

Bridging the Gap in Multilingual Semantic Role Labeling: a Language-Agnostic Approach

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NLP



Semantic Role Labeling

An overview



Semantic Role Labeling (SRL)

An overview

SRL is the task of automatically addressing:

“Who did What to Whom, Where, When and How?”

(Gildea and Jurafsky, 2000; Màrquez et al., 2008)

Semantic Role Labeling (SRL)

An overview

The quick brown fox jumps over the lazy dog

Semantic Role Labeling (SRL)

An overview

The quick brown fox **jumps** over the lazy dog



Predicate
identification

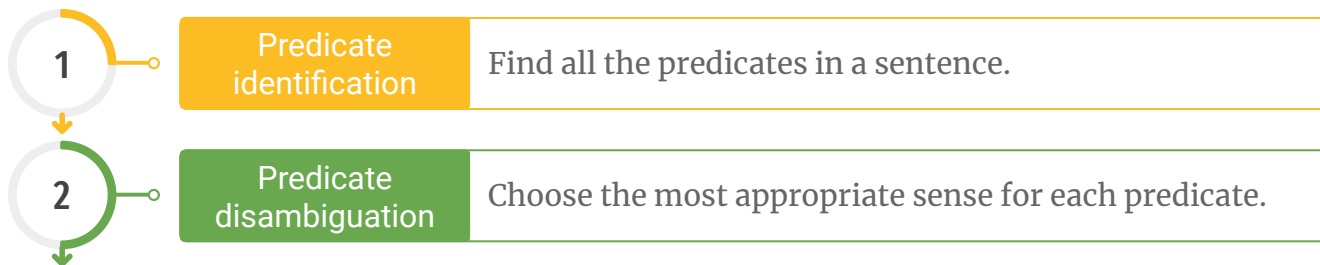
Find all the predicates in a sentence.

Semantic Role Labeling (SRL)

An overview

The quick brown fox **jumps** over the lazy dog

jump.03



Semantic Role Labeling (SRL)

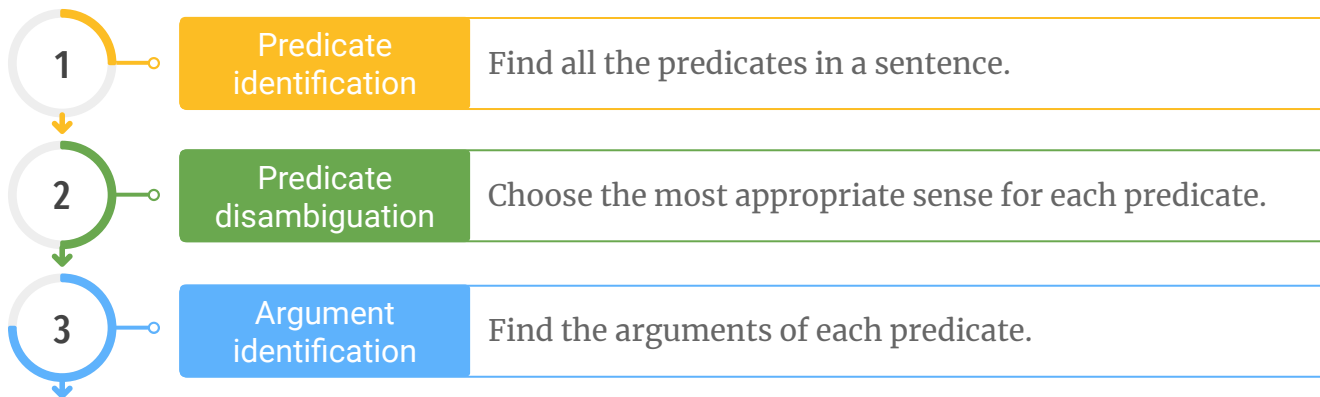
An overview

The quick brown fox

jumps

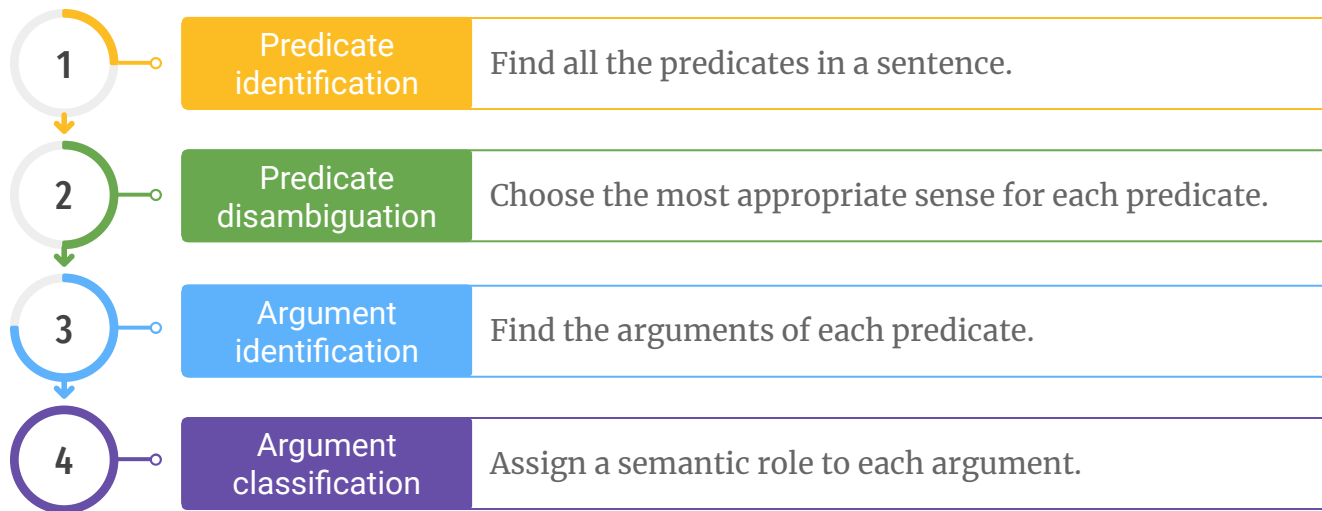
over the lazy dog

jump.03



Semantic Role Labeling (SRL)

An overview



Syntax in Semantic Role Labeling

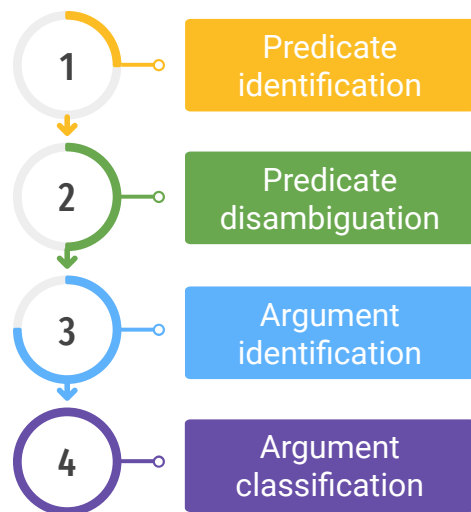
Advantages and Disadvantages



Syntax in SRL

Advantages

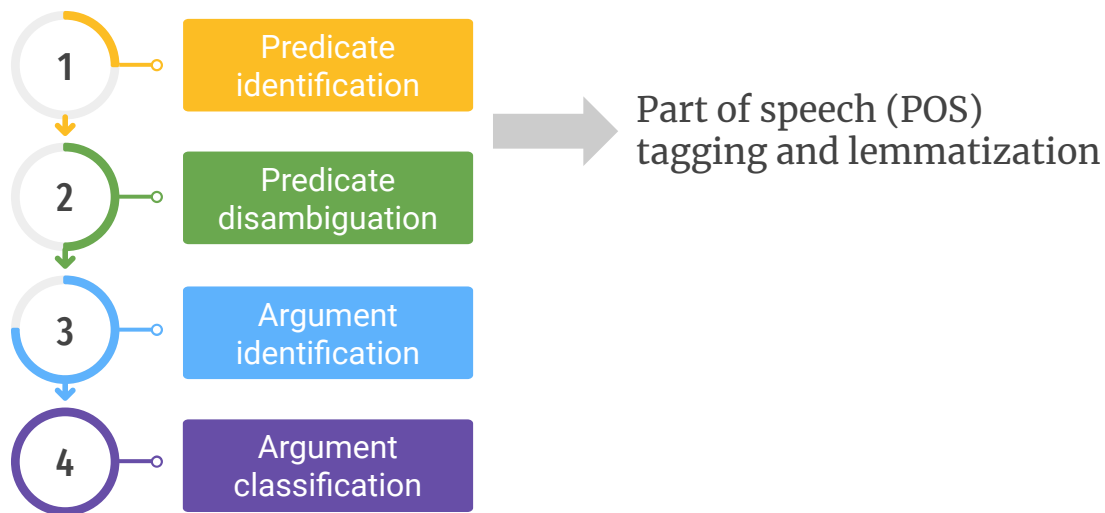
Advantage: syntax can be a strong indicator for many subtasks.



Syntax in SRL

Advantages

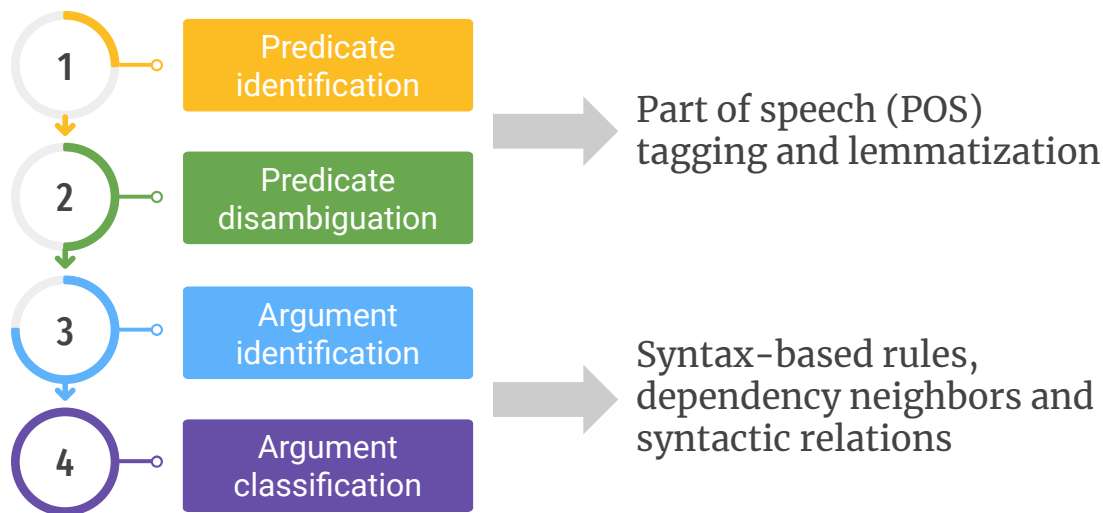
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Syntax in SRL

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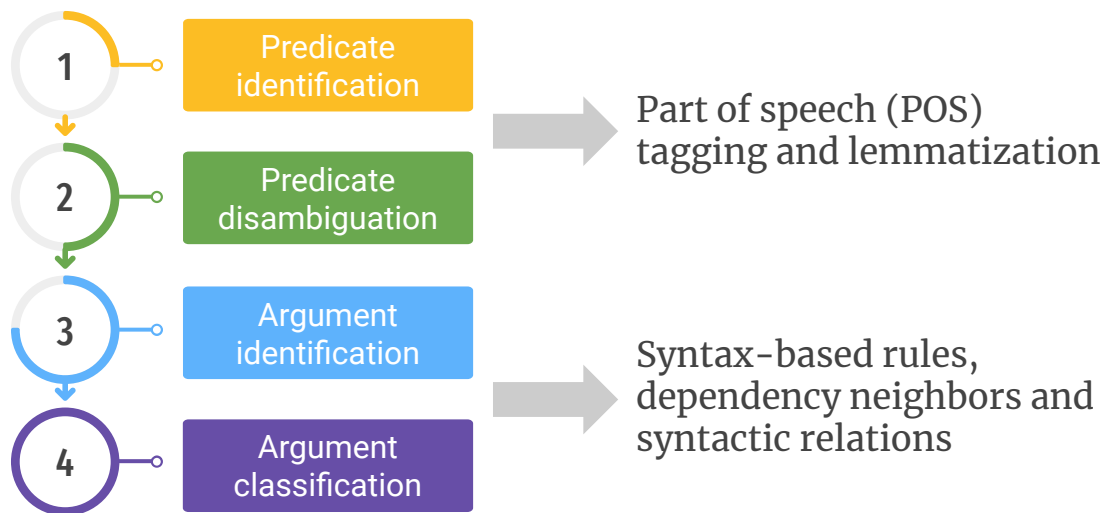
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Syntax in SRL

Disadvantages

Disadvantage: syntactic annotations are sometimes expensive and scarce.

