

# Document Modeling with External Attention for Sentence Extraction

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Shay B. Cohen, Mirella Lapata, Jiangsheng Yu and Yi Chang

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- apparent in problems where capturing long range dependencies is important
- sentence extraction is the **selection of specific sentences from documents**, with an end goal in mind
- Extractive Summarization and Question Answer Selection are two examples of sentence extraction problems

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Seoul (CNN) -- South Korea's Prime Minister Lee Wan-koo offered to resign on Monday amid a growing political scandal.

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**Question: Who resigned over the scandal?**

**Answer: South Korea's Prime Minister Lee Wan Koo**

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both tasks require

- **deep understanding of the document**
- **local and global contextual reasoning**



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more than plain  
text chunks

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- **title**
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which can contain **key events**

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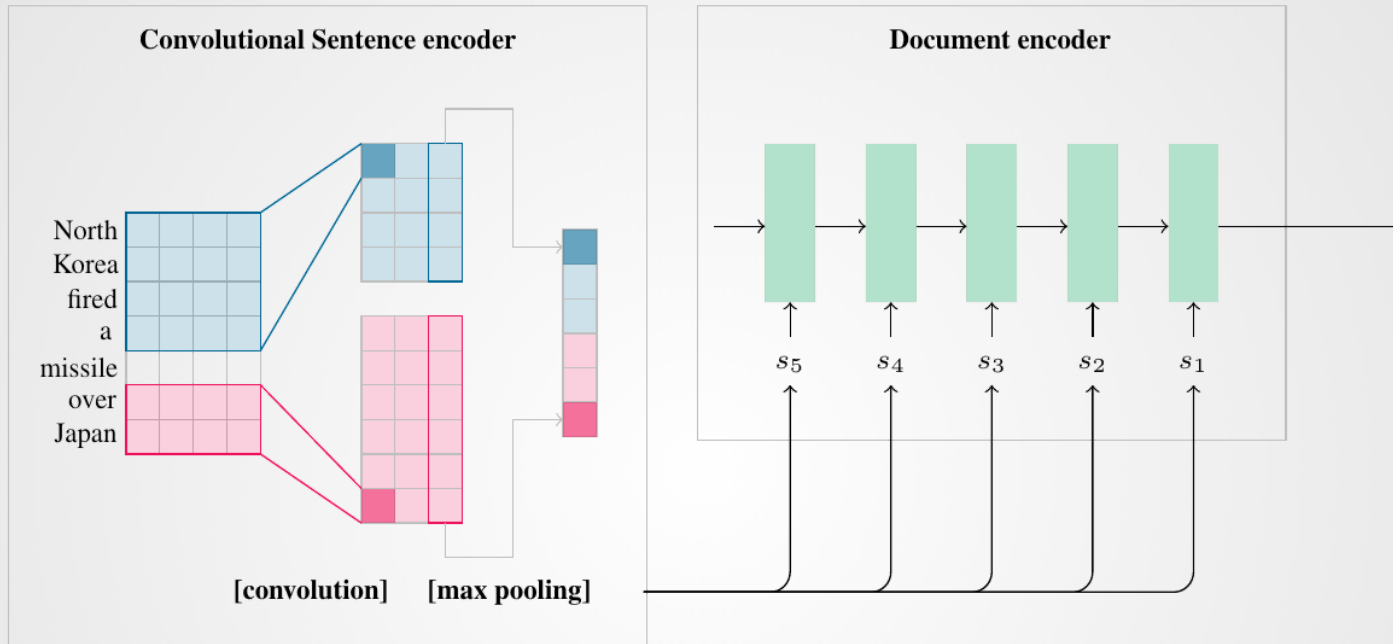
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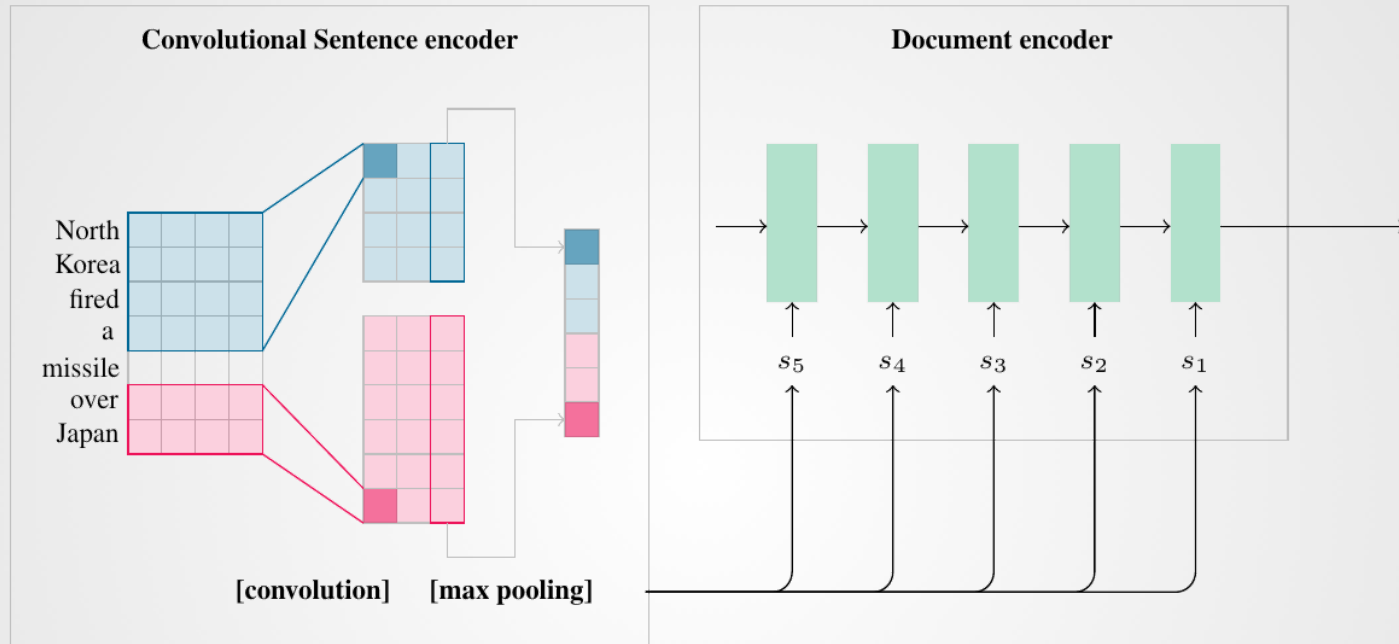
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- document modeling with richer content: **read whole document before** starting to extract sentences
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- neural architecture for sentence extraction (XNet)

