Heidelberg-Boston @ SIGTYP 2024 Shared Task: Enhancing Low-Resource Language Analysis With Character-Aware Hierarchical Transformers

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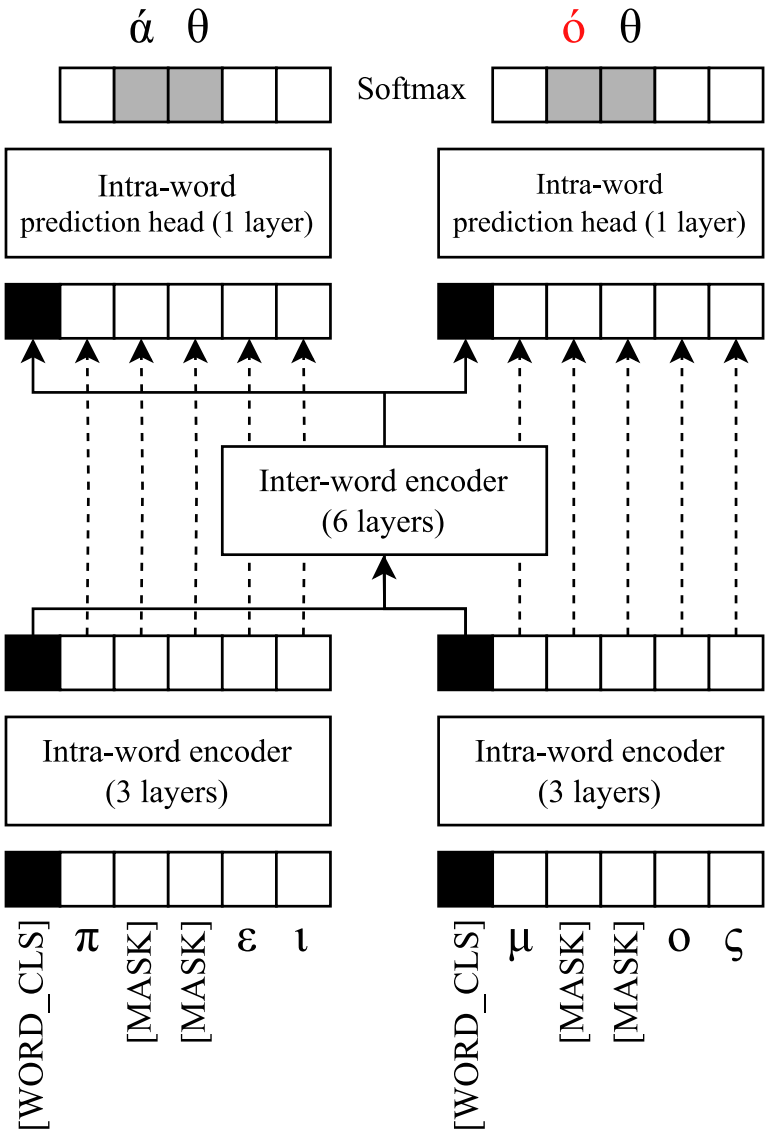
Tokenization