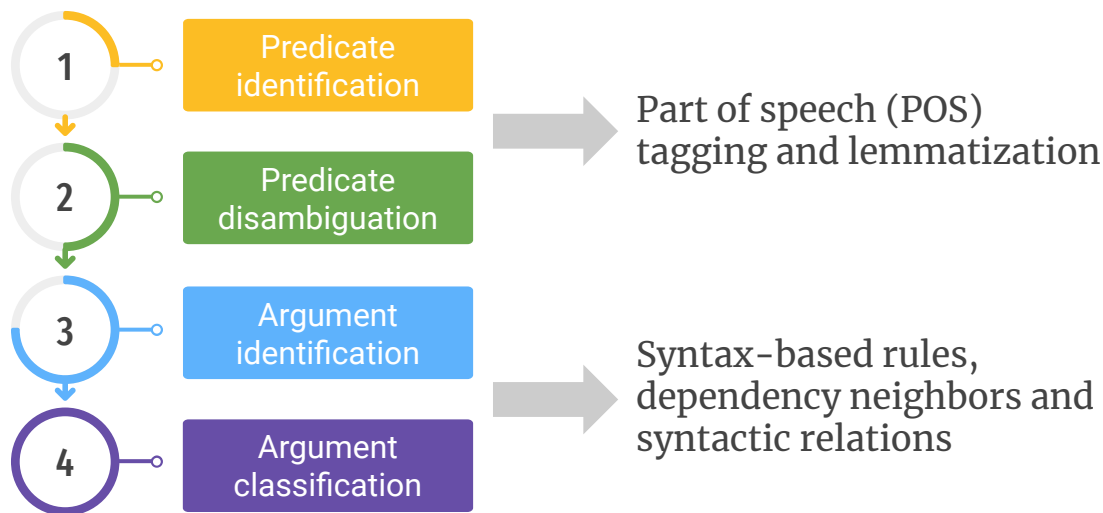


Syntax in SRL

Disadvantages

Especially in
low-resource
languages!

Disadvantage: syntactic annotations are sometimes expensive and scarce.

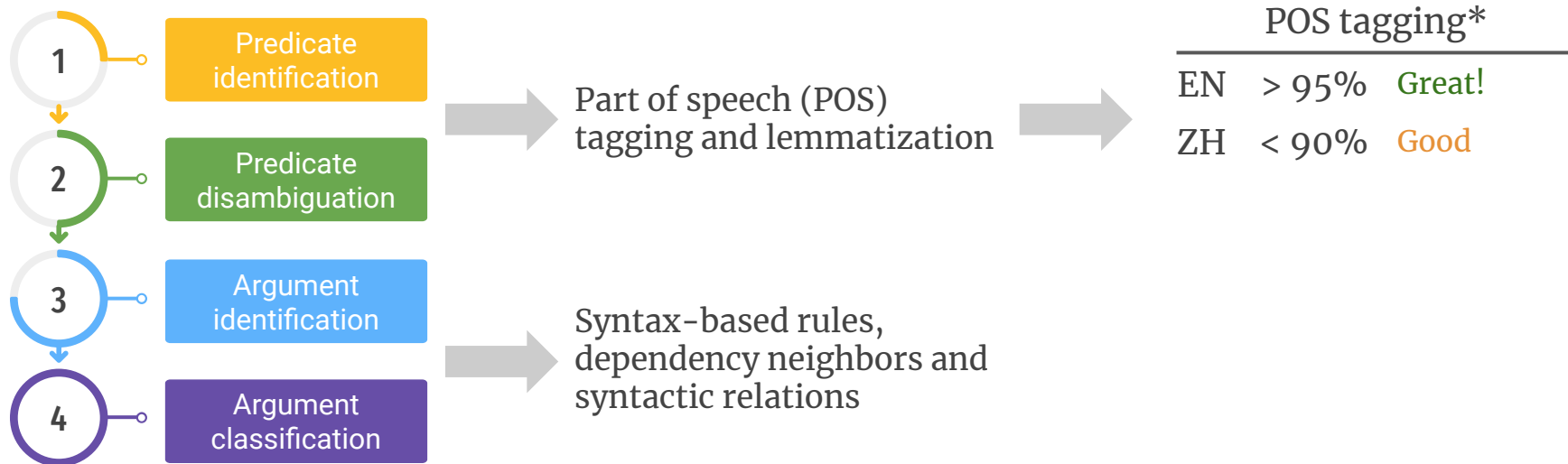


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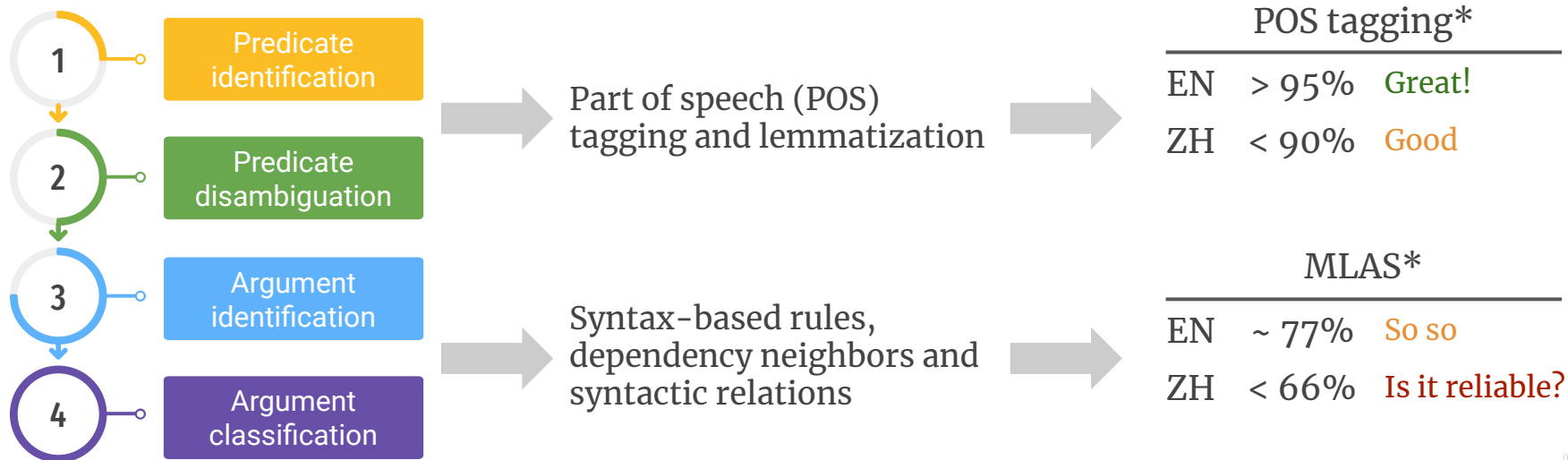
*Results of Stanza NLP in the CoNLL-2018 shared task on syntactic parsing.

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The Multilingual Gap

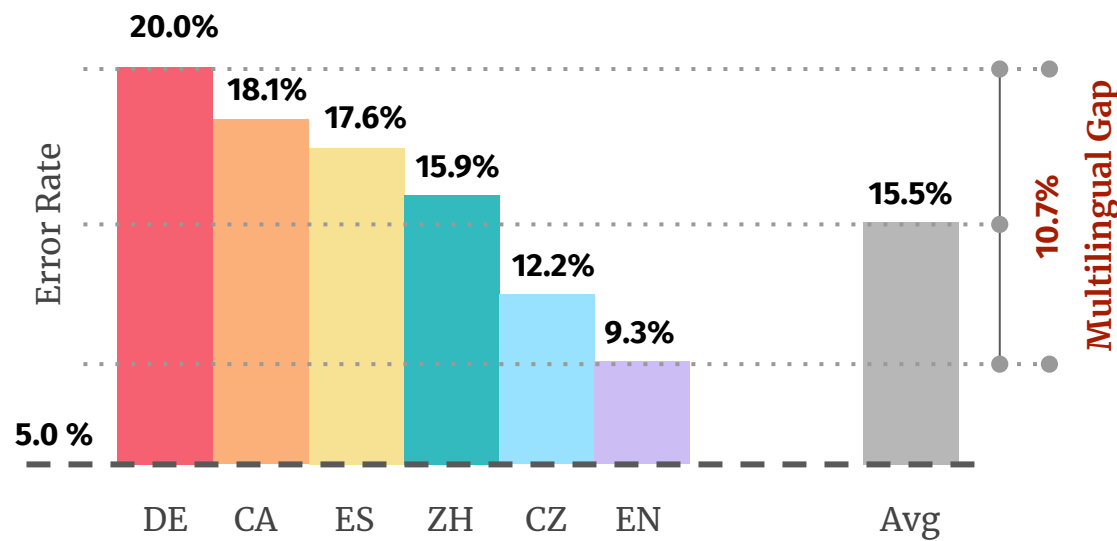
in Semantic Role Labeling



The Multilingual Gap

in Semantic Role Labeling

Recent progress has left a wide gap between high- and low-resource languages.

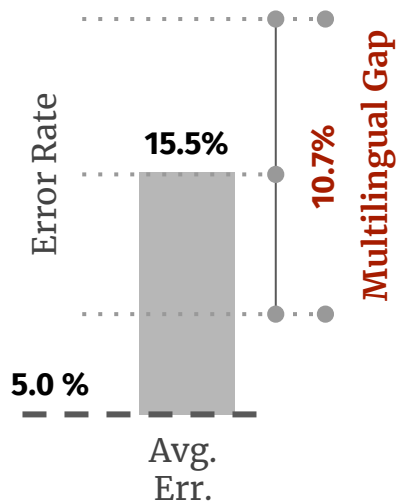


Average error rates (% F1) of state-of-the-art SRL systems presented in 2019 and evaluated on CoNLL-2009.

