CoNLL-SIGMORPHON Shared Task 2018

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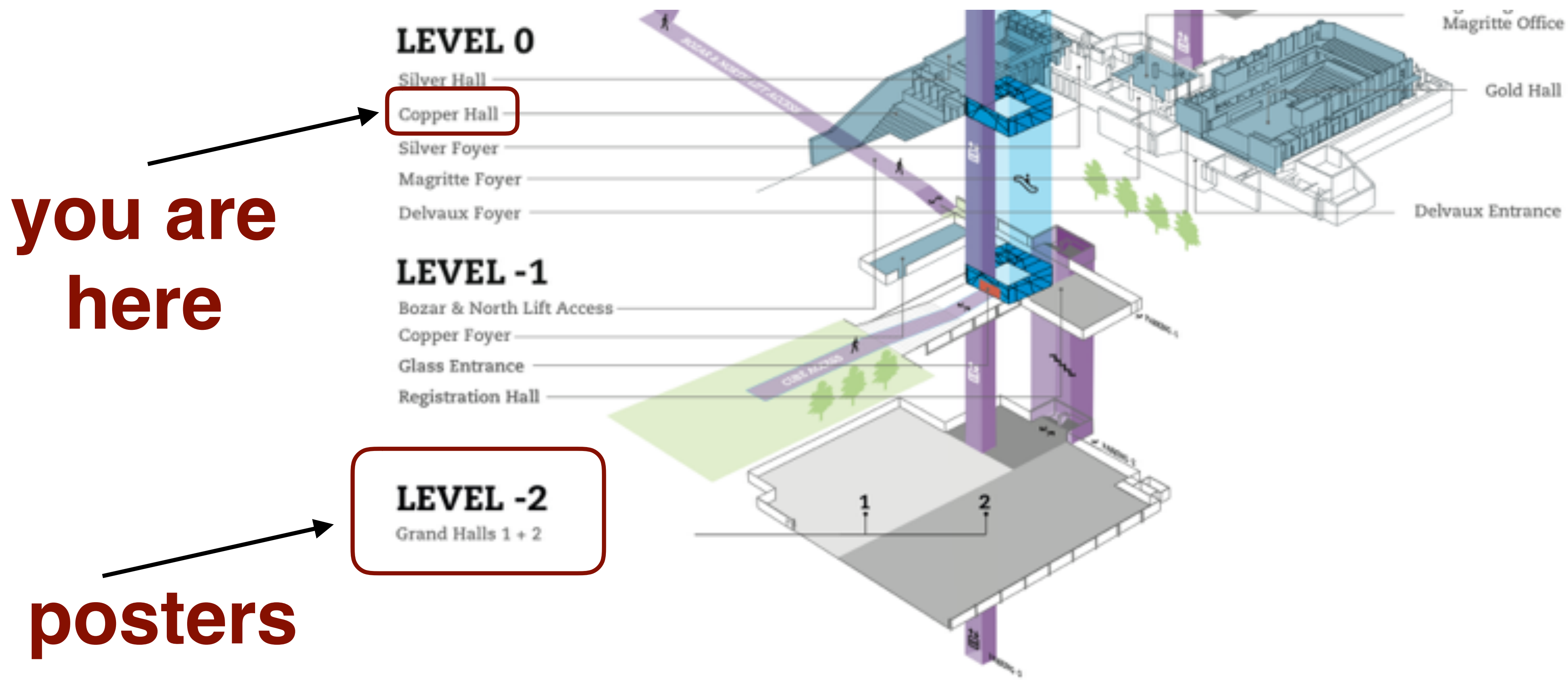
Poster session 11.30-12.30

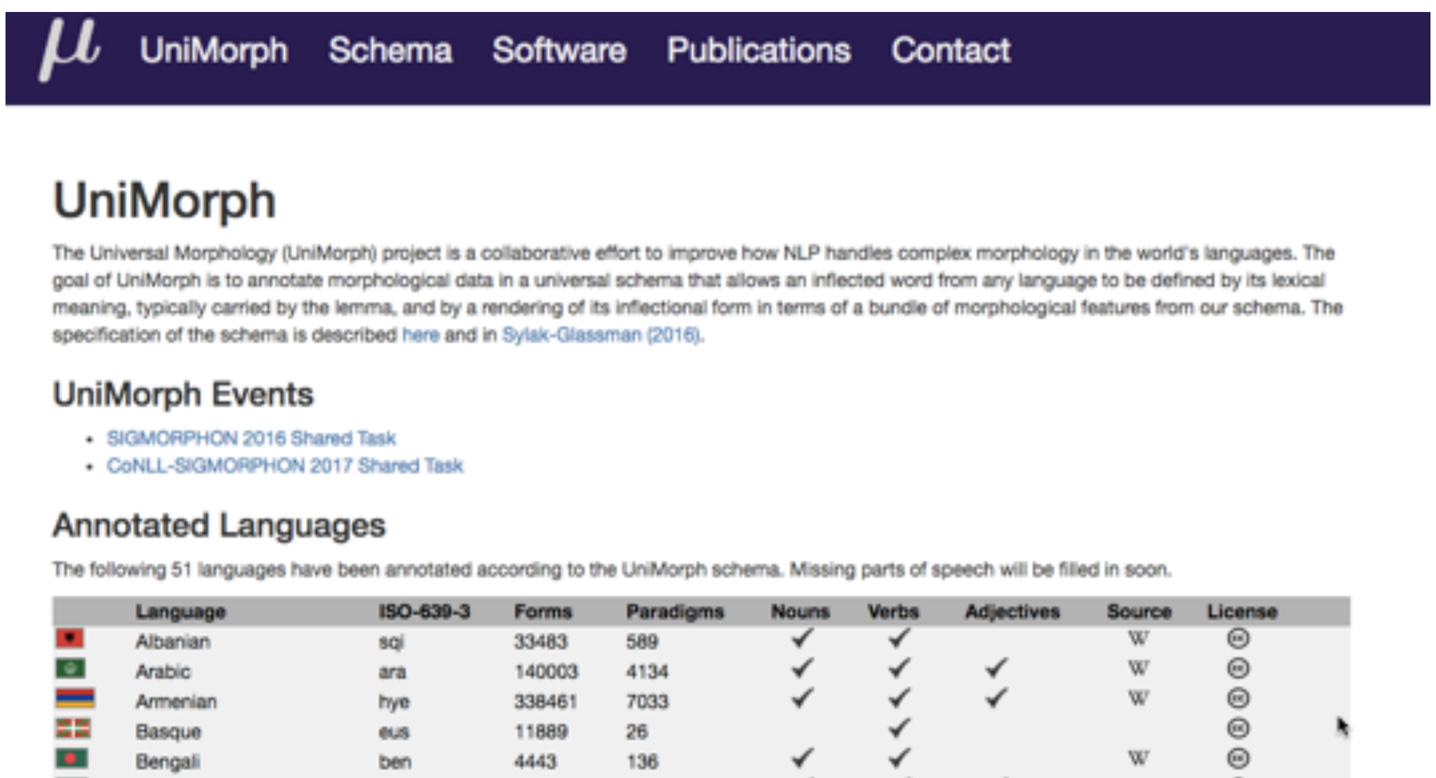
- In Grand Hall (level -2)
- All system papers presented



Get Involved with UniMorph!

- SIGMORPHON's shared tasks over the last three years are part of a larger community effort

- Visit https://unimorph.github.io/ and sign up!


UniMorph Schema Software Publications Contact

UniMorph

The Universal Morphology (UniMorph) project is a collaborative effort to improve how NLP handles complex morphology in the world's languages. The goal of UniMorph is to annotate morphological data in a universal schema that allows an inflected word from any language to be defined by its lexical meaning, typically carried by the lemma, and by a rendering of its inflectional form in terms of a bundle of morphological features from our schema. The specification of the schema is described here and in Sylak-Glassman (2016).

UniMorph Events

- SIGMORPHON 2016 Shared Task
- CoNLL-SIGMORPHON 2017 Shared Task

Annotated Languages

The following 51 languages have been annotated according to the UniMorph schema. Missing parts of speech will be filled in soon.

	Language	ISO-639-3	Forms	Paradigms	Nouns	Verbs	Adjectives	Source	License
	Albanian	sqi	33483	589	✓	✓		W	
	Arabic	ara	140003	4134	✓	✓	✓	W	
	Armenian	hye	338461	7033	✓	✓	✓	W	
	Basque	eus	11889	26		✓			
	Bengali	ben	4443	136	✓	✓		W	

Shared task

Shared task

- Second CoNLL shared task on supervised learning of (inflectional) morphology

Shared task

- Second CoNLL shared task on supervised learning of (inflectional) morphology
- featuring …

Shared task

- Second CoNLL shared task on supervised learning of (inflectional) morphology
- featuring …
    - **2** tasks

Shared task

- Second CoNLL shared task on supervised learning of (inflectional) morphology

- featuring …

  - **2** tasks

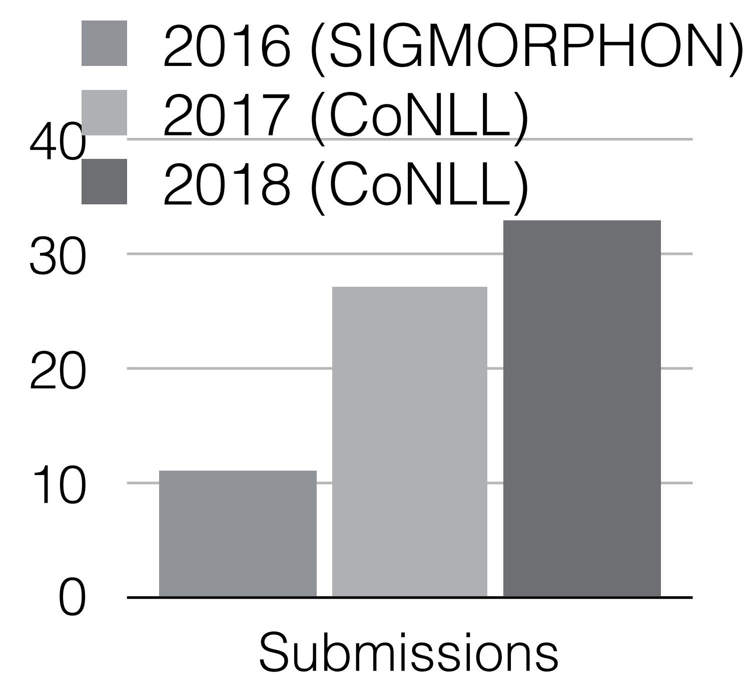
  - **103** languages (task 1); **7** languages (task 2)

