PD3: Better Cross-Lingual Transfer By Combining Direct Transfer and Annotation Projection

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Argumentation Mining

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- Fast-growing research field in NLP

- Different sub-tasks:

1) segmenting arguments from non-arguments in text;
2) classifying them (claim, premise, ...);
3) finding relations between arguments (support, attack)
4) Ranking arguments

Challenges for argumentation mining

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- Going cross-lingual
  - I.e. train system in a source language L1 (typically: English), then apply system to specific target language L2 of interest
  - **Avoids having to redo (high) annotation costs**
- Recently, several works have addressed variants of this setup:
  - Aker and Zhang, 2017; Sliwa et al. 2018; Eger et al., 2018; Rocha et al. 2018

Task considered in our work

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- We consider argumentation mining
  - On the sentence-level
  - Classifying each sentence into 4 classes:
    - Claim, MajorClaim, Premise, None
- Dataset is derived from the Persuasive Essay (PE) dataset of `Stab and Gurevych (2017); Eger et al. (2018)` (bi-lingual variant)
  - But token-level annotations are mapped to the sentence-level

(Mono-lingual) Examples

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- *Not cooking fresh food will lead to lack of nutrition* **Claim**
- *To sum up, [...] the merits of animal experiments still outweigh the demerits* **Major claim**
- *For example, tourism makes up one third of Czech's economy* **Premise**
- *I will mention some basic reasoning as follows* **O**

Our contribution

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- We explore cross-lingual argumentation mining in the **low-resource** setting, i.e., **having very little parallel data**, ….
  - Which is likewise a hot topic concurrently (Zhang et al., 2016; Artetxe et al., 2017; Artetxe et al., 2018; Lample et al., 2018; Schulz et al. 2018)
- … by combining two standard cross-lingual approaches --- direct transfer and annotation projection

Excursion - Cross-lingual transfer 1: Direct Transfer

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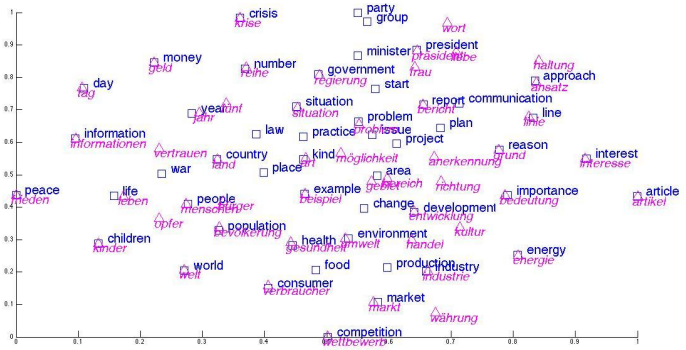
L1

I/PRON love/V children/N
Cats/N like/V me/PRON
…..

L2

Die Stube brennt
Kinder sind doof
…..

Bilingual word embeddings



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Direct Transfer

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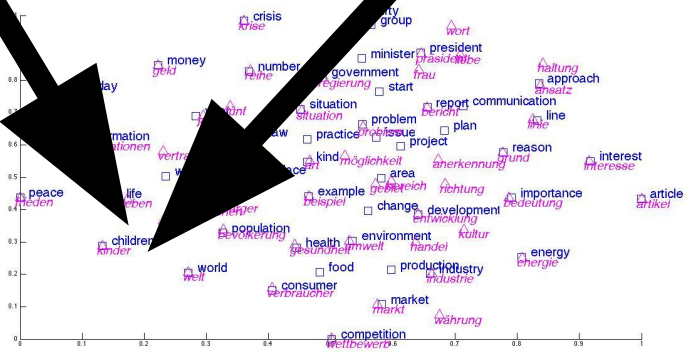

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Excursion - Cross-lingual transfer 2: Annotation Projection

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L1

I/PRON love/V cats/N
Cats/N like/V me/PRON
…..

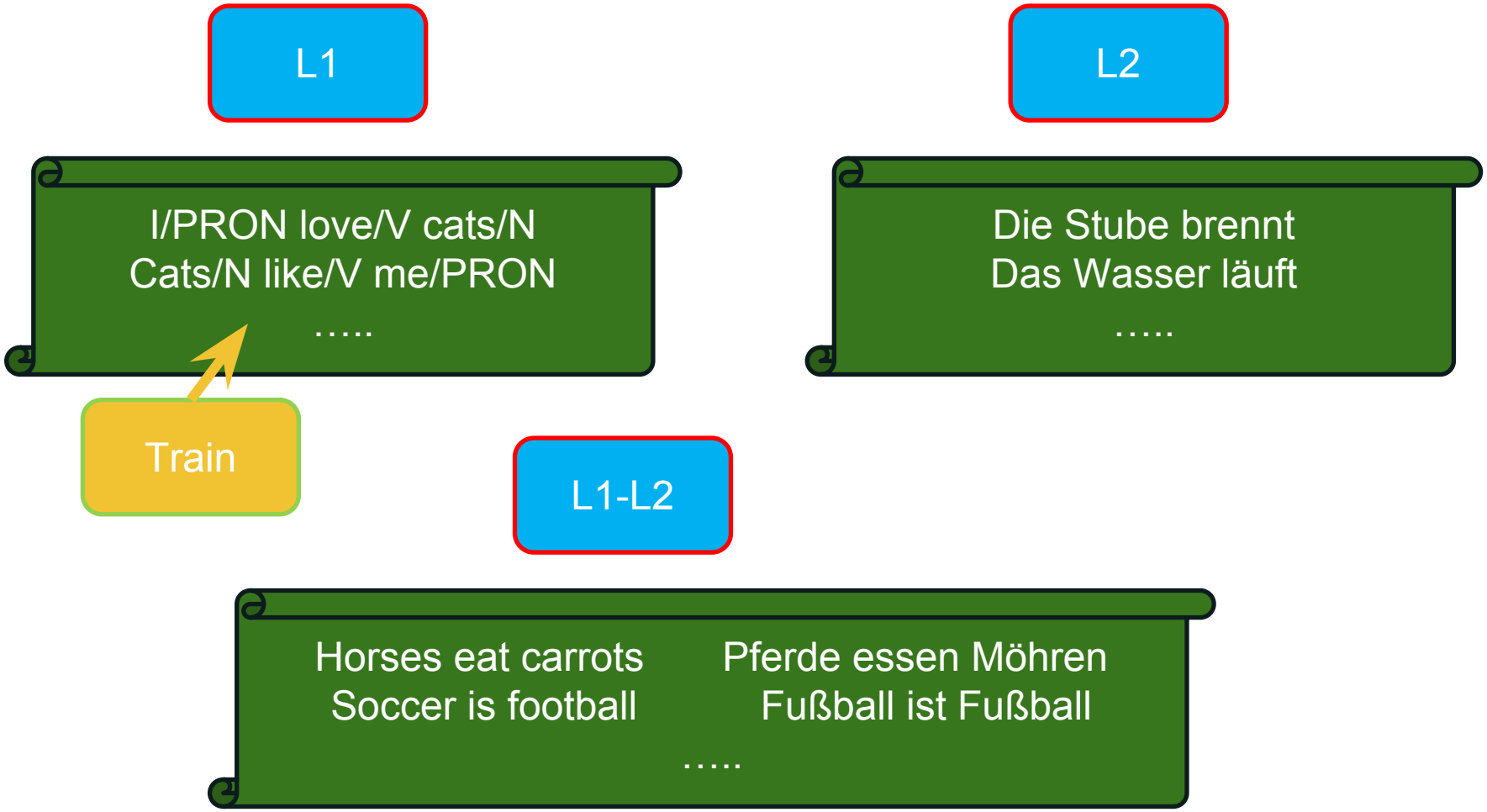
L2

Die Stube brennt
Das Wasser läuft
…..