The Multilingual Gap

in Semantic Role Labeling

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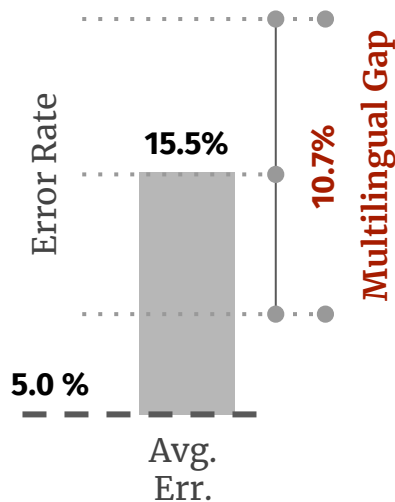


Q: Is it possible to significantly close this gap?

The Multilingual Gap

in Semantic Role Labeling

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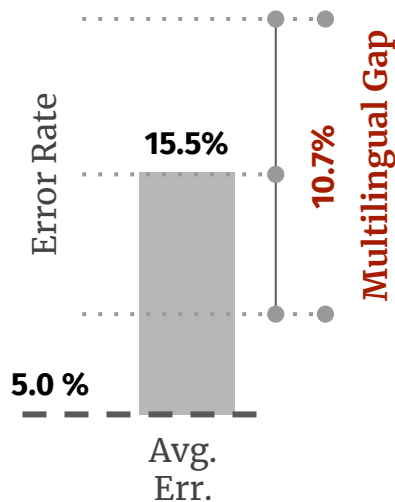
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A: Yes!

The Multilingual Gap

in Semantic Role Labeling

Recent progress has left a wide gap between high- and low-resource languages.



Q: Is it possible to significantly close this gap?

A: Yes! **And we don't need syntax!**

The Multilingual Gap

in Semantic Role Labeling

OBJECTIVE

Bridging the gap in **multilingual Semantic Role Labeling**

The Multilingual Gap

in Semantic Role Labeling

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Bridging the gap in **multilingual Semantic Role Labeling**

without relying on any **language-specific features** (lemma, POS, syntax)

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in Semantic Role Labeling

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and setting a **strong and robust baseline** for future innovations

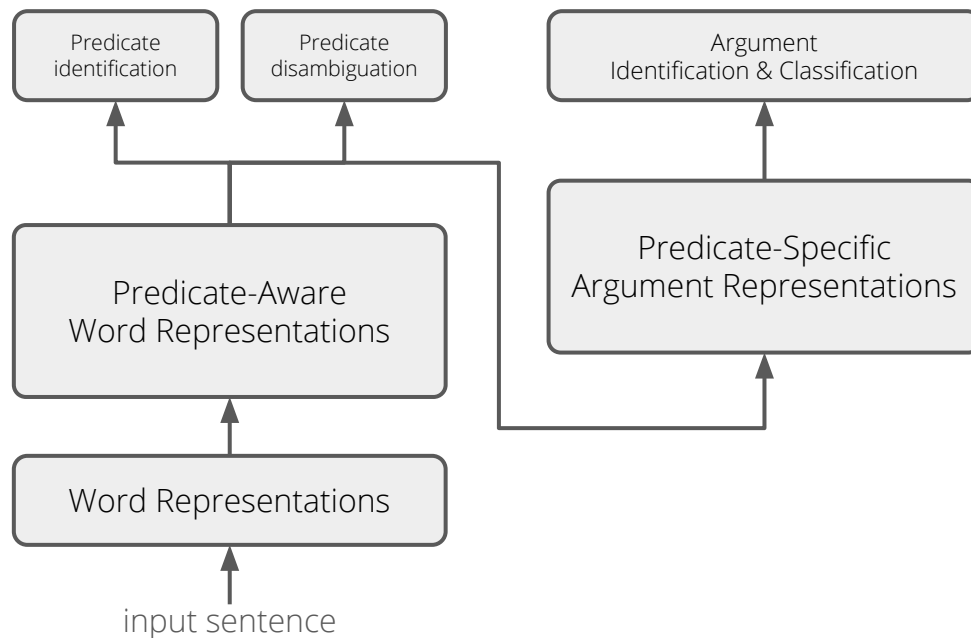
Method

A language-agnostic SRL model



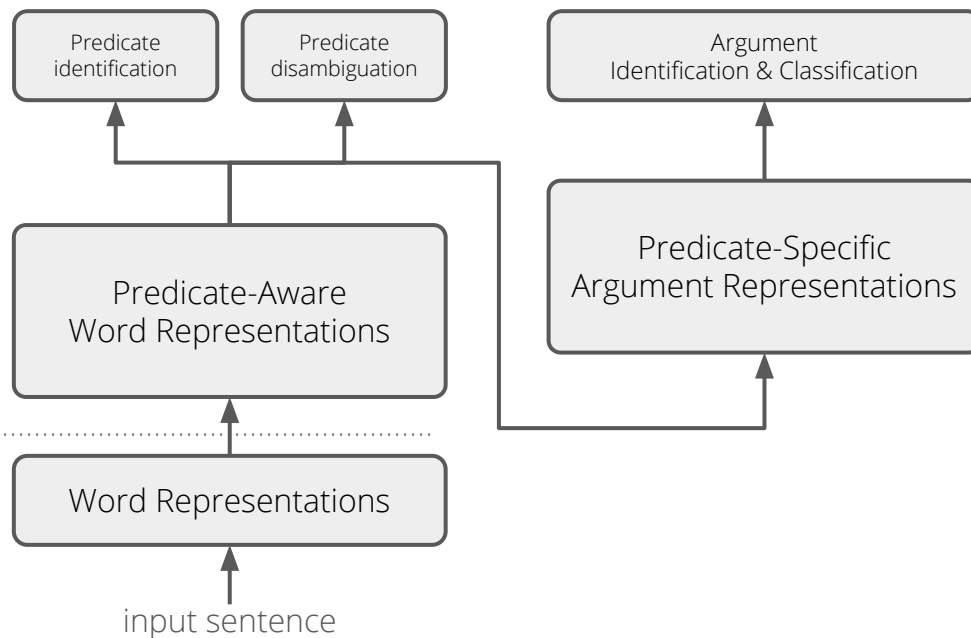
Model Architecture

Overview



Model Architecture

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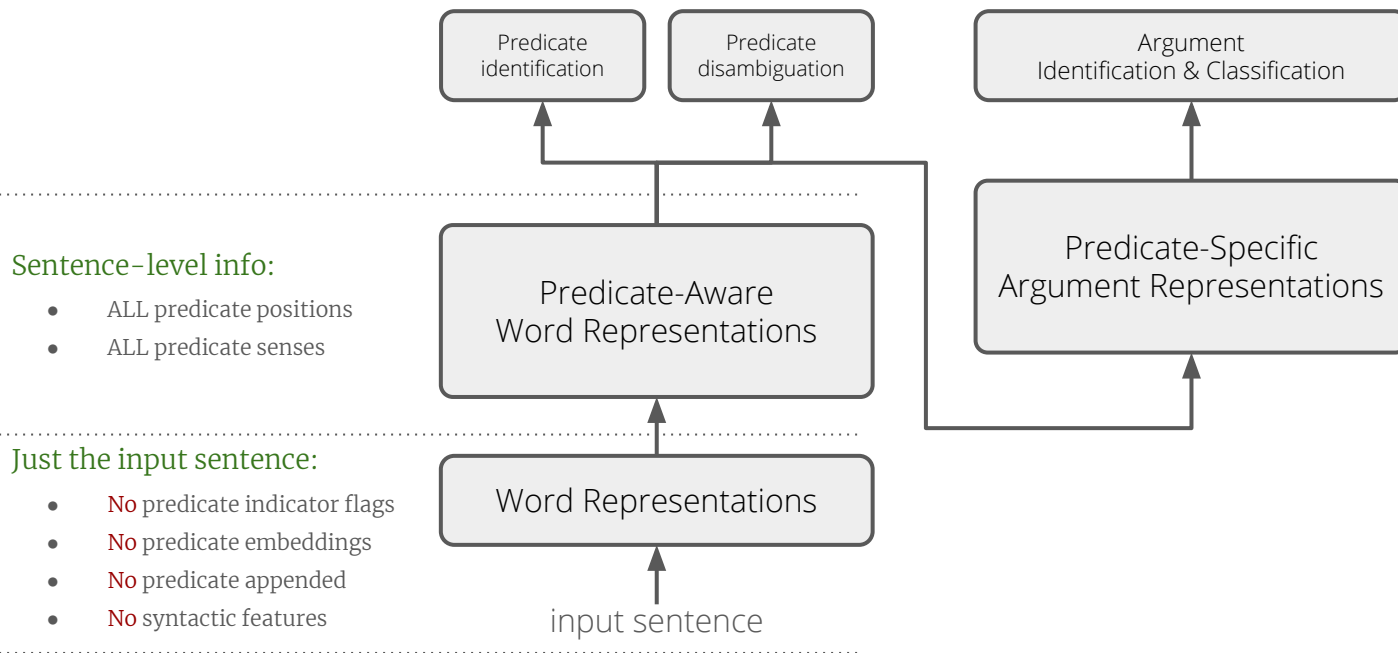


Just the input sentence:

- No predicate indicator flags
- No predicate embeddings
- No predicate appended
- No syntactic features

