



UniRE: A Unified Label Space for Entity Relation Extraction

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Entity Relation Extraction

Natural Language Text

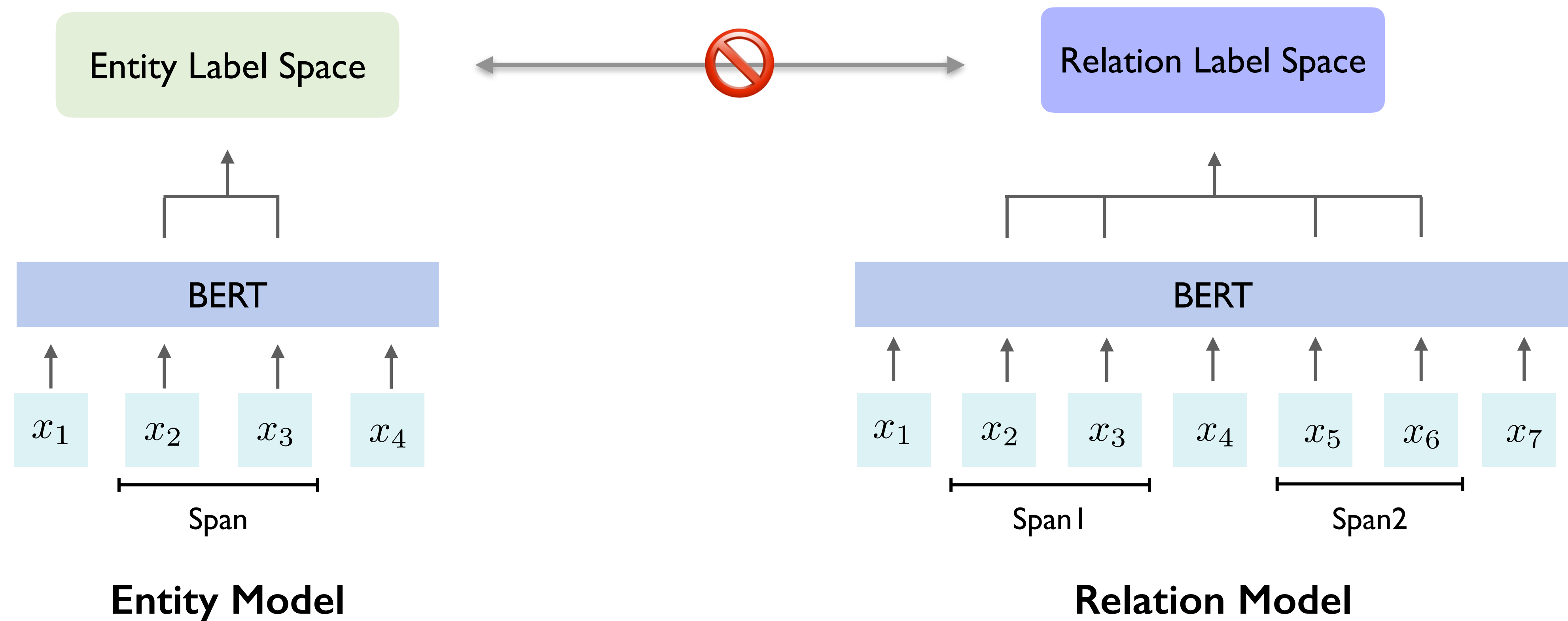
Bill Gates was the
co-founder of Microsoft