Shared task

- Second CoNLL shared task on supervised learning of (inflectional) morphology
- featuring …
    - **2** tasks
    - **103** languages (task 1); **7** languages (task 2)
    - **33** systems submitted, **15** teams, **17** institutions

Shared task

- Second CoNLL shared task on supervised learning of (inflectional) morphology
- featuring …
  - **2** tasks
  - **103** languages (task 1); **7** languages (task 2)
  - **33** systems submitted, **15** teams, **17** institutions



Shared task

Outline

- Overview [**MH**]
- Task 1 Description [**MH**]
- Task 1 Language Data & Results [**CK**]
- Task 2 Description, Data & Results [**MS**]

Shared tasks

Shared tasks

- 1 **Inflection** (generation)

Shared tasks

- 1 **Inflection** (generation)

inflect this lemma

hate; V;V.PTCP;PRS → hating

Shared tasks

- 1 **Inflection** (generation)

inflect this lemma

hate; V;V.PTCP;PRS → hating

- 2 **Cloze Task** (new!) - inflect word in *context*

Shared tasks

- 1 **Inflection** (generation)

inflect this lemma

hate; V;V.PTCP;PRS → hating

- 2 **Cloze Task** (new!) - inflect word in *context*

inflect this lemma in context

The	___	are	barking
the/DT	dog	be/AUX+PRES+3PL	bark/V+V.PTCP

Task 1: Inflection

Sub-task 1(inflection)

train

lemma MSD (features) → word form

test

Sub-task 1(inflection)

train

lemma	MSD (features)	word form
run		

test

Sub-task 1(inflection)

train

lemma | MSD (features) | word form

run

test

Sub-task 1(inflection)

train

lemma	MSD (features)	word form
run	V;PST	ran

test

Sub-task 1(inflection)

train

lemma	MSD (features)	word form
run	V;PST	ran
love	V;V.PTCP;PRS	loving
eat	V;PST	ate

...

test

Sub-task 1(inflection)

train

lemma	MSD (features)	word form
run	V;PST	ran
love	V;V.PTCP;PRS	loving
eat	V;PST	ate

...

test

lemma	MSD (features)	word form
hate	V;V.PTCP;PRS	?

Sub-task 1(inflection)

train

lemma	MSD (features)	word form
run	V;PST	ran
love	V;V.PTCP;PRS	loving
eat	V;PST	ate
	…	

test

hate	V;V.PTCP;PRS	?
read	V;PST	?

Sub-task 1(inflection)

train

lemma	MSD (features)	word form
run	V;PST	ran
love	V;V.PTCP;PRS	loving
eat	V;PST	ate

...

test

lemma	MSD (features)	word form
hate	V;V.PTCP;PRS	hating
read	V;PST	read

Training data

Conjugation [edit]

conjugation of schreiben [hide ▲]

infinitive	schreiben				
present participle	schreibend				
past participle	geschrieben				
auxiliary	haben				
	indicative			**subjunctive**	
present	ich schreibe	wir **schreiben**	**i**	ich schreibe	wir **schreiben**
	du schreibst	ihr schreibt		du schreibest	ihr schreibet
	er schreibt	sie **schreiben**		er schreibe	sie **schreiben**
preterite	ich schrieb	wir schrieben	**ii**	ich schriebe	wir schrieben
	du schriebst	ihr schriebt		du schriebest	ihr schriebet
	er schrieb	sie schrieben		er schriebe	sie schrieben
imperative	schreib (du) schreibe (du)	schreibt (ihr)			

composed forms of schreiben [show ▼]

Training data

Conjugation [edit]

conjugation of schreiben [hide ▲]

infinitive					
present participle	schreibend				
past participle					
auxiliary	haben				
	indicative			**subjunctive**	
present	ich schreibe	wir **schreiben**	**i**		wir **schreiben**
					ihr schreibet
				er schreibe	
preterite		wir schrieben	**ii**	ich schriebe	wir schrieben
imperative	schreib (du)				

composed forms of schreiben [show ▼]

Wiktionary
the free dictionary

Training data

Conjugation [edit]

conjugation of schreiben [hide ▲]

infinitive					
present participle	schreibend				
past participle					
auxiliary	haben				
	indicative			subjunctive	
present	ich schreibe	wir schreiben	i		wir schreiben
					ihr schreibet
				er schreibe	
preterite		wir schrieben	ii	ich schriebe	wir schrieben
imperative	schreib (du)				

composed forms of schreiben [show ▼]

schreiben V;SBJV;PRS;1:PL

Wiktionary
the free dictionary

Rule-based baseline (Task 1)

- Simple prefix/suffix transformation based method
- Designed to run fast and be (somewhat) linguistically informed
- By design hard to beat in low data condition (top in 5 languages)

Baseline example

	lemma	infl. form	features
train	schielen	geschielt	V.PTCP;PST

Baseline example

	lemma	**infl. form**	**features**
train	schielen	geschielt	V.PTCP;PST

align (MED)

```
  schielen
geschielt
```

Baseline example

	lemma	**infl. form**	**features**
train	schielen	geschielt	V.PTCP;PST

align (MED)

```
  schielen
geschielt
```

Baseline example

	lemma	infl. form	features
train	schielen	geschielt	V.PTCP;PST

	Pr	Stem	Suffix
align (MED)		`schiel`	`en`
	`ge`	`schiel`	`t`

suffix-transformation rules V.PTCP;PST

Baseline example

	lemma	infl. form	features
train	schielen	geschielt	V.PTCP;PST

align (MED)

	Pr	Stem	Suffix
		schiel	en
	ge	schiel	t

suffix-transformation rules V.PTCP;PST

```
n$ → $                     en$ → t$
len$ → lt$                 elen$ → elt$
ielen$ → ielt$             hielen$ → hielt$
chielen$ → chielt$         schielen$ → schielt$
```

Baseline example

	lemma	**infl. form**	**features**
train	schielen	geschielt	V.PTCP;PST

	Pr	**Stem**	**Suffix**
align (MED)		schiel	en
	ge	schiel	t

prefix-transformation rules V.PTCP;PST

`$ → $ge`

Baseline example

	lemma	infl. form	features
test	kaufen	???	V.PTCP;PST

Baseline example

	lemma	**infl. form**	**features**
test	kaufen	???	V.PTCP;PST

suffix-transformation rules V.PTCP;PST

```
n$ → $                    en$ → t$
len$ → lt$                elen$ → elt$
ielen$ → ielt$            hielen$ → hielt$
chielen$ → chielt$        schielen$ → schielt$
```

Baseline example

	lemma	infl. form	features
test	kaufen	???	V.PTCP;PST

kaufen → kauft

longest match to lemma

suffix-transformation rules V.PTCP;PST

```
n$ → $                  en$ → t$
len$ → lt$              elen$ → elt$
ielen$ → ielt$          hielen$ → hielt$
chielen$ → chielt$      schielen$ → schielt$
```

Baseline example

	lemma	infl. form	features
test	kaufen	???	V.PTCP;PST

kaufen → (suffix) kauft

prefix-transformation rules V.PTCP;PST

$ → $ge

Baseline example

	lemma	**infl. form**	**features**
test	kaufen	???	V.PTCP;PST

kaufen → (suffix) → kauft

most frequent for V.PTCP;PST

prefix-transformation rules V.PTCP;PST

`$ → $ge`

Baseline example

	lemma	infl. form	features
test	kaufen	gekauft	V.PTCP;PST

kaufen → (suffix) → kauft → (prefix) → gekauft

prefix-transformation rules V.PTCP;PST

`$ → $ge`

Task 1 Data

Task 1 Data Overview

- Inflectional (N, V, ADJ) paradigms from **103** languages
- **93** Development Languages, **10** Surprise Languages
- **~20** linguistic stocks represented

Athabaskan	Isolate	Kartvelian	Quechuan	Semitic	Sino-Tibetan	Turkic	Uralic
Navajo	Basque	Georgian	Quechua	Arabic	Khaling	Turkish	Estonian
	Haida			Hebrew			Finnish
							Hungarian
							Northern Sami

Morphological Processes

- Differing affixation patterns:
  - **Prefixing**: Navajo
  - **Suffixing**: Quechua, Turkish
  - **Circumfixing, Stem-changing**: Georgian, Spanish
- Non-Local Patterns:
  - **Templatic**: Arabic, Hebrew
  - **Vowel Harmony**: Turkish, Finnish, Hungarian
  - **Consonant Harmony**: Navajo

Data Sources

- Wiktionary (www.wiktionary.org): 98 languages
- Alexina Project: 3 languages (Khaling, Kurmanji and Sorani Kurdish)
- Alegria et al. 2009: Basque
- Prof. Jordan Lachler (Univ. of Alberta): Haida

Annotation

- All data sources normalized into triples (lemma, inflection, features):

Lemma	Inflection	Tag
achį’	iichį’	V;REAL;1;DU,PROG
achį’	da’iichį’	V;REAL;1;PL,PROG
achį’	ashchį’	V;REAL;1;SG,PROG
…	…	…