# XNet: Document Encoder

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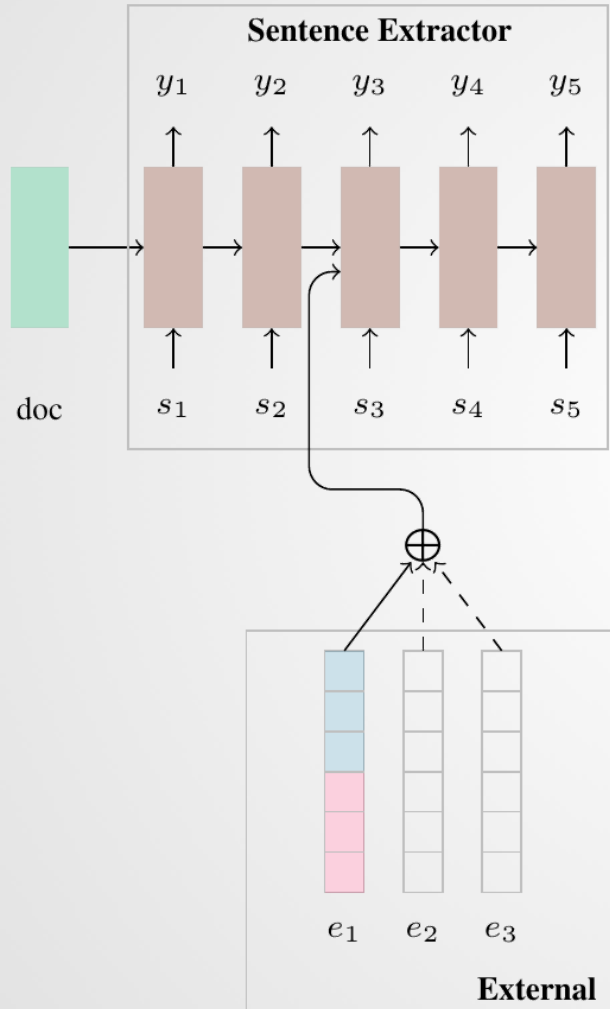
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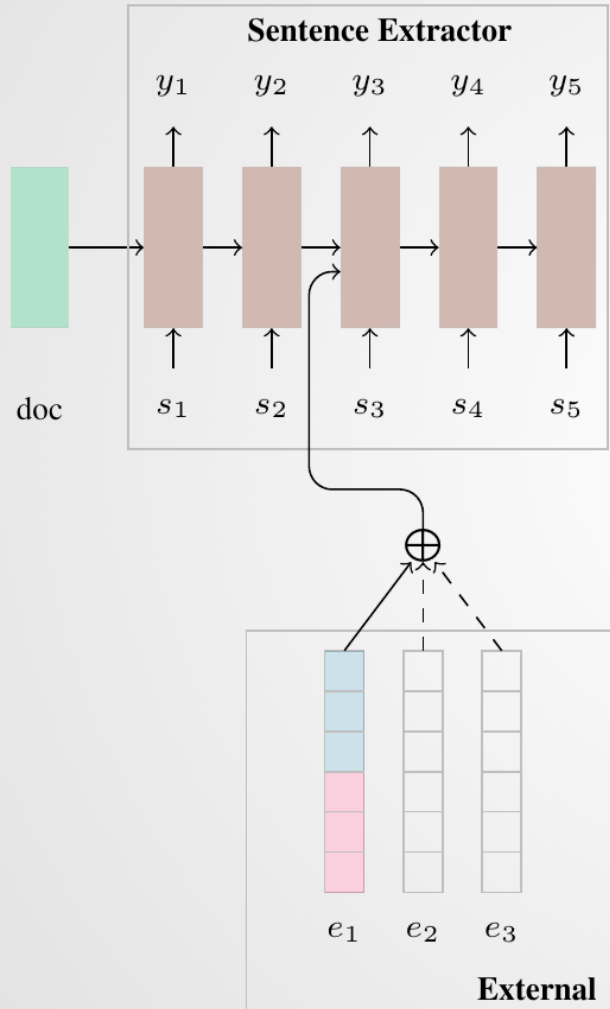
- hierarchical (two-level) encoder
- sentences are encoded by a **convolutional encoder** (Kim, 2014)
- LSTM document encoder
- get a document embedding before extraction begins

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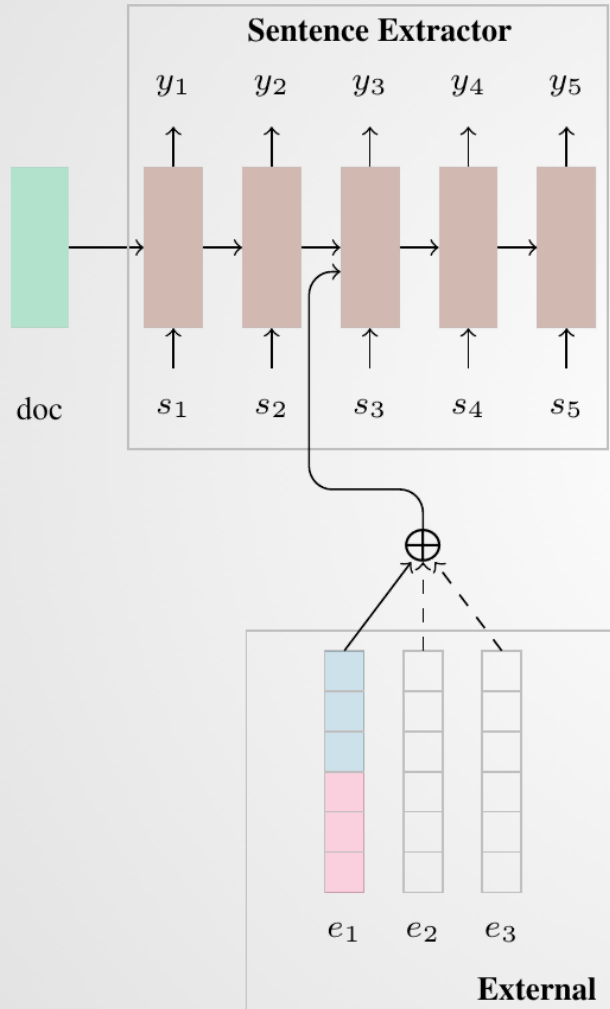
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- RNN extractor

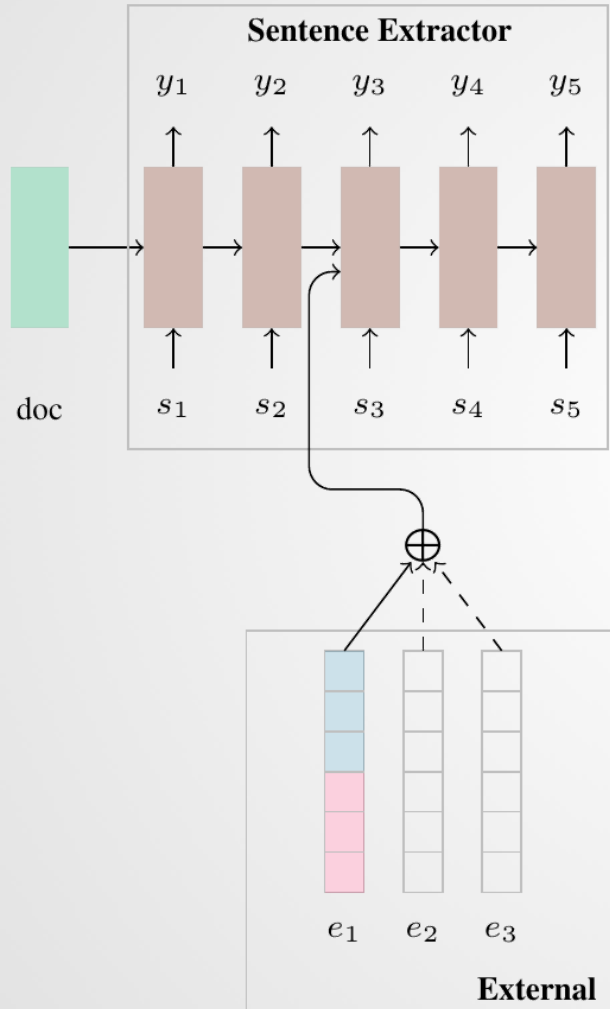


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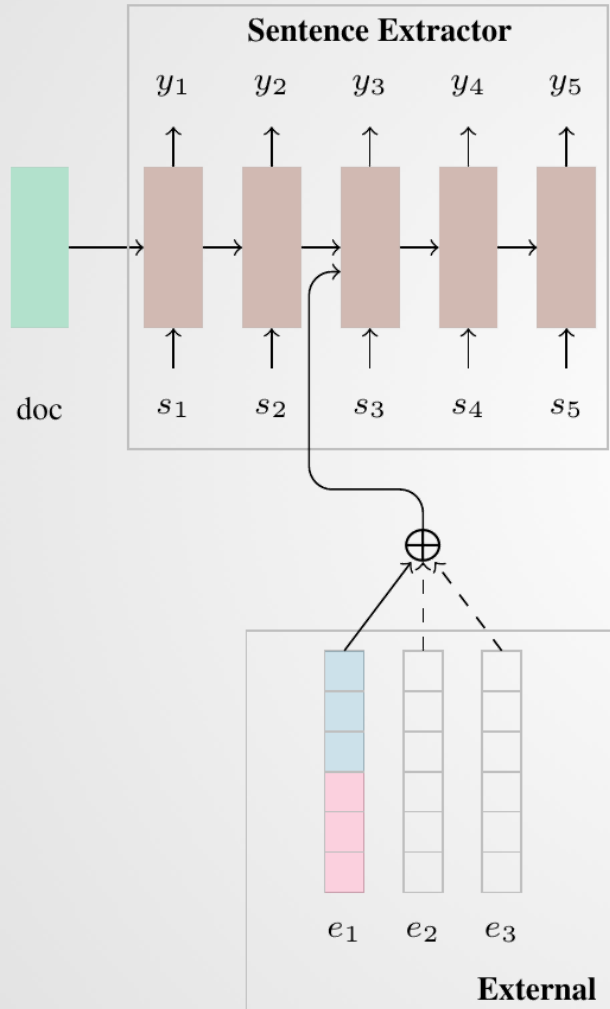
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  - other information

