Implicit Argument Prediction as Reading Comprehension

The University of Texas at Austin

Pengxiang Cheng (pxcheng@utexas.edu)   Katrin Erk (katrin.erk@mail.utexas.edu)

Introduction

Twice in the late 1980s Gillingham came close to winning promotion to the second tier of English football, but a ***decline*** *then set in…*

- We are interested in predicting implicit predicate-argument relations, where the *arguments* are not syntactically connected to the ***predicate*** and may not even be in the same sentence.
- We recently (Cheng & Erk, 2018) proposed a neural model and additional training / testing data for the task.

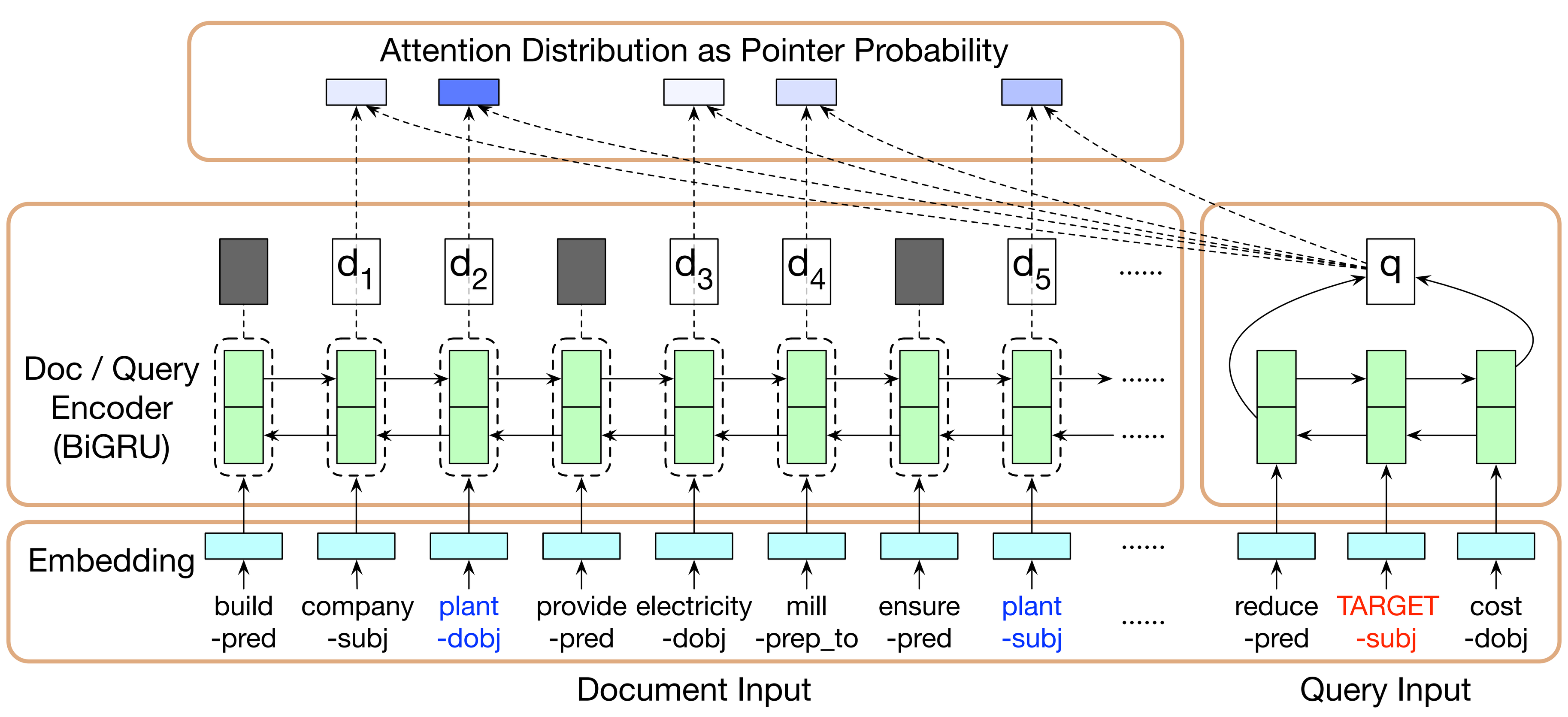
Task

- We view the task as **reading comprehension**.
  - A predicate-argument tuple with the missing argument is a **query**.
  - The answer to the query has to be located in the **document**.