- Simple UTF-8 tab-delimited text format
- All data presented using native orthography
- Tags follow the UniMorph Schema

UniMorph Schema

- UniMorph Schema provides tags for minimal units of meaning for inflectional morphology
  - Developed at Johns Hopkins University based on linguistic typology research that takes into account even extremely low resource languages
  - 25 dimensions of meaning (aka morphological categories) with over 300 feature values
  - Feature values (e.g. PRS = present tense) are string-unique, i.e. do not need type to be specified; both PRS and tense=PRS are equally valid.
- User guide and machine-readable JSON specification available at unimorph.github.io
- Actively maintained with process for making modifications according to community feedback

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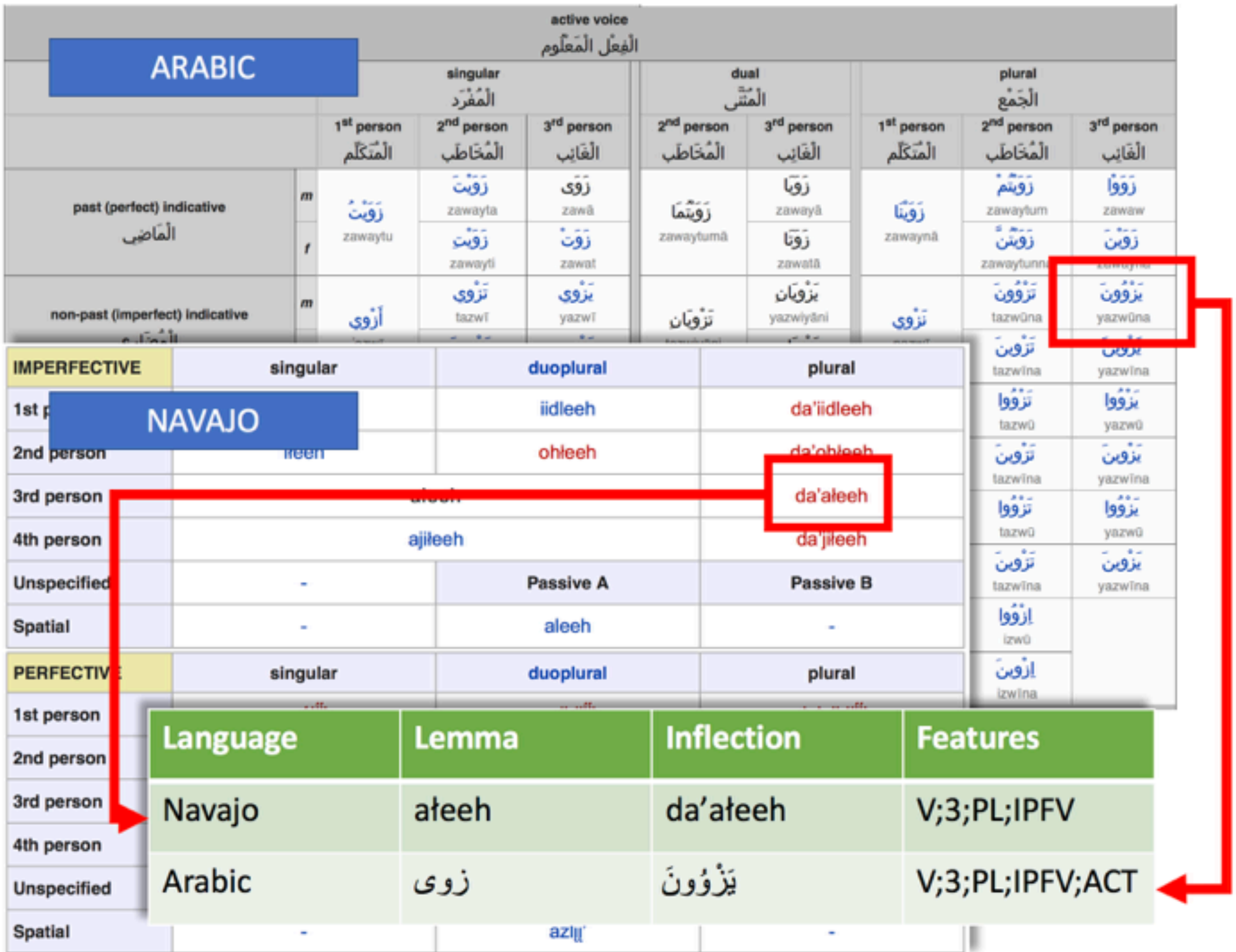
Wiktionary Collection



Language	Lemma	Inflection	Features
Navajo	ałeeh	da'ałeeh	V;3;PL;IPFV
Arabic	زوى	يَزْوُونَ	V;3;PL;IPFV;ACT

Wiktionary Collection

- Each language only has **~2-3** relevant table types per POS, shared across **thousands** of unique lemmas
- In practice, humans can manually annotate a few sample tables, and extrapolate the rest (e.g. **hablo → 1;SG;PRS**)
- Tagging accuracy verified by experts familiar with each language family.

	singular			plural		
	1st person	2nd person	3rd person	1st person	2nd person	3rd person
	yo	tú vos	él/ella usted	nosotros nosotras	vosotros vosotras	ellos/ellas ustedes
present	hablo	hablas (tú) hablás (vos)	habla	hablamos	habláis	hablan
imperfect	hablaba	hablabas	hablaba	hablábamos	hablabais	hablaban

Descriptors			*Unimorph*
singular	4+	→	SG
plural	4+	→	PL
present	4+	→	V;PRS
Imperfect	4+	→	V;IPFV;PST
......			

Inflected forms (Data)	
hablaba	2
hablo	1
hablas	1
hablás	1
habla	1
......	

Annotation Process

- Manually edited html paradigm templates using UniMorph Schema
  - ~300 inflection tags, designed for high typological coverage

	singular	plural
nominative	ле́мма	ле́ммы
genitive	ле́ммы	ле́мм
dative	ле́мме	ле́ммам
accusative	ле́мму	ле́ммы
instrumental	ле́ммой	ле́ммами
prepositional	ле́мме	ле́ммах

	singular	plural
nominative	N;NOM;SG	N;NOM;PL
genitive	N;GEN;SG	N;GEN;PL
dative	N;DAT;SG	N;DAT;PL
accusative	N;ACC;SG	N;ACC;PL
instrumental	N;INS;SG	N;INS;PL
prepositional	N;ESS;SG	N;ESS;PL

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Wiktionary Collection

- Parses available at unimorph.github.io

Annotated Languages

The following 51 languages have been annotated according to the UniMorph schema. Missing parts of speech will be filled in soon.

Language	ISO-639-3	Forms	Paradigms	Nouns	Verbs	Adjectives	Source	License
Albanian	sqi	33483	589	✓	✓		W	cc
Download Data: repo **Report Errors:** issues	**2016 Shared Task Splits:** no **2017 Shared Task Splits:** yes			**Typology:** fusional **Templatic:** no		**Info:** wikipedia **Type:** living		
Arabic	ara	140003	4134	✓	✓	✓	W	cc
Armenian	hye	338461	7033	✓	✓	✓	W	cc
Basque	eus	11889	26		✓			cc
Bengali	ben	4443	136	✓	✓		W	cc
Bulgarian	bul	55730	2468	✓	✓	✓	W	cc
Catalan	cat	81576	1547		✓		W	cc
Central Kurdish	ckb	22990	274	✓	✓	✓		cc
Czech	ces	134527	5125	✓	✓	✓	W	cc
Danish	dan	25503	3193	✓	✓		W	cc
Dutch	nld	55467	4993		✓	✓	W	cc
English	eng	115523	22765		✓		W	cc
Estonian	est	38215	886	✓	✓		W	cc

Data Sampling

- Constructed MLE probability distributions for over data triples (*lemma*, *infl_form*, *infl_fts*) by counting tokens of inflected forms in Feb. 2017 Wikipedia dump for each language
- Estimated a smooth unigram distribution over triples using this method: *Cotterell et al. 2018. Unsupervised disambiguation of syncretism in inflected lexicons. NAACL.*
- Sampled 12000 triples without replacement from this distribution
- From those triples, sampled all train, dev, and test data
- Train, dev, test split data available at: https://github.com/sigmorphon/conll2018

Data Quantities

- *Task 1 training*: 10,000 (high), 1,000 (medium), 100 (low) forms
- *Test & Dev*: 1,000 forms each in Task 1
- 40 languages had fewer forms in one or more condition due to data constraints. E.g.: Haida, Bengali, Scottish Gaelic, Basque, Middle High German, Middle Low German, Mapudungun, …
- Detailed explanation of data contents available in paper