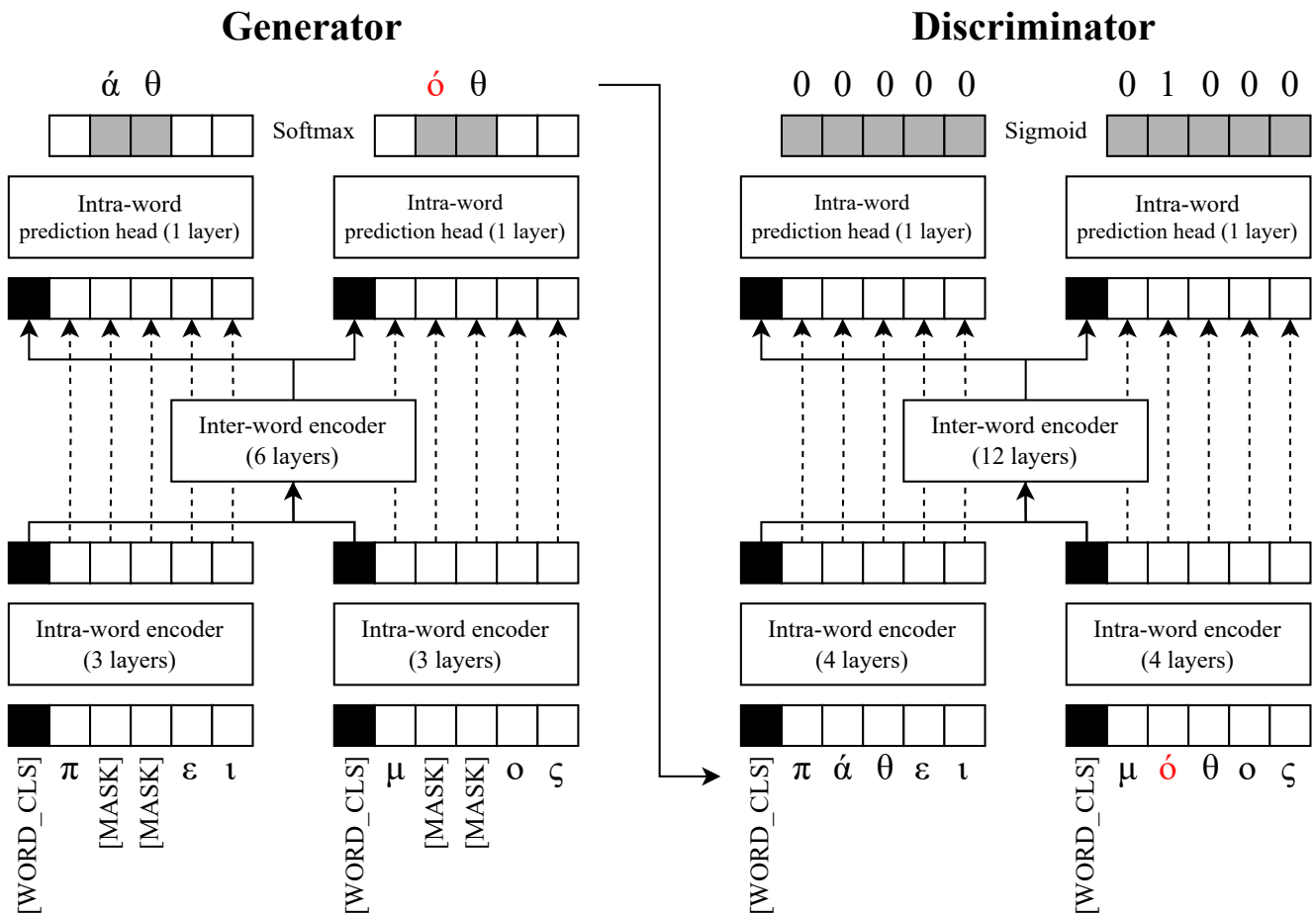
- **word-level**
  - ✗ low-resource context → rare occurrence of words
  - ✗ inflected languages → unique word forms exceedingly rare
- **subword-level**
  - ✗ much character information lost
  - ✗ no explicit word representations
- **character-level**
  - ✗ long sequence lengths
  - ✗ no explicit word representations

Hierarchical Language Model[1]



[1] Sun et al. 2023.

Replaced Token Detection



Masking Strategy

- **whole-word** masking
- **character** masking
- **character n-gram** masking

Lemmatization

- **sequence-to-sequence** task
- **character-based T5** model

Morphological Tagging

- **concatenate** intra- and inter-word embeddings
- **classifier** for each feature