From raw text	Extract entities and events	Construct document-query pair
Manville Corp. said it will build a $ 24 million power plant to provide electricity to its Igaras pull and paper mill in Brazil. *The company said the plant will ensure that it has adequate energy for the mill and will reduce the mill's energy costs.*	x_0 = company x_1 = mill x_2 = power plant e_0: (build-pred, x_0-subj, x_2-dobj, —) e_1: (provide-pred, —, electricity-dobj, x_1-prep_to) e_2: (ensure-pred, x_2-subj, —, —) e_3: (has-pred, x_0-subj, energy-dobj, x_1-prep_for) e_4: (reduce-pred, x_2-subj, cost-dobj, —)	**Document** (e_0 ~ e_3): build-pred company-subj plant-dobj provide-pred electricity-dobj mill-prep_to ensure-pred plant-subj has-pred company-subj energy-dobj mill-prep_for **Query** (e_4): reduce-pred TARGET-subj cost-dobj

Model

- We draw on the Attentive Reader [1] and Pointer Networks [2].

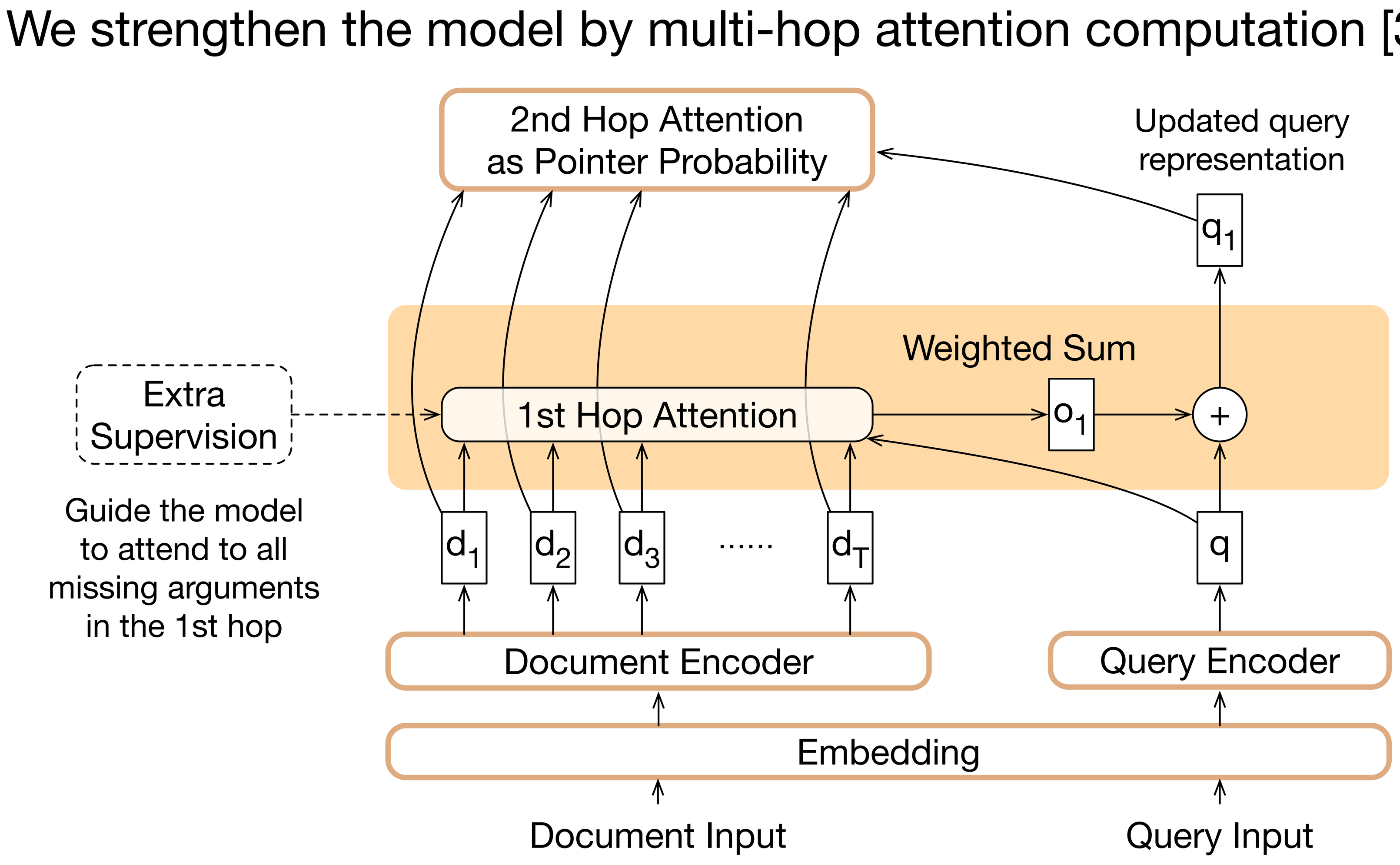


Multi-hop Inference

- A single predicate can have more than one implicit arguments.
- Occurred in over 30% of the **G&C dataset** (Gerber & Chai, 2010).

The average interest rate rose to 8.3875% at [Citicorp]$_{subj}$'s $50 million weekly auction of [91-day commercial paper]$_{obj}$, or corporate IOUs, from 8.337% at last week's [sale]$_{pred}$.

- We strengthen the model by multi-hop attention computation [3].

