Document Modeling with External Attention for Sentence Extraction

Shashi Narayan, Ronald Cardenas, Nikos Papasarantopoulos, Shay B. Cohen, Mirella Lapata, Jiangsheng Yu and Yi Chang

ACL 2018
Sentence extraction
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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
Sentence extraction
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Seoul (CNN) -- South Korea's Prime Minister Lee Wan-koo offered to resign on Monday amid a growing political scandal.

Lee will stay in his official role until South Korean President Park Geun-hye accepts his resignation.

Park heard about the resignation ...

Calls for Lee to resign began after South Korean tycoon Sung Woan-jong was found hanging ...

Sung, who was under investigation for fraud and bribery left a note listing names and amounts of cash given to top officials, including those who work for the President.

Lee and seven other politicians ...
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**Question:** Who resigned over the scandal?

**Answer:** South Korea's Prime Minister Lee Wan Koo
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They can also contain

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- **title**
- **images**
- **image captions**

which can contain **key events**

---

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South Korean PM offers resignation over bribery scandal

Suicide note leads to government bribery investigation

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- document modeling with richer content: **read whole document before** starting to extract sentences
- do not rely on similarity metrics to extract sentences
- neural architecture for sentence extraction (XNet)
XNet: Document Encoder
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Convolutional Sentence encoder

[convolution] [max pooling]

Document encoder

\( s_5 \) \( s_4 \) \( s_3 \) \( s_2 \) \( s_1 \)
XNet: Document Encoder

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

\[ \text{doc} \rightarrow s_1 \rightarrow s_2 \rightarrow s_3 \rightarrow s_4 \rightarrow s_5 \]

\[ y_1 \rightarrow y_2 \rightarrow y_3 \rightarrow y_4 \rightarrow y_5 \]

\[ e_1 \rightarrow e_2 \rightarrow e_3 \]

External
XNet: Sentence Extractor

- RNN extractor
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  - sentence embeddings
  - other information
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- softmax over the output produces binary labels
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- attention over external information
  - title
  - image captions
- sentences encoded with the convolutional sentence encoder
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Extractive Summarization Experiments
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- CNN part of CNN/DailyMail dataset

Mosquito-borne virus chikungunya worries CDC
By Val Willingham, CNN

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
Extractive Summarization Experiments

- CNN part of CNN/DailyMail dataset
- preprocess
  - extract titles (each article has a title) and image captions (avg 3 captions per article; 40% articles have at least one)
  - **oracle summaries**: select sentences that give collectively high ROUGE score wrt the gold summary (Nallapati et al., 2017)
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- summary: 3 top-scoring sentences according to the extractor
Ablation results on validation set (ROUGE recall scores)

PointerNet is Cheng and Lapata (2016)
External info helps extractive summarization

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<tr>
<td>full</td>
<td>75 b</td>
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(XNet is XNet+title+caption, PointerNet is Cheng and Lapata (2016))
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XNet variants

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<tr>
<td>XNet</td>
<td>35.50</td>
<td>54.43</td>
<td>26.18</td>
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<tr>
<td>XNetTopK</td>
<td>36.09</td>
<td>55.00</td>
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<tr>
<td>XNet+</td>
<td>79.39</td>
<td>57.08</td>
<td>47.23</td>
<td>23.07</td>
</tr>
<tr>
<td>LRXNet</td>
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<td>32.92</td>
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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$>$
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- consistent behavior on SQuAD, WikiQA and MSMarco
- consistent behavior on all metrics
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considering external information helps
Thank you!

code and datasets available
https://git.io/fbpI3