$$\mathcal{L}_{\text{morph}} = \frac{1}{k} \sum_{m=0}^{k-1} \mathcal{L}_m$$

PoS Tagging

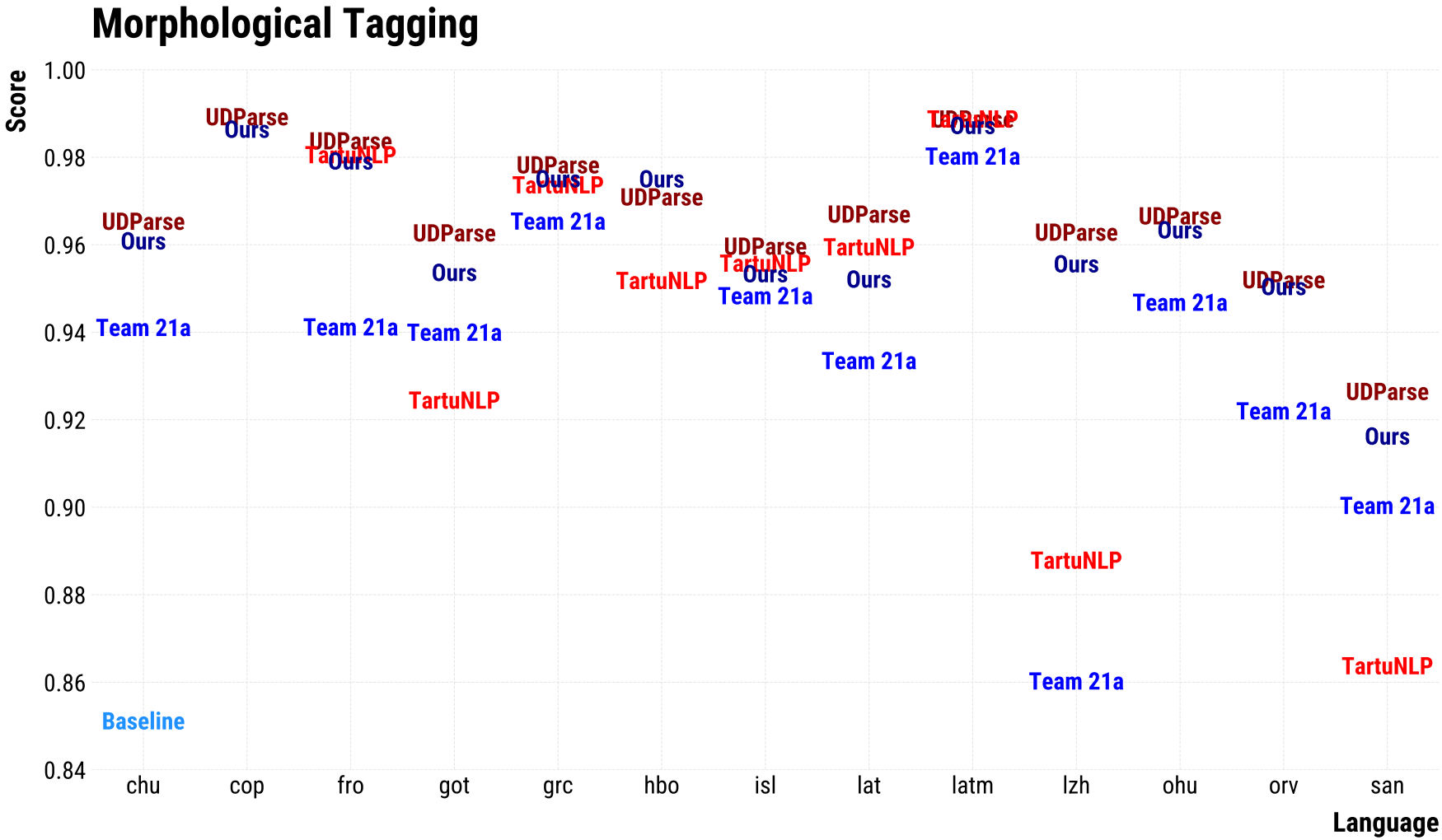
- **concatenate** intra- and inter-word embeddings
- **multi-task** learning with POS + morph

$$\mathcal{L}_{\text{UPoS}} + \mathcal{L}_{\text{morph}}$$

Lemmatization

Input	Label
quem PRON	quis
me PRON	ego
arbitramini VERB	arbitror
esse AUX	sum
non ADV	non
sum AUX	sum
ego PRON	ego