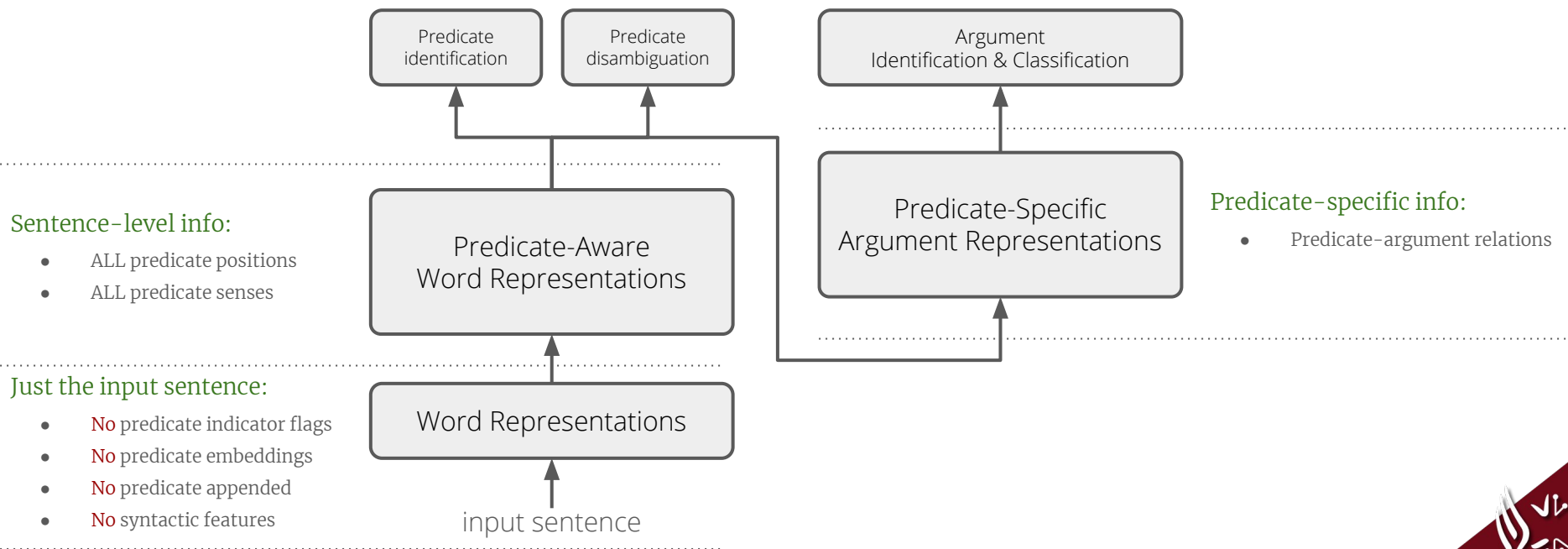
Model Architecture

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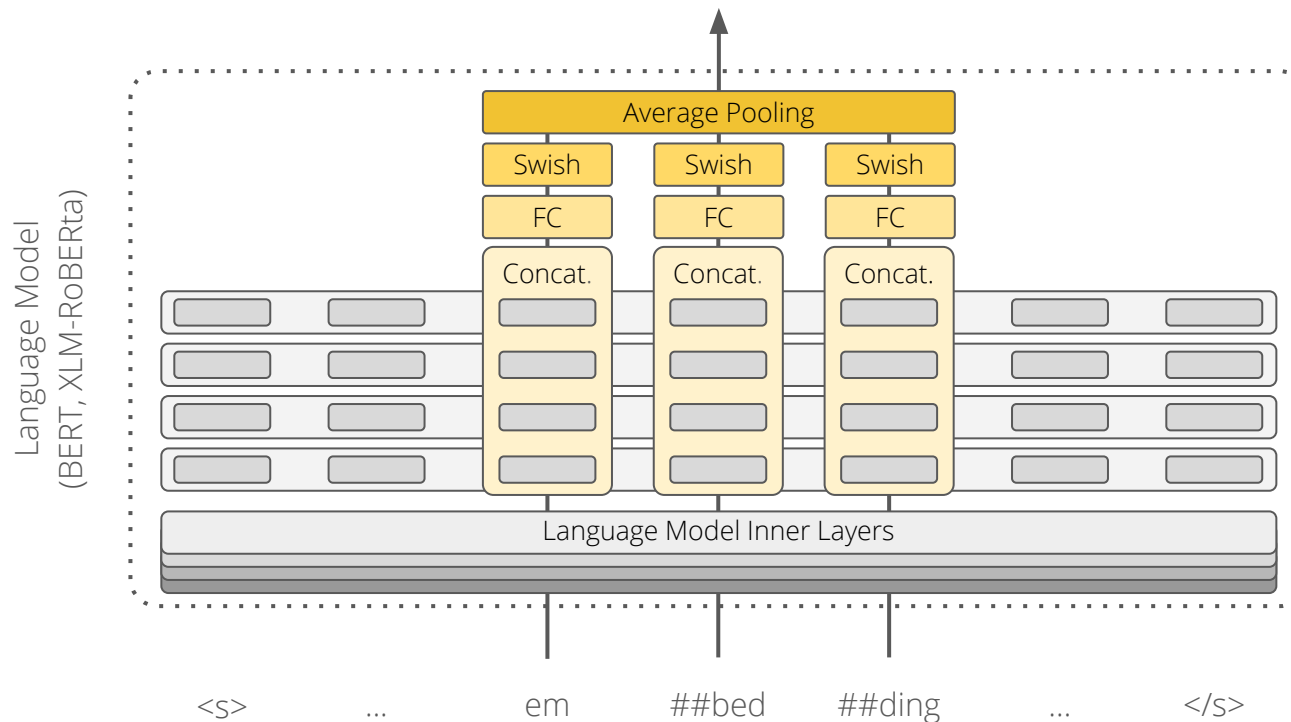
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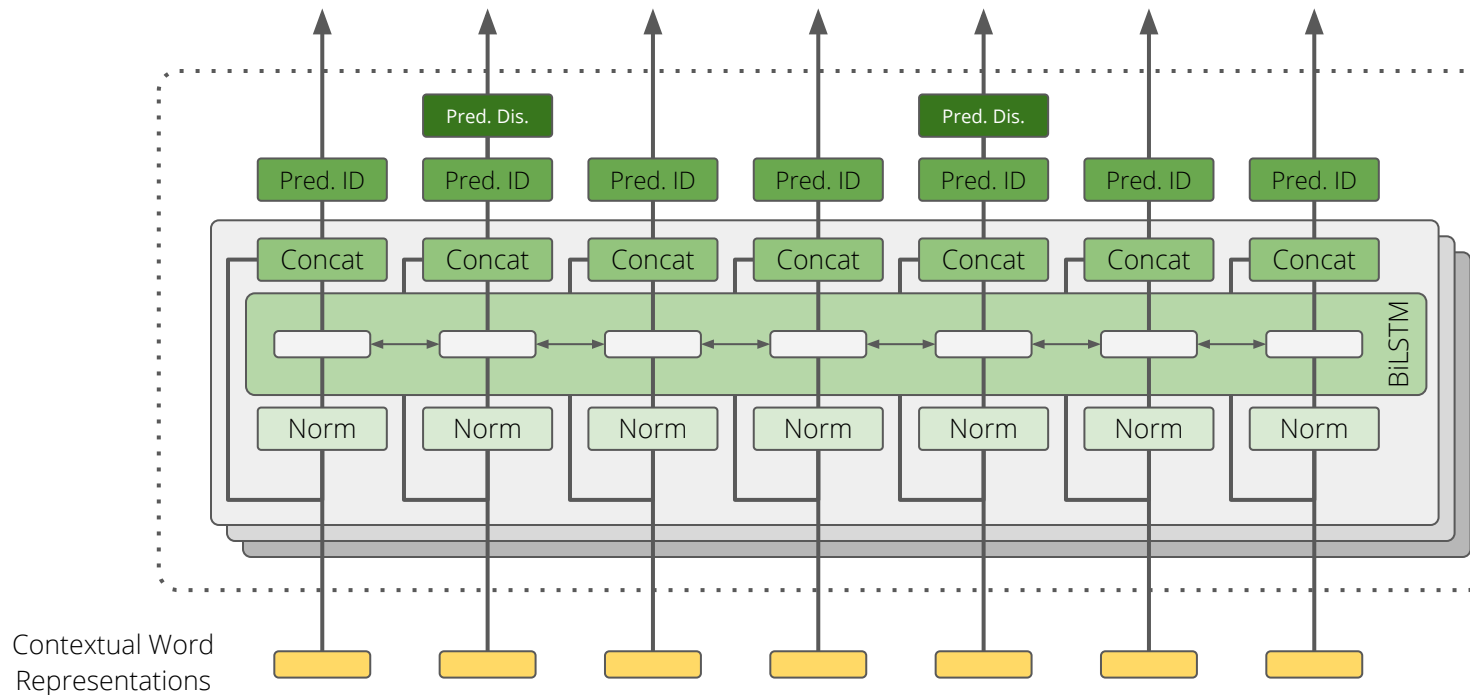
Contextualized Word Representations

Exploiting the inner layers



Predicate-Aware Word Representations

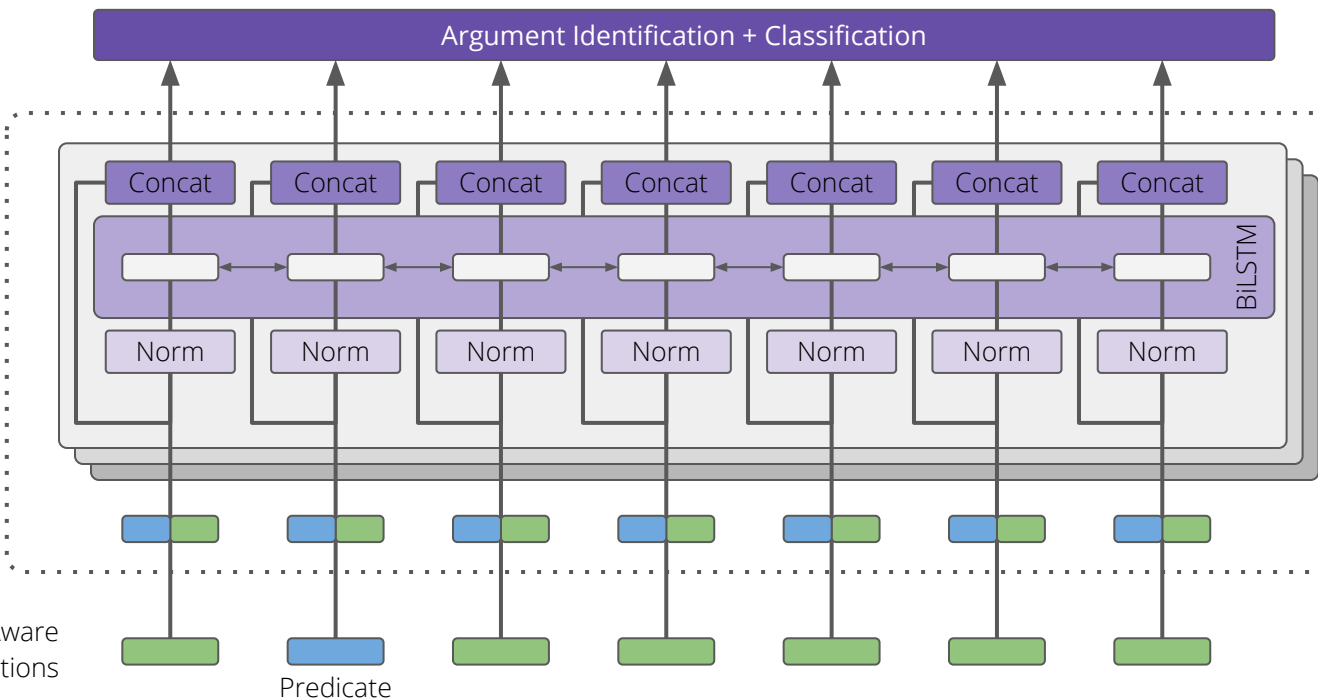
Recontextualizing the representations with respect to ALL the predicates