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- softmax over the output produces binary labels

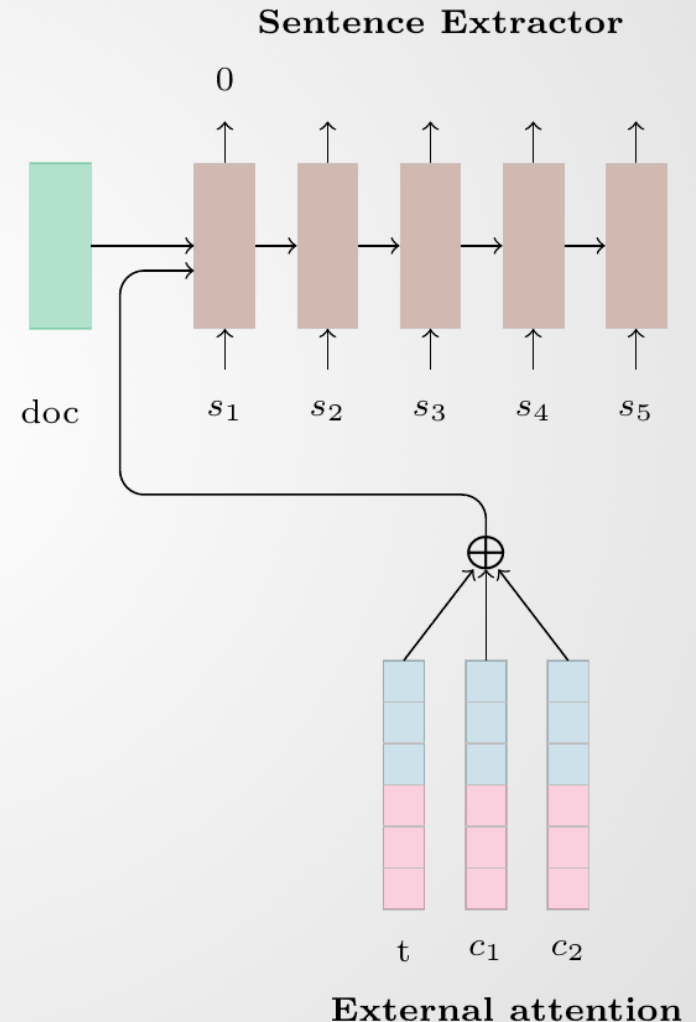
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- attention over external information
  - title
  - image captions
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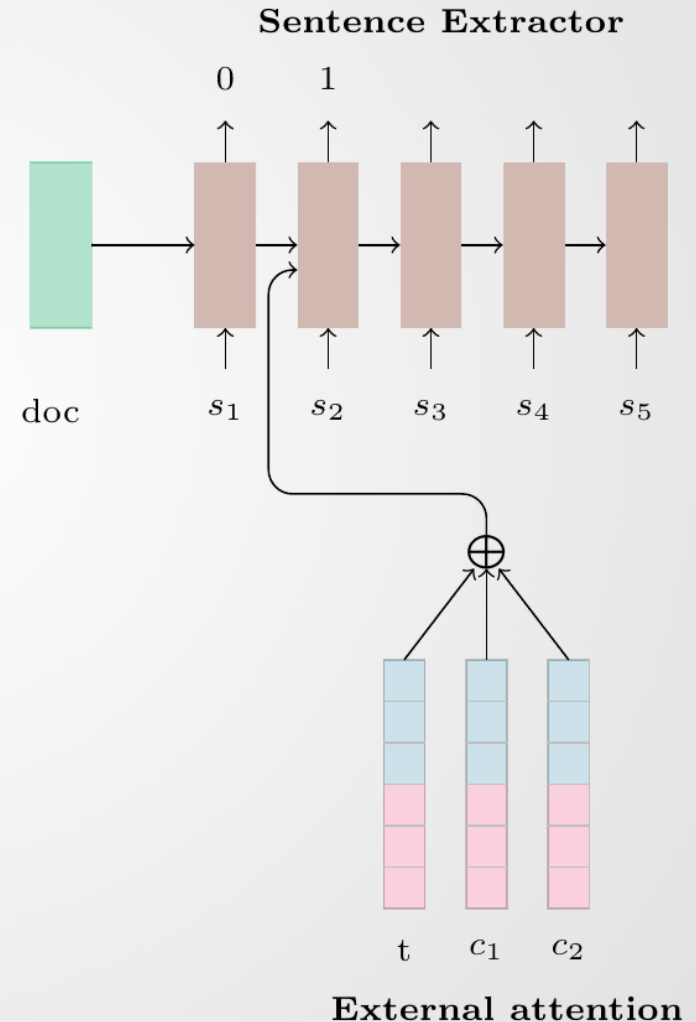
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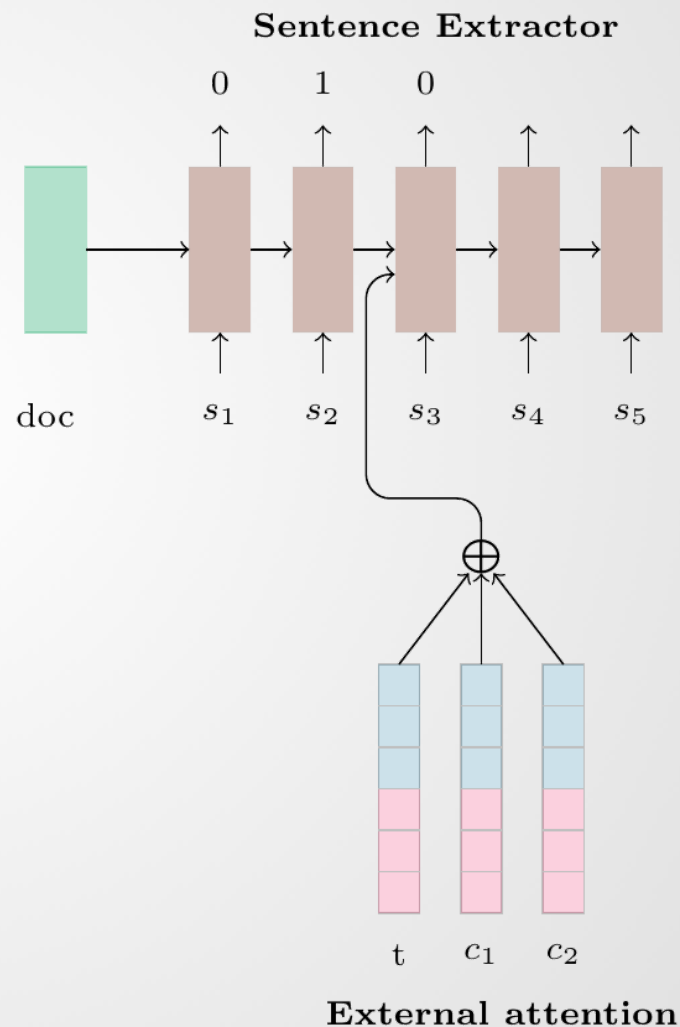
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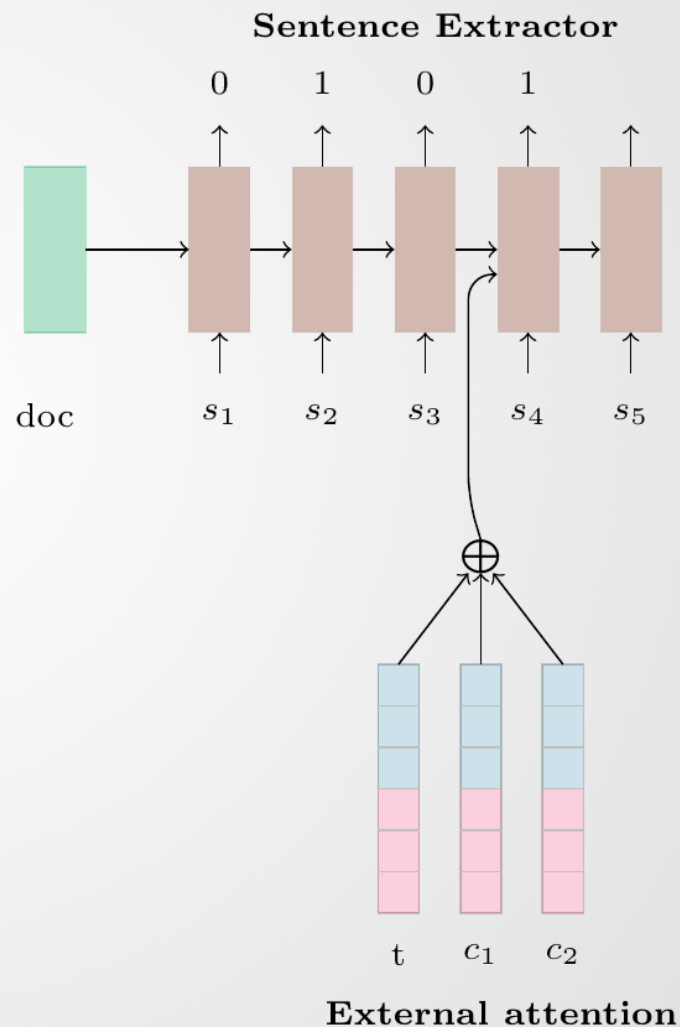
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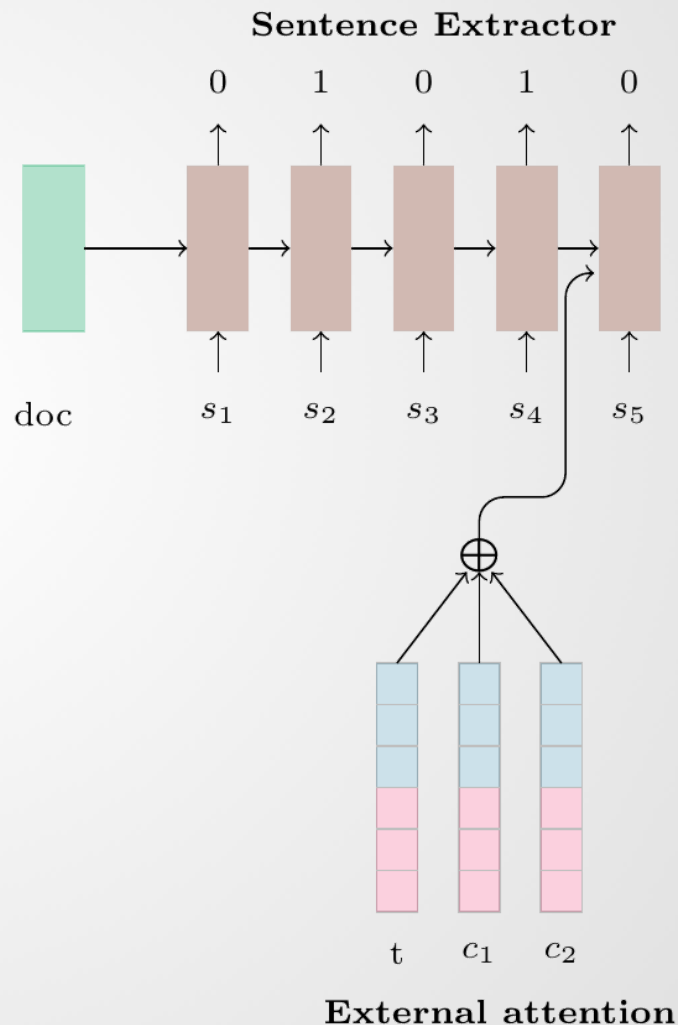
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By Val Willingham, CNN