Structured Representations

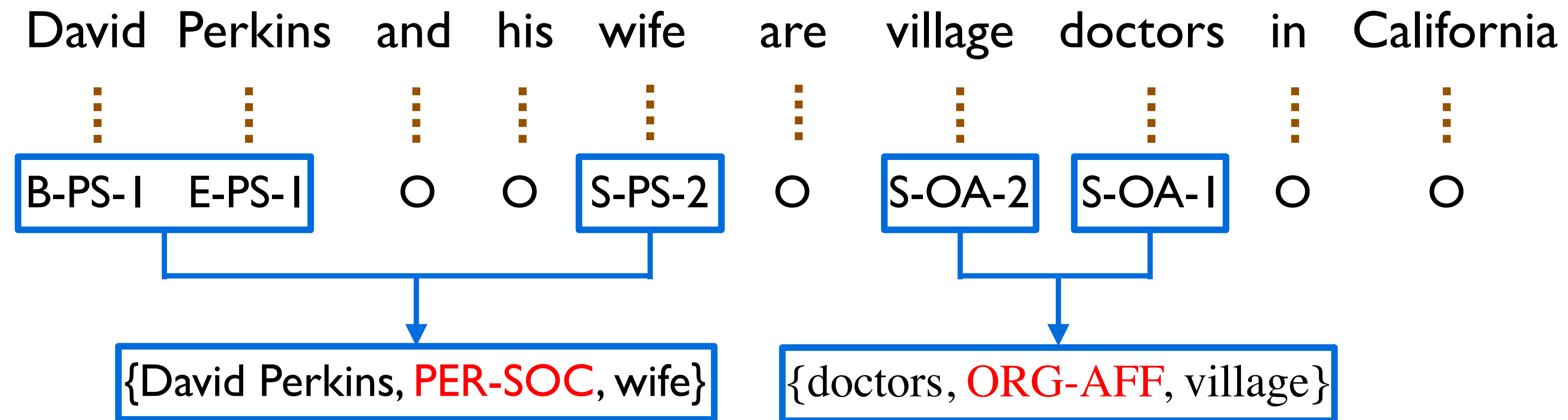
(Bill Gates, Microsoft, founder)
PER **ORG**

Recent Work: Pipeline Method Outperforms Joint Method



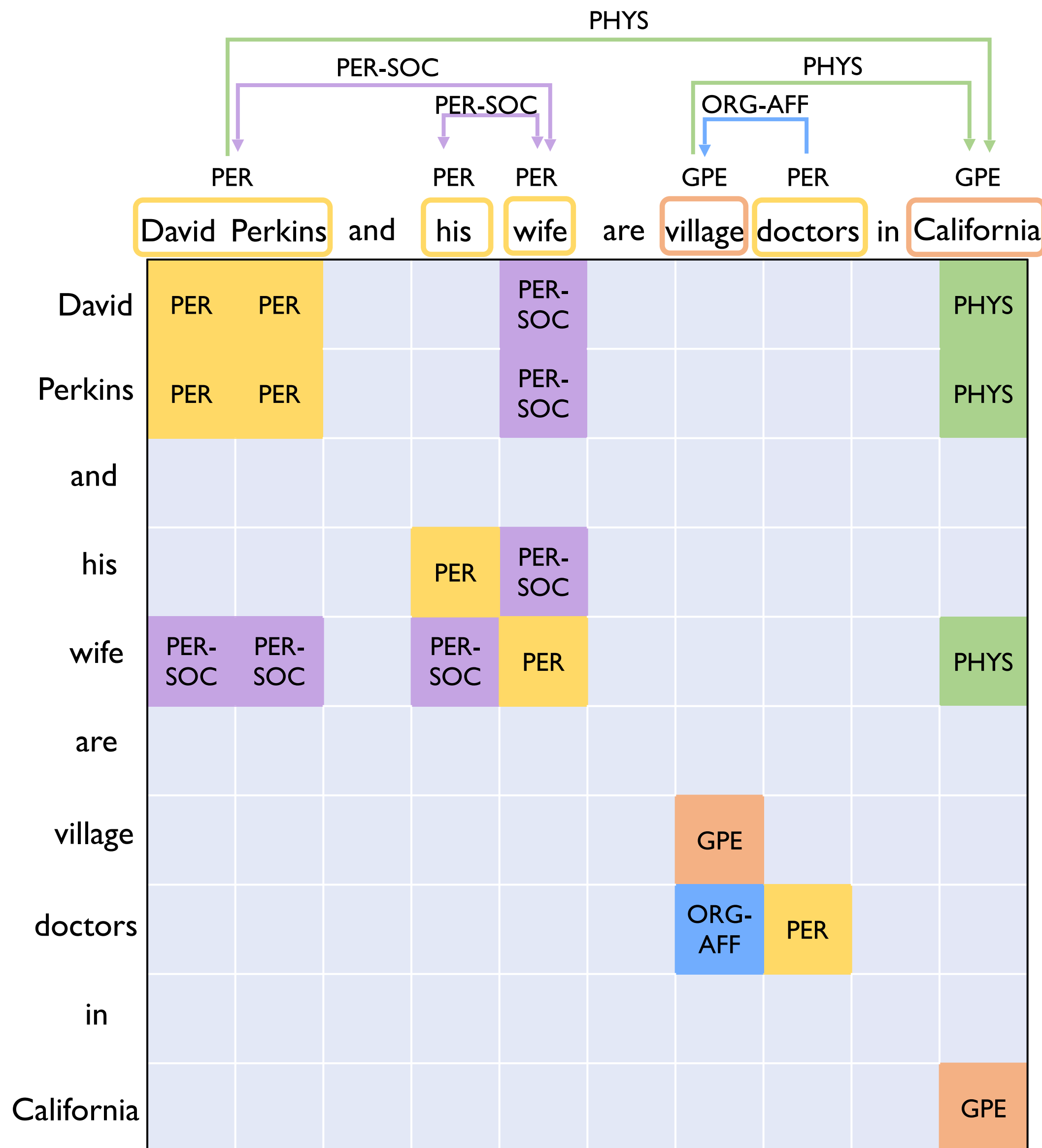
[Zhong and Chen. 2021. A frustratingly easy approach for joint entity and relation extraction.]