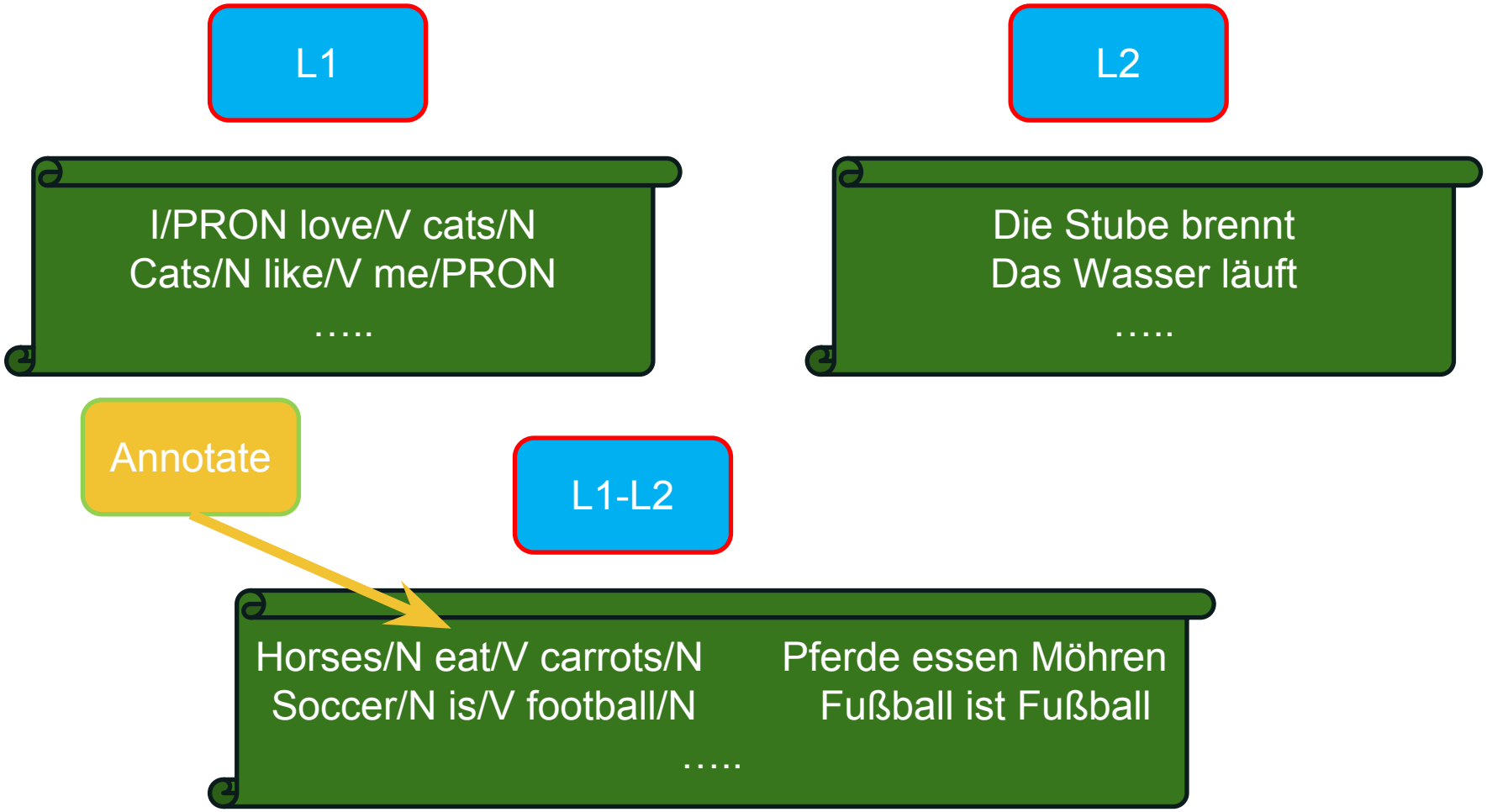
L1-L2

Horses eat carrots — Pferde essen Möhren
Soccer is football — Fußball ist Fußball
…..

