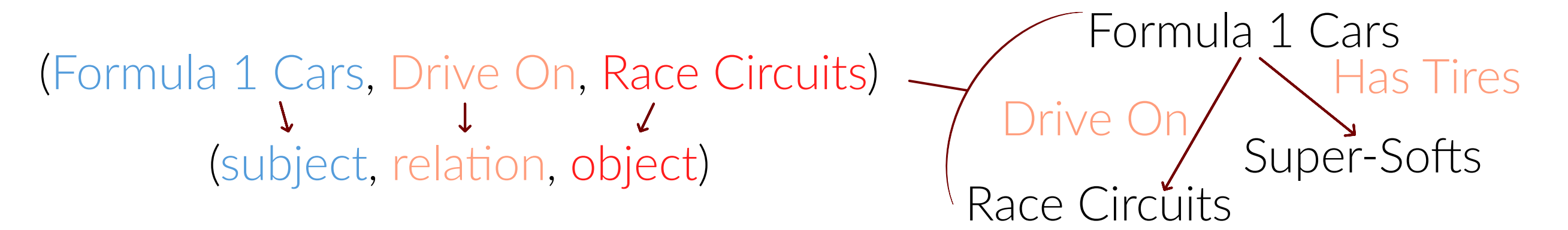


Knowledge Graph Link Prediction & Relation Extraction

Relation Extraction (RE): Determine Relationships between **subjects** and **objects** in text

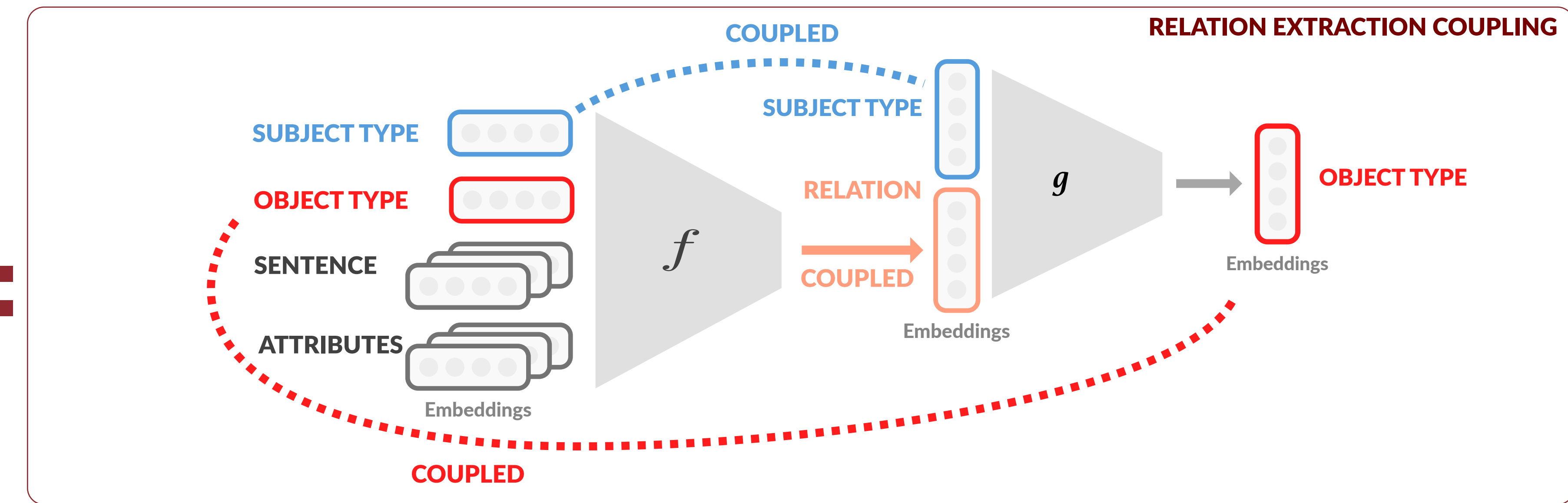
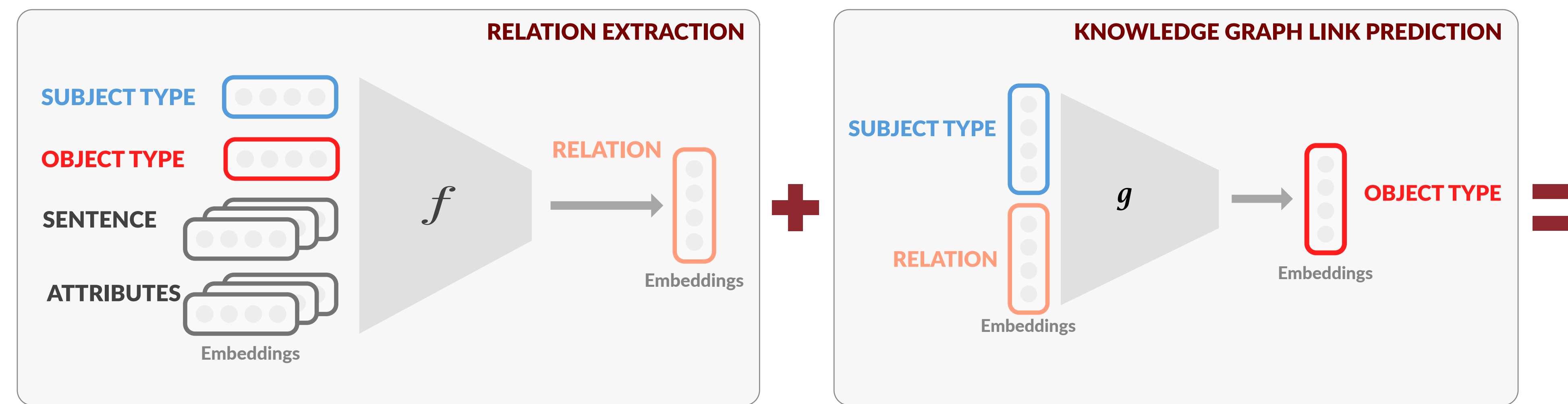
"*Formula 1 cars* drive on *race circuits*."
Drive On