Results


Morphological Tagging
Score
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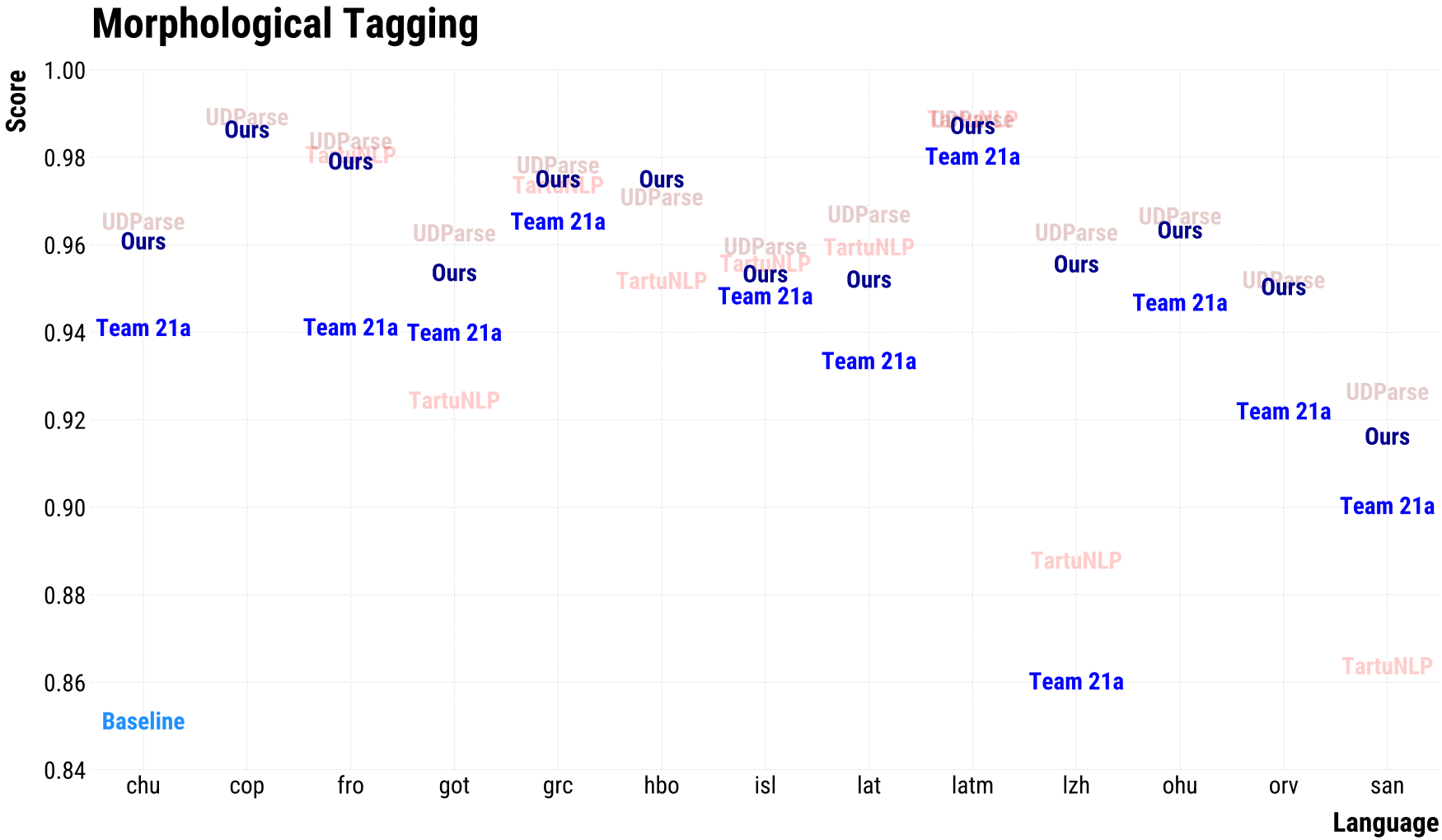
Language
UDParse
Ours
Team 21a
TartuNLP
Baseline