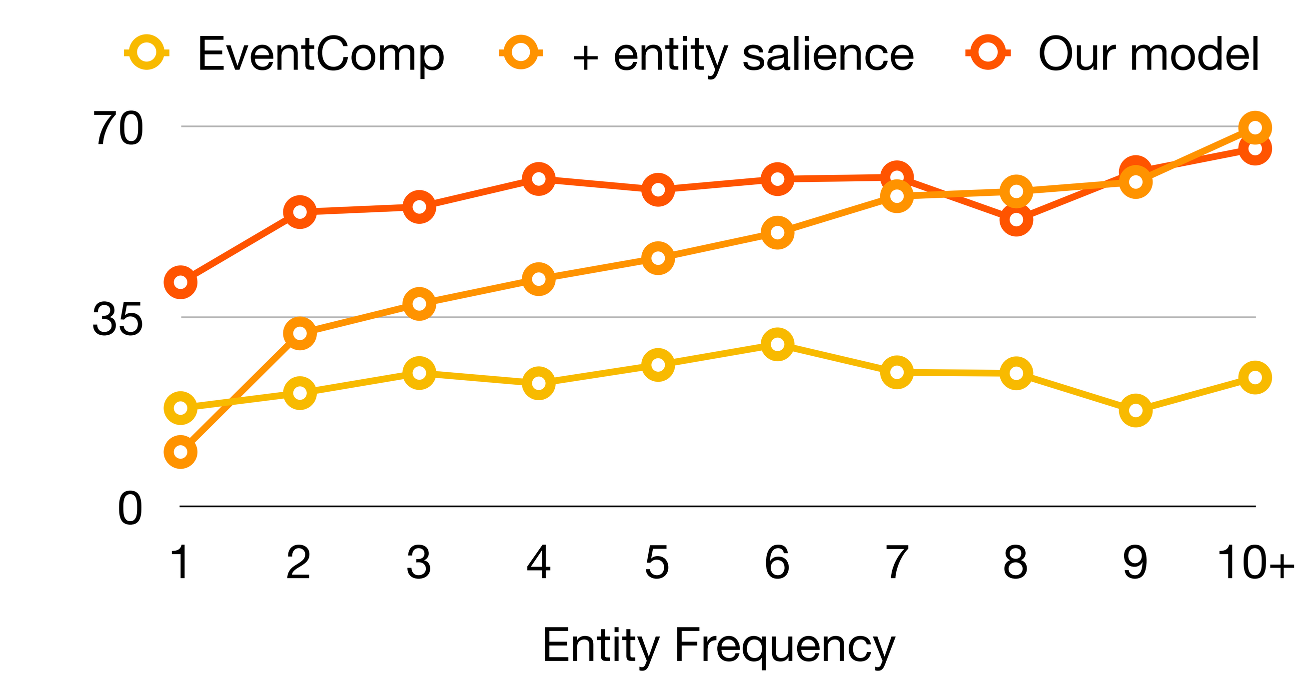


Results on OntoNotes

- Comparing to the previous EVENTCOMP model (Cheng & Erk, 2018).
- Our model does much better on the harder ON-LONG dataset with longer documents.

Accuracy (%)	ON-SHORT	ON-LONG
EVENTCOMP	36.90	21.26
+ entity salience	46.06	31.43
Our model	**58.12**	**51.52**

- Our model performs well on both frequent and infrequent entities out of the box.



Results on G&C

Model	F1
Gerber & Chai (2012)	50.3
GCAUTO*	44.5
EVENTCOMP	**48.3**
Our model	44.4
+ 2-hop attention	46.2
+ extra supervision	**48.3**