Updated 1120 GMT (1920 HKT) June 13, 2014



Dangerous mosquito illness on the rise 01:16

### Story highlights

North Carolina reports first case of mosquito-borne virus called chikungunya

Chikungunya is primarily found in Africa, East Asia and the Caribbean islands

Virus is not deadly, but it can be painful, with symptoms lasting for weeks

A debilitating, mosquito-borne virus called chikungunya has made its way to North Carolina, health officials say. It's the state's first reported case of the virus.

The patient was likely infected in the Caribbean. according to the [Forsyth](#)

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- summary: 3 top-scoring sentences according to the extractor

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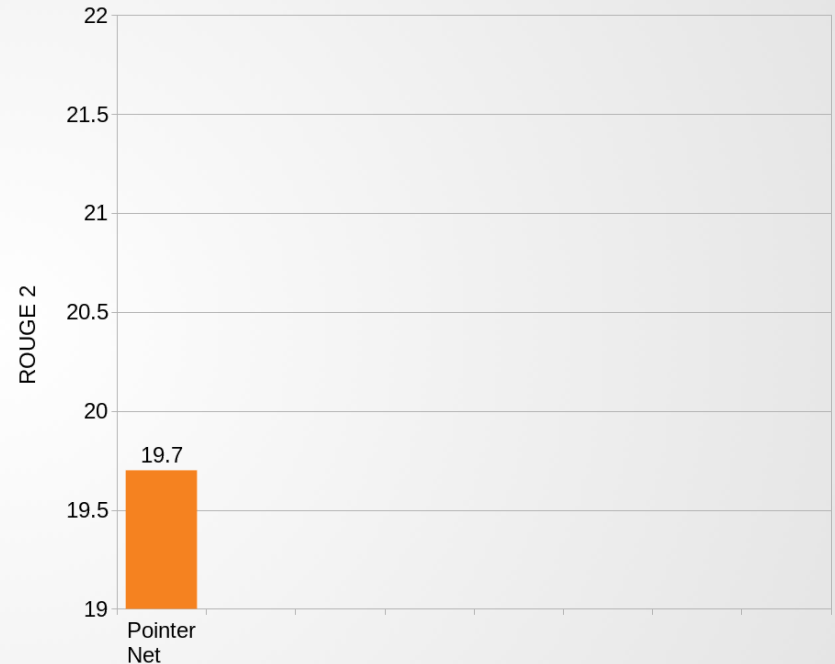
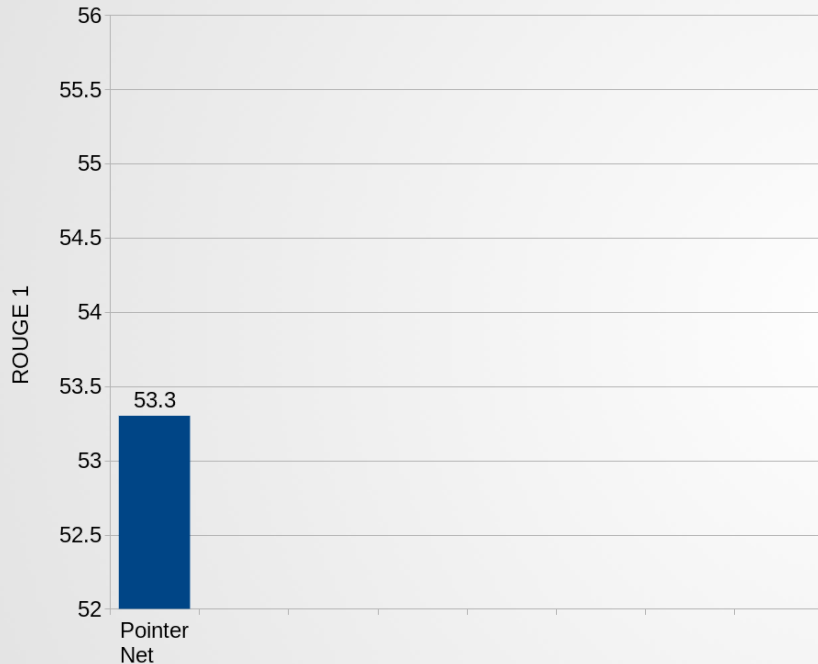
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*Ablation results on validation set (ROUGE recall scores)  
PointerNet is Cheng and Lapata (2016)*