Results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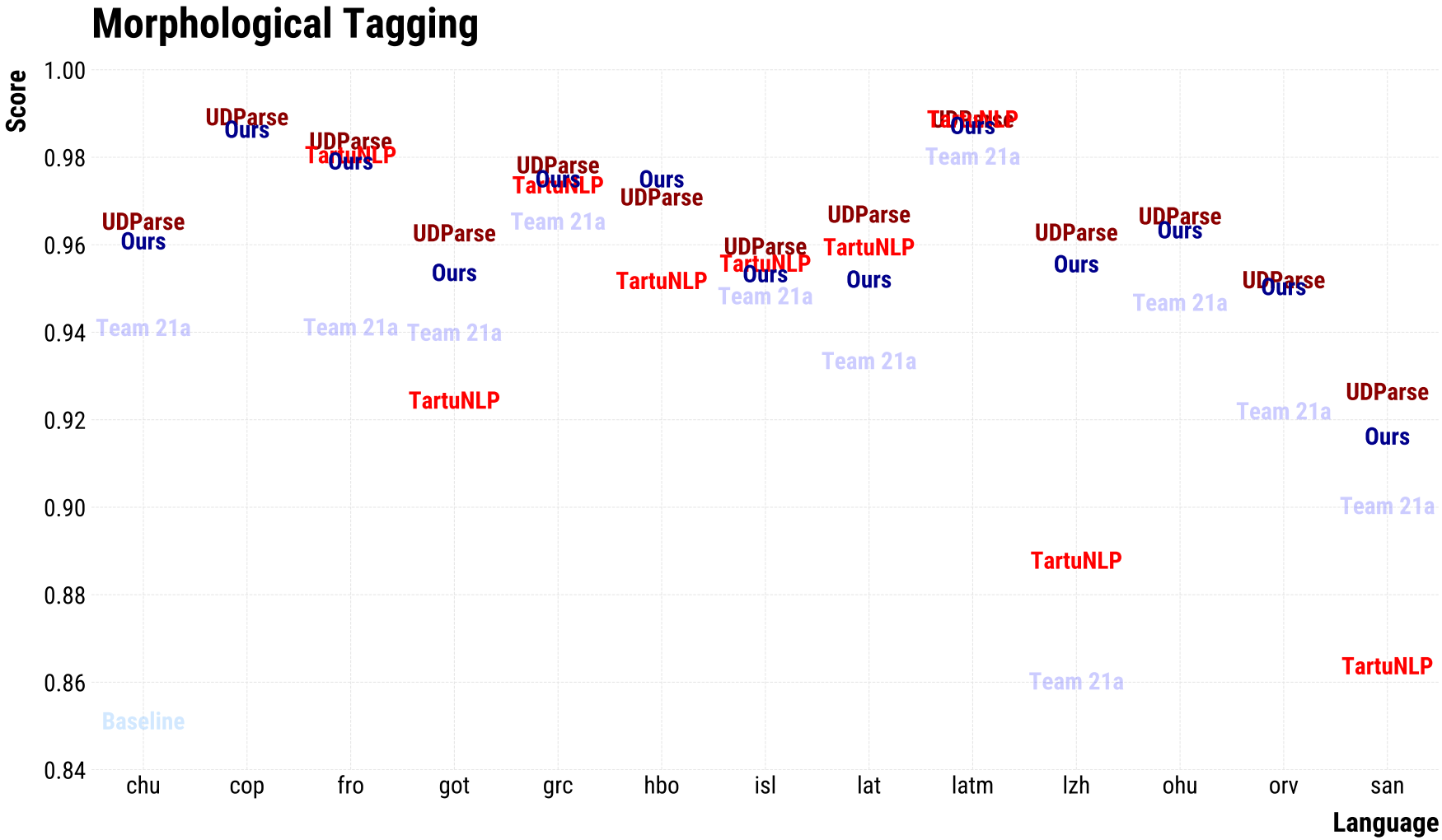
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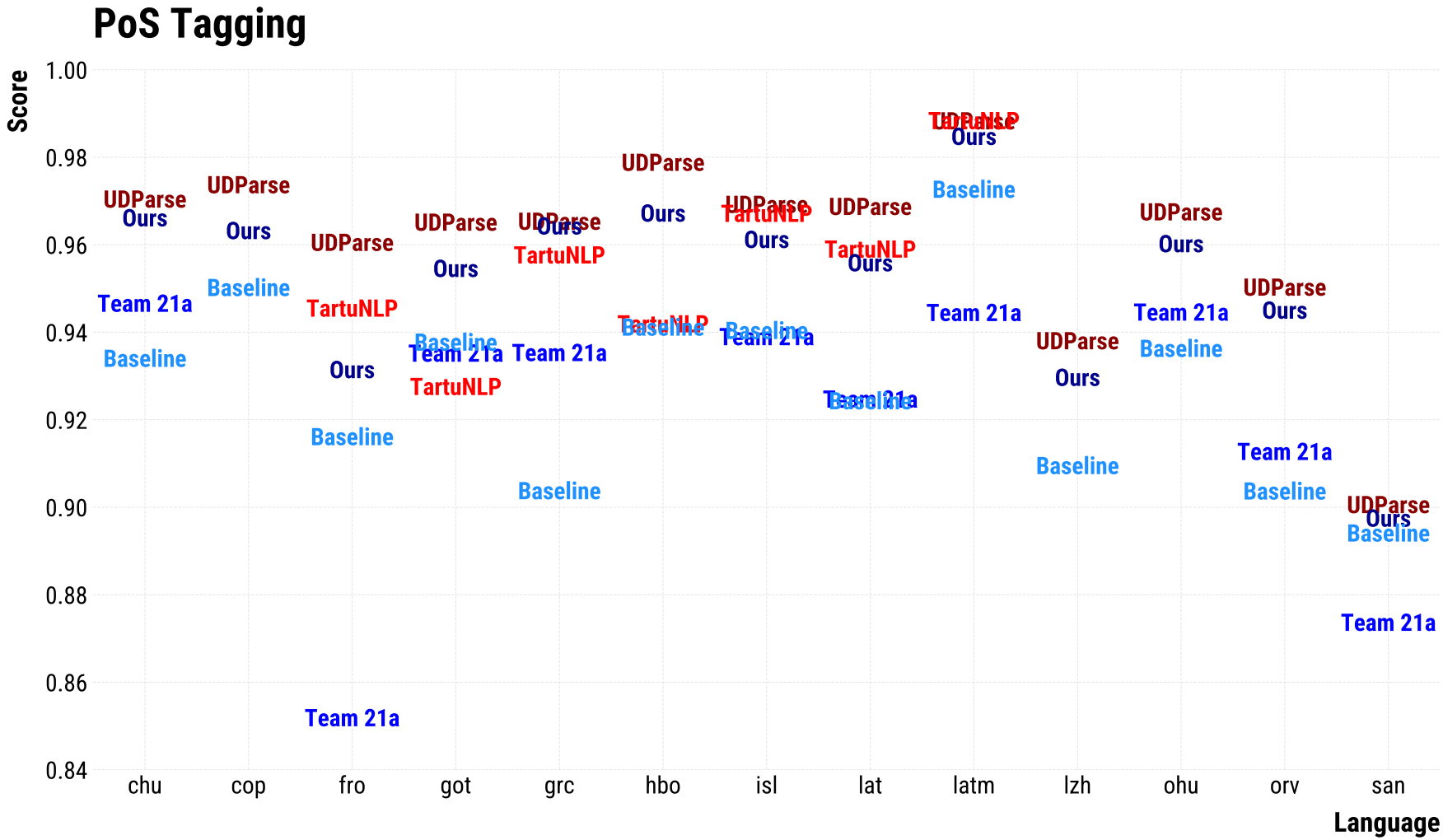
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