* GCAUTO is a re-implementation of Gerber & Chai (2012) by removing gold features for a fair comparison.

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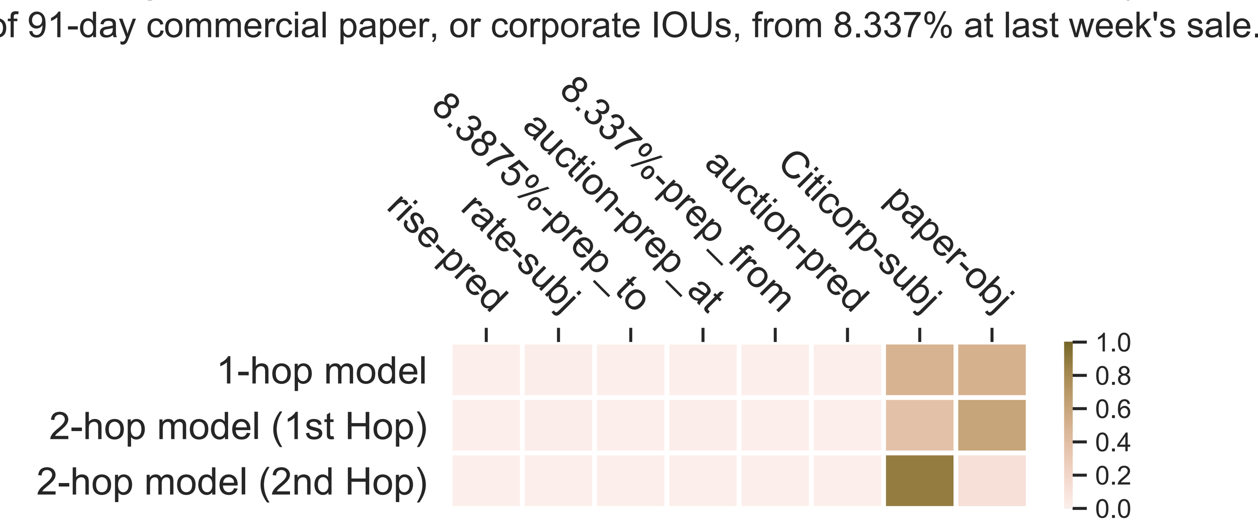

Query: (sale/sell-pred, TARGET-subj, MISS-obj) Answer: Citicorp

References

[1] Hermann, Karl Moritz, et al. "Teaching machines to read and comprehend." *NIPS*. 2015.
[2] Vinyals, Oriol, Meire Fortunato, and Navdeep Jaitly. "Pointer networks." *NIPS*. 2015.
[3] Sukhbaatar, Sainbayar, Jason Weston, and Rob Fergus. "End-to-end memory networks." *NIPS*. 2015.