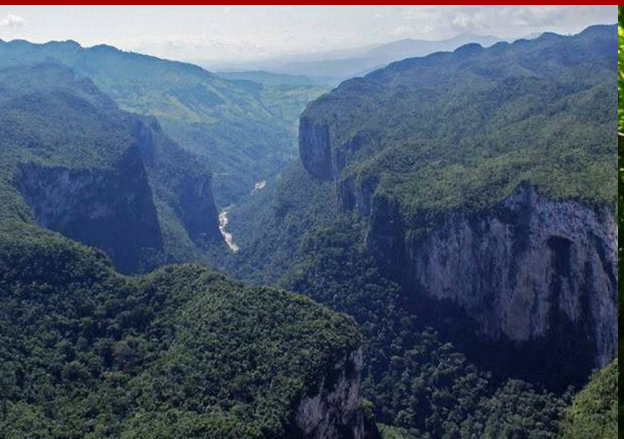
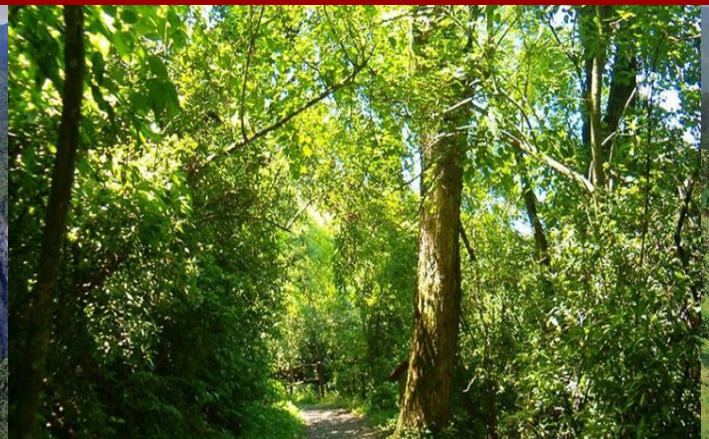
# A Universal Dependencies Treebank for Highland Puebla Nahuatl

Robert Pugh & Francis Tyers

Indiana University, Department of Linguistics





# Overview

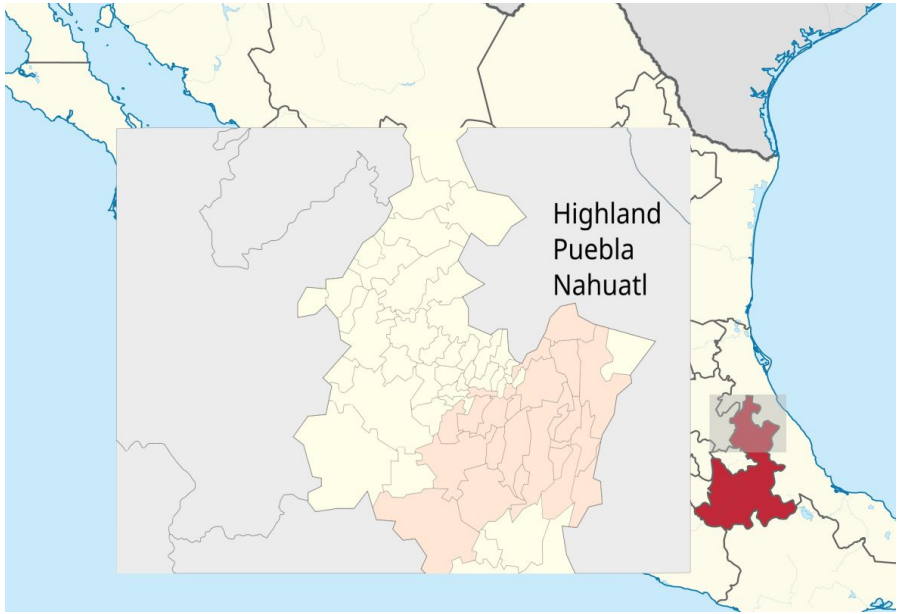
- Highland Puebla Nahuatl (HPN)
- Universal Dependencies (UD) treebanks
- Previous and related work
- Data
- Annotation process and some constructions
- Corpus comparison
- Training a UD parser for HPN.