Prior Attempt: Sequence Labelling w/ Composite Labels



- 😭 Sacrifice expressiveness.
- 😭 Abandon overlapped relations & isolated entities.

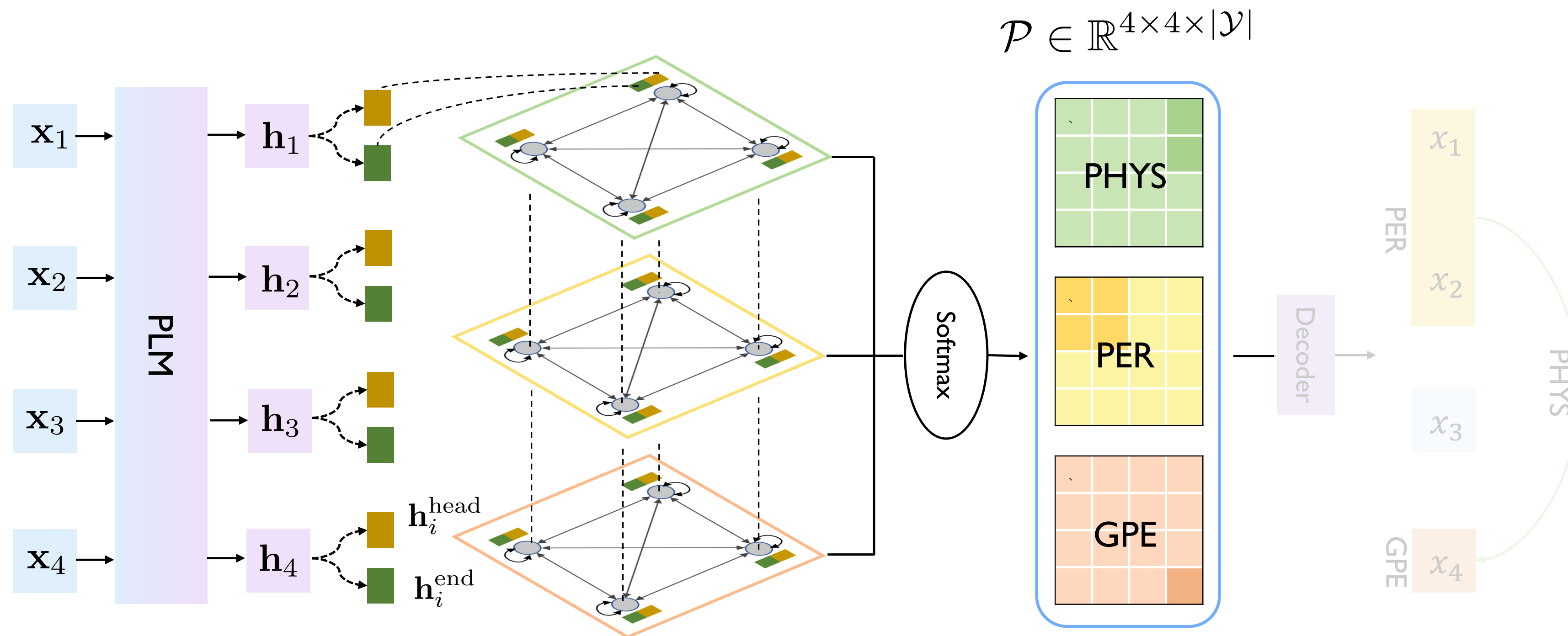
UniRE: Joint Extraction of Entity and Relation