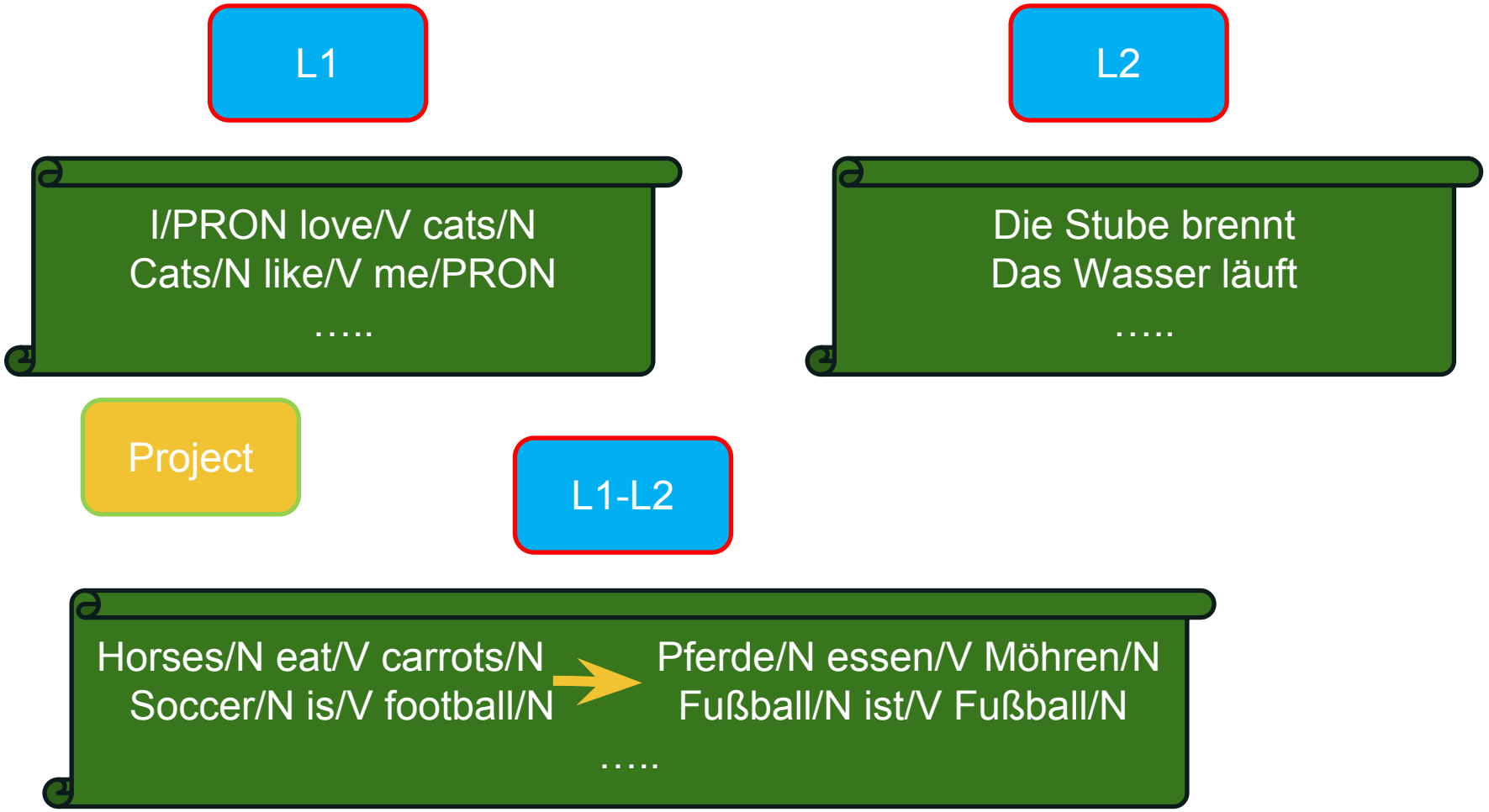
Projection


L1
L2
I/PRON love/V cats/N
Cats/N like/V me/PRON
…..
Die Stube brennt
Das Wasser läuft
…..
Train
L1-L2
Horses eat carrots
Soccer is football
Pferde essen Möhren
Fußball ist Fußball
…..

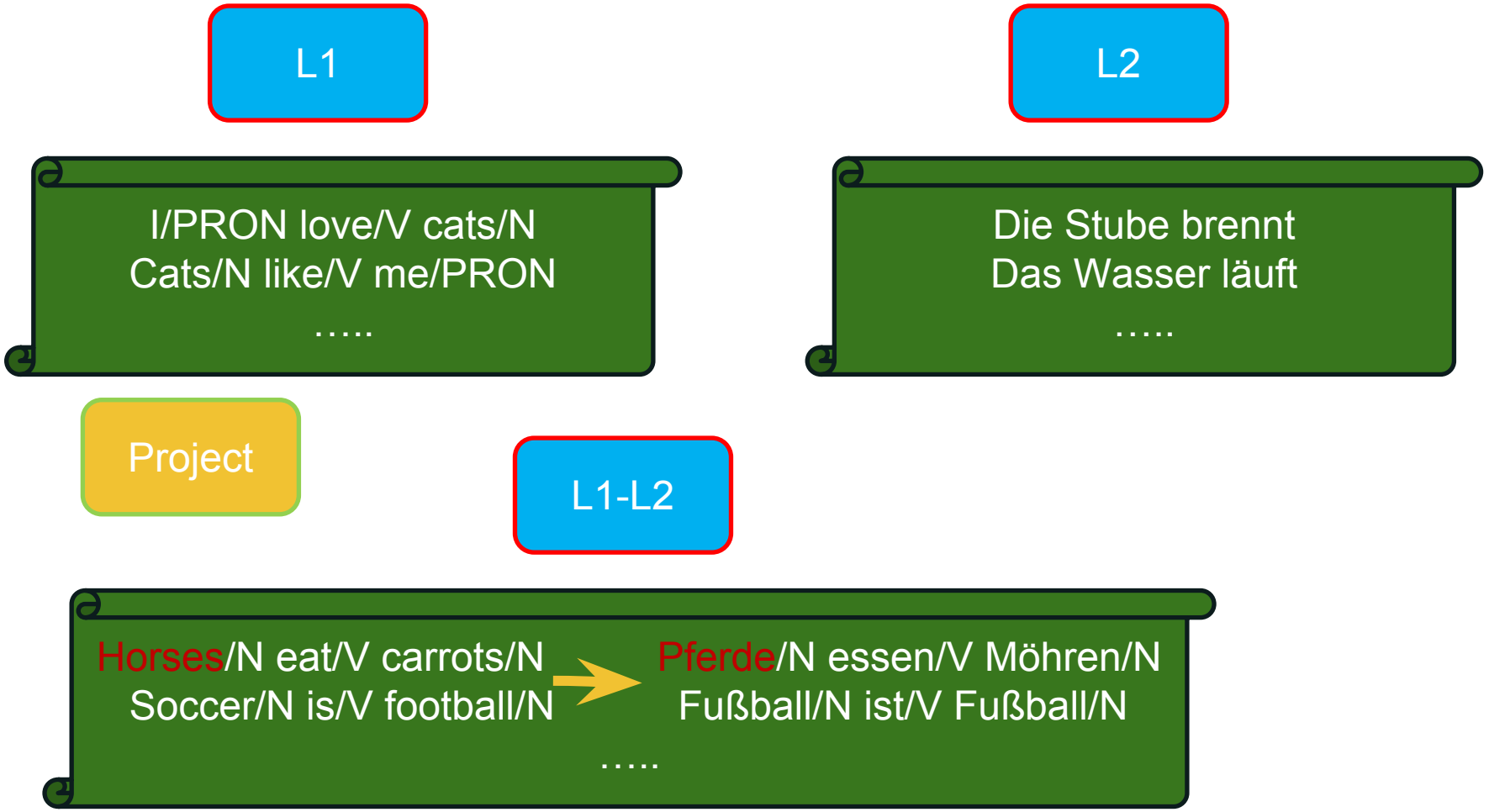
Projection


L1
L2
I/PRON love/V cats/N
Cats/N like/V me/PRON
…..
Die Stube brennt
Das Wasser läuft
…..
Annotate
L1-L2
Horses/N eat/V carrots/N
Soccer/N is/V football/N
…..
Pferde essen Möhren
Fußball ist Fußball

Projection


L1
L2
I/PRON love/V cats/N
Cats/N like/V me/PRON
…..
Die Stube brennt
Das Wasser läuft
…..
Project
L1-L2
Horses/N eat/V carrots/N
Soccer/N is/V football/N
Pferde/N essen/V Möhren/N
Fußball/N ist/V Fußball/N
…..

