56th Annual Meeting of the Association for Computational Linguistics (ACL 2018)

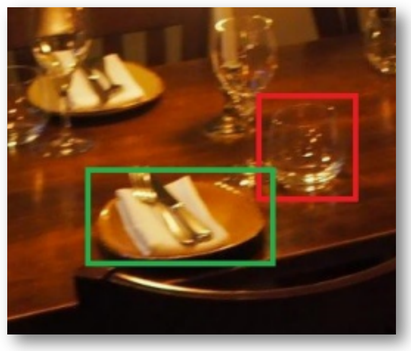
Automatic Extraction of Commonsense LocatedNear Knowledge

Frank F. Xu*, Bill Yuchen Lin*, Kenny Q. Zhu
Shanghai Jiao Tong University, Shanghai, China

SHANGHAI JIAO TONG UNIVERSITY

Introduction

LocatedNear Relation: A kind of commonsense knowledge describing two physical objects that are typically found near each other in real life. For example, <table, *LocatedNear*, chair>.



Example of LocatedNear Knowledge Benefiting AI Systems: If **a set of knife, fork and plate** is on the table, one may believe there is **a glass** beside based on the commonsense knowledge, even though these objects are hardly visible.

Motivation:

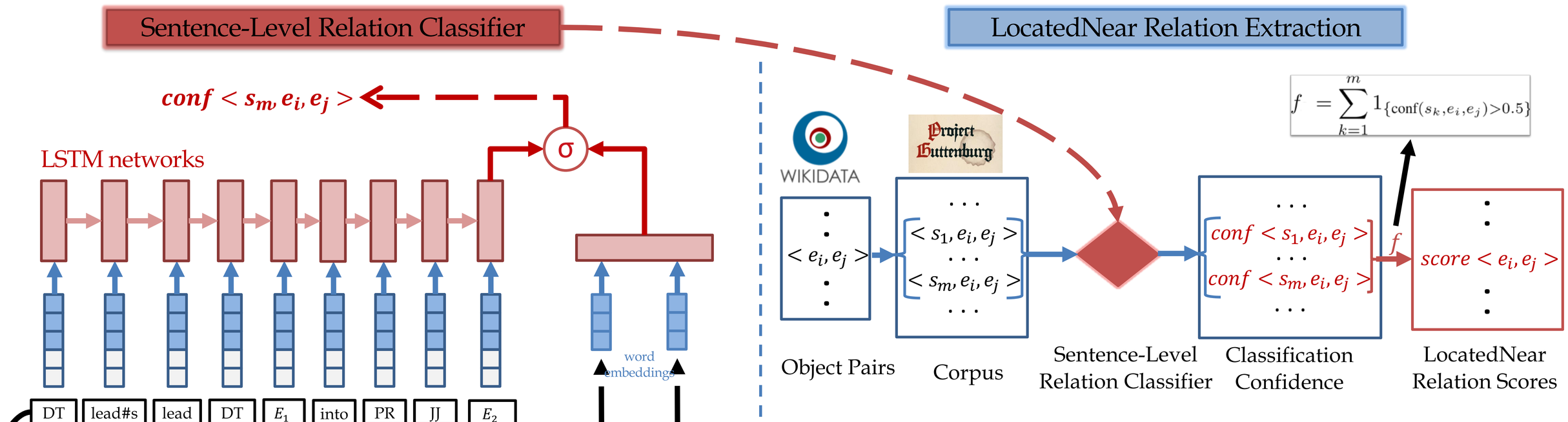
- ❖ LocatedNear facts are helpful prior knowledge for object detection in complex image scenes.
- ❖ It can potentially benefit general reasoning in reading comprehension, question answering, and other AI tasks.
- ❖ Existing knowledge bases have very few facts for this relation (ConceptNet has only **49** triplets).

ConceptNet
An open, multilingual knowledge graph

Contribution:

- ➢ We released the first datasets for extracting LocatedNear relation.
- ➢ We proposed several methods of extracting the relation, including feature-based models and LSTM-based neural architectures.
- ➢ We extract in total **2067** new LocatedNear triplets.

Approach



Each instance $< s_m, e_i, e_j >$ consists of a sentence and two objects.

Sentence Normalization: Disentangling the LocatedNear Relation

Level	Examples
Objects	E_1, E_2
Lemma	open, lead, into, ...
Dependency Role	open#s, open#o, into#o, ...
POS Tag	DT, PR, CC, JJ, ...

- ❖ Words that are irrelevant to the relation enlarge the vocabulary size and thus cause overfitting.
- ❖ Semantic differences of them may introduce noise.

For example, if we replace the sentence in the above instance with
"A criminal led the dog into a poor garden."
The semantic differences between "criminal" and "king", "nice" and "poor", are totally irrelevant to extract relation between dog and garden from the sentences.

Workflow

For each object pair $<e_i, e_j>$, we find all the m sentences in our corpus mentioning both objects. Then, we classify the m instances with the sentence-level relation classifier and get confidences for each instance, feed them into a function f to obtain the final score of the object pair .

Examples of Extracted Object Pairs with LocatedNear Relation

(door, room)	(boy, girl)	(cup, tea)
(ship, sea)	(house, garden)	(arm, leg)
(fire, wood)	(house, fire)	(horse, saddle)
(fire, smoke)	(door, hall)	(door, street)
(book, table)	(fruit, tree)	(table, chair)

Experimental Results and Future Directions

	Random	Majority	SVM	SVM(-BW)	SVM(-BPW)	SVM(-BAP)	SVM(-GF)
Acc.	0.500	0.551	0.584	0.577	0.556	0.563	**0.605**
P	0.551	0.551	0.606	0.579	0.567	0.573	**0.616**
R	0.500	1.000	0.702	0.675	0.681	**0.811**	0.751
F1	0.524	0.710	0.650	0.623	0.619	0.672	**0.677**

	SVM(-SDP)	SVM(-SS)	DRNN [22]	LSTM+Word	LSTM+POS	LSTM+Norm	
Acc.	0.579	0.584	0.635	0.637	0.641	**0.653**	
P	0.597	0.605	**0.658**	0.635	0.650	0.654	
R	0.728	0.708	0.702	**0.800**	0.751	0.784	
F1	0.656	0.652	0.679	0.708	0.697	**0.713**	

Future Directions

- ❖ Exploring to utilize distant supervision.
- ❖ Incorporating knowledge graph embedding techniques for commonsense knowledge graph.
- ❖ Applying the extracted knowledge to improve the performance down-stream applications.