Participation Results Task 1

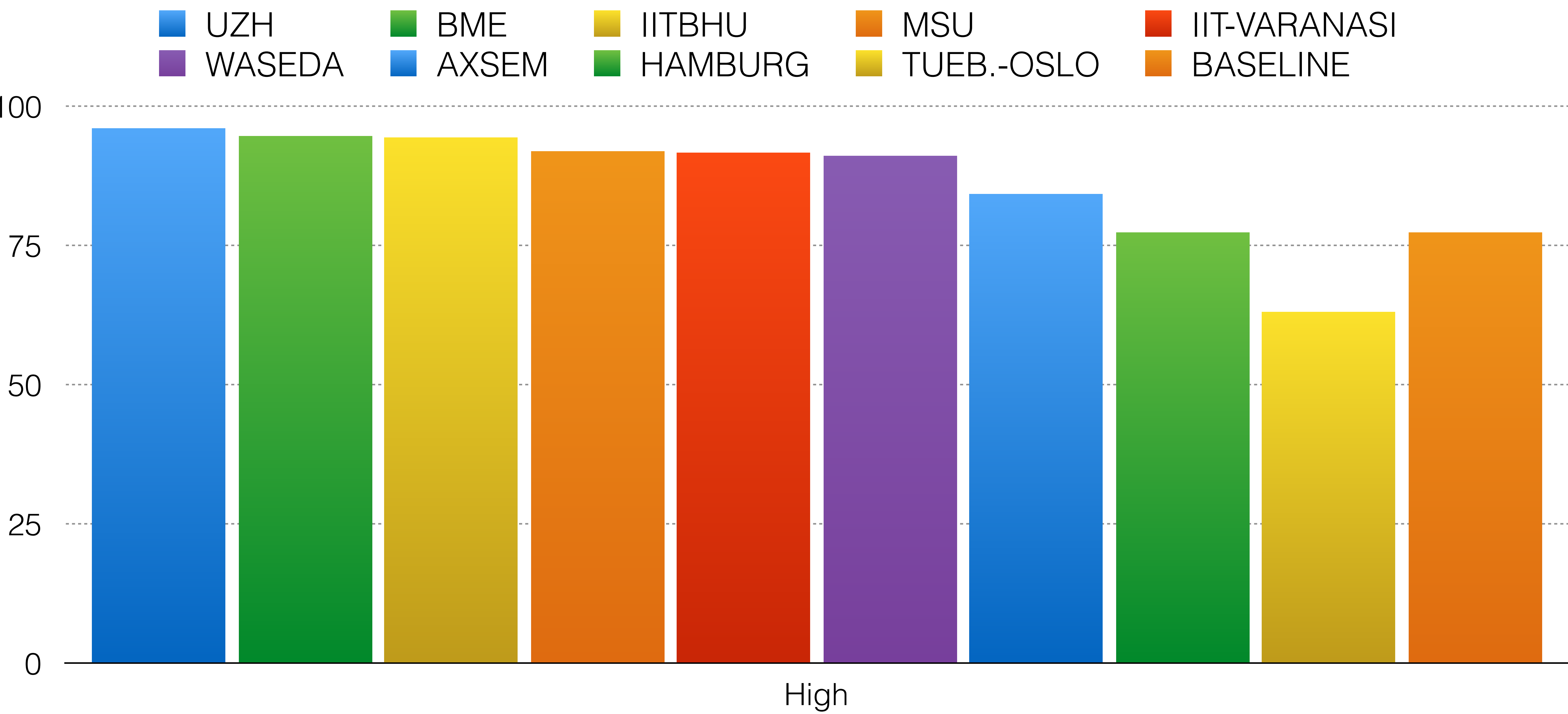
General Participation Statistics

- **15** individual teams competed
- **17** universities and institutes
- **33** individual systems
- **40** authors in total
- (A whole lot of morphology)

Team Overview

Team	Institute(s)
AXSEMANTICS[1]	AX Semantics
BME[1]/BME-HAS[2]	Budapest University of Technology and Economics / Hungarian Academy of Sciences
COPENHAGEN[2]	University of Copenhagen
CUBoulder[2]	University of Colorado, Boulder
HAMBURG[1]	Universität Hamburg
IITBHU[1]	IIT (BHU) Varanasi / IIIT Hyderabad
IIT-VARANASI[1]	Indian Institute of Technology (BHU) Varanasi
KUCST[1]	University of Copenhagen, Centre for Language Technology
MSU[1]	Moscow State University
NYU[2]	New York University
RACAI[1]	Romanian Academy
TUEBINGEN-OSLO[1]	University of Oslo / University of Tübingen
UA[1]	University of Alberta
UZH[1,2]	University of Zurich
WASEDA[1]	Waseda University

Task 1 Results: High



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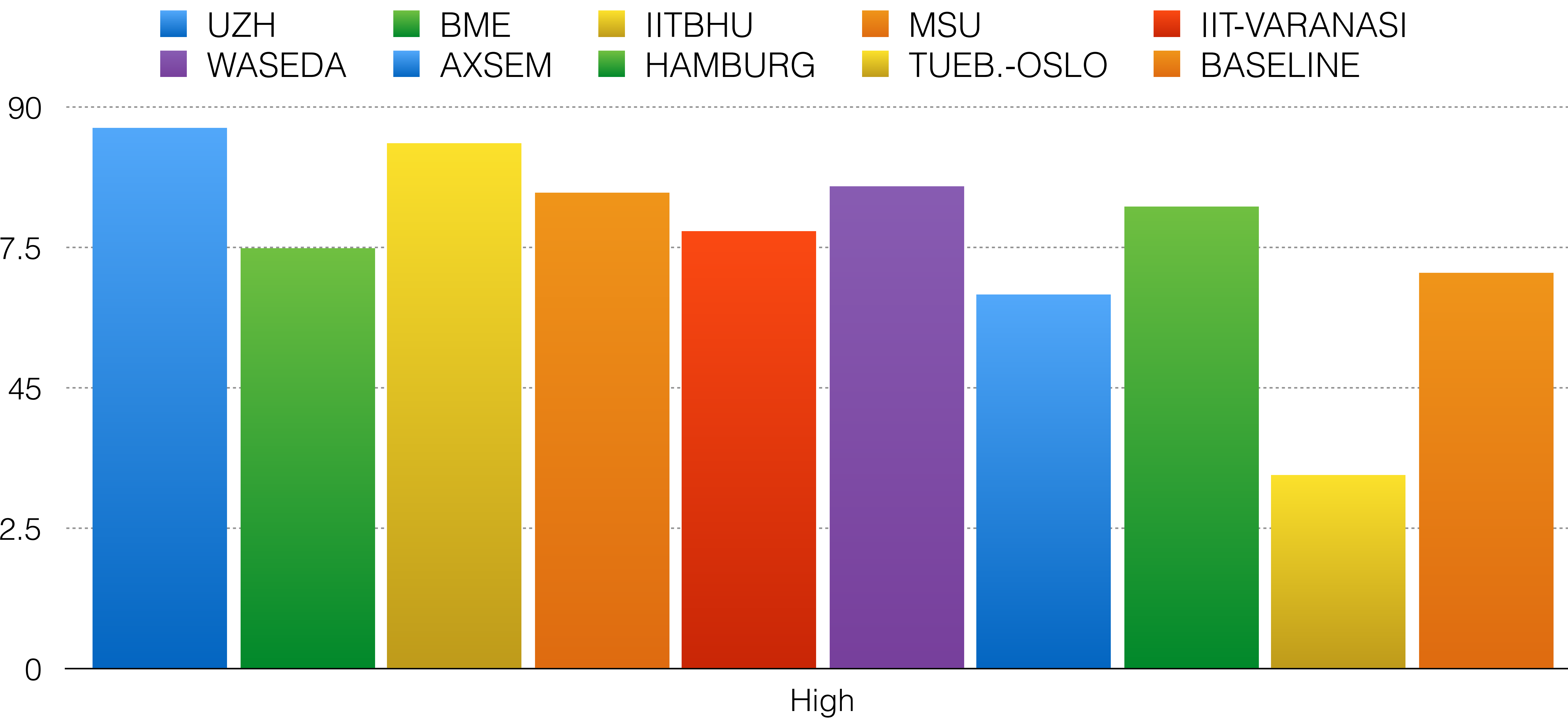
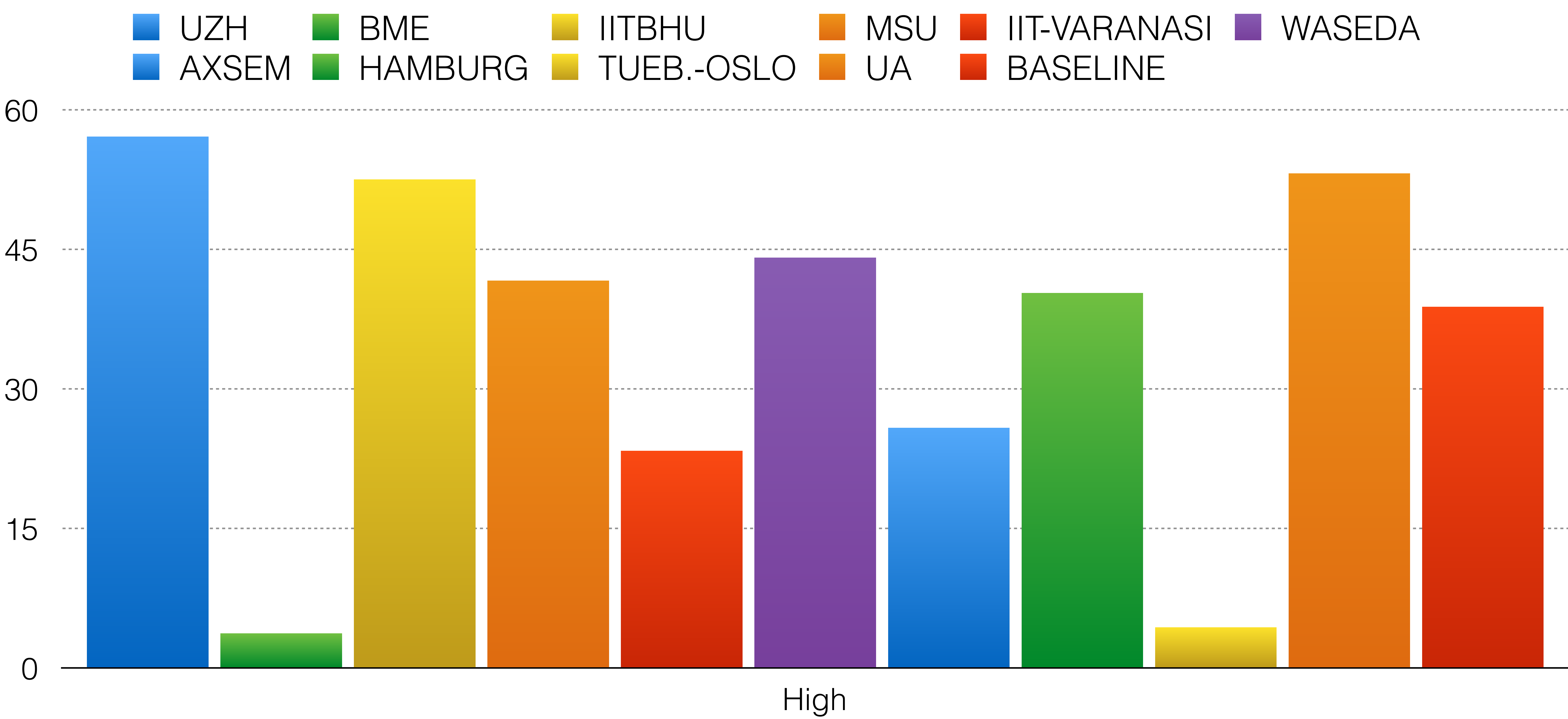
Task 1 Results: Medium



Task 1 Results: Low



Innovations for Task 1

- **41** languages (out of **52** in 2017) improved in low-resource setting vs. 2017
- Best results, especially in the low/medium data, conditions were achieved using the following strategies:
  - Generating sequences of edit operations instead of standard str2str transduction (AX SEMANTICS, UZH, HAMBURG, MSU, RACAI)
  - Augmenting the available training data with artificial data (TUEBINGEN-OSLO, WASEDA)
- Detailed description papers in CoNLL proceedings!