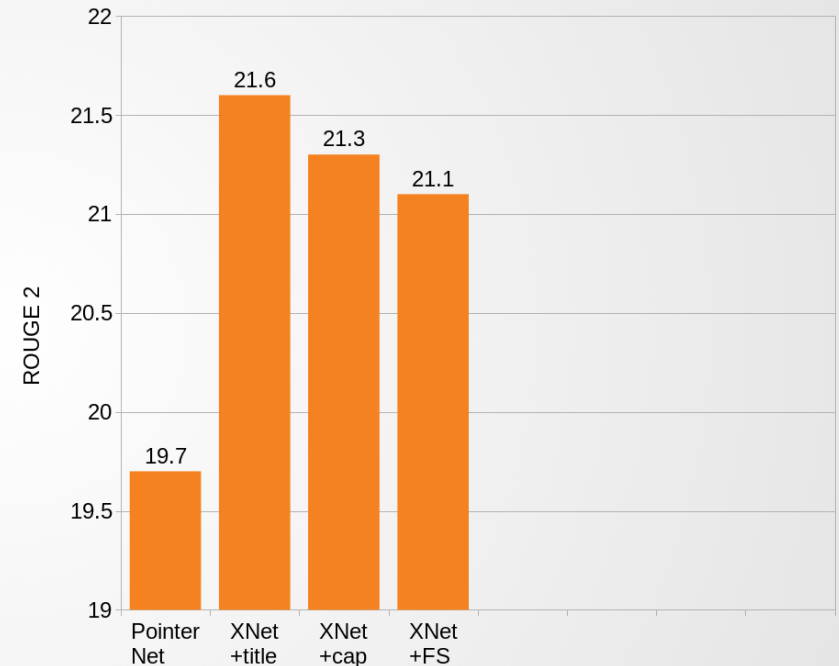
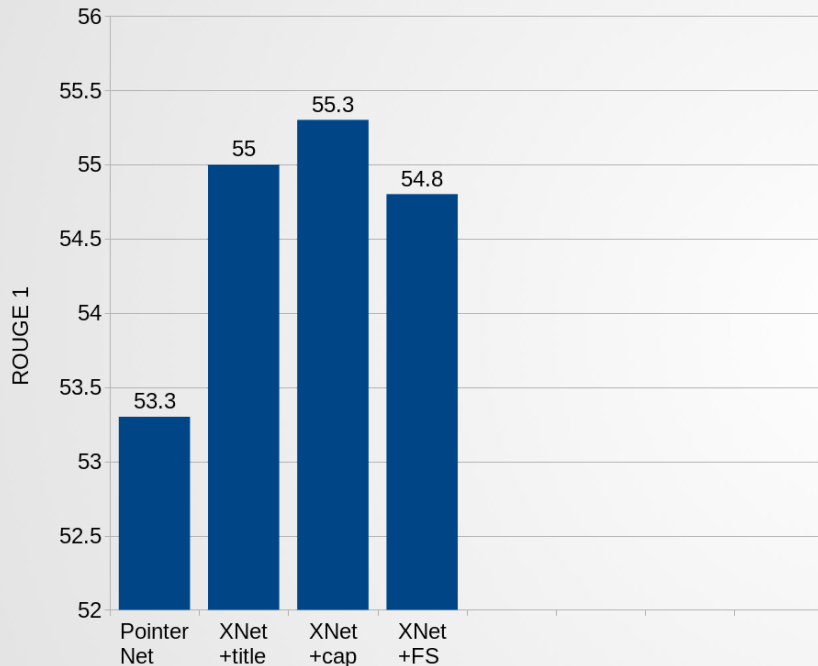
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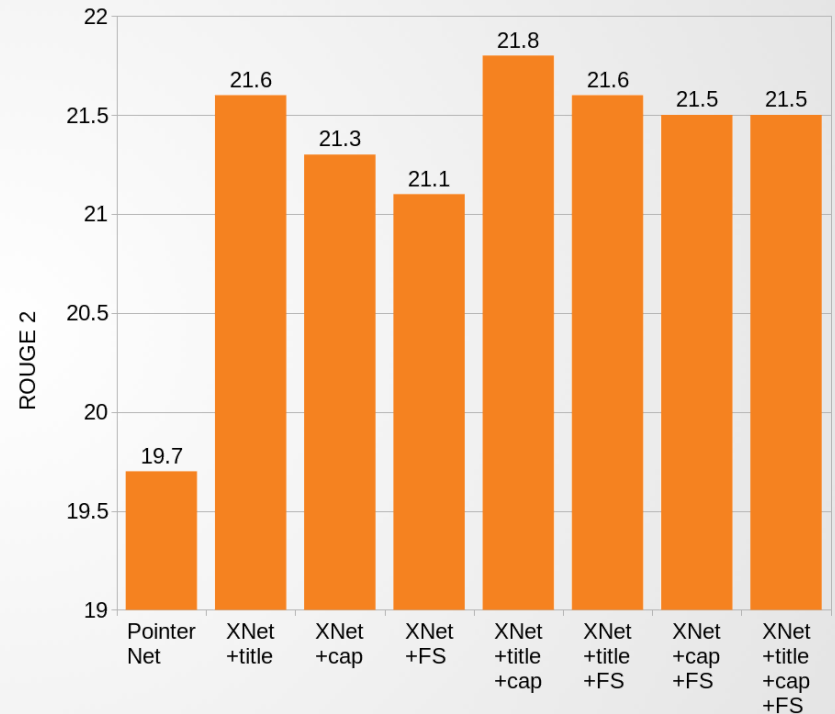
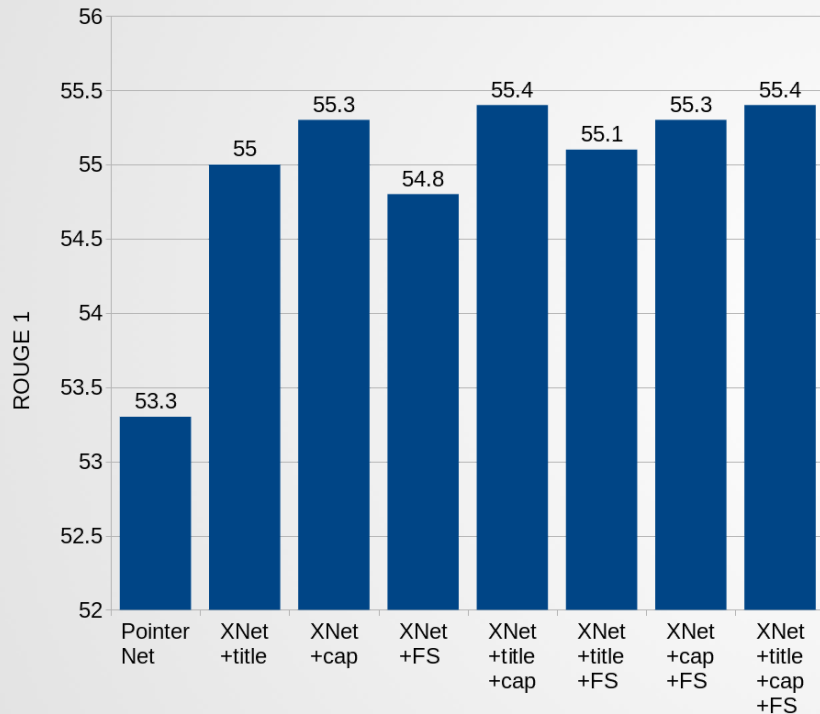


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# Results

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275 b				
full				

*(XNet is XNet+title+caption, PointerNet is Cheng and Lapata (2016))*

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	model	ROUGE 1	ROUGE 2	ROUGE L
75 b	LEAD	20.1	7.1	14.6
	<b>PointerNet</b>	<b>20.3</b>	<b>7.2</b>	<b>14.8</b>
	XNet (this work)	20.1	7.1	14.6
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275 b	LEAD	39.1	14.5	34.6
	PointerNet	38.6	13.9	34.3
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full	LEAD	49.3	19.5	43.8
	PointerNet	51.7	19.7	45.7
	<b>XNet (this work)</b>	<b>54.2</b>	<b>21.6</b>	<b>48.1</b>

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model	1st	2nd	3rd	4th
LEAD	0.15	0.17	<b>0.47</b>	0.21
PointerNet	0.16	0.05	0.31	<b>0.48</b>
XNet (this work)	0.28	<b>0.53</b>	0.15	0.04
Human	<b>0.41</b>	0.25	0.07	0.27