Projection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L1-L2
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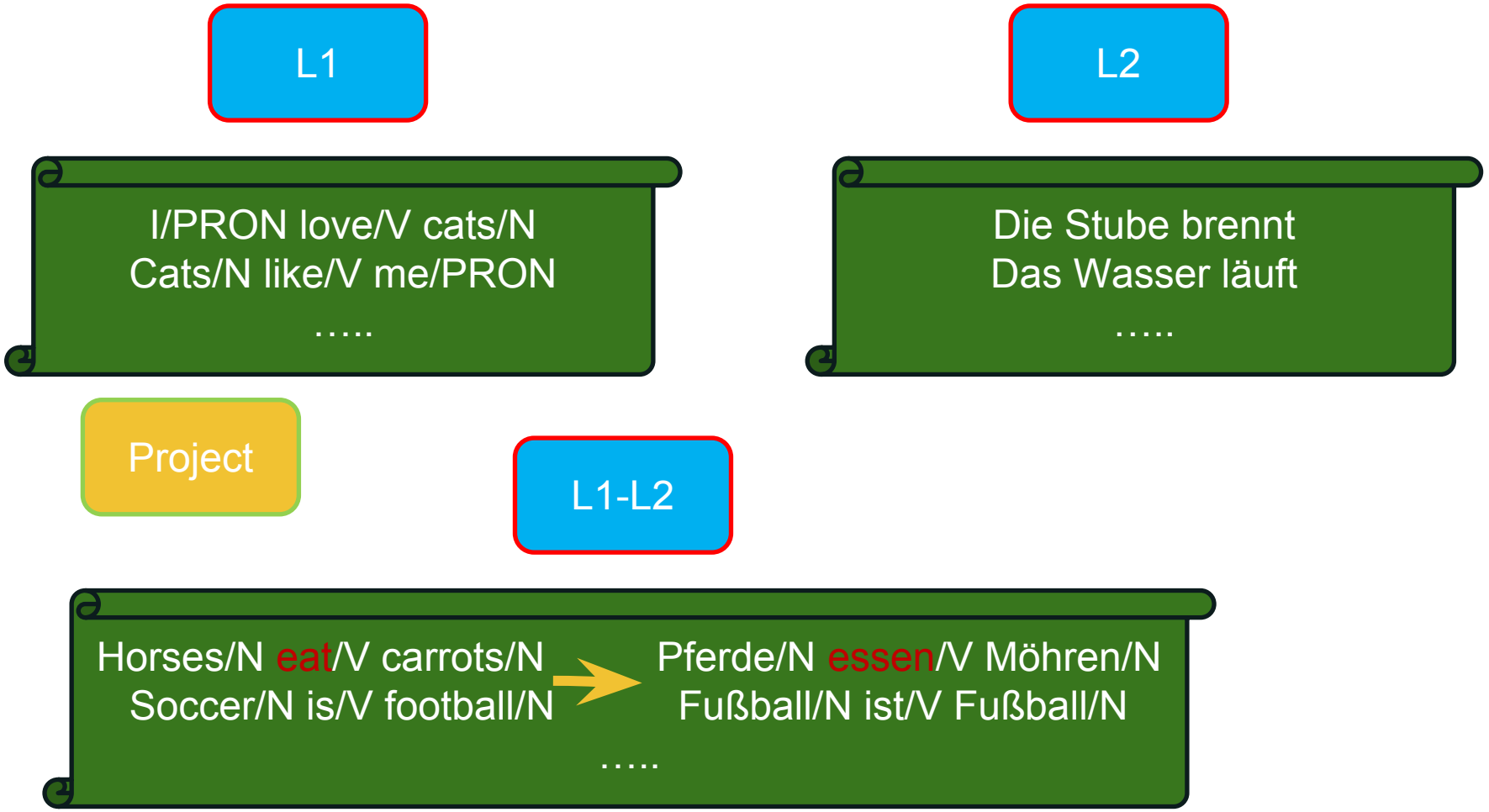
Fußball/N ist/V Fußball/N
…..