Task 2: Inflection in Context

Task 2: Inflection in Context

"The cloze test"

Task 2 Description

TRACK 1:

The	___	are	barking
the/DT	dog	be/AUX+PRES+3PL	bark/V+V.PTCP

Task 2 Description

TRACK 1:

The	**dogs**	are	barking
the/DT	dog	be/AUX+PRES+3PL	bark/V+V.PTCP

Task 2 Description

TRACK 1:

The	**dogs**	are	barking
the/DT	dog	be/AUX+PRES+3PL	bark/V+V.PTCP

TRACK 2:

The **dogs** are barking.

dog

Track 1 Data

`train:`

Tropical	species	have	moved	up	to	Florida	.
tropical/	species/	have/	move/	up/	to/	Florida/	./
ADJ	N;PL	AUX;IND;PRS;FIN	V;PST;V.PTCP	ADP	ADP	PROPN;SG	PUNCT

Track 1 Data

train:

Tropical	species	have	moved	up	to	Florida	.
tropical/ ADJ	species/ N;PL	have/ AUX;IND;PRS;FIN	move/ V;PST;V.PTCP	up/ ADP	to/ ADP	Florida/ PROPN;SG	./ PUNCT

test:

Many	_	want	to	use	diplomacy	.
many/ ADJ	people	want/ V;IND;PRS;FIN	to/ PART	use/ V;NFIN	diplomacy/ ADJ	./ PUNCT

Track 1 Data

train:

Tropical	species	have	moved	up	to	Florida	.
tropical/ ADJ	species/ N;PL	have/ AUX;IND;PRS;FIN	move/ V;PST;V.PTCP	up/ ADP	to/ ADP	Florida/ PROPN;SG	./ PUNCT

test:

Many	_	want	to	use	diplomacy	.
many/ ADJ	people	want/ V;IND;PRS;FIN	to/ PART	use/ V;NFIN	diplomacy/ ADJ	./ PUNCT

Track 2 Data

`train:`

Tropical species have moved up to Florida .

move

Track 2 Data

`train:`

Tropical	species	have	moved	up	to	Florida	.
			move				

`test:`

Many	_	want	to	use	diplomacy	.
	people					

Data Sources

Starting point: Universal Dependencies v2 Treebanks for seven European languages:

English, Finnish, French, German, Russian, Spanish and Swedish

```
Der      der      ART      Case=Nom|Definite=Def|Gender=Masc|Number=Sing|PronType=Art
Firma    Firma    NN       Case=Nom|Gender=Masc|Number=Sing
liegt    liegen   VVFIN    Number=Sing|Person=3|VerbForm=Fin
genau    genau    ADJD     _
am       _        _        _
an       an       APPR     _
dem      der      ART      Case=Dat|Definite=Def|Gender=Masc,Neut|Number=Sing|PronType=Art
Ortseingang       Ortseingang      NN       Case=Dat|Gender=Masc,Neut|Number=Sing
.        .        $.       _
```

Data Sources

Starting point: Universal Dependencies v2 Treebanks for seven European languages:

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word form

```
Der       der       ART       Case=Nom|Definite=Def|Gender=Masc|Number=Sing|PronType=Art
Firma     Firma     NN        Case=Nom|Gender=Masc|Number=Sing
liegt     liegen    VVFIN     Number=Sing|Person=3|VerbForm=Fin
genau     genau     ADJD      _
am        _         _         _
an        an        APPR      _
dem       der       ART       Case=Dat|Definite=Def|Gender=Masc,Neut|Number=Sing|PronType=Art
Ortseingang         Ortseingang       NN        Case=Dat|Gender=Masc,Neut|Number=Sing
.         .         $.        _
```

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word form

```
Der      der      ART     Case=Nom|Definite=Def|Gender=Masc|Number=Sing|PronType=Art
Firma    Firma    NN      Case=Nom|Gender=Masc|Number=Sing
liegt    liegen   VVFIN   Number=Sing|Person=3|VerbForm=Fin
genau    genau    ADJD    _
am       _        _       _
an       an       APPR    _
dem      der      ART     Case=Dat|Definite=Def|Gender=Masc,Neut|Number=Sing|PronType=Art
Ortseingang       Ortseingang     NN      Case=Dat|Gender=Masc,Neut|Number=Sing
.        .        $.      _
```

lemma

Data Sources

Starting point: Universal Dependencies v2 Treebanks for seven European languages:

English, Finnish, French, German, Russian, Spanish and Swedish

word form

MSD

```
Der         der         ART         Case=Nom|Definite=Def|Gender=Masc|Number=Sing|PronType=Art
Firma       Firma       NN          Case=Nom|Gender=Masc|Number=Sing
liegt       liegen      VVFIN       Number=Sing|Person=3|VerbForm=Fin
genau       genau       ADJD        _
am          _           _           _
an          an          APPR        _
dem         der         ART         Case=Dat|Definite=Def|Gender=Masc,Neut|Number=Sing|PronType=Art
Ortseingang             Ortseingang        NN        Case=Dat|Gender=Masc,Neut|Number=Sing
.           .           $.          _
```

lemma

Data Conversion

UD morphosyntactic annotation was converted to the UniMorph schema using deterministic rules.

```
Der         der         DET;NOM;DEF;MASC;SG
Firma       Firma       N;NOM;MASC;SG
liegt       liegen      V;SG;3;FIN
genau       genau       ADV
an          an          ADP
dem         der         DET;DAT;DEF;MASC;NEUT;SG
Ortseingang             Ortseingang     N;DAT;MASC;NEUT;SG
.           .           PUNCT
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an          an          ADP
dem         der         DET;DAT;DEF;MASC;NEUT;SG
Ortseingang             Ortseingang     N;DAT;MASC;NEUT;SG
.           .           PUNCT
```

Because there are few languages in task 2, this was doable.

Manual Annotation

Contextually plausible forms were annotated into the test data.

Das	der	PRO;NOM;NEUT;SG
ragt	ragen	_
mal	mal	ADV
angenhem	angenehm	ADV
heraus	heraus	ADV
aus	aus	ADP
dem	der	DET;DAT;DEF;NEUT;SG
Einheitssbrei	Einheitssbrei	N;DAT;NEUT;SG
.	.	PUNCT

Manual Annotation

Contextually plausible forms were annotated into the test data.

Das	der	PRO;NOM;NEUT;SG
ragt/rage/ragte	ragen	_
mal	mal	ADV
angenhem	angenehm	ADV
heraus	heraus	ADV
aus	aus	ADP
dem	der	DET;DAT;DEF;NEUT;SG
Einheitssbrei	Einheitssbrei	N;DAT;NEUT;SG
.	.	PUNCT

Plausible forms in context

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Contextually plausible forms were annotated into the test data.

Das	der	PRO;NOM;NEUT;SG
ragt/rage/ragte	ragen	_
mal	mal	ADV
angenhem	angenehm	ADV
heraus	heraus	ADV
aus	aus	ADP
dem	der	DET;DAT;DEF;NEUT;SG
Einheitssbrei	Einheitssbrei	N;DAT;NEUT;SG
.	.	PUNCT

Plausible forms in context

Annotators chose among forms in UniMorph tables

ragen	ragen	V;IND;PRS;1;PL
ragen	raget	V;SBJV;PRS;2;PL
ragen	**rage**	V;SBJV;PRS;3;SG
ragen	ragst	V;IND;PRS;2;SG
ragen	ragten	V;SBJV;PST;3;PL
ragen	ragtest	V;SBJV;PST;2;SG
ragen	ragtet	V;SBJV;PST;2;PL
ragen	**ragte**	V;SBJV;PST;3;SG
ragen	**ragt**	V;IND;PRS;3;SG
ragen	rag	V;IMP;2;SG
. . .		

