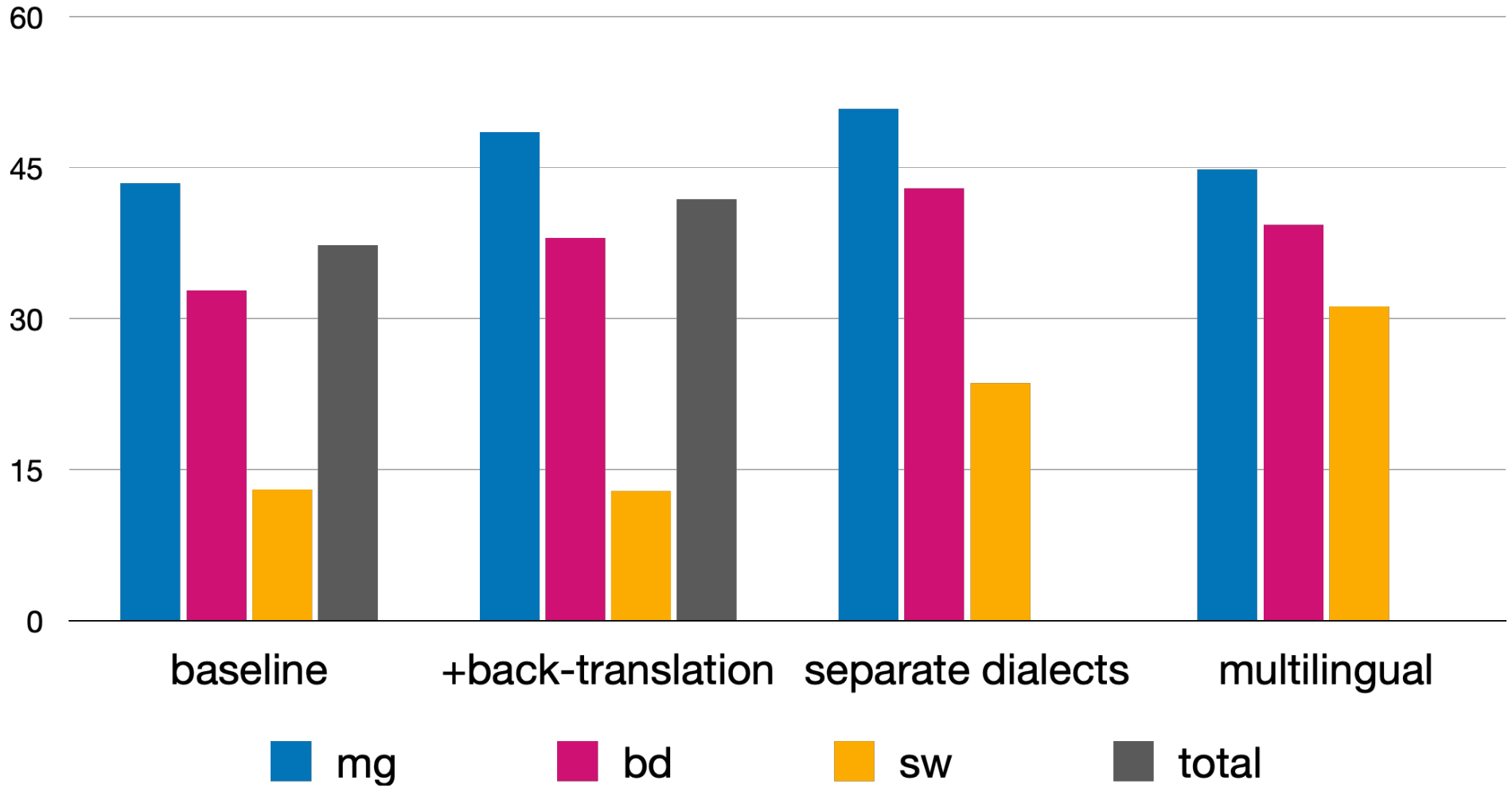
Differentiating Alemannic variants

Target (mg):
S ältst bekannt Dokumänt, wo Aiche als Ort gnännt wird, chunnt uss em Johr 1275. Dört, wo hütt di ehemoligi Gmeind isch, hät mer scho 1160 e Kapälle dokumentiert.

Hypothesis (mg):
S eltscht bekannt Dokumänt, wu Aiche as Ort gnännt, stammt us em Johr 1275. E Kapelle im Biet vum hitige Ort isch scho 1160 dokumäntiert wore.

Hypothesis (sw):
S eldeschde bekannde Dokument, wo Aiche als Ort zom erschte Mol gnennt, stammt us-em Johr 1275 em Gebiet vom heidiga Ort isch scho 1160 dokumentlicht worra.

Conclusion


60
45
30
15
0
baseline
+back-translation
separate dialects
multilingual
mg
bd
sw
total

Outlook

- Data preprocessing to remove spelling inconsistencies
  - e.g., Swiss-German dictionary of variations in speech and writing
  - e.g., word alignments and choosing the most frequent spelling
- Train the multi-dialectal model longer
- Use the German version of BERT/RoBERTa, i.e., GottBERT, for transfer learning
- Integrate speech data

Thank you!