Unified label space, Full expressiveness👍

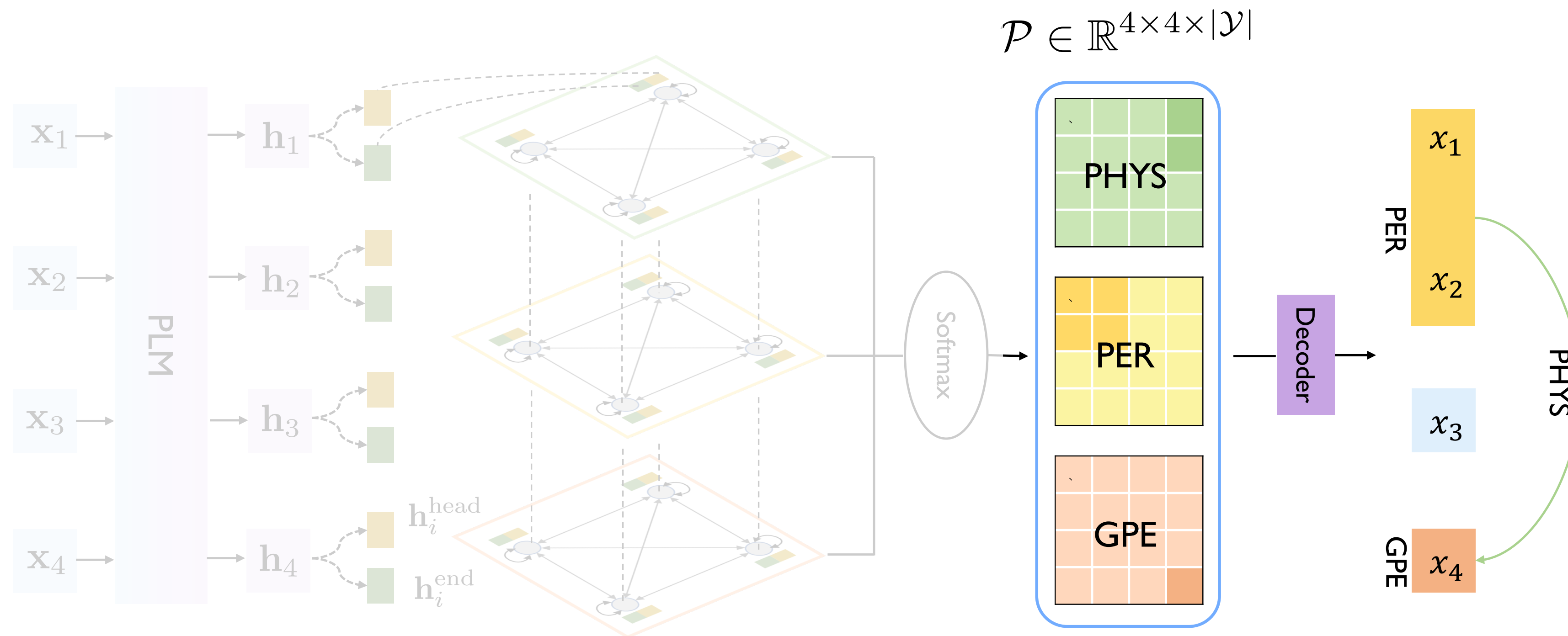
- 🤔 A 2D word relational table.
- 🤔 Each cell presents the relation of a word pair.
- 🤔 Entities are squares on the diagonal: **PER**, **GPE**.
- 🤔 Relations are rectangles off the diagonal.
 - Directed relations: **PHYS**, **ORG-AFF**.
 - Undirected relations: **PER-SOC**.
 - Overlapped relations: two **PHYS**.

Filling the Word Relational Table



Learn and predict each cell's label with a biaffine model.