Data Splits

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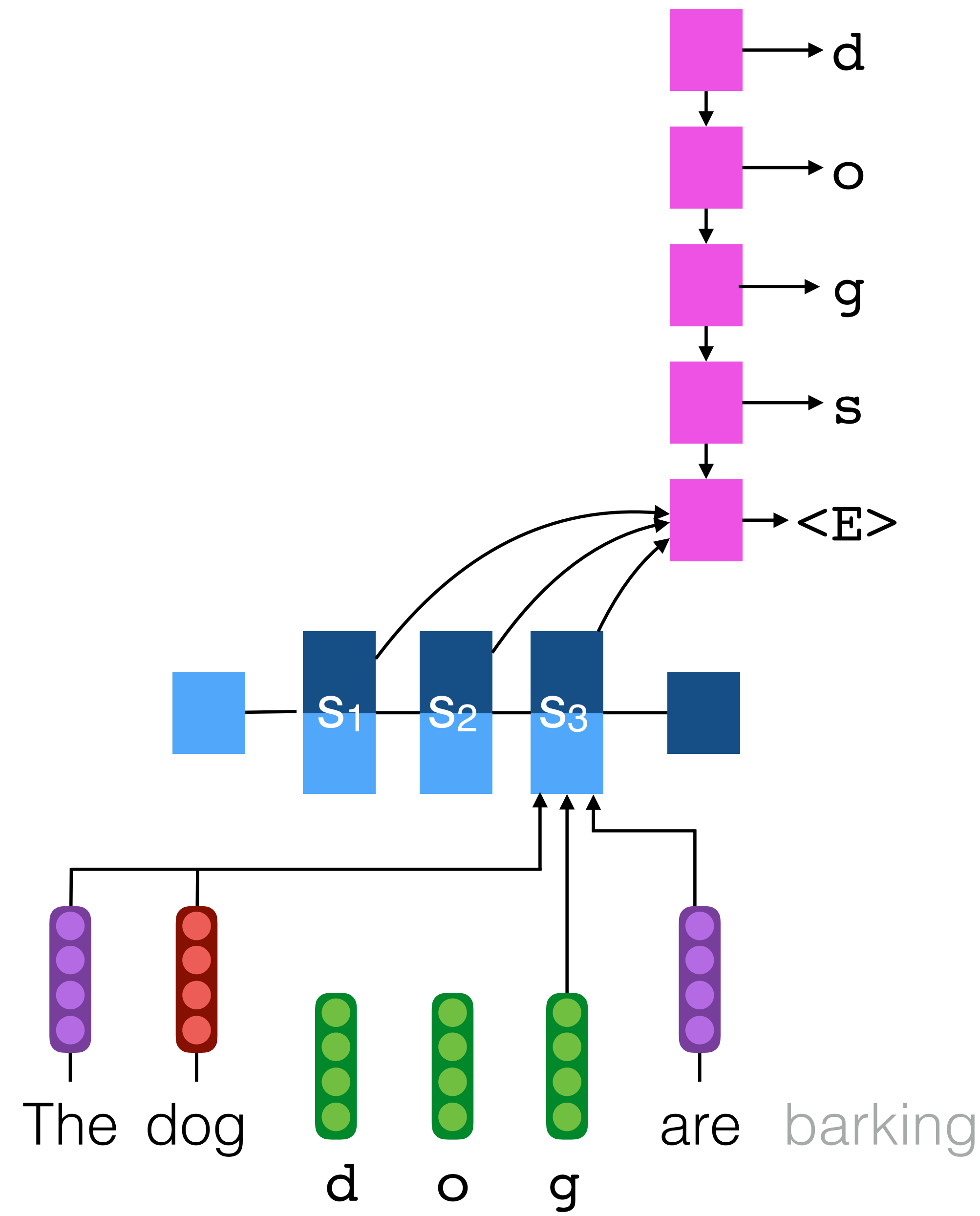
We saw two ___ and one ___ .

dog cat

Neural Baseline Model for Task 2

- **Basis:** Bidirectional LSTM Encoder-Decoder with attention
- **Encoder conditioned on:** lemmata, forms and MSDs of the left and right context token **in track 1**.
- **Encoder conditioned on:** the left and right context word form **in track 2**.

Track 2 baseline:



System Features

All systems were neural.

	predict MSD	subword context	context RNN	context attention	multilingual	beam search
BME-HAS (Ács, 2018)	–	✓	✓	–	–	–
COPENHAGEN (Kementchedjhieva et al., 2018)	✓	–	✓	–	✓	–
CUBoulder (Liu et al., 2018)	✓	–	–	–	–	–
NYU (Kann et al., 2018)	–	✓	✓	✓	–	–
UZH (Makarov and Clematide, 2018)	–	✓	–	–	–	✓

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NYU (Kann et al., 2018)	–	✓	✓	✓	–	–
UZH (Makarov and Clematide, 2018)	–	✓	–	–	–	✓

- First **predict MSD** of the target lemma, then inflect.

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CUBoulder (Liu et al., 2018)	✓	–	–	–	–	–
NYU (Kann et al., 2018)	–	✓	✓	✓	–	–
UZH (Makarov and Clematide, 2018)	–	✓	–	–	–	✓

- First **predict MSD** of the target lemma, then inflect.
- Use character-based or other **subword context** model.

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CUBoulder (Liu et al., 2018)	✓	–	–	–	–	–
NYU (Kann et al., 2018)	–	✓	✓	✓	–	–
UZH (Makarov and Clematide, 2018)	–	✓	–	–	–	✓

- First **predict MSD** of the target lemma, then inflect.
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- Encode the sentence context using a **context RNN.**

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CUBoulder (Liu et al., 2018)	✓	–	–	–	–	–
NYU (Kann et al., 2018)	–	✓	✓	✓	–	–
UZH (Makarov and Clematide, 2018)	–	✓	–	–	–	✓

- First **predict MSD** of the target lemma, then inflect.
- Use character-based or other **subword context** model.
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NYU (Kann et al., 2018)	–	✓	✓	✓	–	–
UZH (Makarov and Clematide, 2018)	–	✓	–	–	–	✓

- First **predict MSD** of the target lemma, then inflect.
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CUBoulder (Liu et al., 2018)	✓	–	–	–	–	–
NYU (Kann et al., 2018)	–	✓	✓	✓	–	–
UZH (Makarov and Clematide, 2018)	–	✓	–	–	–	✓

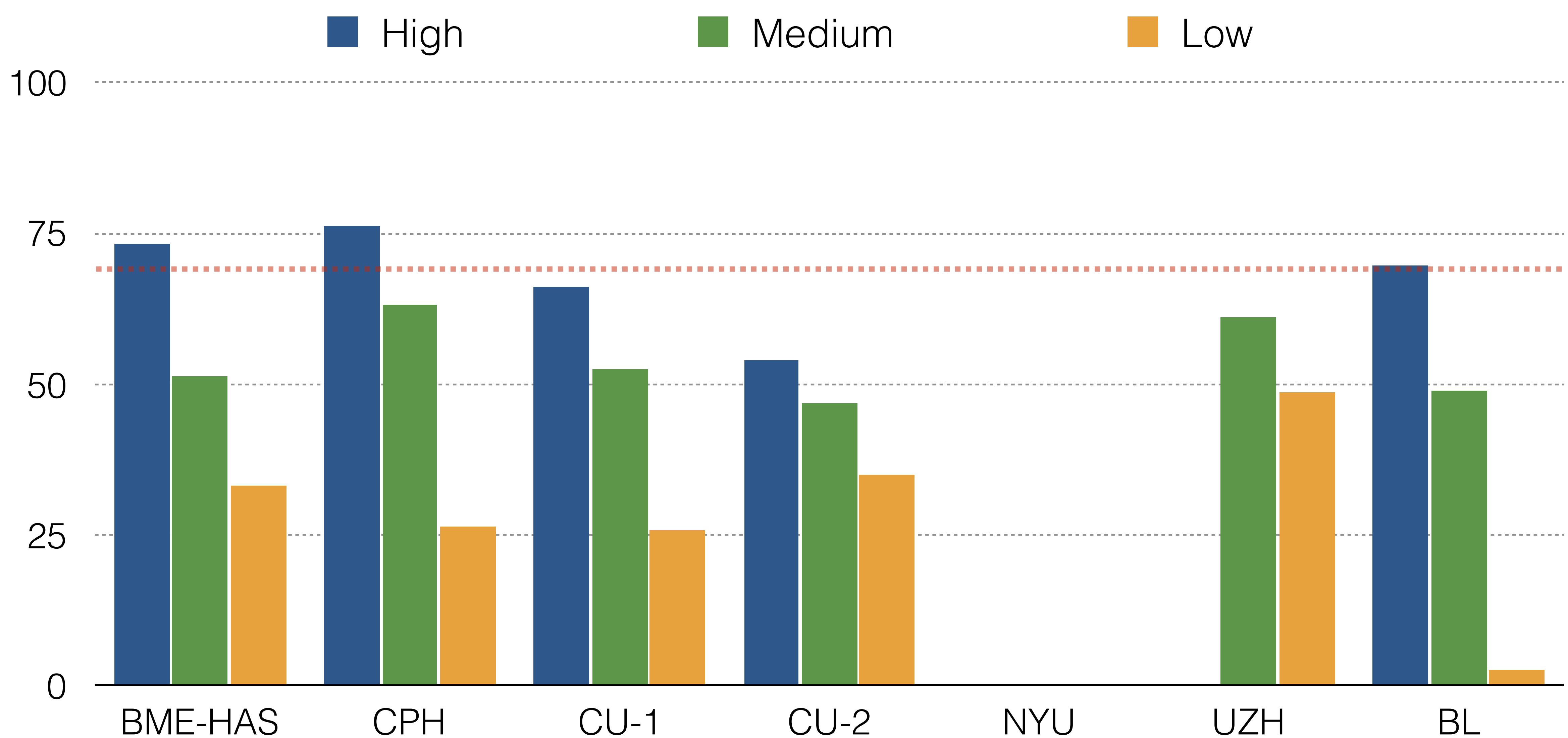
- First **predict MSD** of the target lemma, then inflect.
- Use character-based or other **subword context** model.
- Encode the sentence context using a **context RNN.**
- Use a **context attention** mechanism.
- Combine training sets for different languages into **multilingual** training sets.
- Use **beam search** when decoding.