# Highland Puebla Nahuatl

- Nahuatl: **polysynthetic**, **agglutinating** Uto-Aztecan language continuum spoken in **Mexico and Mesoamerica**

- Highland Puebla Nahuatl (azz): 1 of ~30 variants, spoken in the **northeastern Sierra region**, by about **70k speakers** in **24 municipalities**

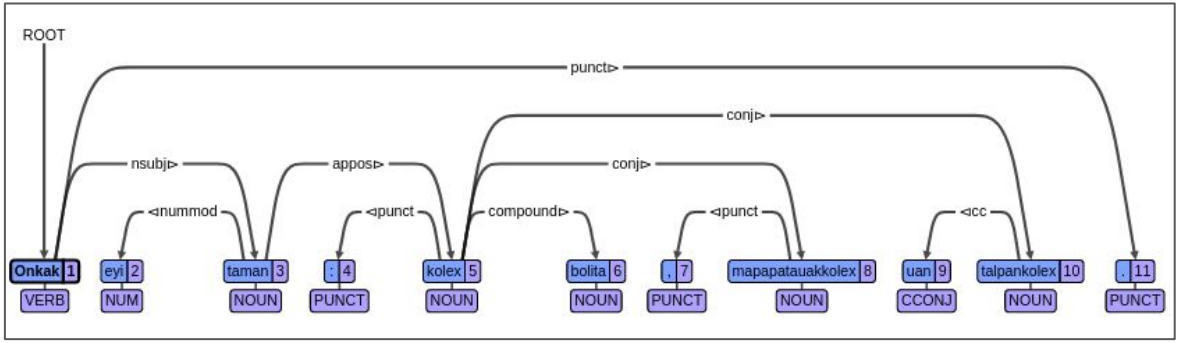
- Rapid language shift to Spanish in most communities