Projection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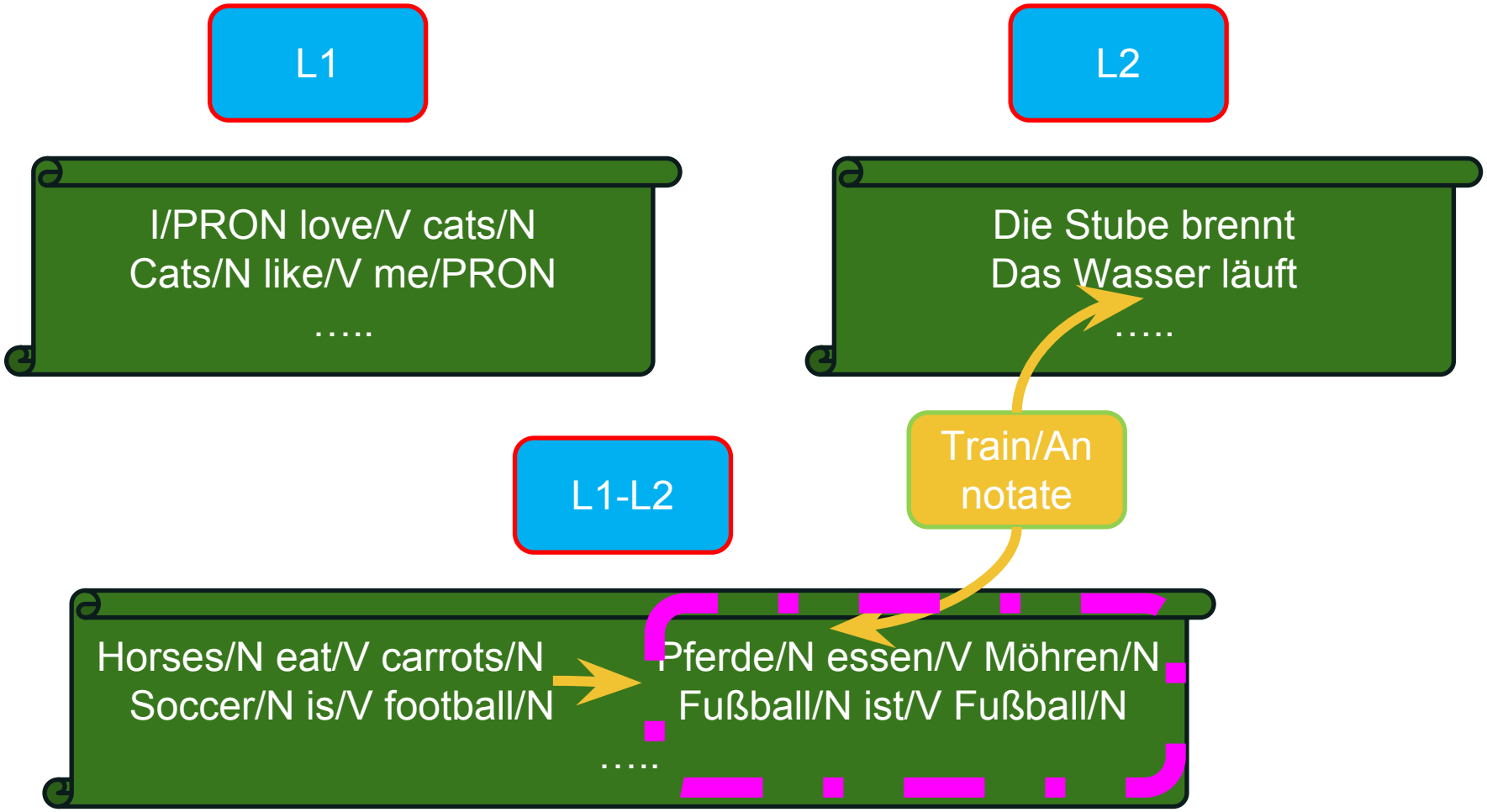
Projection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L2
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…..
Die Stube brennt
Das Wasser läuft
…..
Train/An notate
L1-L2
Horses/N eat/V carrots/N
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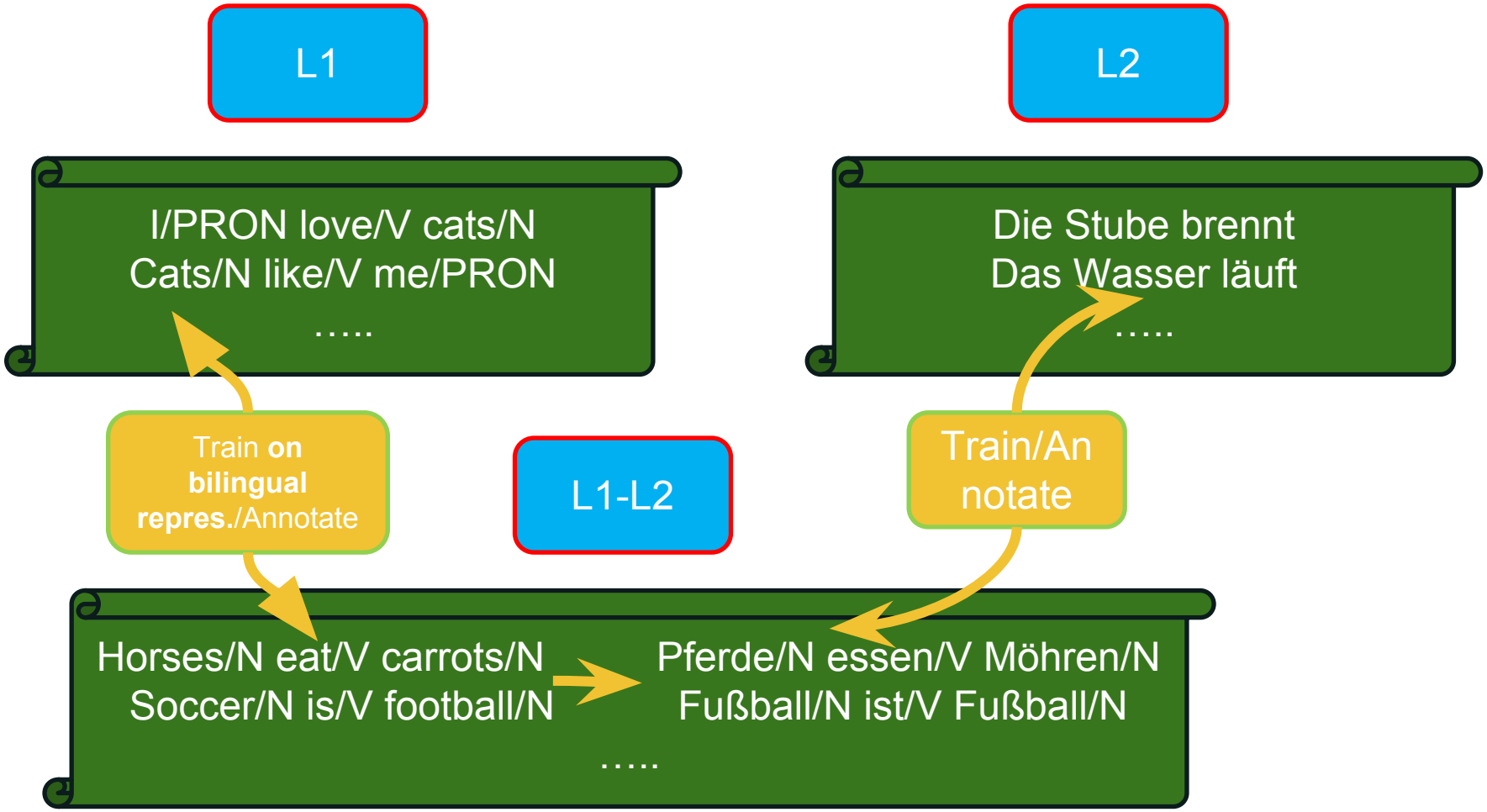
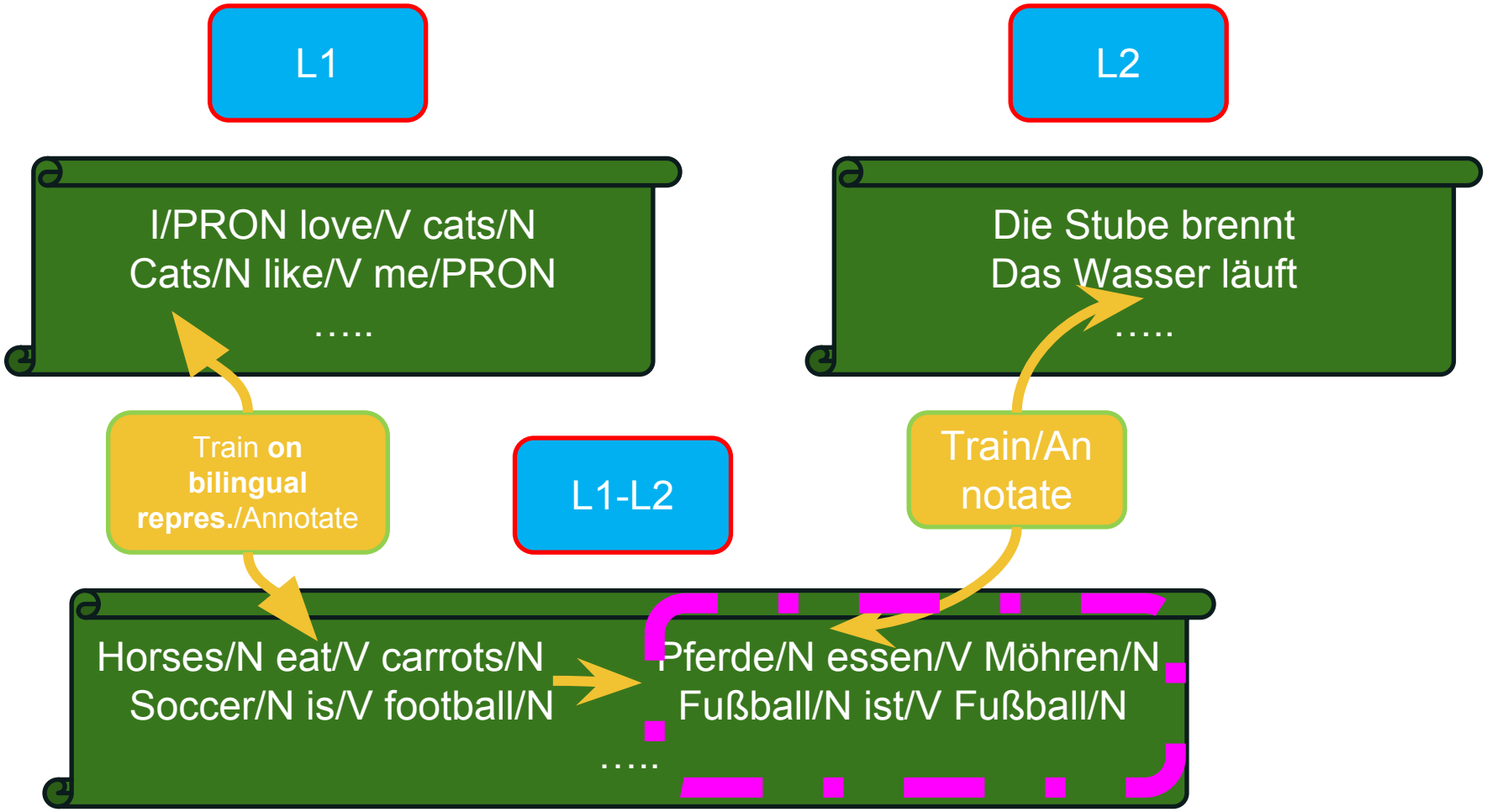
Pferde/N essen/V Möhren/N
Fußball/N ist/V Fußball/N