Evaluation

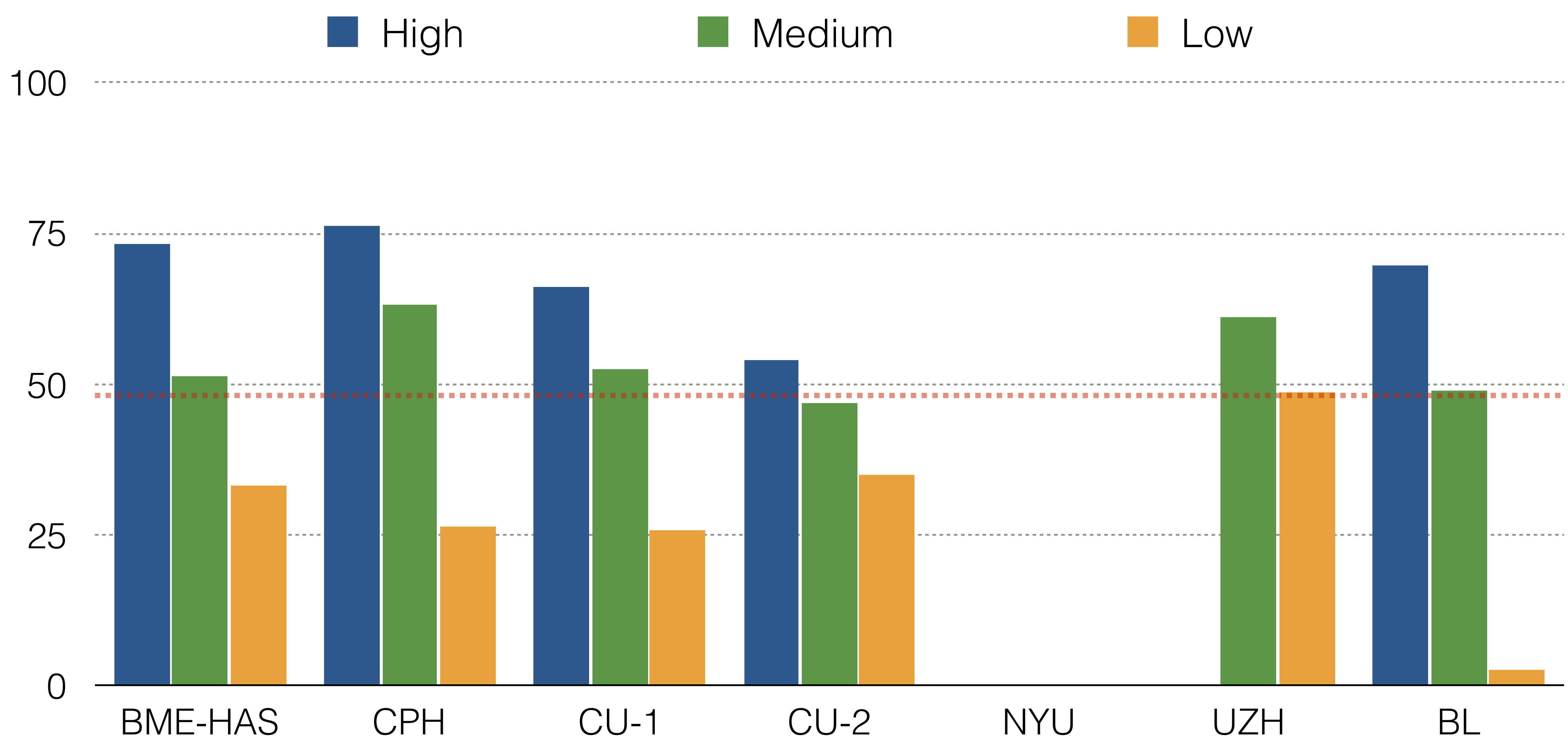
Accuracy for original forms

Relaxed accuracy for plausible forms: Correct if the output matches any of the plausible forms

Task 2: Track 1 Results



Task 2: Track 1 Results



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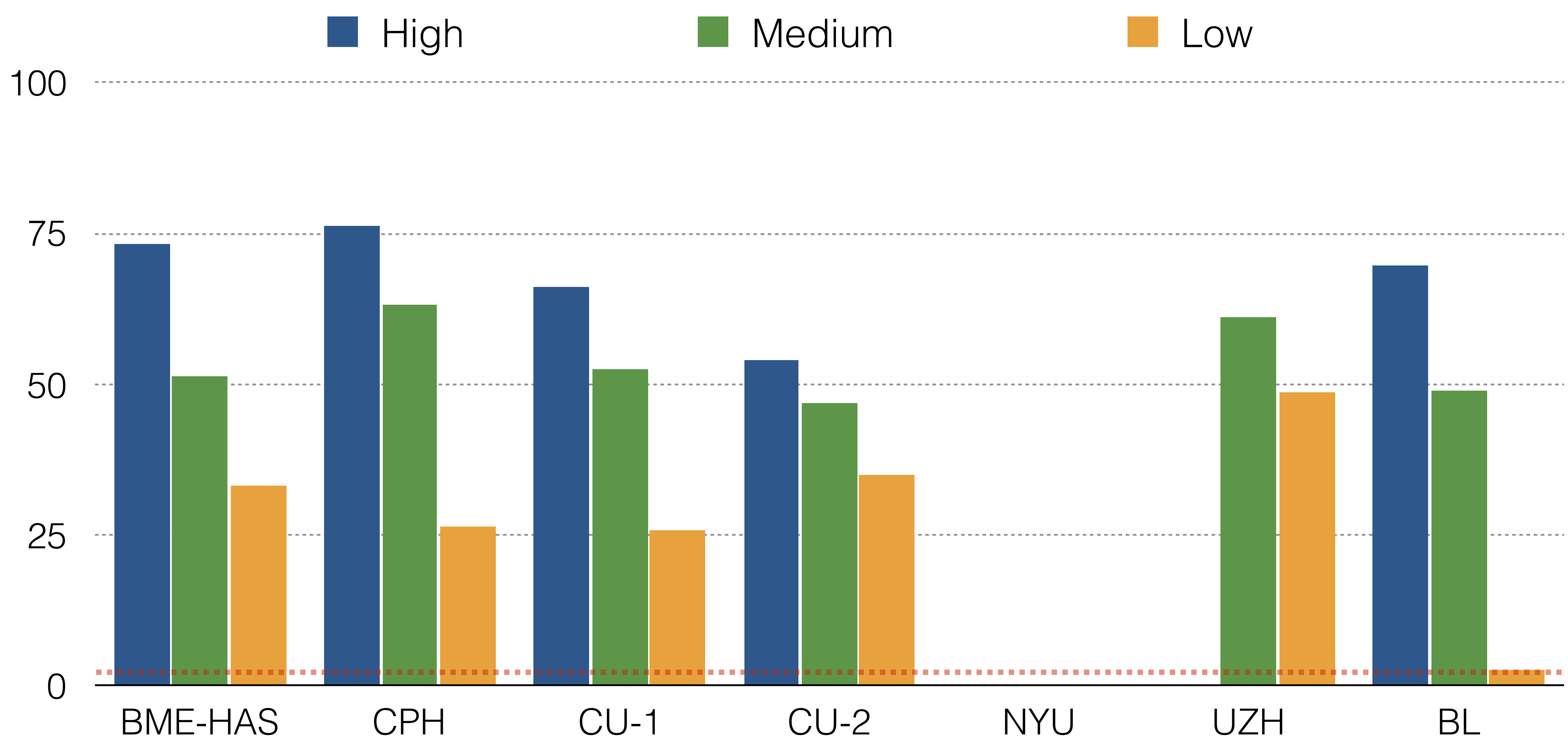
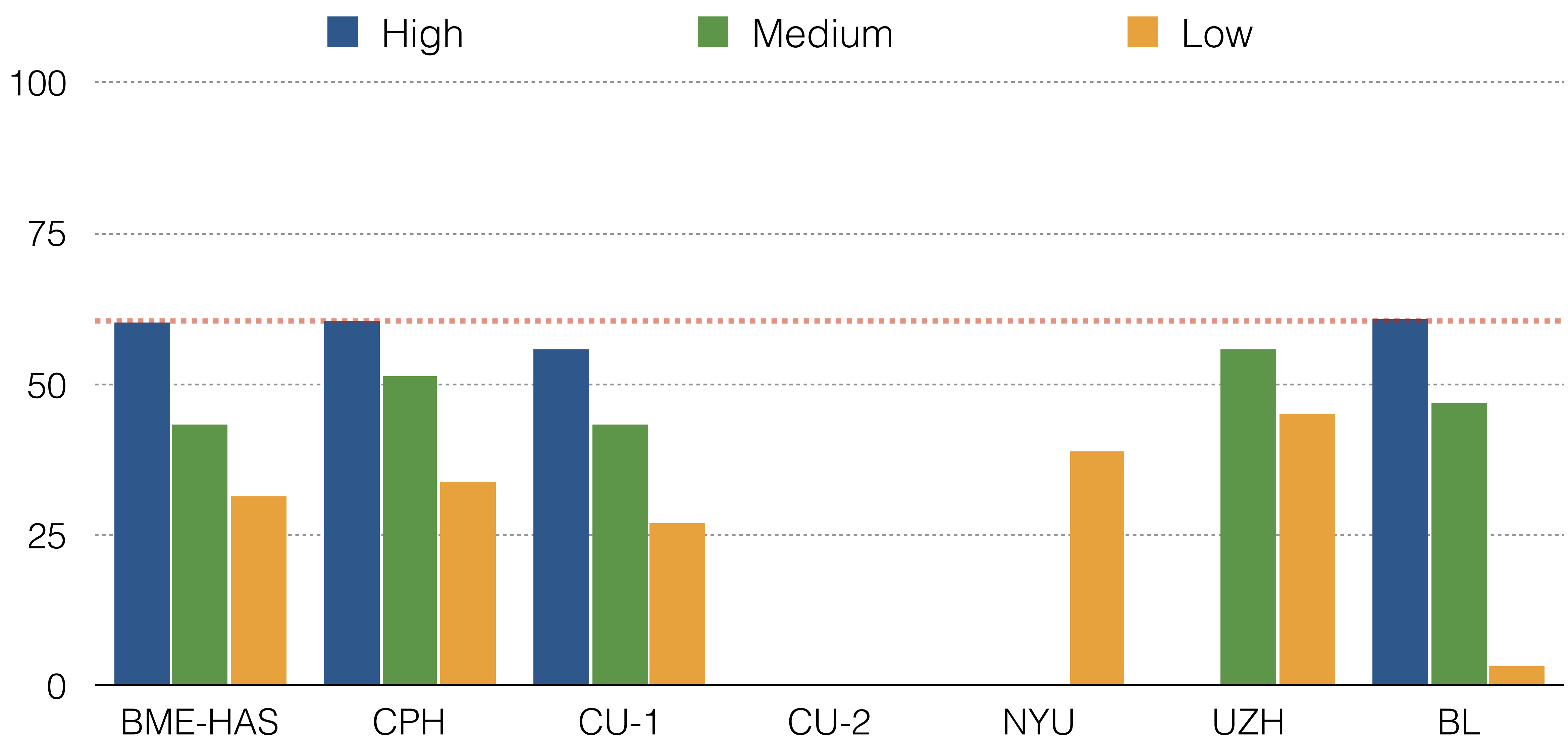


