Semi-Supervised Extractive Question Summarization Using Question-Answer Pairs

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Extractive Question Summarization

Motivation:

Community question answering (CQA) sites tend to display the first sentence as the headline.

☹ They do not necessarily represent the most important.

　→ Users face difficulties to efficiently search questions.

Question: Hello, I have an AU's iPhone 5S ...
Hello, I have an AU iPhone 5S, but it still has the default settings　**Default Headline Sent.**
I have no Wi-Fi at home, so I cannot set it up
Is there any way to do the iPhone's initial setup without Wi-Fi?　**Actual Important Sent.**
If there is, please tell me:)

Task: Input : question post
　　　Output: single-sentence summary

Existing Approaches

- Previous approaches are mostly supervised models.
  - Feature-based classifiers [Tamura+2005];
  - Learning-to-rank approach [Higurashi+2018]

- Neural network-based models can also be applied.
  [Nallapati+2016, Chen&Lapanta2016 and many others]

  ☹ We need costly annotated data!

  ➡ We investigate how we can use <u>question-answer pairs</u>

Our Semi-supervised setting

- We use question-answer pairs in addition to manually annotated questions.
  1. **Label**: a small dataset with costly annotated sentences.
  2. **Pair** : a large dataset with question-answer pairs.

Question: Hello, I have an AU's iPhone 5S ...	Answer: The iPhone's initial setup
Hello, I have an AU iPhone 5S, but it still has the default settings **Default Headline Sent.** I have no Wi-Fi at home, so I cannot set it up Is there any way to do the iPhone's initial setup without Wi-Fi? **Actual Important Sent.** If there is, please tell me:)	requires a SIM card and a PC that can use the Internet. If you don't have a PC, try connecting to Wi-Fi at a convenience store or other location. If you don't have a SIM card, borrow someone else's.

Example showing the usefulness of answers

- The answer part also includes some important words such as Wi-Fi or iPhone.

  Research Question:

  Is it possible to improve the performance of summarizers if we additionally use answers?
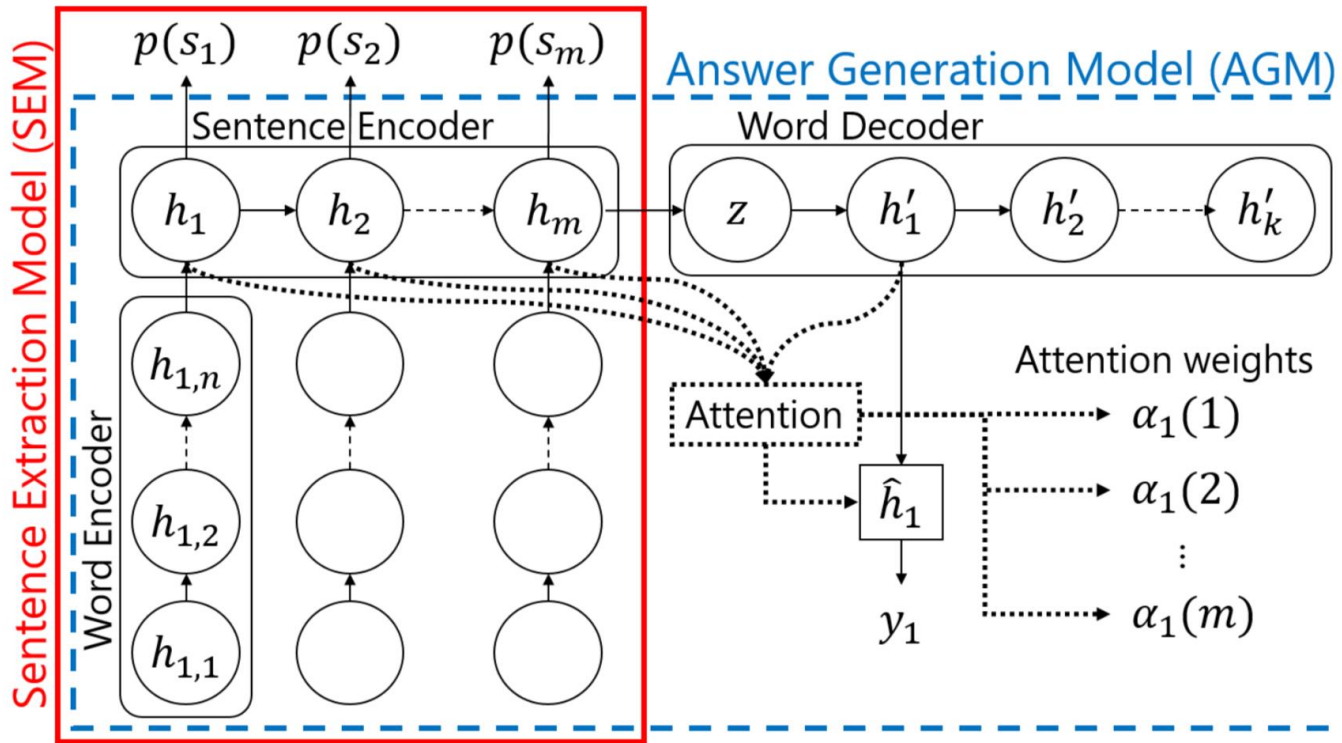
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Our Framework