PD3


L1
L2
I/PRON love/V cats/N
Cats/N like/V me/PRON
…..
Die Stube brennt
Das Wasser läuft
…..
Train on bilingual repres./Annotate
L1-L2
Train/An notate
Horses/N eat/V carrots/N
Soccer/N is/V football/N
Pferde/N essen/V Möhren/N
Fußball/N ist/V Fußball/N
…..

PD3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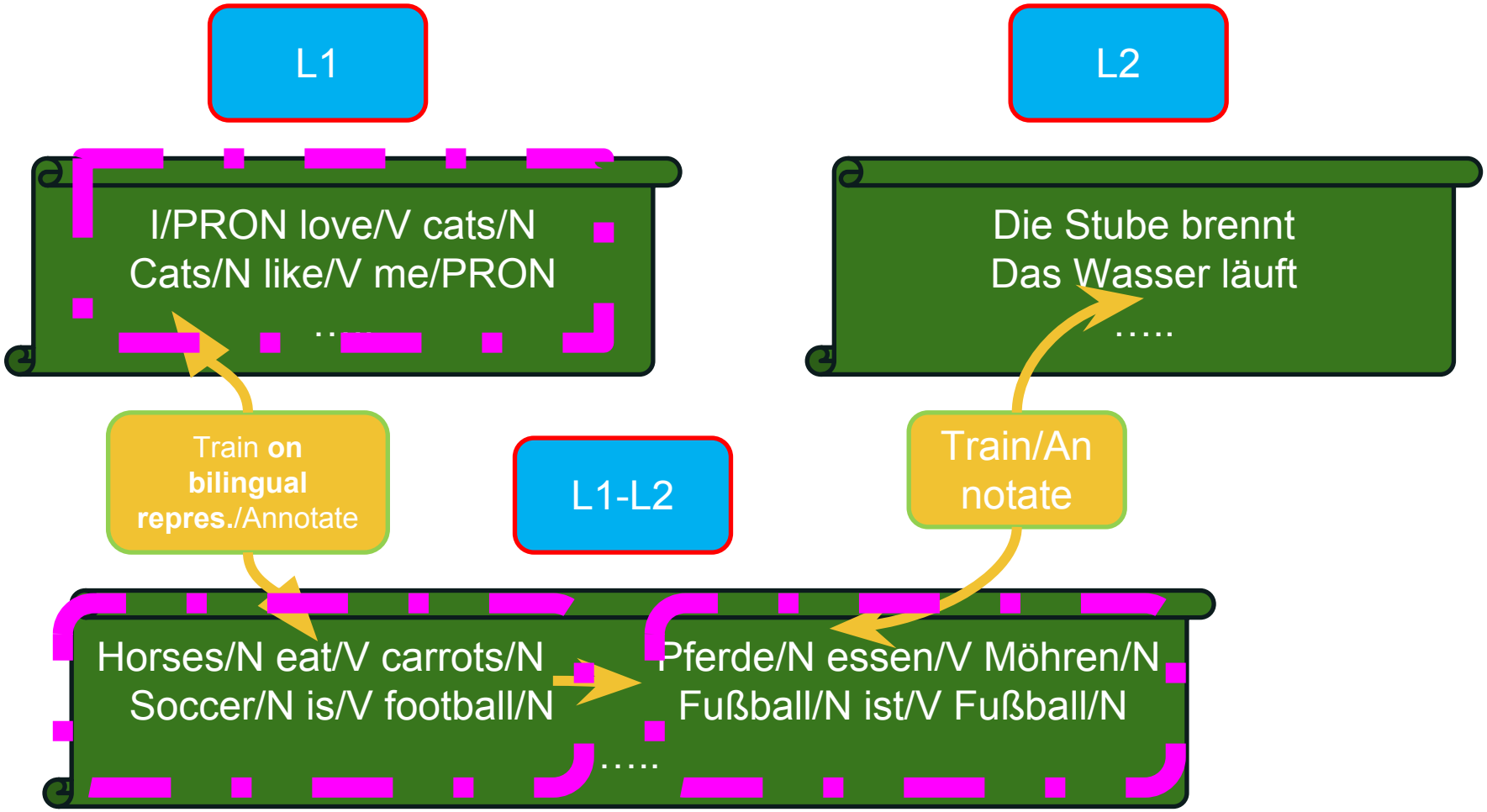
PD3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Fußball/N ist/V Fußball/N

PD3: Combining Direct Transfer and Projection

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- One last issue:
  - Can either **merge** all 3 datasets
  - Or use **multi-task learning**, taking e.g., both L1 datasets as Task1 and the L2 dataset as Task2

