Memory-based Story Learning for Conversational Question and Answering

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Contents

Overview

- Objective: To learn story of fables and answer the question about the story conversationally.

Q: Which instrument did the little mermaid play?

A: The little mermaid played the harp.

Q: What did the little mermaid wish for?

A: The little mermaid wished for human legs and marry the prince.

Q: Where does the little mermaid live?

A: The little mermaid lives deep inside the sea.

Overview

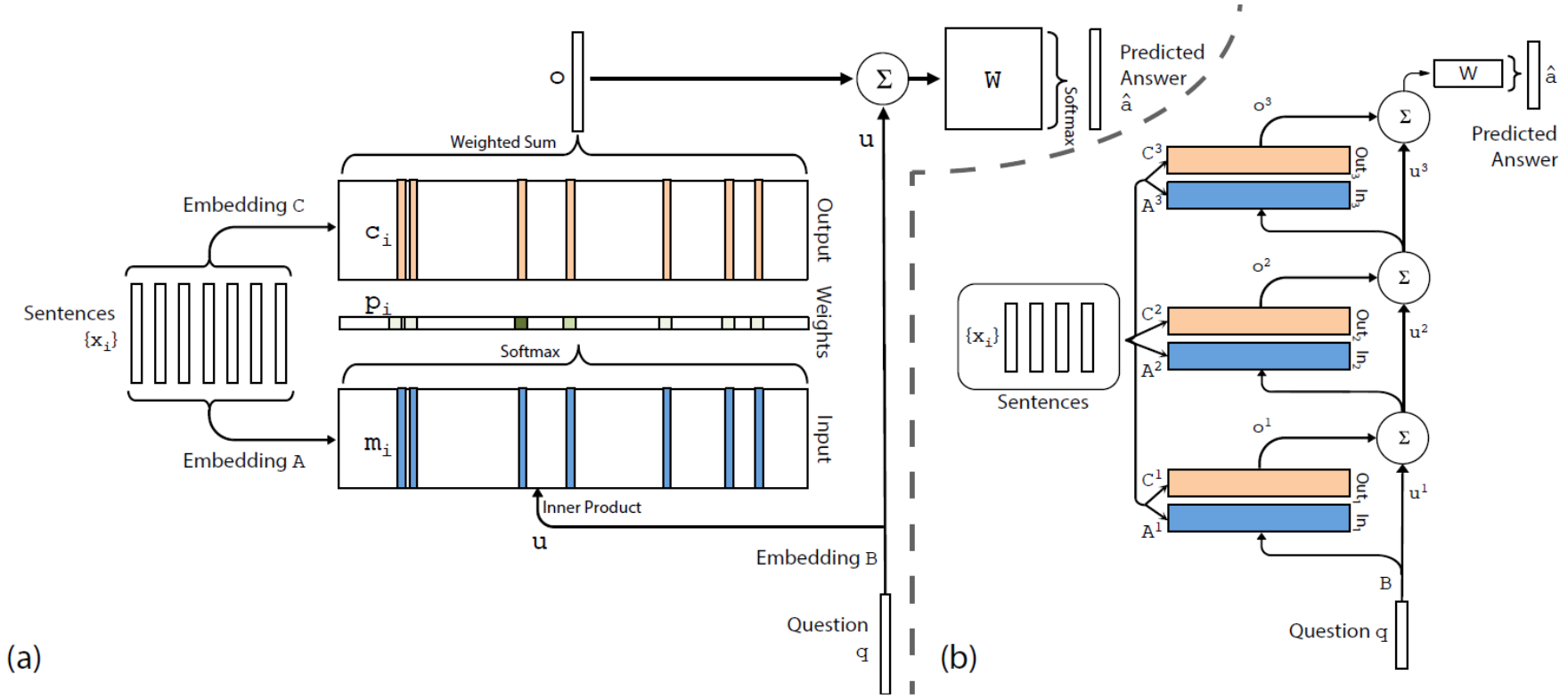
- Many representative models are able to answer the question in word level.
  - bAbI dataset : word unit

  → require to process a unit of sentence

- Suggestion of question answering model in sentence level
  - Use End-to-End Memory Networks[1](MemN2N) for story learning
  - Extract sentence representation through Skip Thought Vector[2](Sent2Vec) and retrieve the answer
  - Utilize the commercialized data