*annotators ranked systems from best (1st) to worst (4th)*



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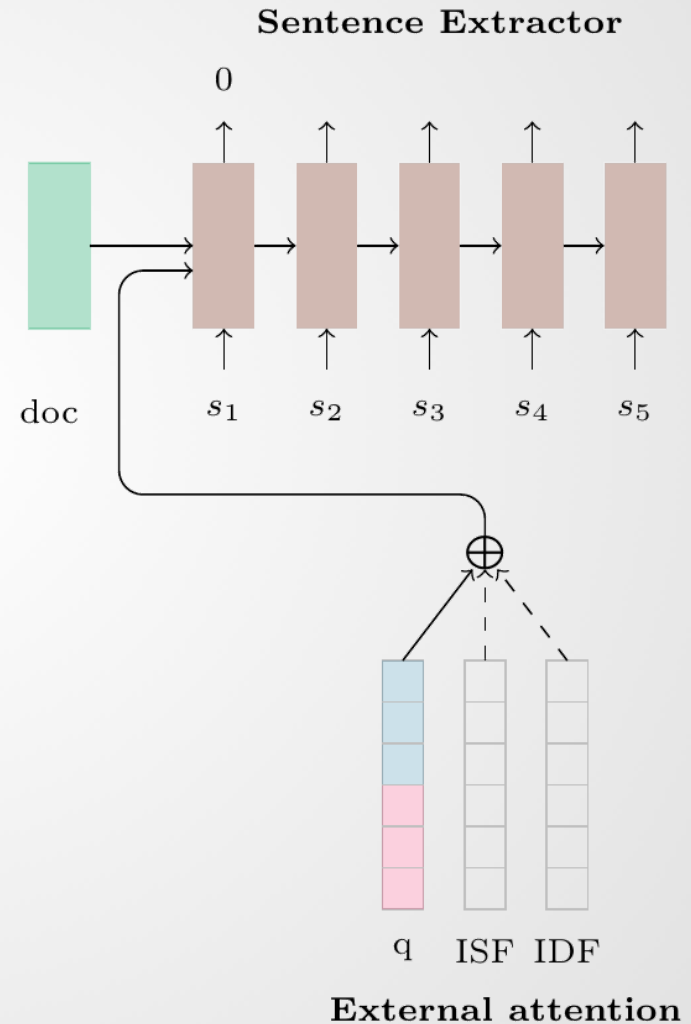
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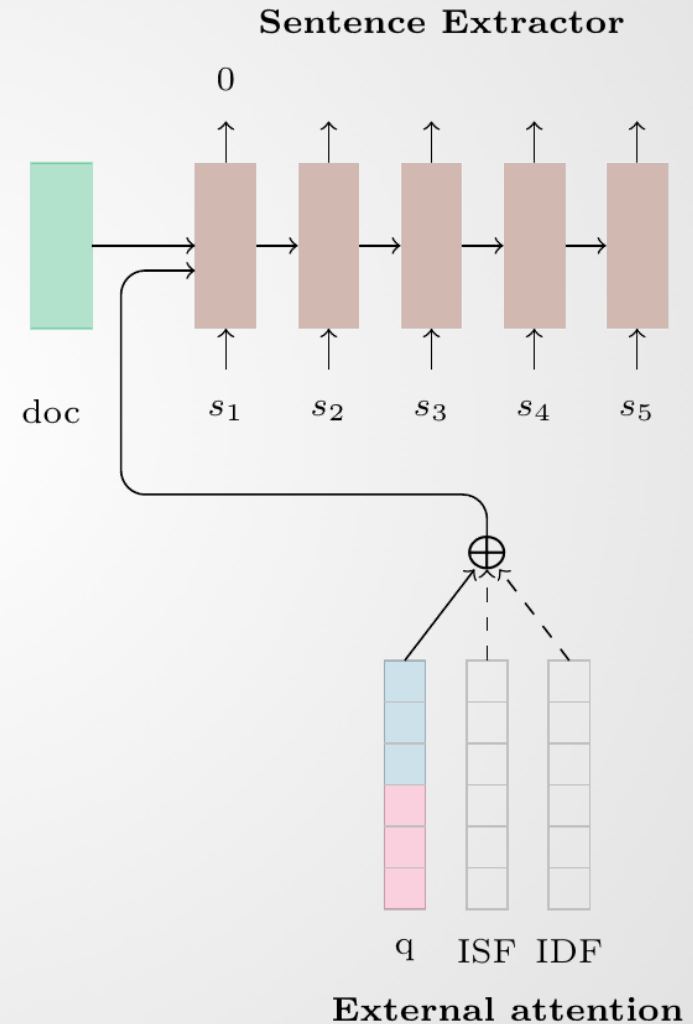
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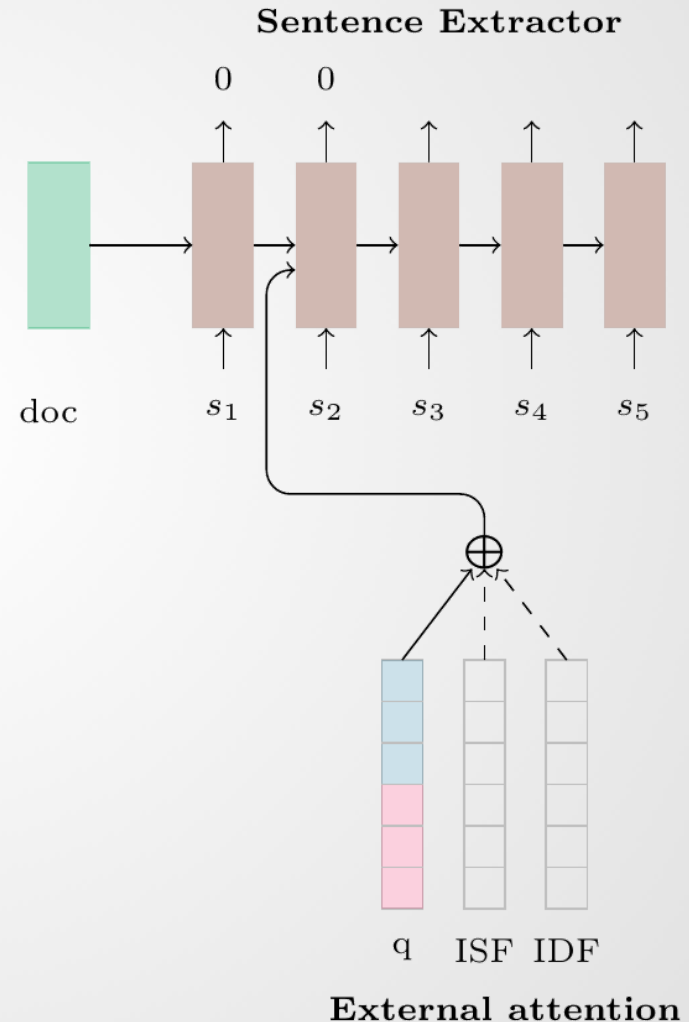
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- attention over
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    - inverse sentence frequency (ISF; Trischler et al., 2016)
    - local ISF (ISF with considering no of sents in article)