Fig. 2. Overview of our framework.
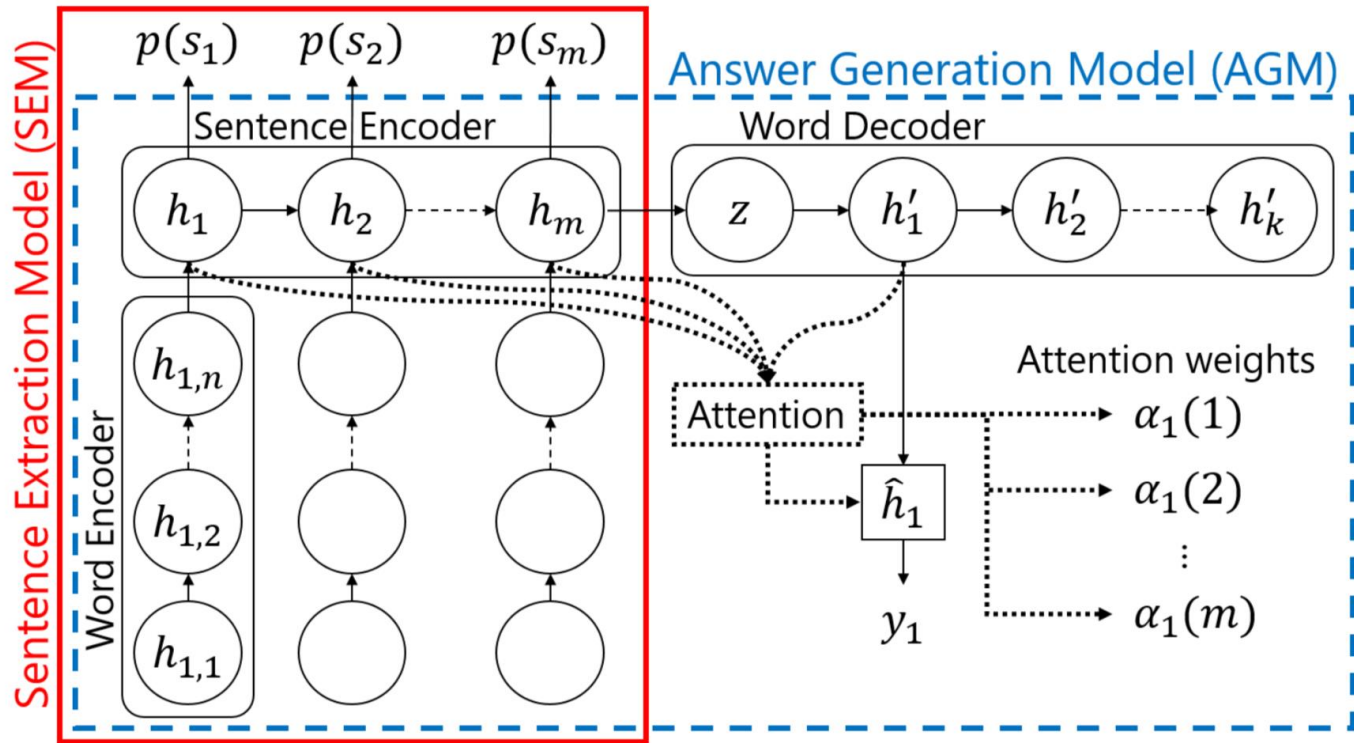
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SEM is a main component for scoring sentences.
We use LSTM-based encoders and linear layer + softmax.
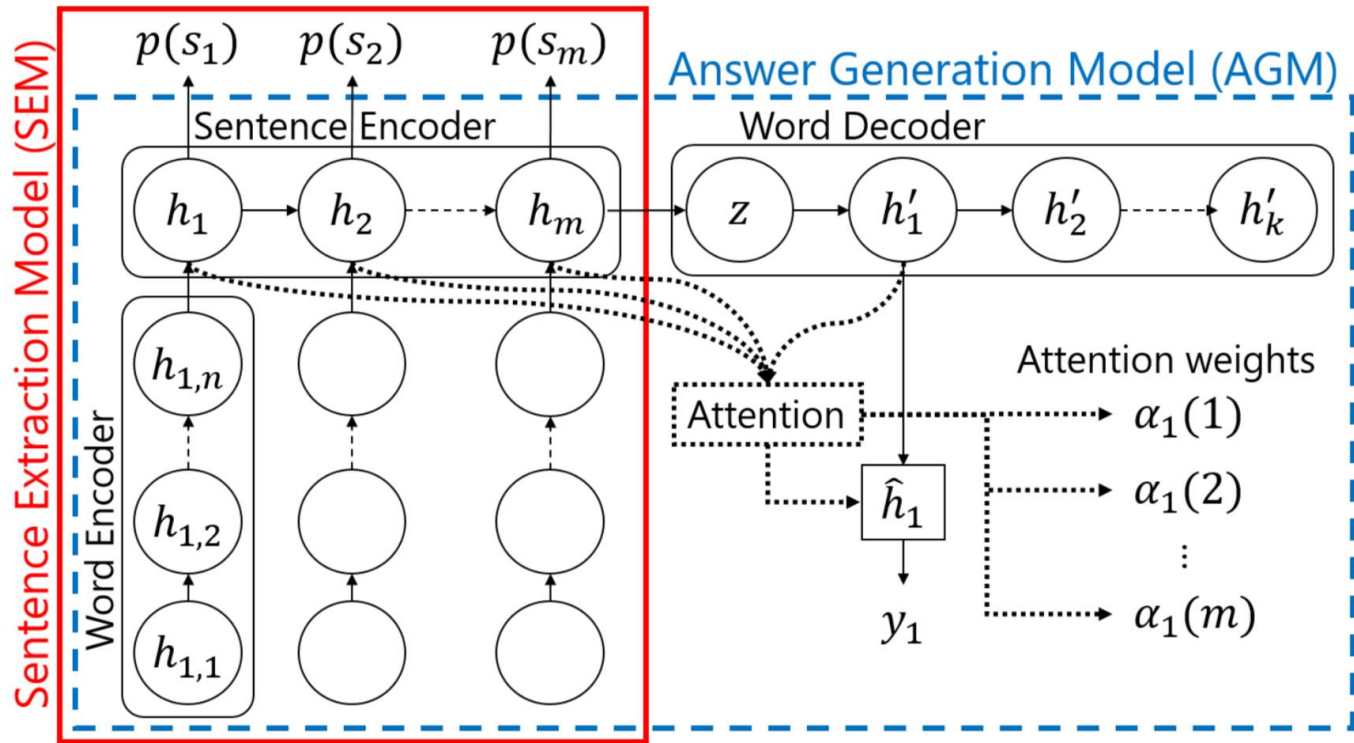
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AGM generates an answer by an encoder-decoder with an attention.
We calculate the importance score for every sentence as the sum of
attention weights.

Experiments

- Evaluation: Accuracy on Label (cross-validation)
  (# of correctly predicted questions/ # of total questions)

		Label	Pair	Acc.
・Unsupervised baselines	Lead	–	–	.690
	TfIdf	–	–	.237
	SimEmb	–	–	.472
	LexRank	–	–	.587
・Train and use SEM only	Ext	✓	–	.813
・Train and use AGM only	Gen	–	✓	.649
・Train SEM and AGM separately and combined.	Sep	✓	✓	.828
・Train SEM after pretraining the encoder by AGM.	Pre	✓	✓	.788
・Train AGM and SEM simultaneously	Multi	✓	✓	.770
・Multi with oversampling of Label	MultiOver	✓	✓	.833
・Multi with undersampling with Pair	MultiUnder	✓	✓	.857

☺ Simultaneously train AGM and SEM with an appropriate sampling method worked well

Conclusion

- We proposed a framework to use question-answer pairs for the extractive question summarization task.

- Using QA pairs works well when we apply an appropriate sampling method.

- Our data will be publicly available.