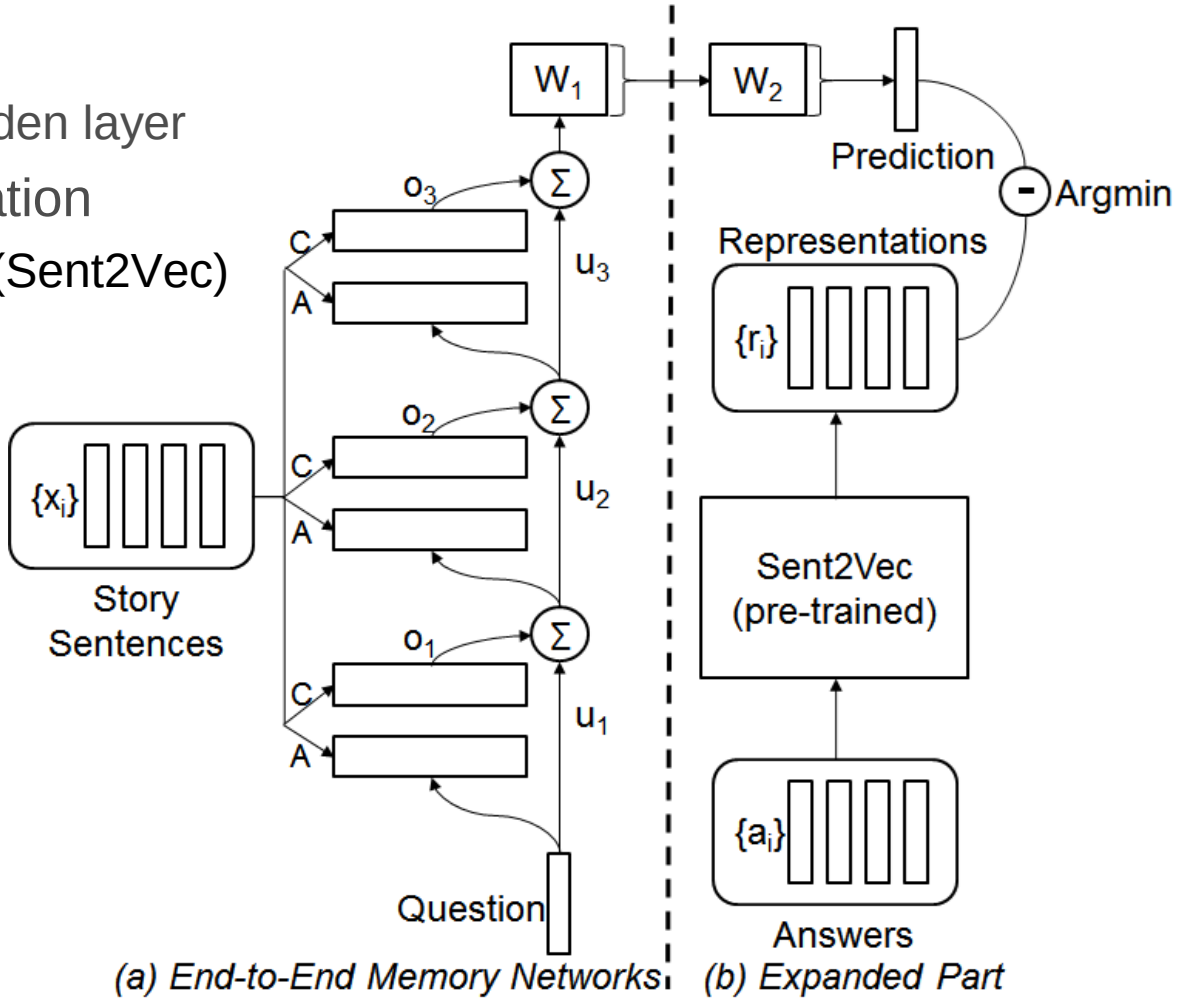
[1] Sainbayar Sukhbaatar, Arthur Szlam, Jason Weston, and Rob Fergus. End-To-End Memory Networks. NIPS. 2015
[2] Ryan Kiros, Yukun Zhu, Ruslan Salakhutdinov, Richard S. Zemel, Antonio Torralba, Raquel Urtasun, Sanja Fidler. Skip-Thought Vectors. NIPS. 2015.