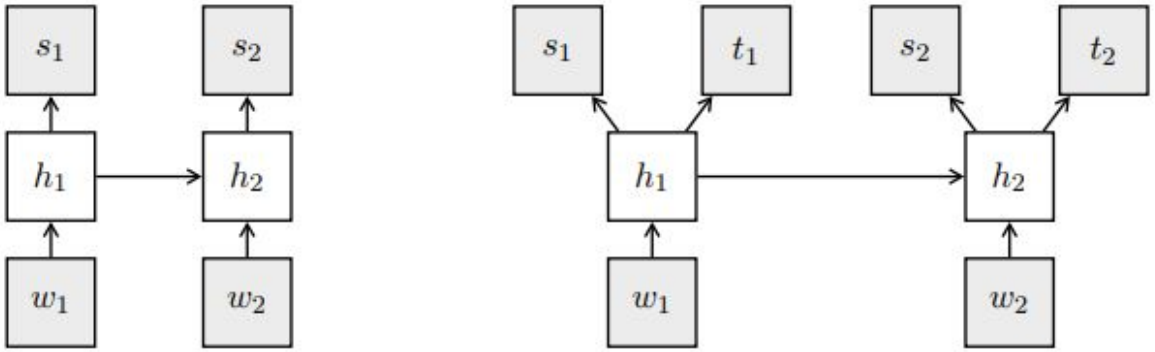


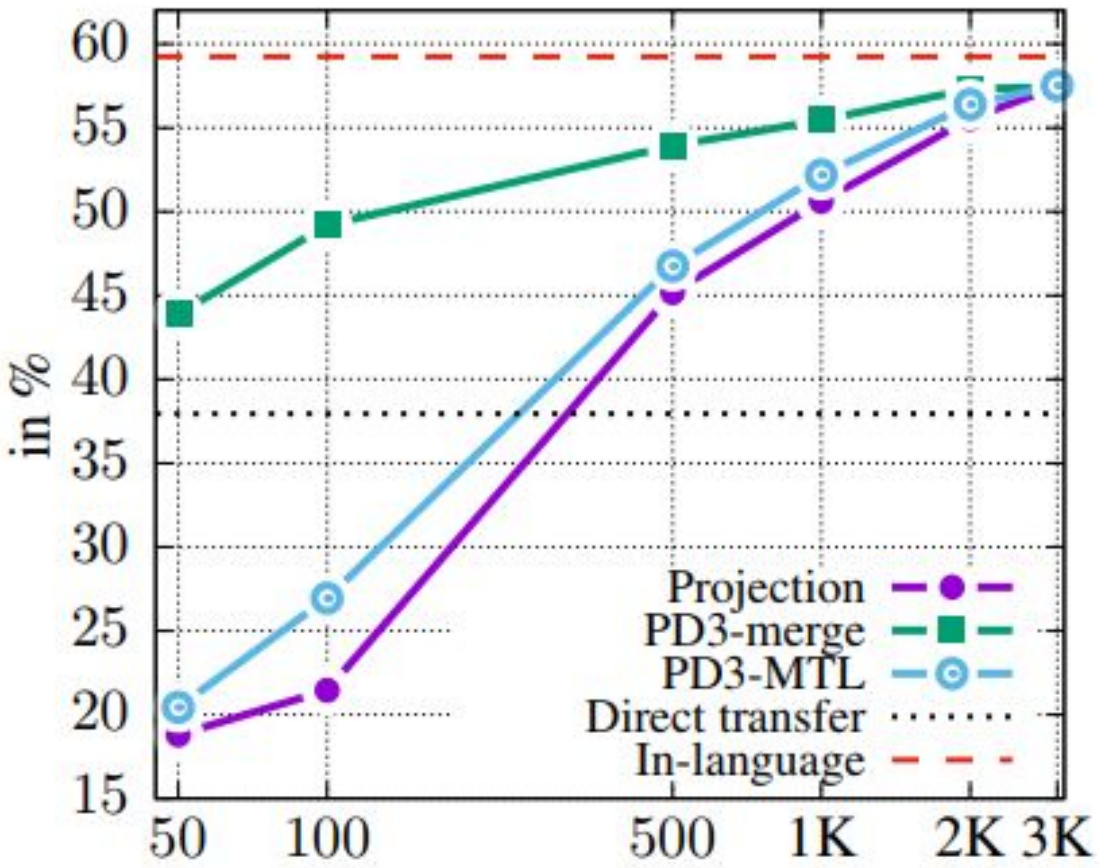
Figure 1: Sequence tagging STL vs. MTL with two tasks. For readability, character-level representations and CRF connections in the output layers are omitted. Bidirectional connections in the hidden layers are also missing. Here, w are the input words and s and t denote different tasks; h are the hidden layers.

Experiments

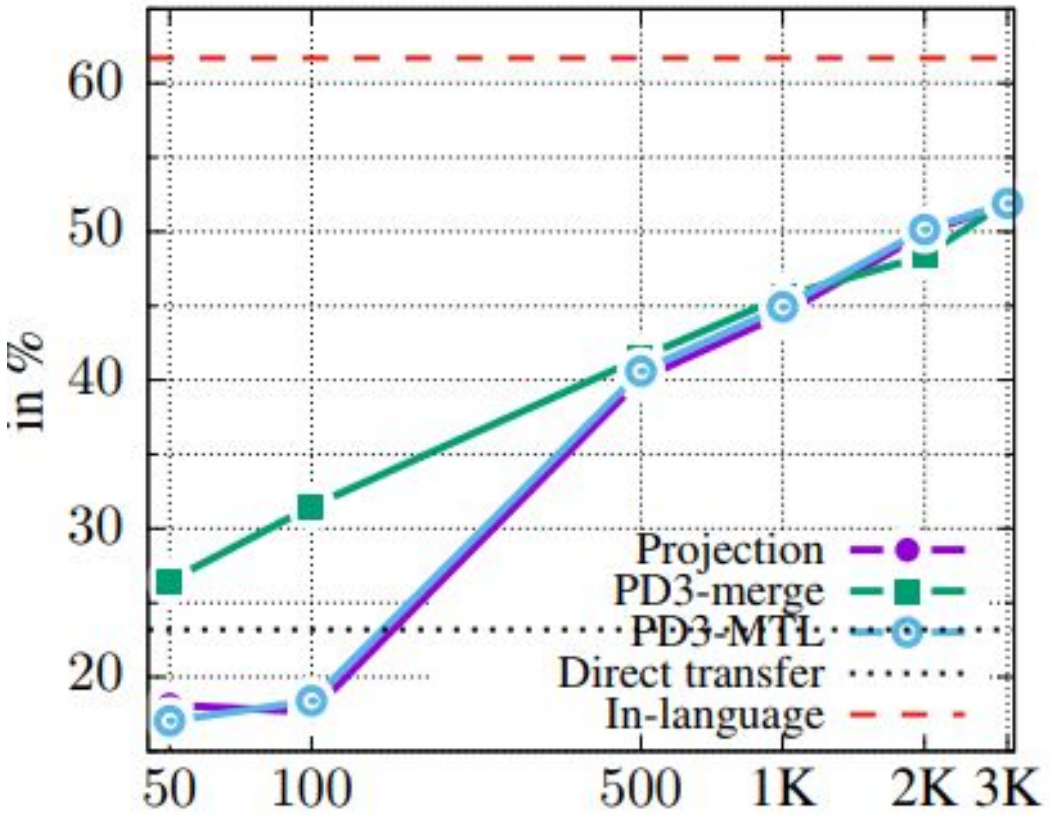
- Bilingual data:
  - en: *To sum up [...], the merits of animal experiments still outweigh the demerits* **MajorClaim**
  - de: *Zusammenfassend kann ich bestätigen [...], dass die Vorzüge von Tierversuchen die Nachteile [...] überwiegen* **MajorClaim**
  - About 7k parallel sentences, available here: https://github.com/UKPLab/coling2018-xling_argument_mining