Three-step Decoding Algorithm



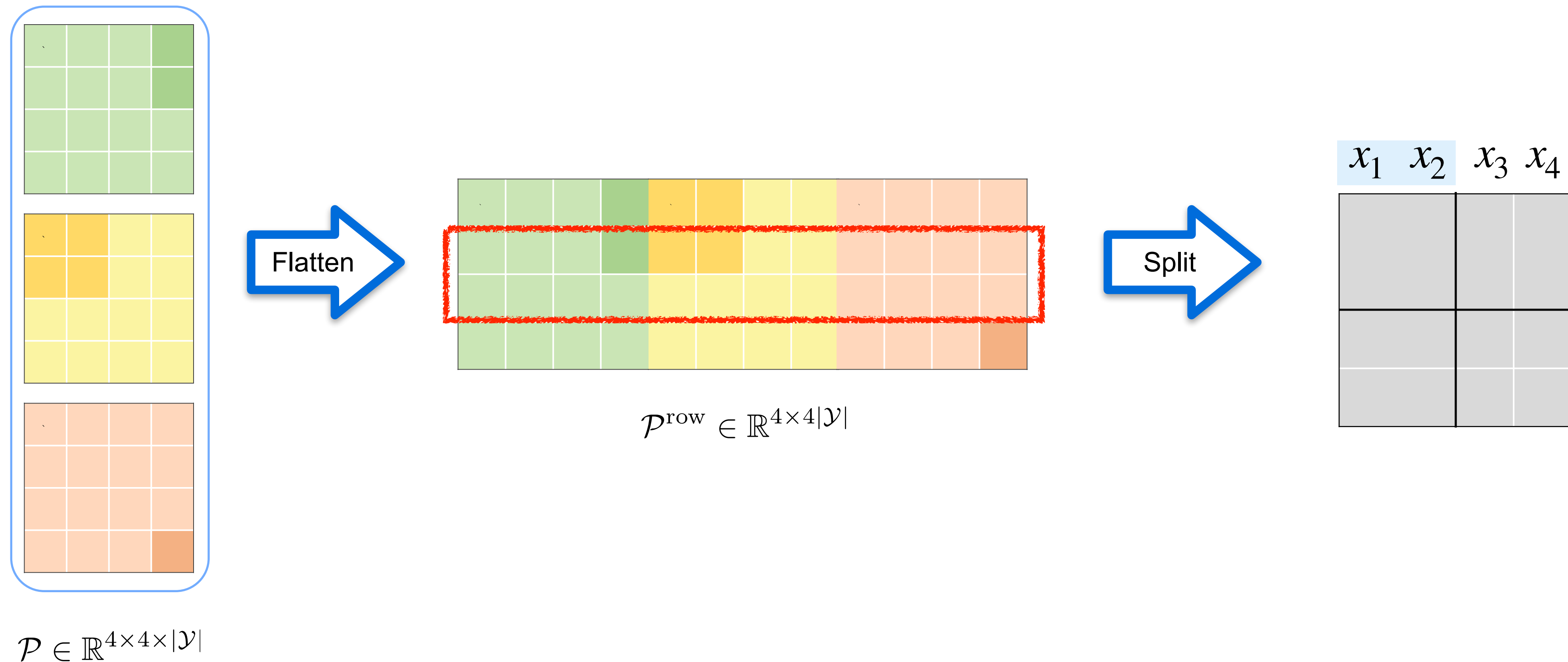
Given the model prediction $\mathcal{P} \in \mathbb{R}^{4 \times 4 \times |\mathcal{Y}|}$, find all entities and relations.

Observation

David	PER	PER			PER-SOC					PHYS
Perkins	PER	PER			PER-SOC					PHYS
and										
his				PER	PER-SOC					
wife	PER-SOC	PER-SOC		PER-SOC	PER					PHYS
are										
village							GPE			
doctors							ORG-AFF	PER		
in										
California										GPE