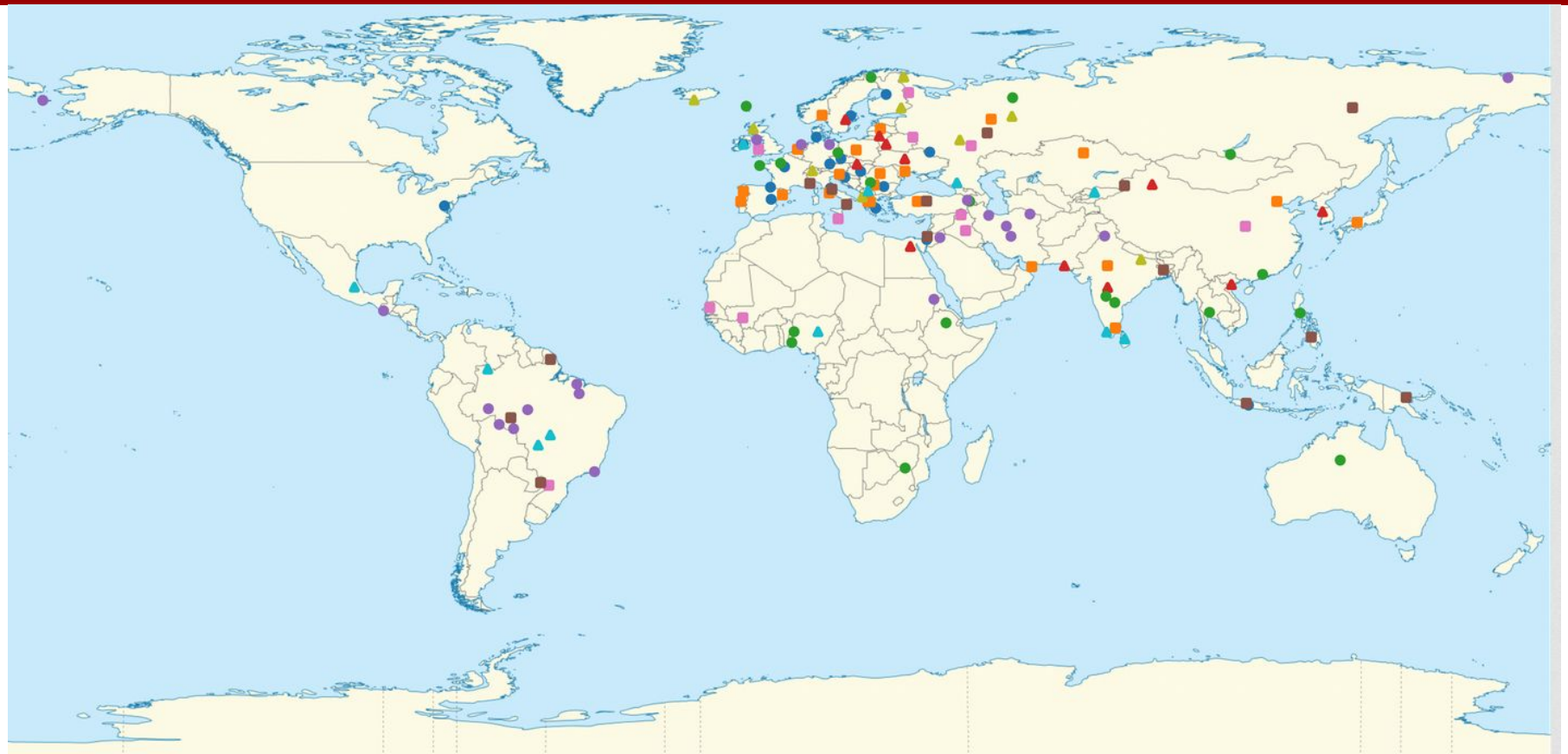
# Universal Dependencies

- Framework for **cross-linguistically-consistent morphosyntactic annotation**.
  - useful for NLP applications, linguistic typology research, psycholinguistic research, etc.