Contextual Word
Representations

Predicate-Specific Argument Representations

Specializing word representations with respect to a SINGLE predicate



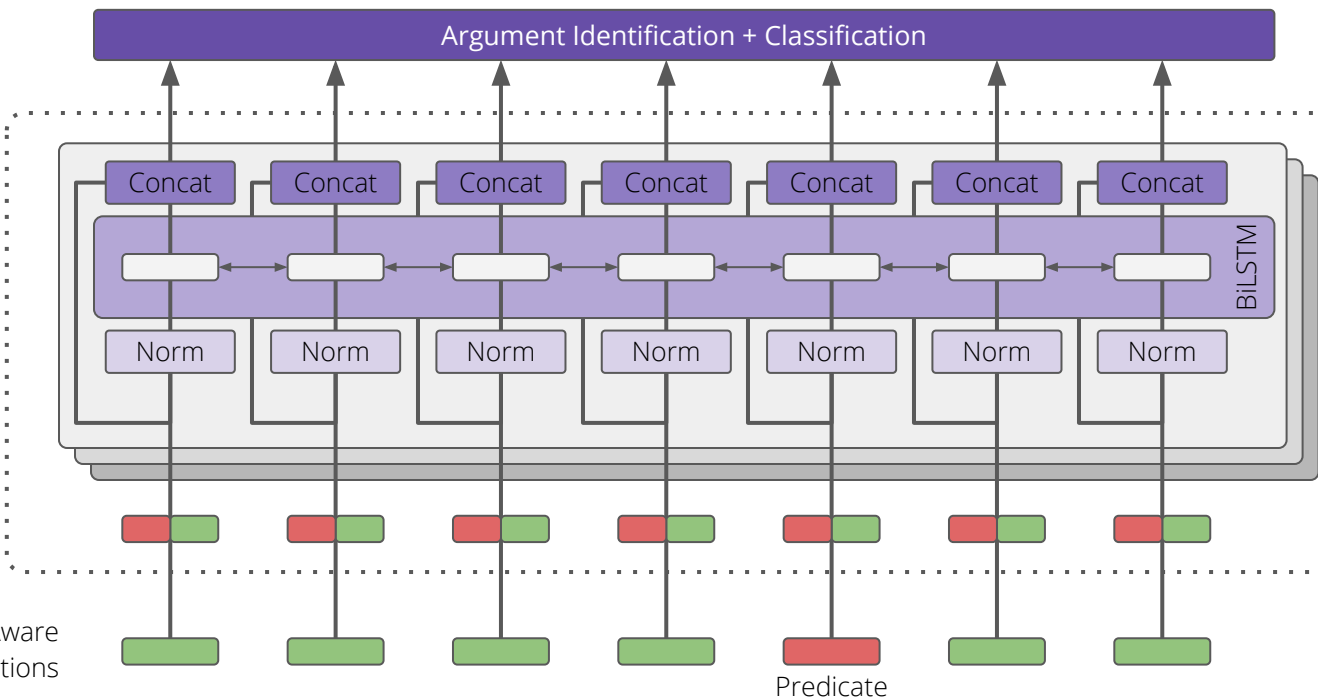
Predicate-Aware
Representations

Predicate



Predicate-Specific Argument Representations

Specializing word representations with respect to a SINGLE predicate



Predicate-Aware
Representations

Predicate

Evaluation

Dependency- and Span-based English SRL



English SRL

Dependency-based SRL on CoNLL-2009



English SRL

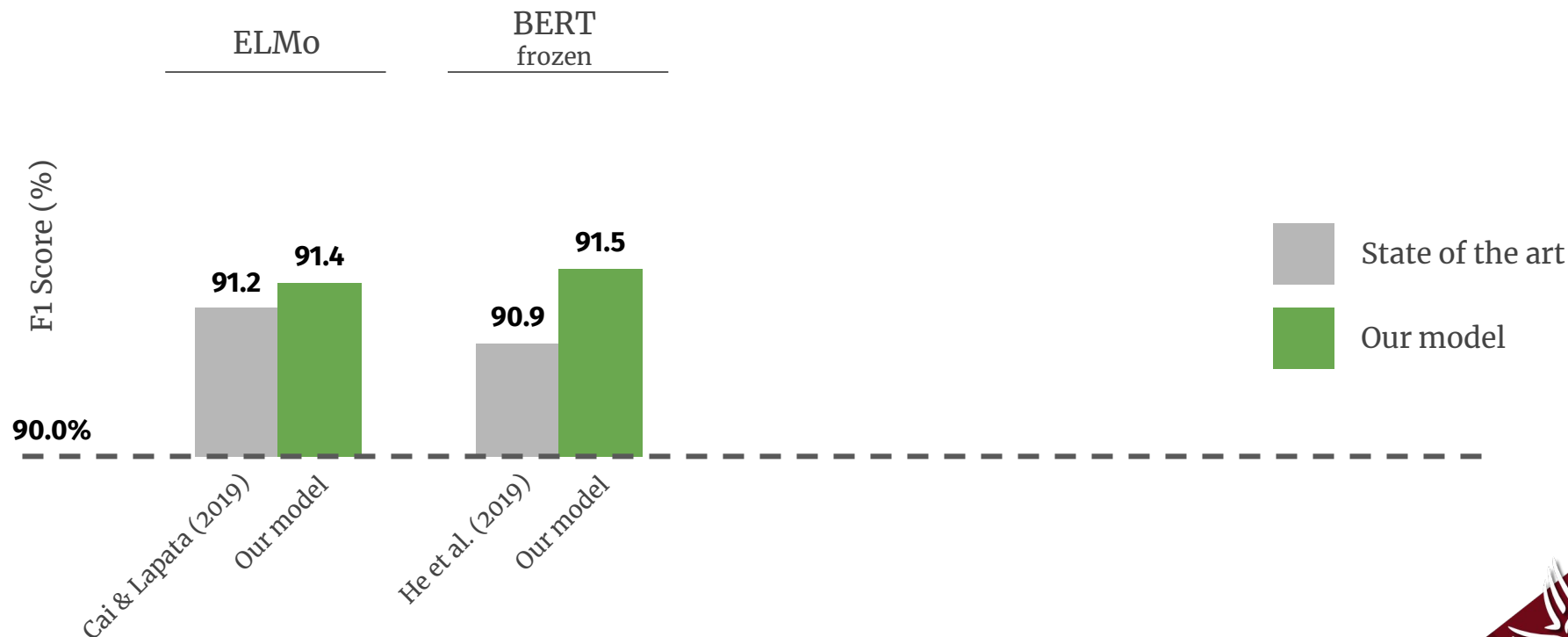
Dependency-based SRL on CoNLL-2009

ELMo



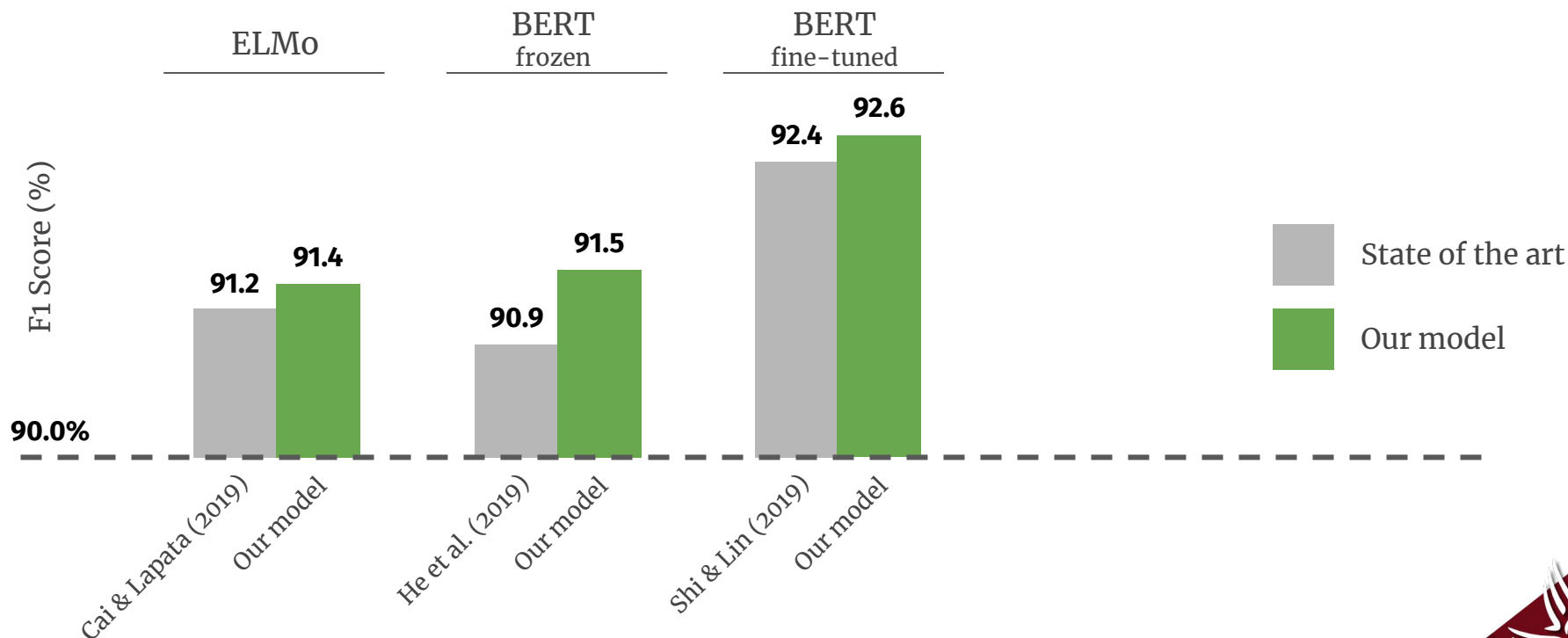
English SRL

Dependency-based SRL on CoNLL-2009



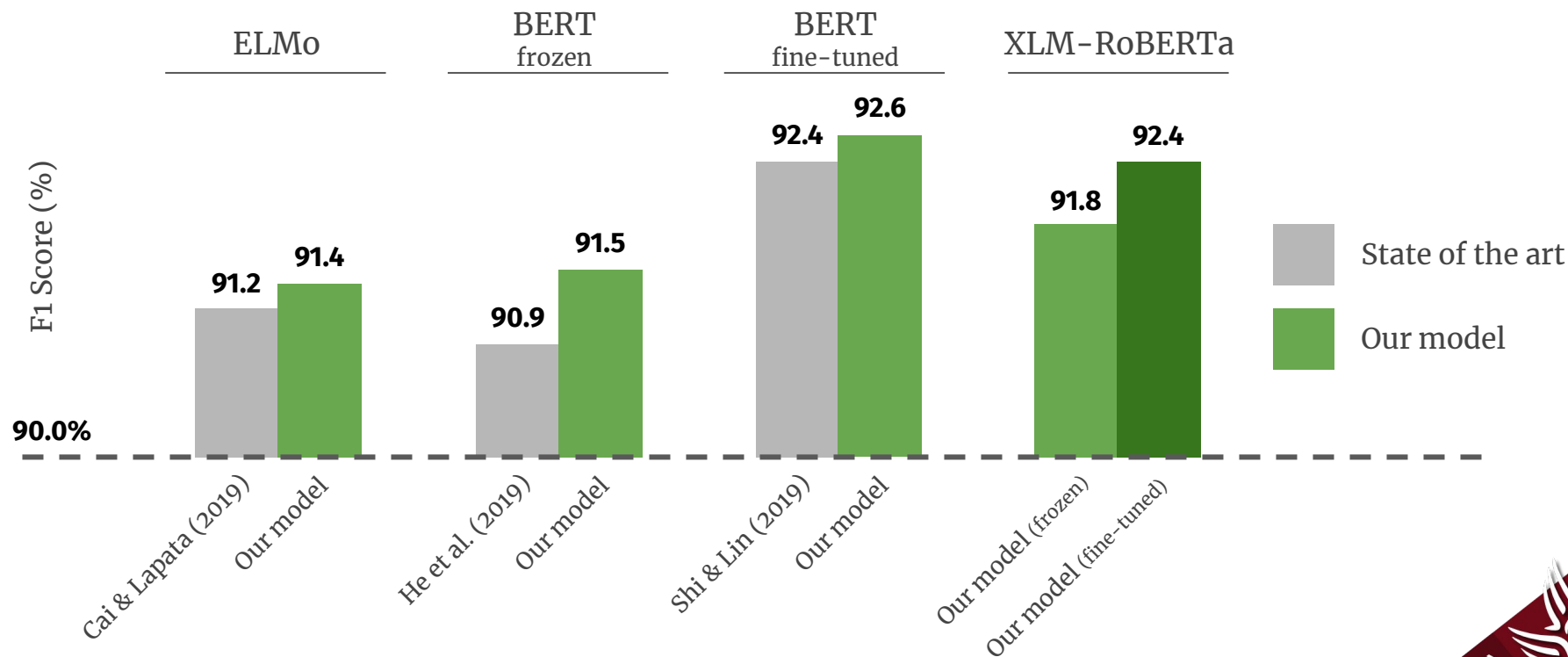
English SRL

Dependency-based SRL on CoNLL-2009



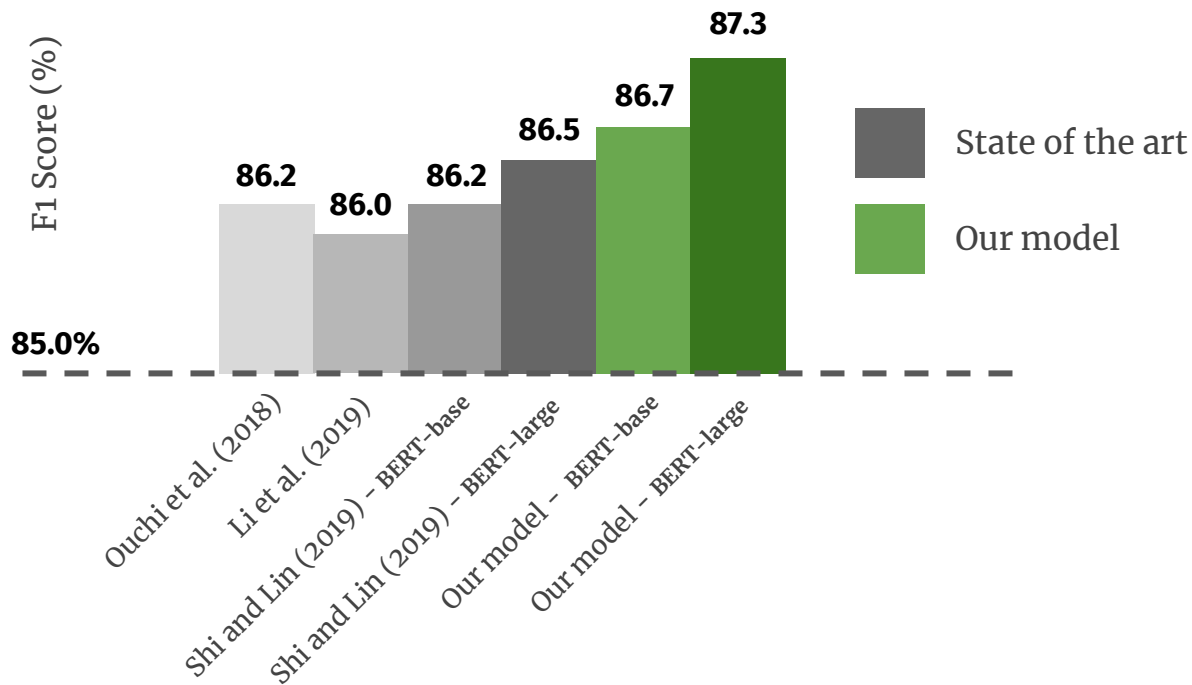
English SRL

Dependency-based SRL on CoNLL-2009



English SRL

Span-based SRL on CoNLL-2012



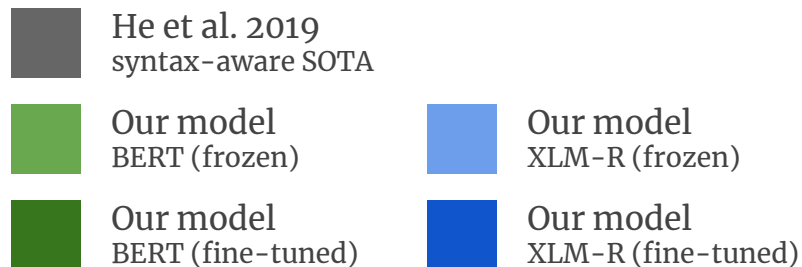
Evaluation

Multilingual and Cross-Lingual SRL



Multilingual SRL

on CoNLL-2009



F1 Score (%)