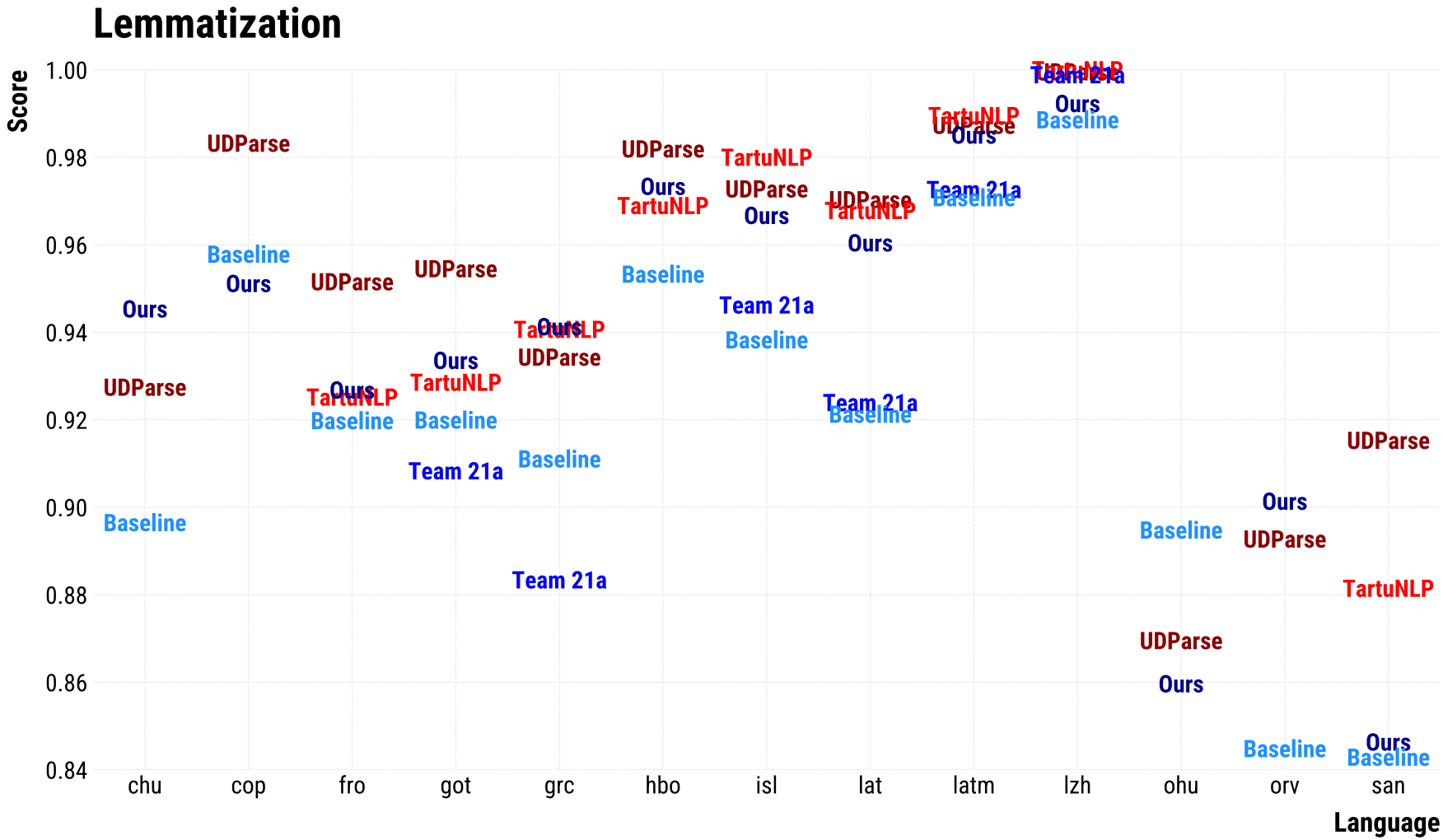
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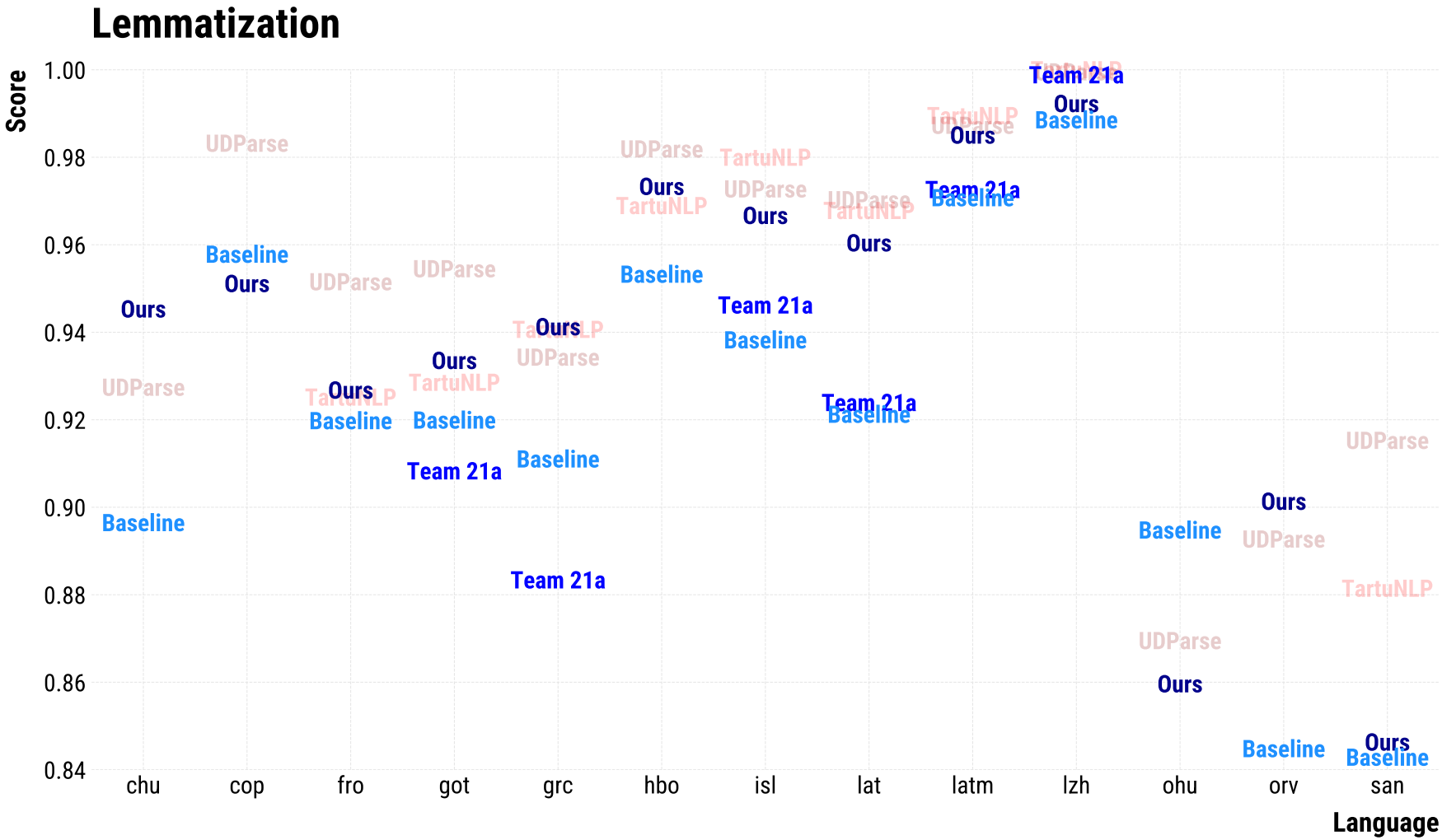
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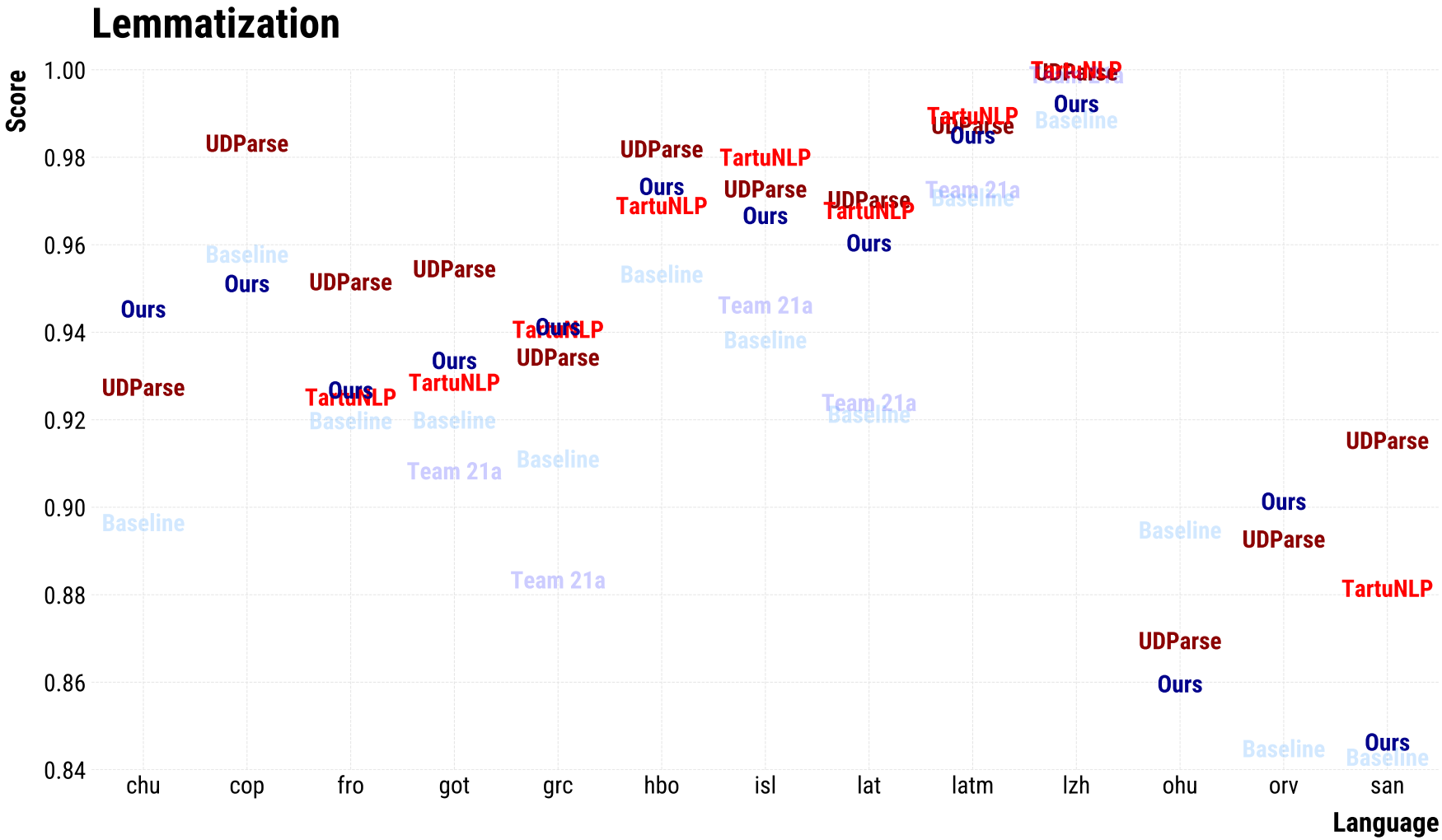
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Negative Results

- **multi-task** learning
- **tall** models
  - narrower and deeper architecture
  - benefits for Masked Langugage Modeling but not for Replaced Token Detection

Take-aways

- **Hierarchical Language Model** to learn **efficiently** from **every character**
- **DeBERTa-V3** with **Replaced Token Detection**
- **lemmatization** as **character-level sequence-to-sequence** problem

Thank you for your attention!