Task 2: Track 2 Results



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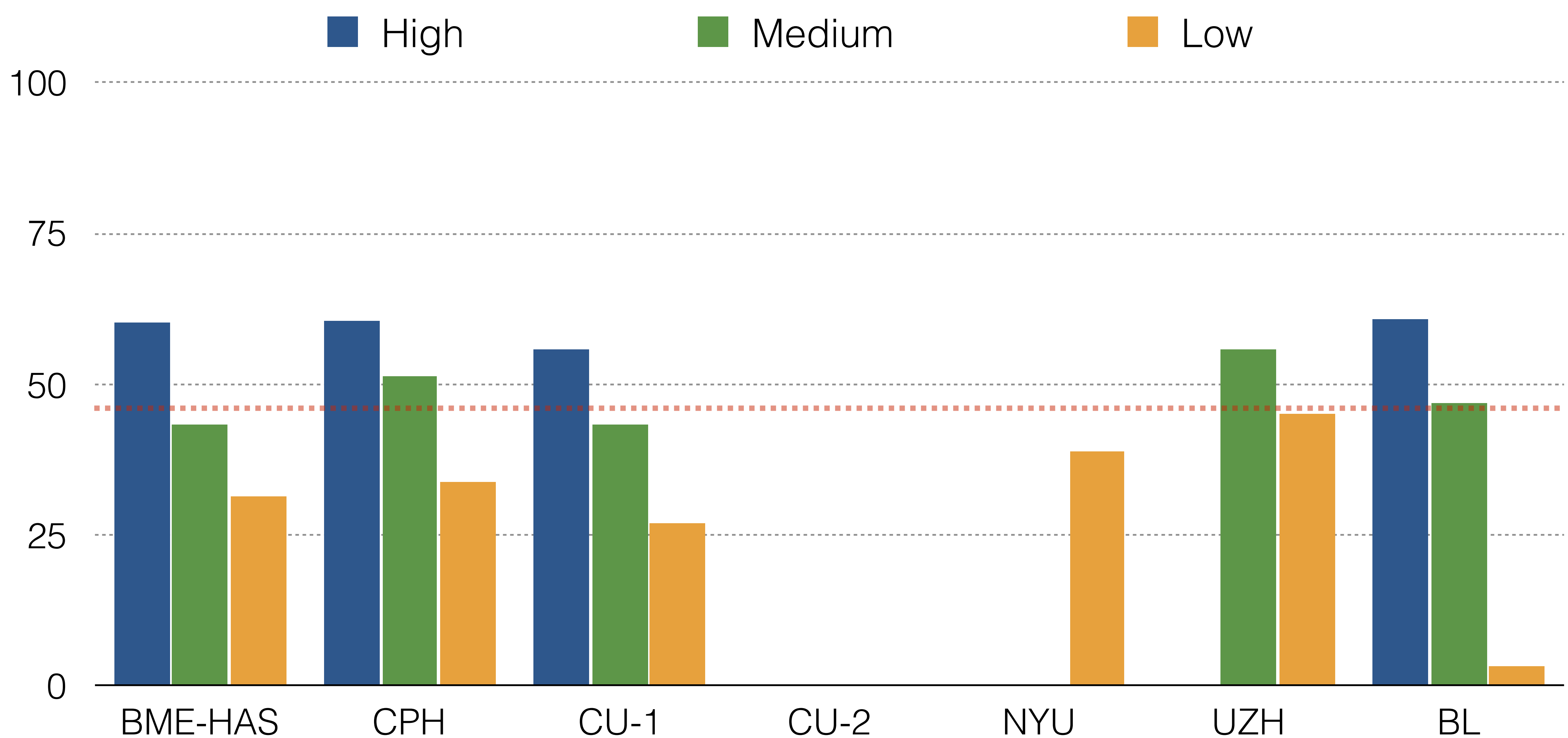

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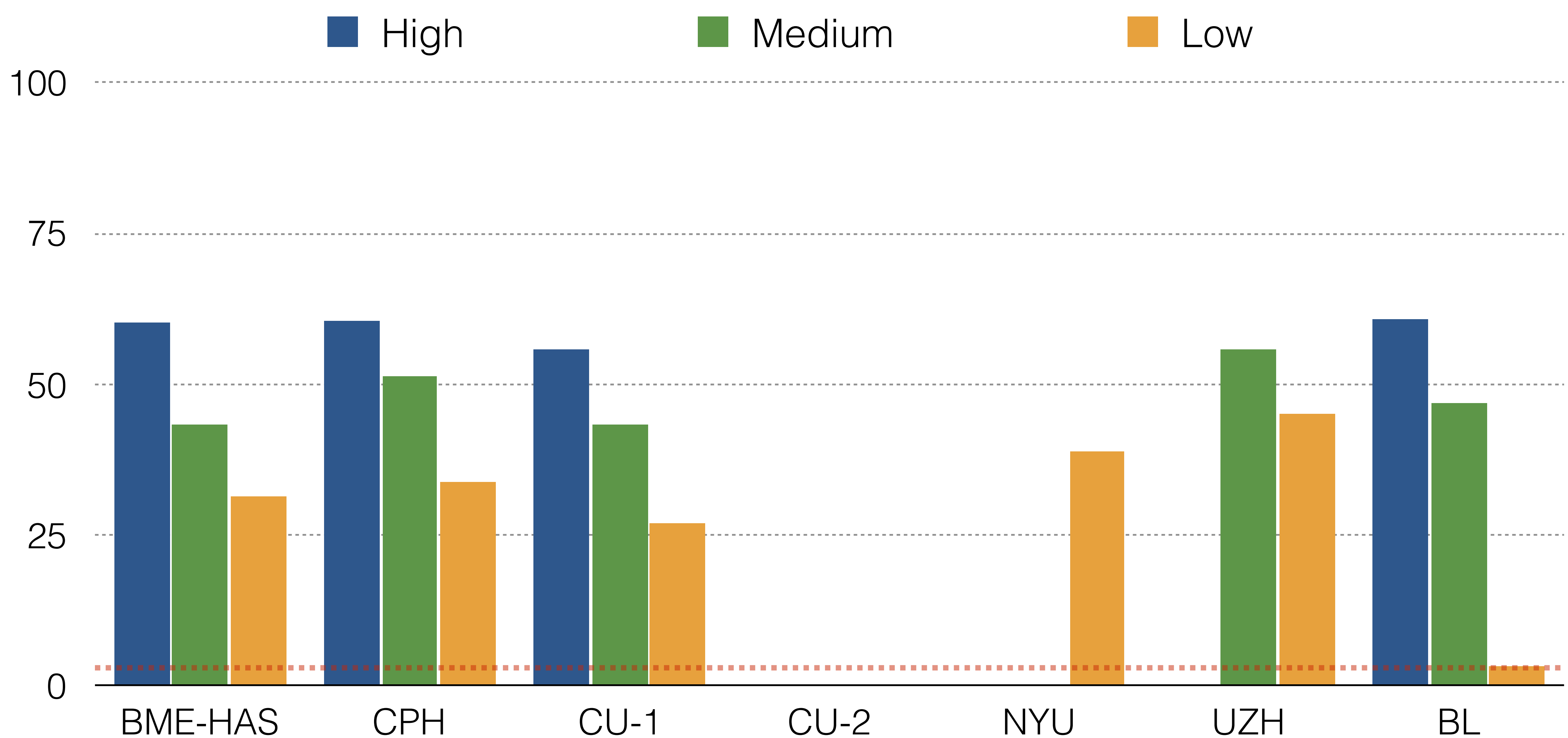

Task 2 Conclusions

- Neural transition-based transducer by Zurich works the best in the low and medium setting.
- Multilinguality incorporated by Copenhagen also clearly pays off.
- It is difficult to improve upon the baseline in the high setting in track 2. This might change given more training data or in a semisupervised scenario.
- The best track 1 system outperforms the best track 2 system for all languages. Context MSDs and lemmata clearly help!

SIGMORPHON 2019 Shared Task?

- There may be a fourth shared task next year (under SIGMORPHON)!
  - Consider participating or helping organize and providing task suggestions!
- If arranged, it will feature new tasks, new languages

Thank you!

/ Shared Tasks / 2018

CoNLL–SIGMORPHON 2018 Shared Task: Universal Morphological Reinflection

- Task 1: Type-level inflection
- Task 2: Inflection in context
- Data and Baselines
- Registration
- Google Group
- Organizers
- Dates

Questions?
Suggestions?
Comments?

- Training/Dev/Test data available at:
- https://sigmorphon.github.io/sharedtasks/2018/