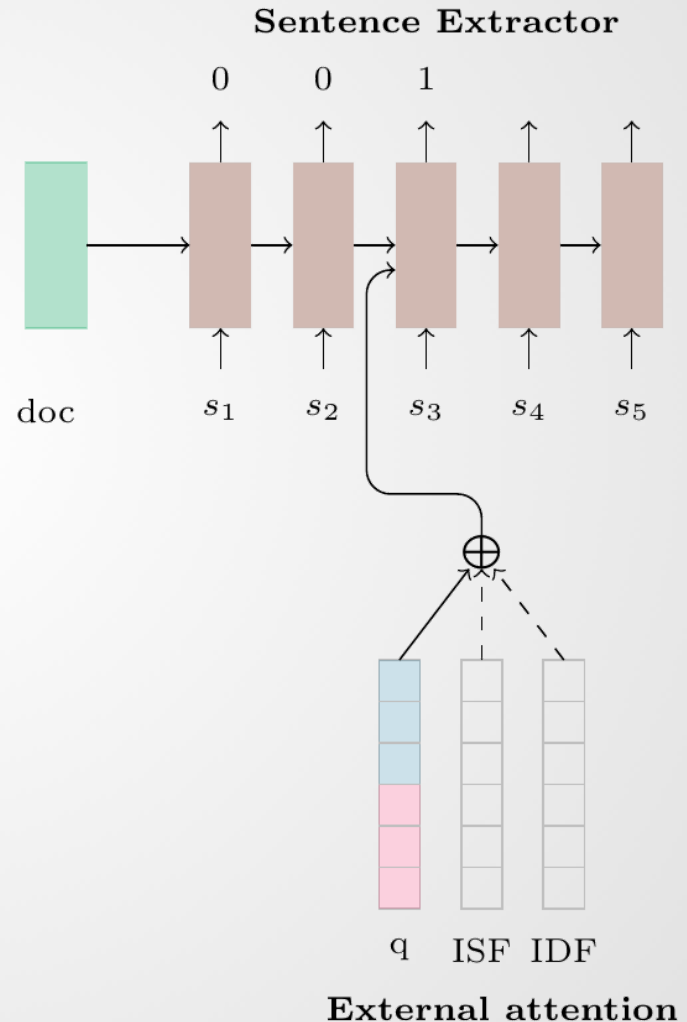
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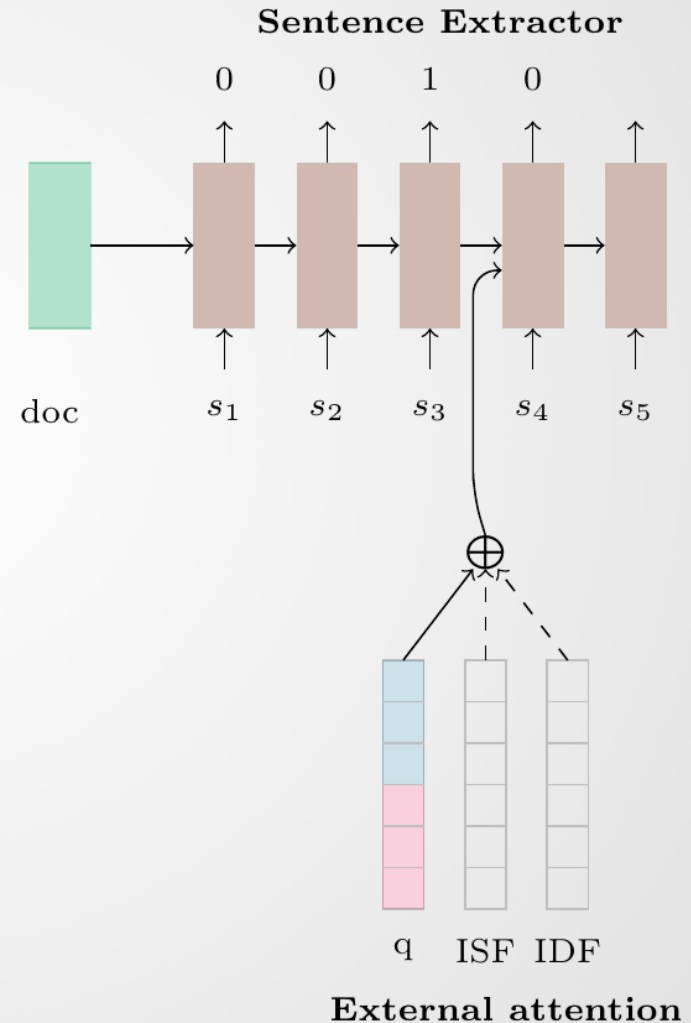
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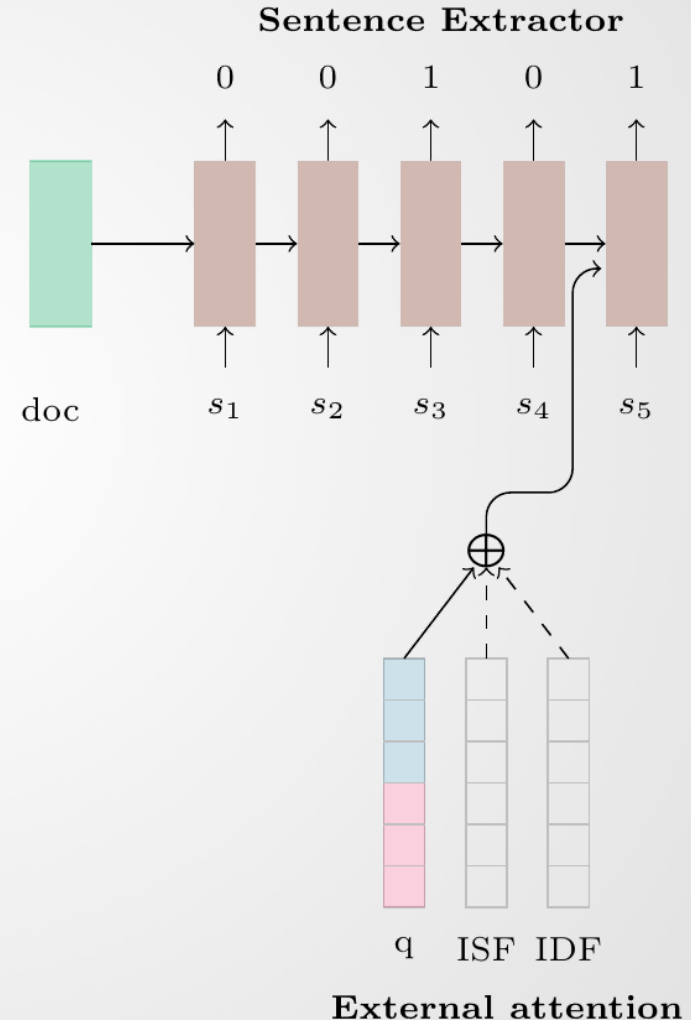
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  - NewsQA
  - SQuAD
  - WikiQA
  - MSMarco

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- leave out unanswered questions

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- four datasets
  - NewsQA
  - SQuAD
  - WikiQA
  - MSMarco
- leave out unanswered questions
- report scores for accuracy, Mean Average Precision (MAP) and Mean Reciprocal Rank (MRR)

# XNet variants

model	SQuAD	WikiQA	NewsQA	MSMarco
XNet	35.50	54.43	26.18	15.45
XNetTopK	36.09	55.00	29.41	17.04
XNet+	79.39	57.08	47.23	23.07
LRXNet	<b>85.63</b>	<b>63.29</b>	<b>55.17</b>	<b>32.92</b>

*comparison of XNet variants*

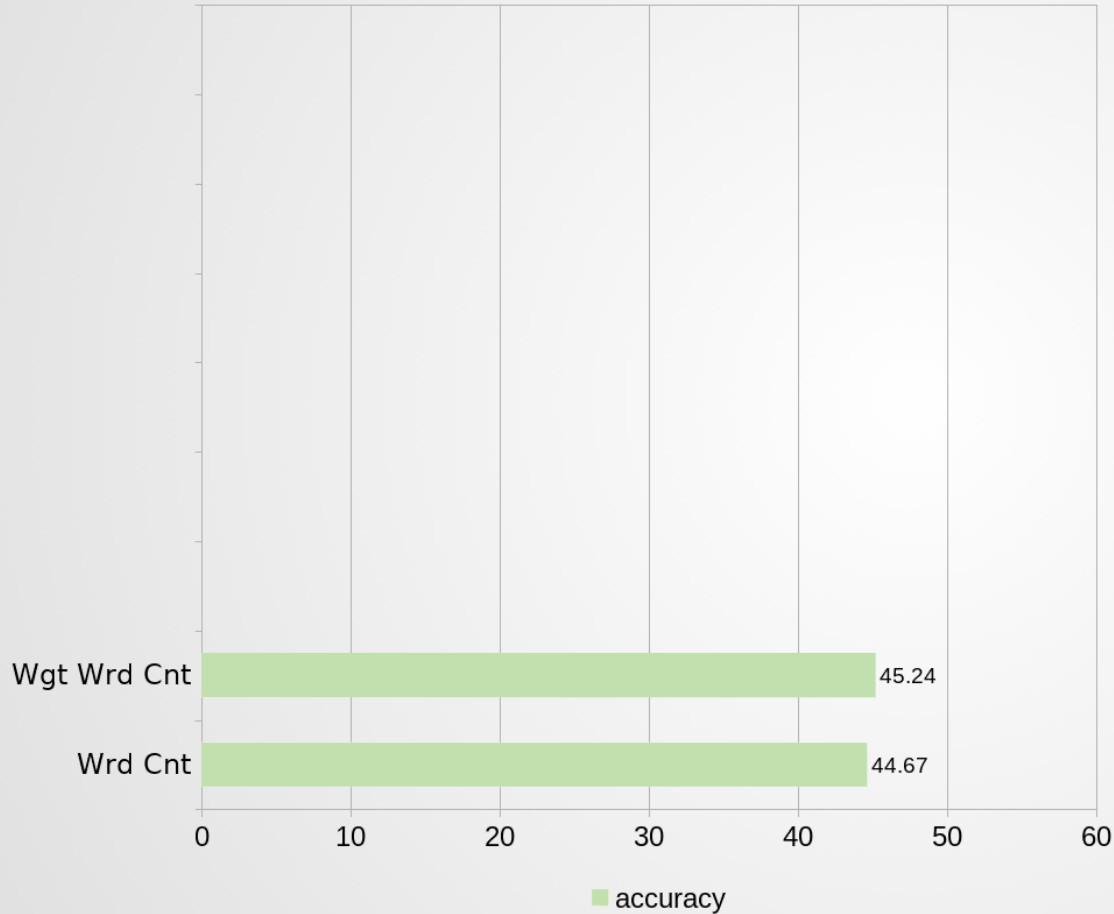
*reporting accuracy, similar patterns for MRR and MAP*