Knowledge Graphs (KGs): A concise way to store factual information



KGLP & RE Are Cyclically Coupled: Relations predicted by RE models can be fed as input to KGLP models that infer objects. These in turn may be passed as input to the same RE methods.

Link Prediction (KGLP): Infer missing *links* to questions (Formula 1 Car, Drives On, ?)



Jointly Reasoning over Relation Extraction with Link Prediction (JRRELP)

- General:** Can be applied to arbitrary RE & KGLP tasks to boost RE performance
- Cyclical:** Enhances cross-task transfer by cyclically coupling mode parameters
- Scalable:** Introduces minimal overhead over RE baselines (only 6% slower batch updates)

JRRELP jointly learns RE & KGLP models through a single non-intrusive objective function,

$$\mathcal{L}_{\text{JRRELP}} = \mathcal{L}_{\text{RE}} + \lambda_{\text{KGLP}} \mathcal{L}_{\text{KGLP}} + \lambda_{\text{COUPLING}} \mathcal{L}_{\text{COUPLING}}$$

$$\lambda_{\text{KGLP}} \geq 0 \ \& \ \lambda_{\text{COUPLING}} \geq 0$$

Results

Dataset	Metric	Models							
		TRE	BERT _{EM}	PA-LSTM	PA-LSTM	C-GCN	C-GCN	SpanBERT	SpanBERT
TACRED	Precision	70.1	–	65.7	67.8*	69.9	74.1*	69.2*	74.0*
	Recall	65.0	–	64.5	65.0*	63.3	61.9*	71.2*	67.3*
	F1	67.4	71.5 [†]	65.1	66.4*	66.4	67.4*	70.2*	70.8*
SemEval-MM	Precision	–	–	75.2	74.8	76.5	76.9	81.2	82.7
	Recall	–	–	78.0	80.6	79.5	80.3	86.1	85.2
	F1	–	–	76.6	77.6	78.0	78.5	83.6	83.9

Dataset	Metric	Ablation Experiments			
		PA-LSTM [†]	PA-LSTM [‡]	C-GCN [†]	C-GCN [‡]
TACRED	F1	65.6	66.3	66.8	67.0
SemEval-MM	F1	76.8	77.3	78.1	78.4

Repository: <https://github.com/gstoica27/JRRELP.git>