Modeling – MemN2N



Modeling – Expanded MemN2N

- Expanded End-to-End Memory Networks
  - Expanded MemN2N
    : 1 fully connected hidden layer
  - Sentence Representation
    : Skip-Thought Vector(Sent2Vec)



Experiments - Dataset

- Panda data
  - Story: 5 fables provided by Smart Study[6]
    - Hansel and Gretel
    - Snow White and the Seven Dwarves
    - The Little Mermaid
    - The Wolf and the Seven Sheep
    - The Three Little Pigs
  - Question & Answer: Amazon Mechanical Turk
  - Dataset: 600 set per a fable

```
1 Open up open up open up the door.
2 It's your it's your  it's your mom.
3 It's a trick It's a trick.
...
56 Mama and the seven little sheep laugh loudly.
57 How many children does the poor wood cutter have?	The poor wood cutter has two children  a son and a daughter.
```


[6] Smart Study Pinkfong, [Online]. Available web-site: https://about.pinkfong.com/en/about

Experiments - Method

- Training
  - Epoch: 2000
- Variables
  - Normalization level: 1, 2
  - Learning rate: 0.001 ~ 0.1
- Evaluation
  - Accuracy: BLEU-score[7]

[7] Kishore Papineni, Salim Roukos, Todd Ward, and Wei-Jing Zhu. Bleu: a method for automatic evaluation of machine translation. In ALC, 2002.

Result - Optimization

- Optimization
  - Learning rate: 0.01
  - Objective function: L2-normalization

목적함수	학습률	헨젤	백설공주	인어공주	아기돼지	늑대와 염소	평균	수렴
2-norm	0.1	0.11546301	0.12346822	0.17493818	0.11273602	0.11538935	0.128399	X
2-norm	0.02	0.14035298	0.17792955	0.15799572	0.17993282	0.10739112	0.15272	X
2-norm	**0.01**	0.36085919	**0.4454903**	0.4392761	**0.410672**	**0.3646428**	**0.40419**	O
2-norm	0.005	**0.3717181**	0.43047444	**0.4486243**	0.39230467	0.35374006	0.399372	O
2-norm	0.002	0.36759598	0.40487163	0.42858272	0.34304905	0.34201153	0.377222	O
2-norm	0.001	0.33552655	0.3885798	0.45642594	0.36106846	0.34012867	0.376346	O
1-norm	0.01	**0.3705079**	0.38636985	0.43292968	0.3697812	0.34270558	0.380459	O
2-norm	0.01	0.33284323	**0.4280891**	**0.4613515**	**0.399882**	**0.3433286**	**0.3931**	O

Result - Example

Question	Desire	Prediction
how many little sheep mama sheep had	seven little sheeps.	six little sheeps.
how mama sheep cuts open the wolf's stomach	with scissors.	the mama sheep cut open the wolf's stomach with scissor.
what mama sheep said to little sheep before going to the market	don't open the door for anyone.	don't open the door for anyone.
who knocked on the door	the wolf.	the wolf.
what did wolf put on his feet to make them white	white flour.	white flour.
how many little sheep did wolf find	six sheep.	six little sheep.
what he did with six little sheep he fond	he swallows them whole.	the wolf falls in the pond.
where the seventh sheep was hiding	in the clock case.	the seventh sheep was hiding in the clock case.
at what time cuckoo comes out from clock	three'o clock.	three'o clock.
whose eye did cuckoo pokes	wolf's eye.	wolf's eye.
who knocked on the door	the wolf.	the wolf.
where was the seventh sheep	in the cuckoo clock.	the seventh sheep was hiding in the clock case.
what colour was the wolf's feet	black.	she put stones in the wolf's stomach.
what did the wolf pore on his feet	white flour.	the mama sheep cut open the wolf's stomach with scissor.
how many little sheeps did the wolf eat	six little sheeps.	the wolf found six sheep.

Future works

- Incremental Learning
  - Assist swlee to experiment.
  - Learn my interesting area and how to research.
  - Combine with Q&A task for my research topic.

- Project: Guess What!
  - VQA
  - Question Generation
  - Attention Model