- **XNet**: only considering  $q$
- **XNet+**: considers  $q$ , IDF, ISF, LocalISF
- **XNetTopk**: choose *top k* sentences based on ISF and then XNet
- **LRXNet**: ensemble <XNet, CompAggr (Wang et al., 2017), classifier considering word overlap scores>

# Results

- results for NewsQA
- consistent behavior on SQuAD, WikiQA and MSMarco
- consistent behavior on all metrics

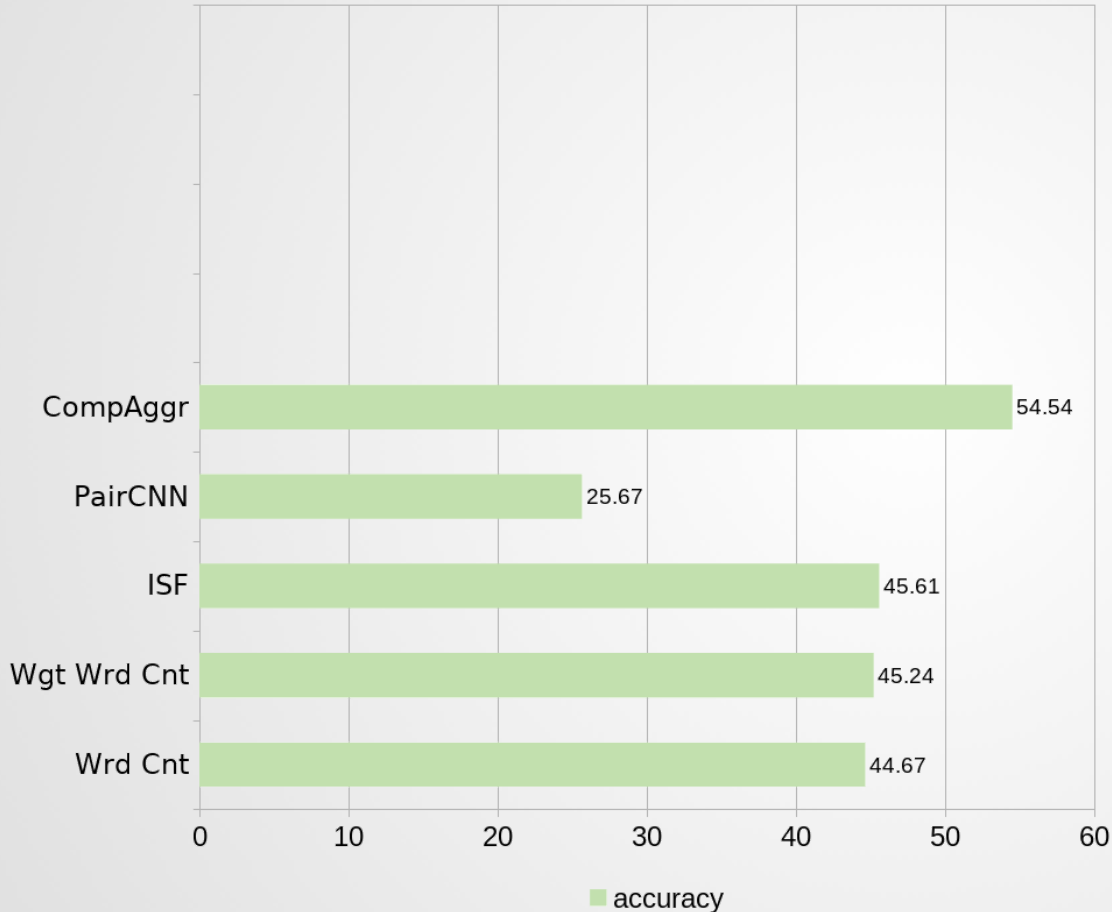
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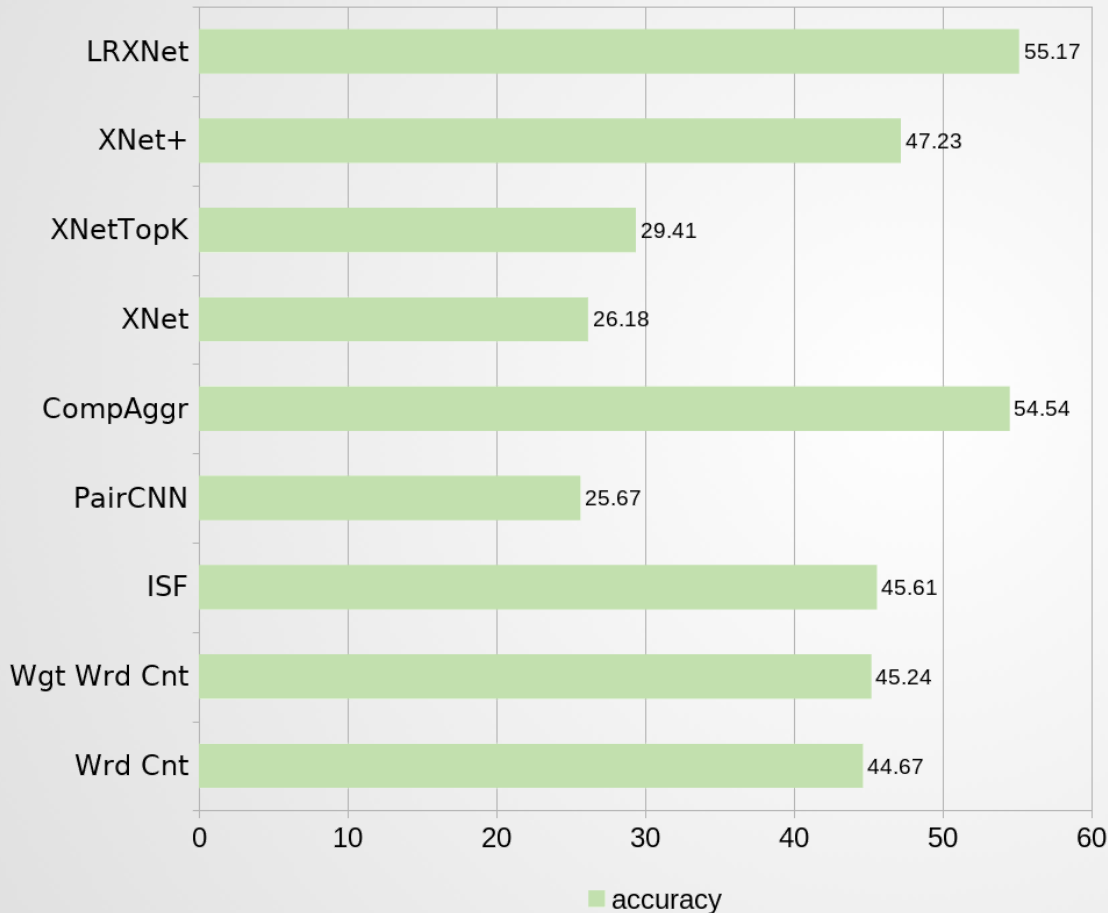


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considering external information helps

# Thank you!



code and datasets available

<https://git.io/fbpl3>