85.0 %

CA

CZ

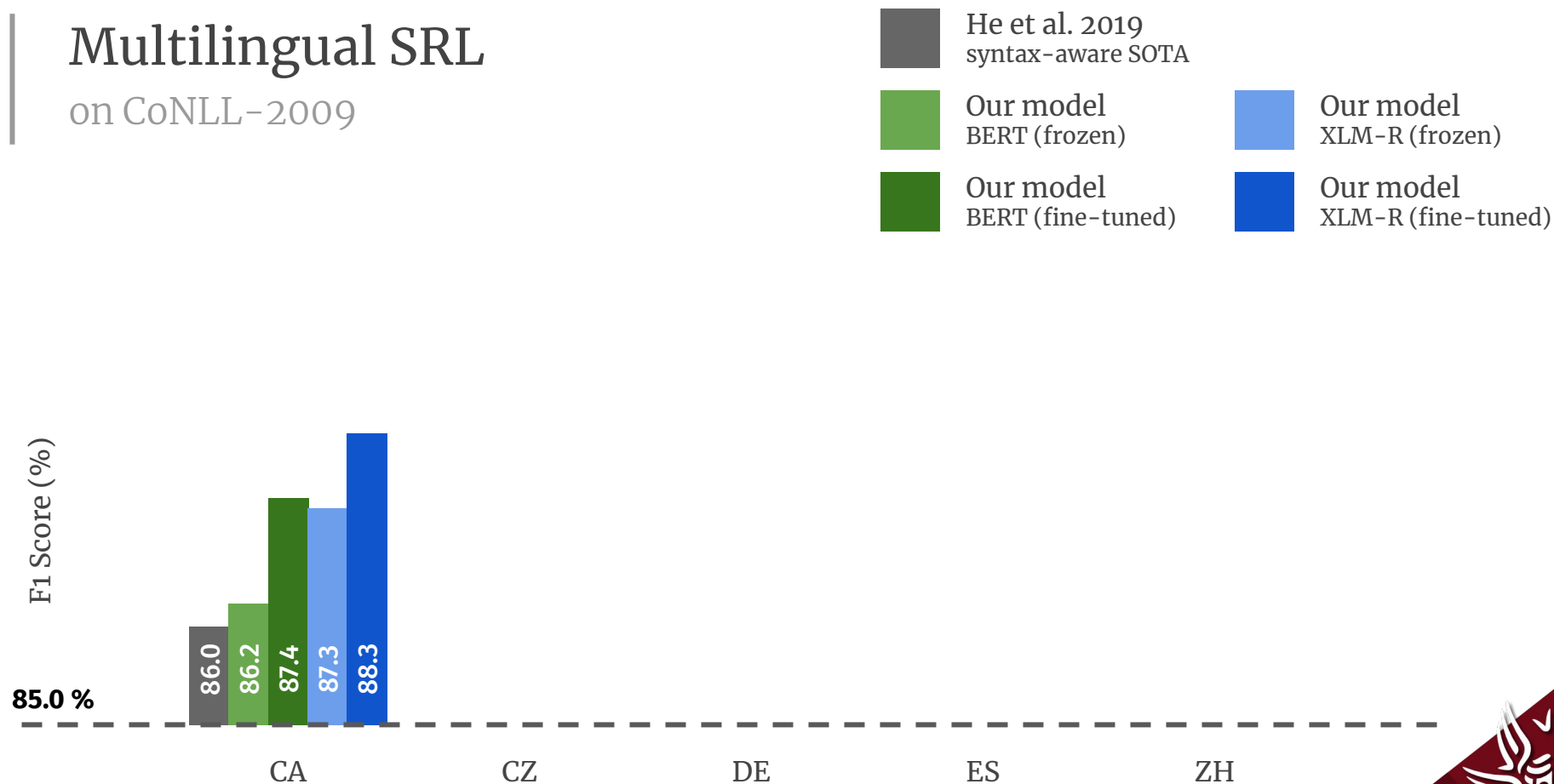
DE

ES

ZH

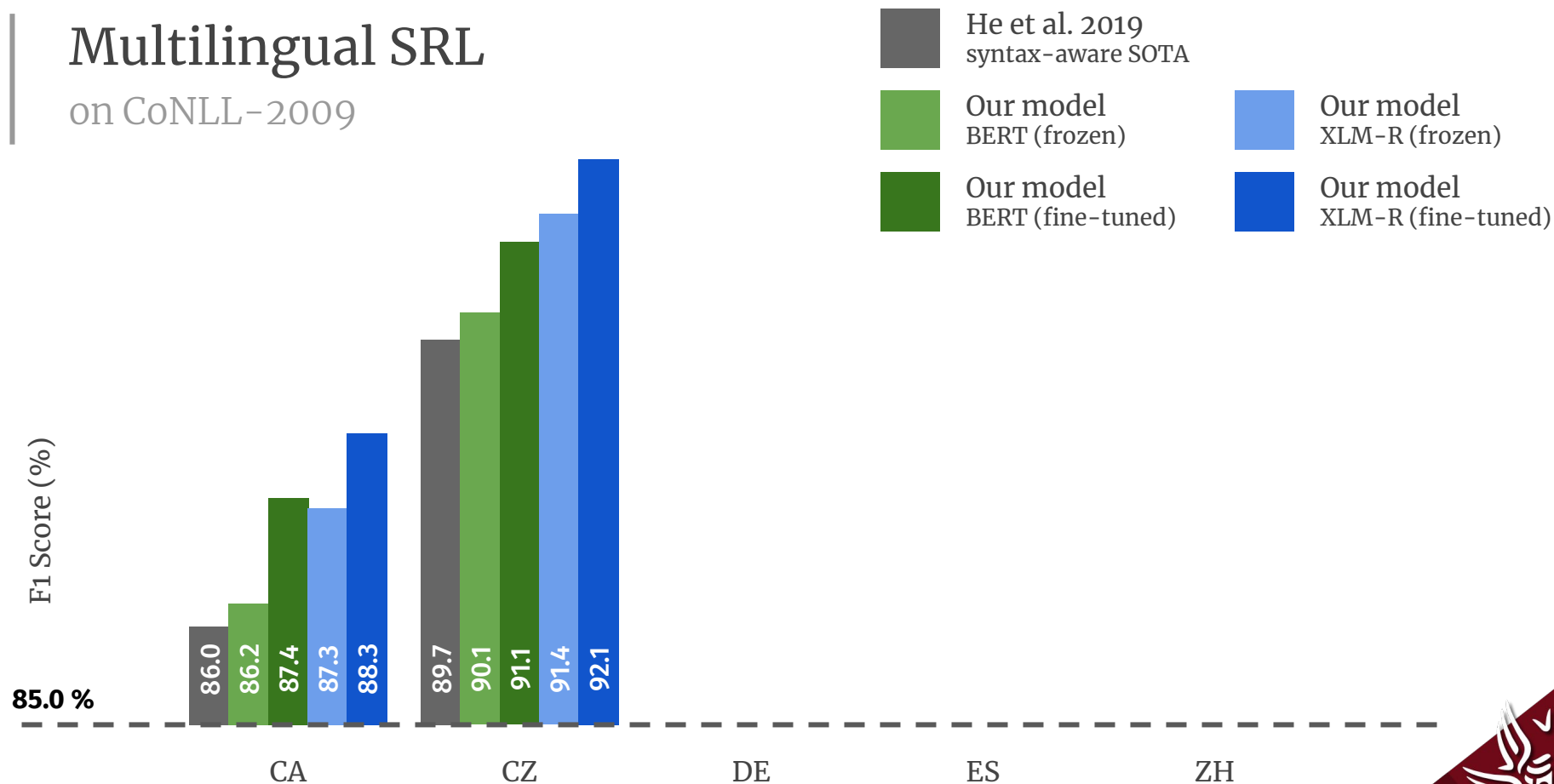
Multilingual SRL

on CoNLL-2009



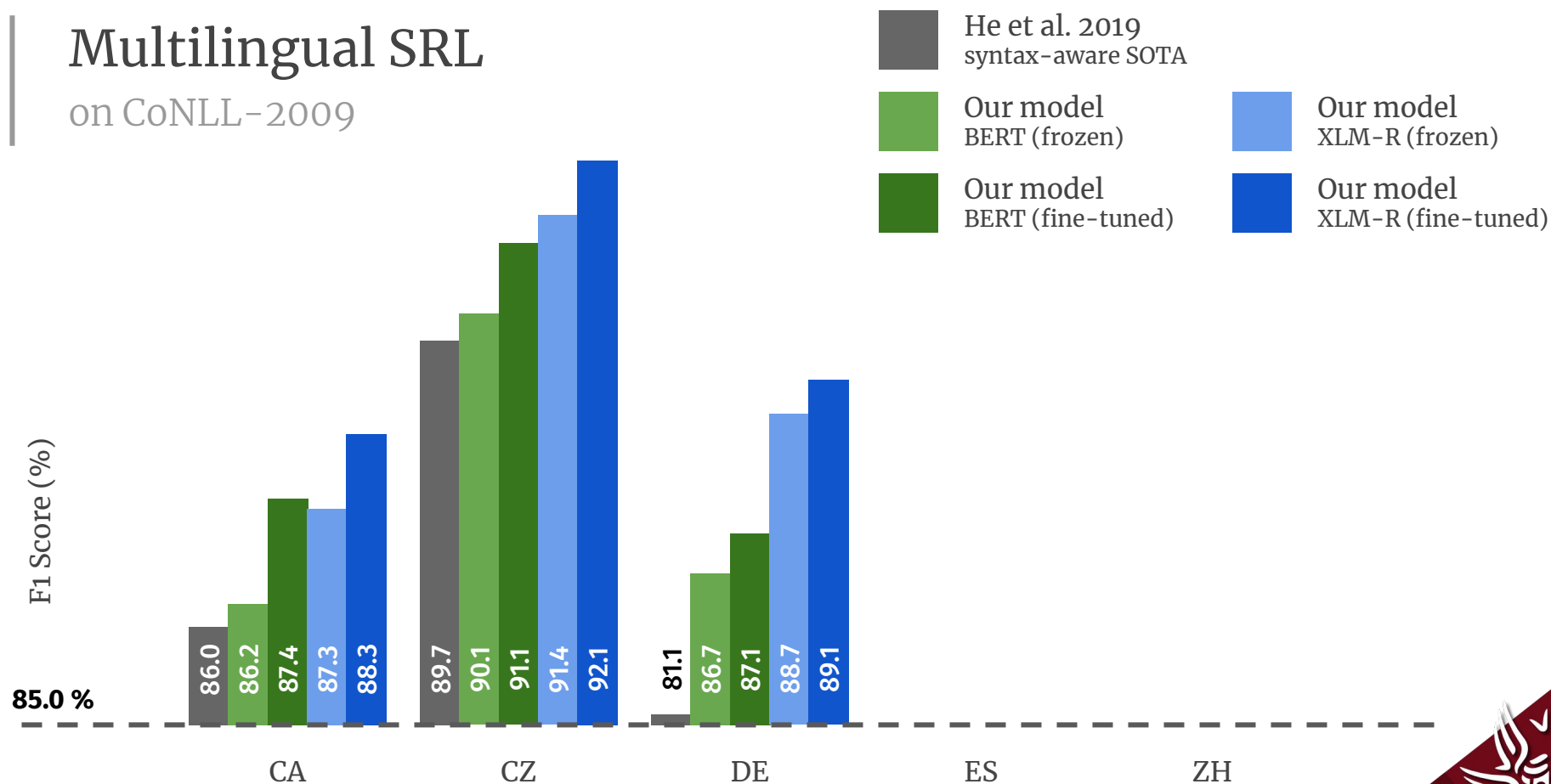
Multilingual SRL