- Setup:
  - 2k for train (en), 0.5k for dev (en), 1.5k for test (de)
  - 3k as parallel data (and further subsets thereof)
    - We also consider non-argumentative parallel data from TED
  - Evaluation Metric is Macro-F1

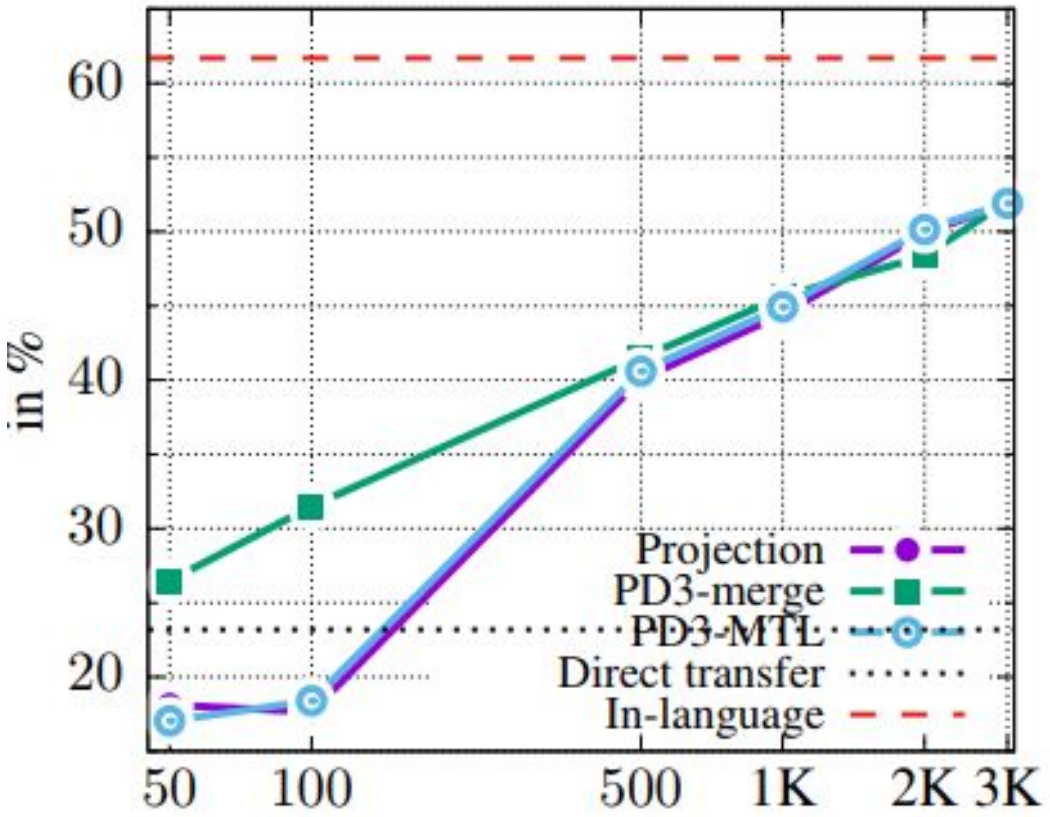
Results - high quality bilingual embeddings



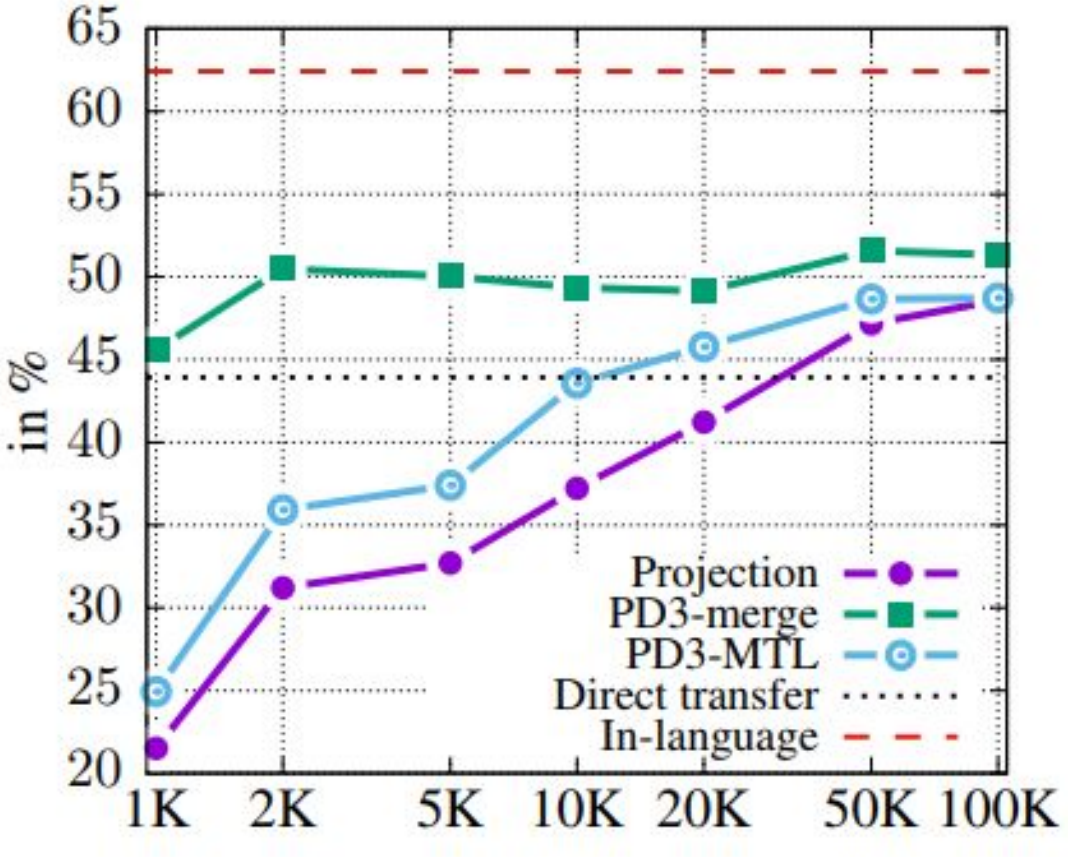
Results - low quality bilingual embeddings



Results - low quality bilingual embeddings



Results - non-argumentative parallel data



Conclusion

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- Considered low-resource language transfer for ArgMin
  - By combining direct transfer and annotation projection
- There are benefits, but they're small
- Also, they diminish quickly
- True low-resource language transfer still a big challenge
  - And an important avenue for the future
- Doing annotation projection using machine translation **without any parallel data** (Artexte et al. 2018, Lample et al. 2018) may be worthwhile to investigate prospectively

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THÁNK YÕU