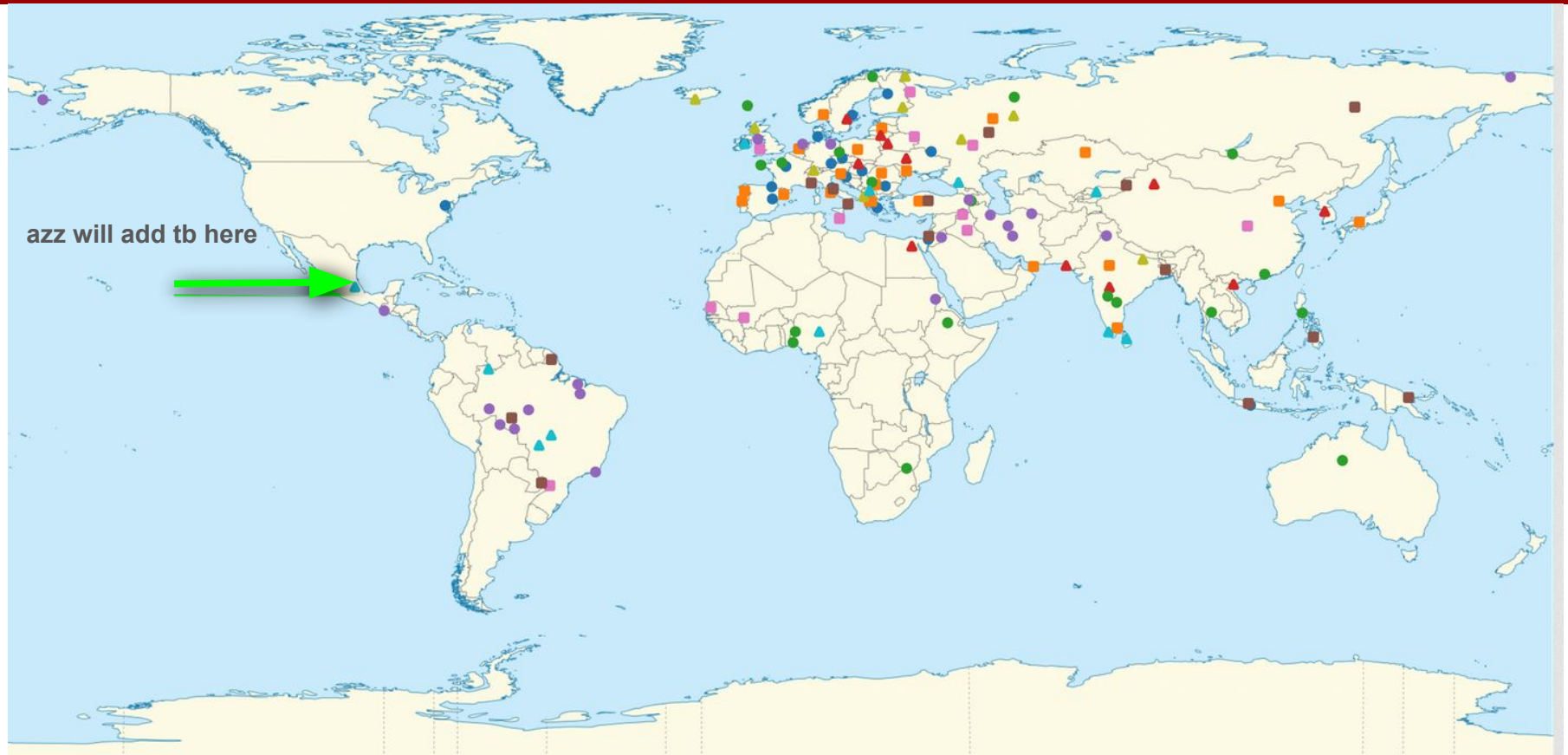
161 languages, 283 treebanks



# Universal Dependencies



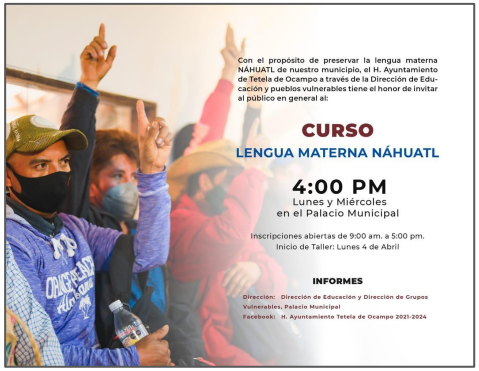
# Universal Dependencies



# Data

AXOLOTL
CORPUS PARALELO
NÁHUATL-ESPAÑOL

smf
SOCIEDAD MEXICANA DE FÍSICA




OpenSLR

# Data

| Source | Genre | Trees | Tokens |
|---|---|---|---|
| Gutierrez-Vasques et al. (2016) | nonfiction | 660 | 5,002 |
| Amith et al. (2019) | spoken | 499 | 3,882 |
| Sociedad Mexicana de Física | nonfiction | 68 | 1,088 |
| Pedagogical examples | grammar | 33 | 116 |
| **Totals** | | 1,261 | 10,088 |

# Annotation Process

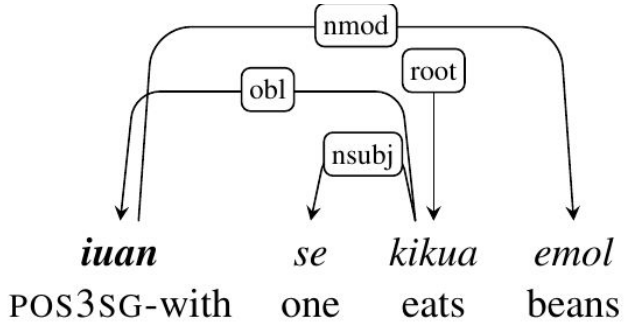
- Lemmas, UPOS, and morphological features from FST [morphological analyzer]

```
^Ixua/<s_sg3>ixua<v><iv><pres>$
^uan/huan<cnjcoo>$
^moskaltia/<s_sg3>moskaltia<v><iv><pres>$
^,/,<cm>$
^ijuak/ijhuak<cnjsub>$
^motamiti/<s_sg3>motami<v><iv><and>$
^peua/<s_sg3>pehua<v><iv><pres>$
^xochiyoua/<s_sg3>xochiyohua<v><iv><pres>$
^./.<sent>$
```