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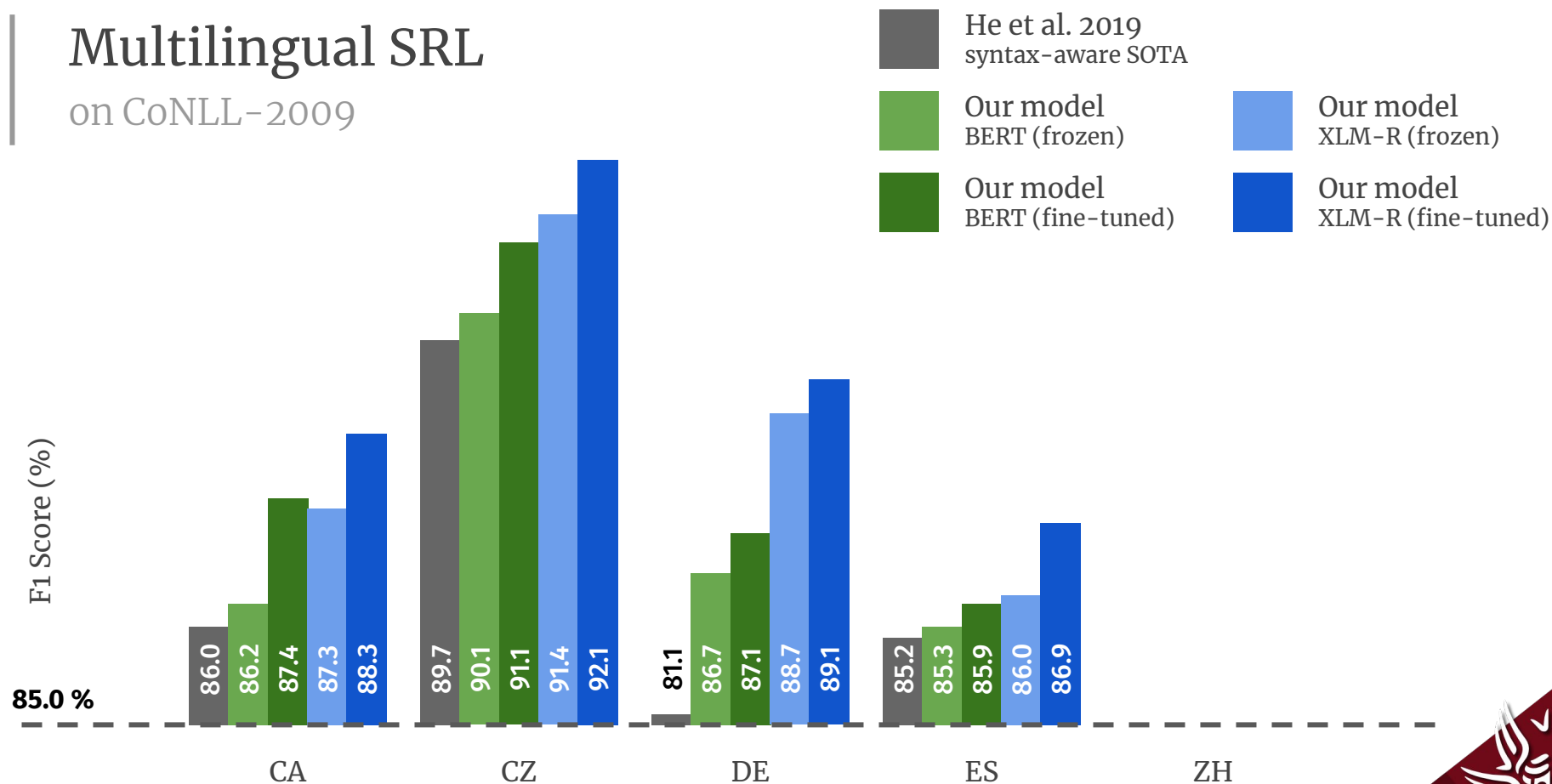
Multilingual SRL

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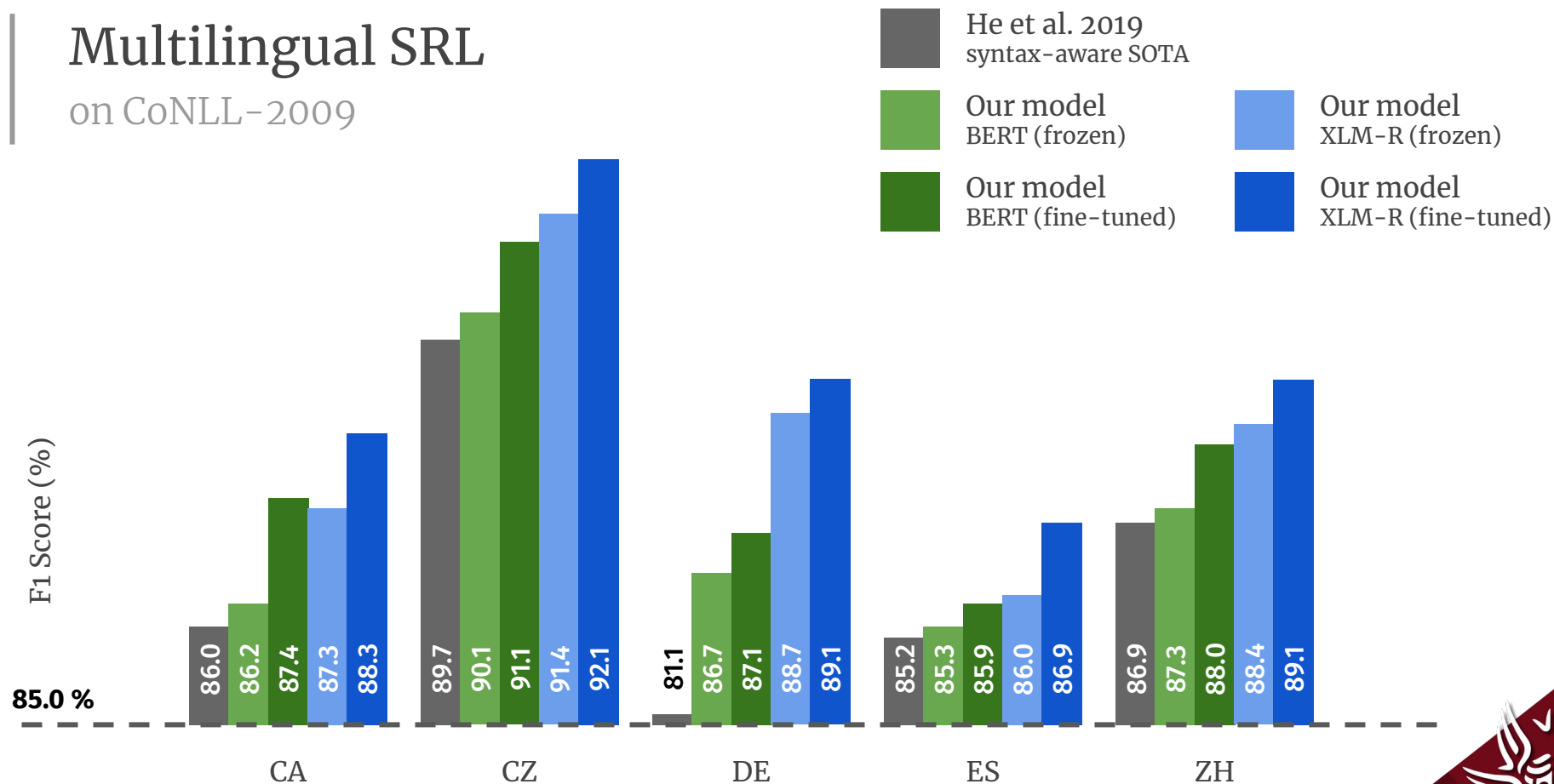
Multilingual SRL