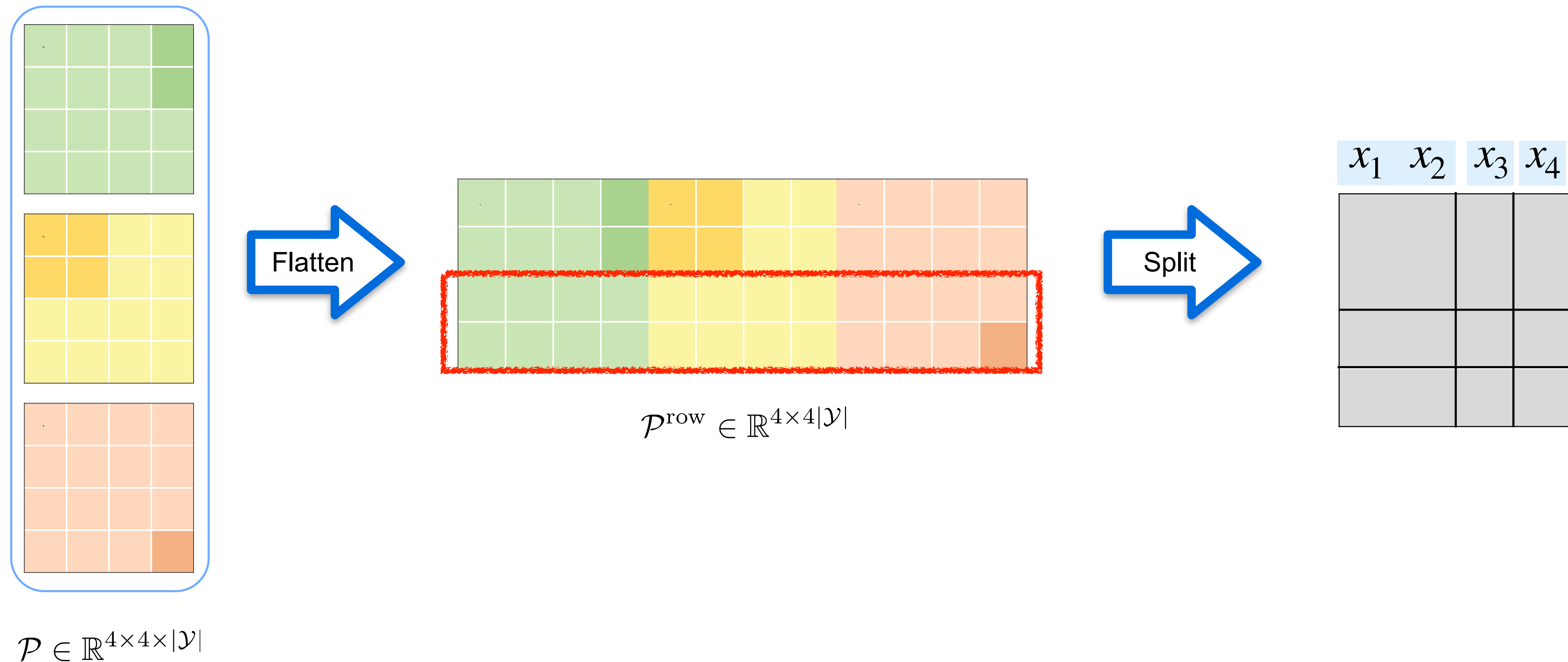
Rows (columns) corresponding to a same entity are identical in the table.

Span Decoding



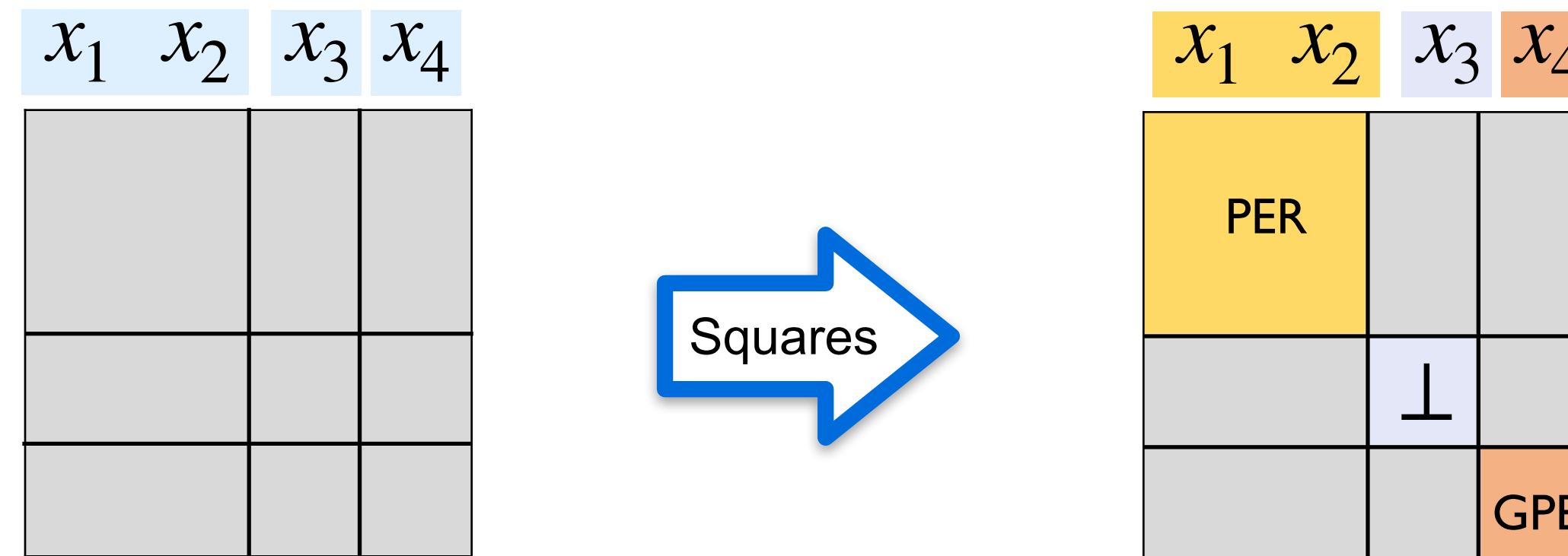
- Finding span split positions according to the distance of adjacent rows (columns).