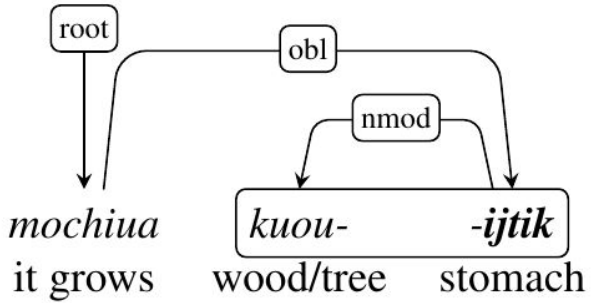
- Syntactic heads and relation labels **manually annotated** and then **manually reviewed** by a different annotator, with **discussion**

# Syntactic constructions

- Relational Nouns
  - possessed or compounded
  - can be disjoint



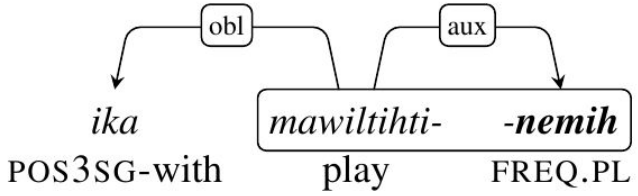

“It is eaten with beans.”




“It grows in the woods.”

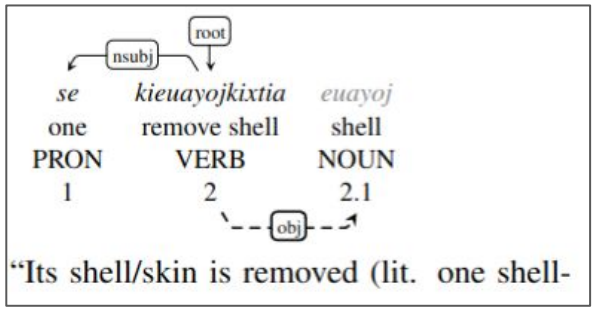
# Syntactic constructions

- Verb-Aux compounds

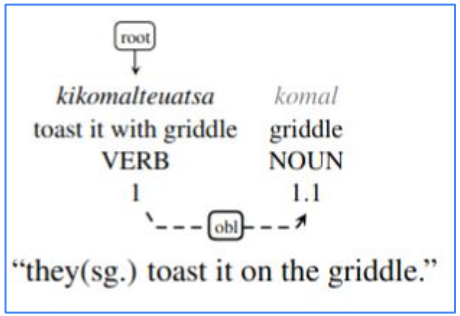



"Children go around playing with it."

- Noun incorporation (and/or Noun/Verb compounding)



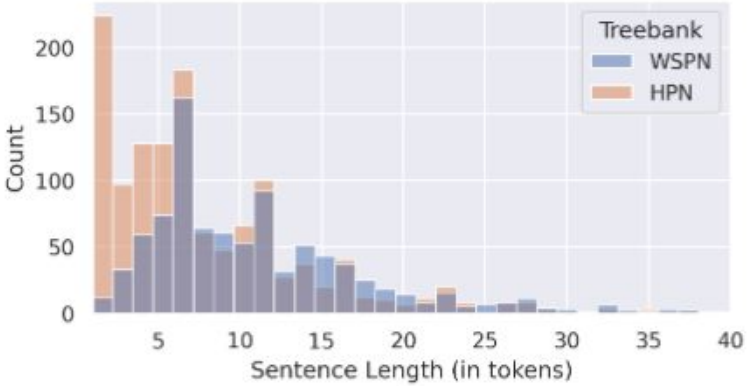

"Its shell/skin is removed (lit. one shell-

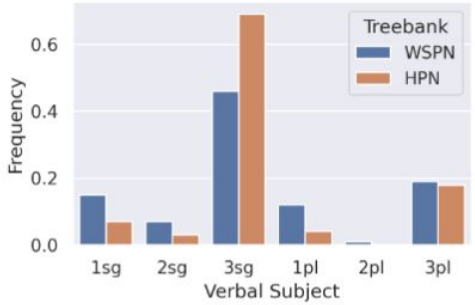


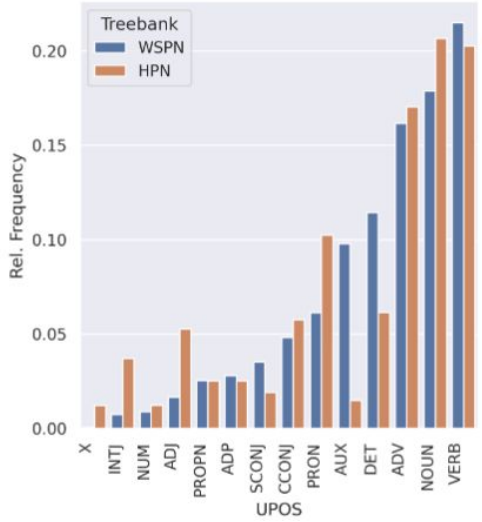

"they(sg.) toast it on the griddle."