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Multilingual SRL

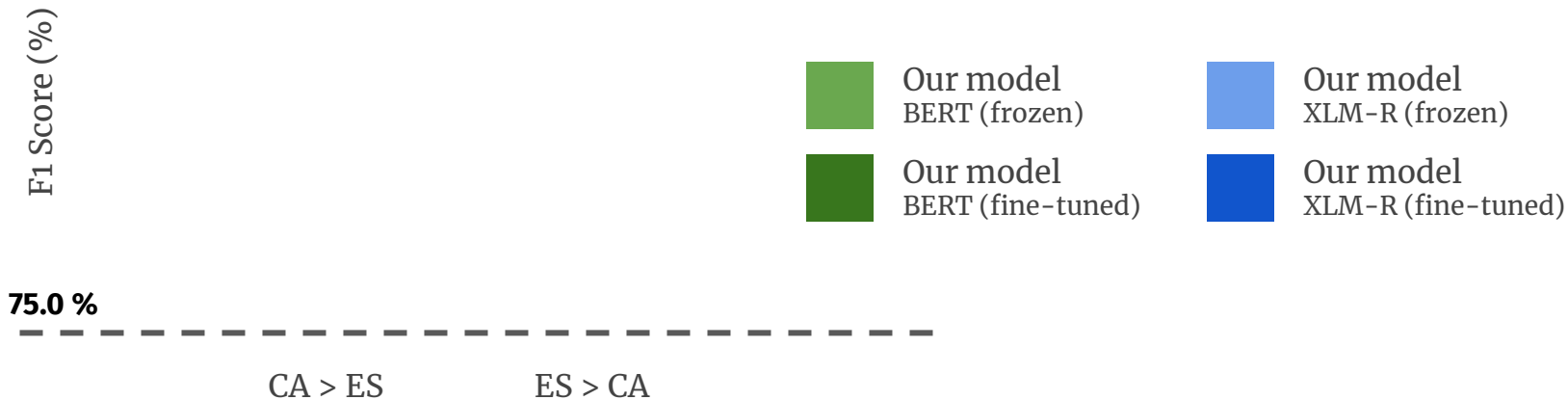
on CoNLL-2009



Zero-Shot Cross-Lingual SRL

on CoNLL-2009

Our approach shows promising results in zero-shot cross-lingual SRL*.

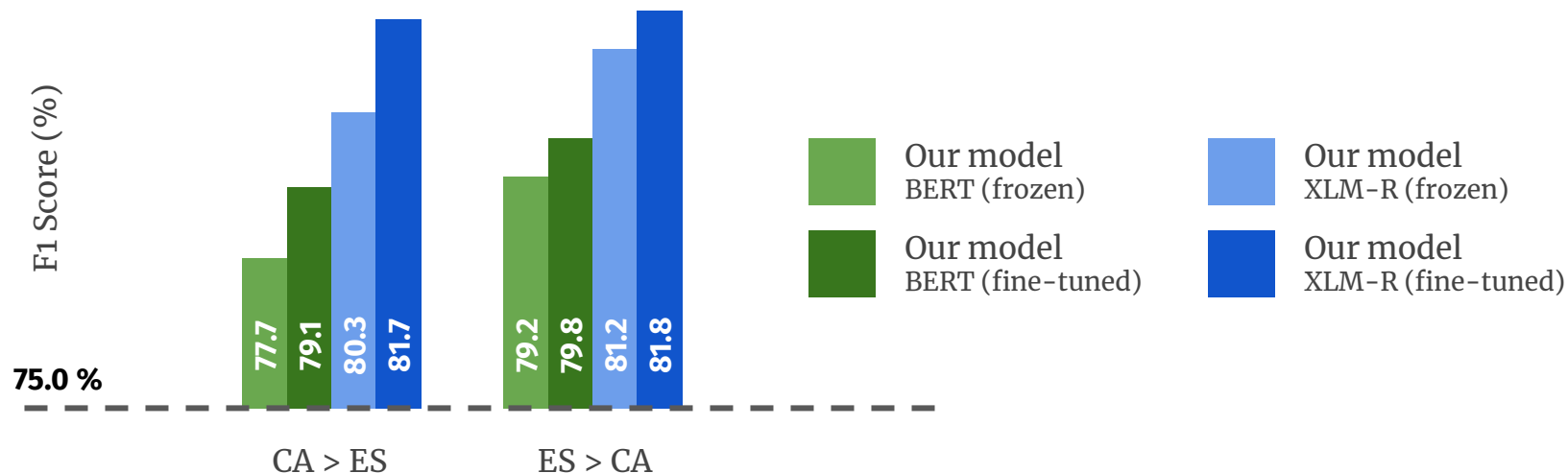


* Spanish and Catalan are the only languages annotated with the same predicate-argument structure inventory in CoNLL-2009.

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Robust SRL in Low-Resource Settings

Learning curves

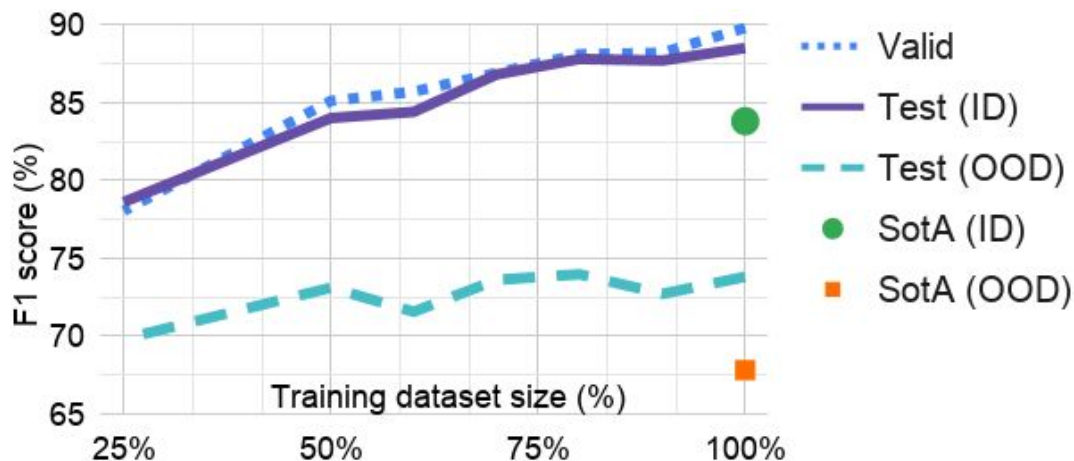
There are **only 17K predicates in German** (vs 37K in Catalan and 180K in English).

Robust SRL in Low-Resource Settings

Learning curves

There are **only 17K predicates in German** (vs 37K in Catalan and 180K in English).

SOTA results with
just 50% of the training data!



Conclusion

and Future Work



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Our objective

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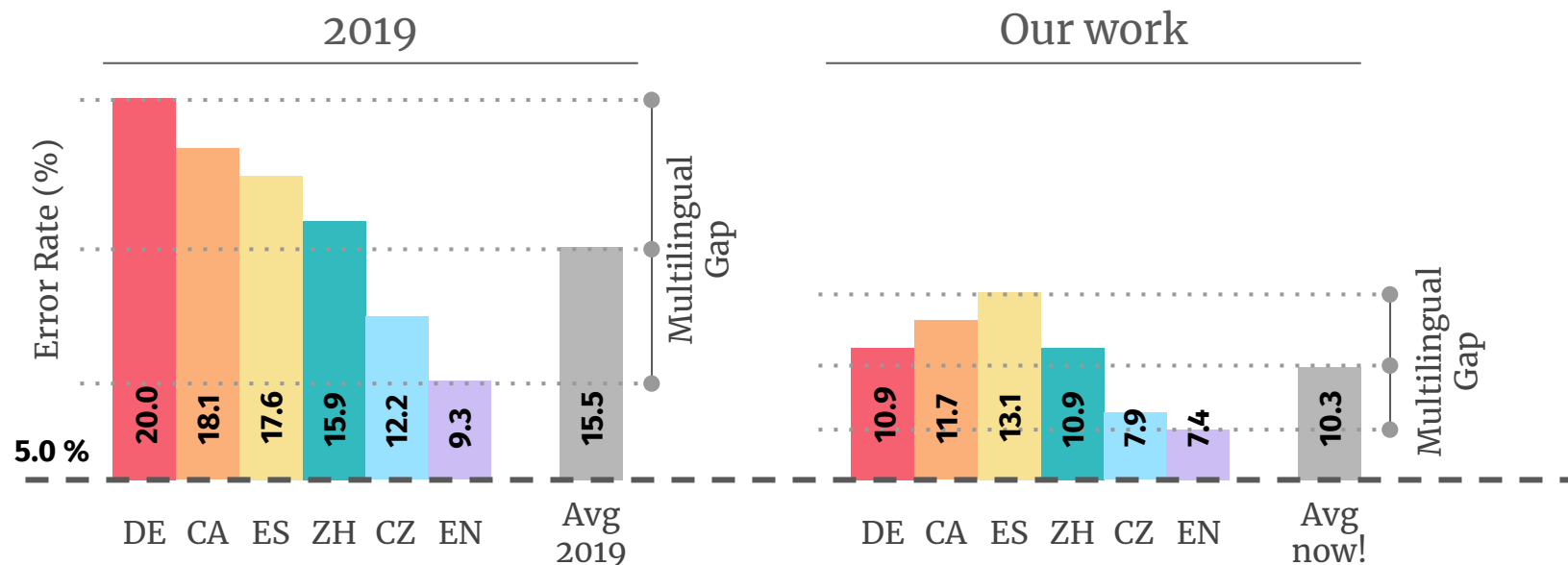
without relying on any **language-specific features** (lemma, POS, syntax)

and setting a **strong and robust baseline** for future innovations

Conclusion

Bridging the multilingual gap

Our approach significantly narrows the multilingual gap in SRL.



Conclusion

and Future Work

Our language-agnostic approach:

- Significantly **narrows the multilingual gap**
- Advances the **state of the art** in 6 languages
- Is **robust** in low-resource settings
- Shows promising results in **zero-shot cross-lingual SRL**

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Our language-agnostic approach:

- Significantly **narrows the multilingual gap**
- Advances the **state of the art** in 6 languages
- Is **robust** in low-resource settings
- Shows promising results in **zero-shot cross-lingual SRL**

We hope that our work will:

- Provide a **strong multilingual baseline** for syntax-based innovations
- Prompt further work in **cross-lingual SRL**
- Encourage the use of SRL in **cross-lingual downstream tasks**

Thank you for your attention!



@ConiaSimone



Code and model checkpoints:

<https://github.com/SapienzaNLP/multi-srl>



Learn more about the Sapienza NLP group:

<http://nlp.uniroma1.it>



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