Span Decoding



- Finding span split positions according to the distance of adjacent rows (columns).

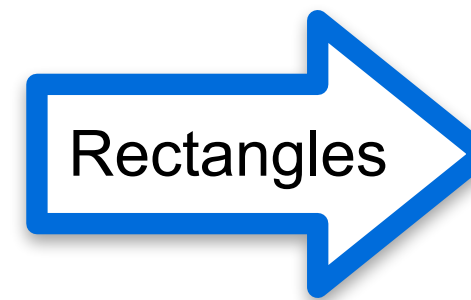
Entity Type Decoding



- Calculating average scores of corresponding squares on the diagonal.
- Choosing the entity label (including None) with the highest score.

Relation Type Decoding

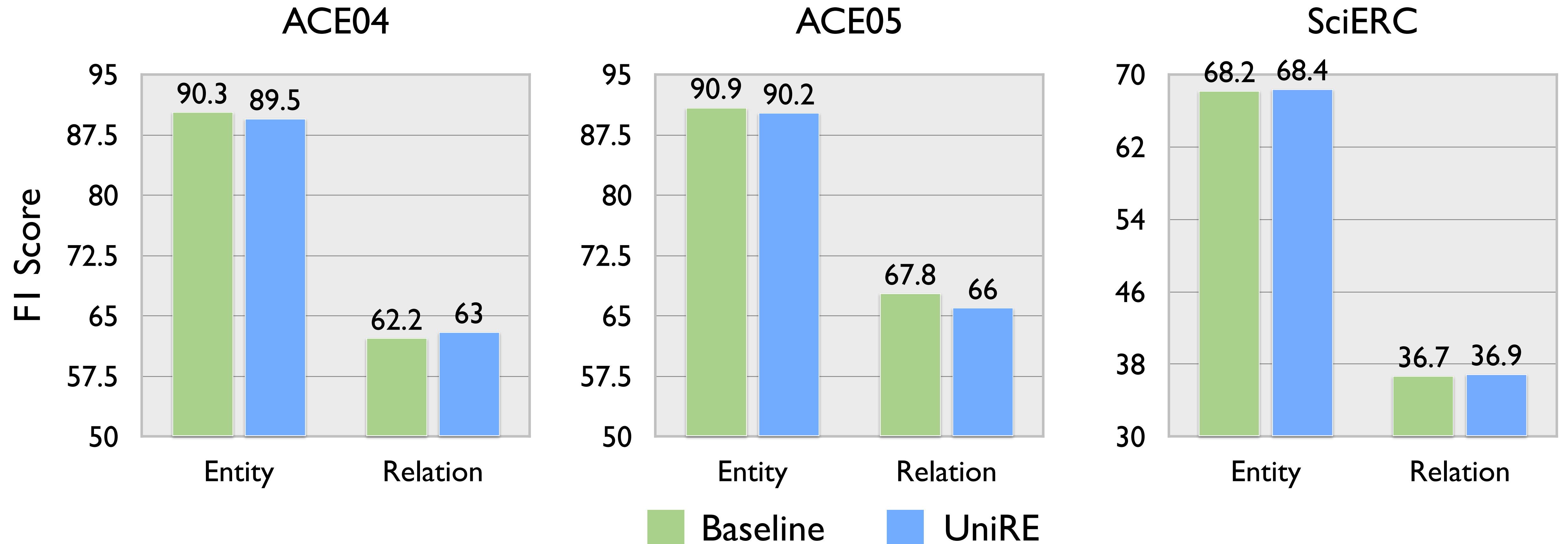
x_1	x_2	x_3	x_4
PER			
		⊥	
			GPE



x_1	x_2	x_3	x_4
PER		⊥	PHYS
⊥	⊥	⊥	⊥
⊥	⊥	⊥	GPE

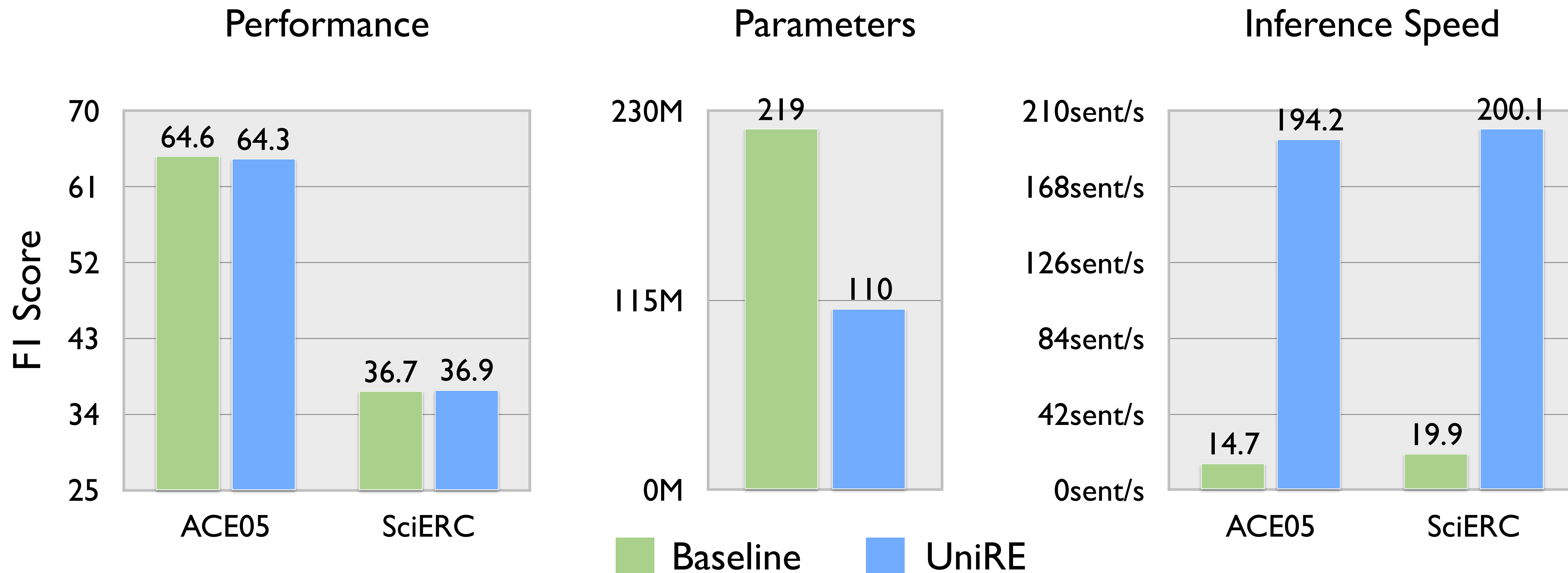
- Calculating average scores of corresponding rectangles off the diagonal.
- Choosing the relation label (including None) with the highest score.

UniRE is effective on multiple datasets!



Best performances on ACE04 and SciERC, a comparable result on ACE05.

Benefit: Fewer Parameters, Faster Speed!



Comparable performance, **half** the number of parameters, **10x** faster inference speed!

Summary and Takeaway

- ★ UniRE: a new joint paradigm on a unified label space.
 - ▶ The word relational table expresses all entities and relations.
 - ▶ Table Filling and Three-step decoding.
- ★ Better performance & efficiency.
- ★ Paper & Code: <https://github.com/Receiling/UniRE>.
- ★ Also at ACL: Probabilistic Graph Reasoning for Natural Proof Generation.