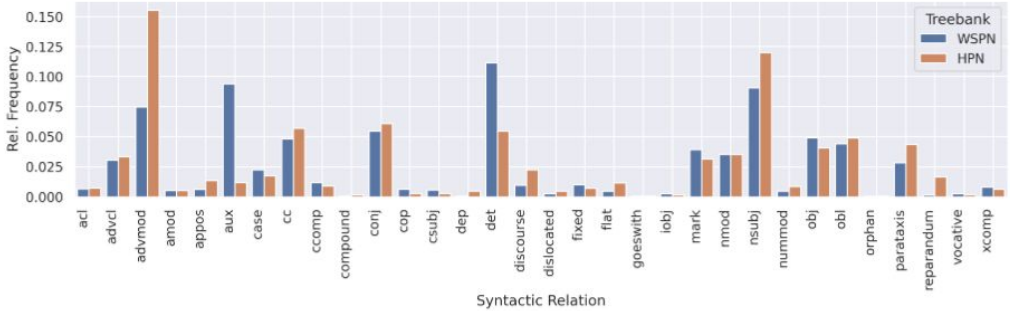
# Comparison with WSPN treebank

# Comparison with WSPN treebank



# HPN Parser

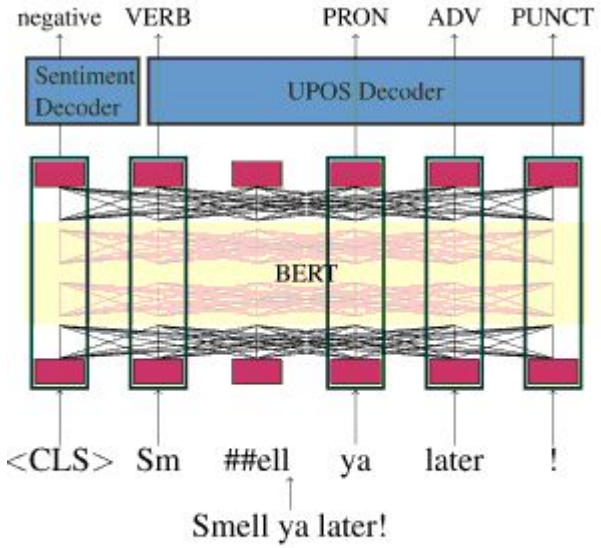



Figure 1: Overview of MACHAMP, when training jointly for sentiment analysis and POS tagging. A shared encoding representation and task-specific decoders are exploited to accomplish both tasks.

https://github.com/machamp-nlp/machamp

# HPN Parser: Experiments

- How well can a neural parser learn to annotate these texts?
  - 10-fold **cross-validation** on treebank
  - **Accuracy**: lemmas, UPOS, morph features, unlabeled and labeled attachment

- Evaluate **domain-specificity** of parser trained on this data.
  - **Zero-shot prediction** on sample from **unseen domain** (narratives about cultural practices)
  - **Manually post-edit predictions** to get the correct annotations.
  - Omit lemmas and morph (time-consuming to post-edit)

# HPN Parser

| Metric | Result | |
|---|---|---|
| | *In domain* | *Out domain* |
| Lemmas | $89.8 \pm 1.1$ | — |
| UPOS | $94.5 \pm 0.8$ | 87.6 |
| Morpho Feats | $91.7 \pm 1.2$ | — |
| UAS | $79.8 \pm 2.2$ | 86.7 |
| LAS | $72.7 \pm 2.0$ | 76.6 |

# Future Work

- Expand the domains of azz UD treebank
- Continue larger project of creating annotated corpora for Nahuatl varieties
- Quantitative, corpus-based analysis of syntactic dimension of Nahuatl dialectology.

# Tasojkamatik