Story Ending Generation with Incremental Encoding and Commonsense Knowledge

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Introduction

Today is **Halloween** .
Jack is so excited to go **trick or treating** tonight .
He is going to **dress up** like a **monster** .
The **costume** is real **scary** .
He hopes to get a lot of **candy** .

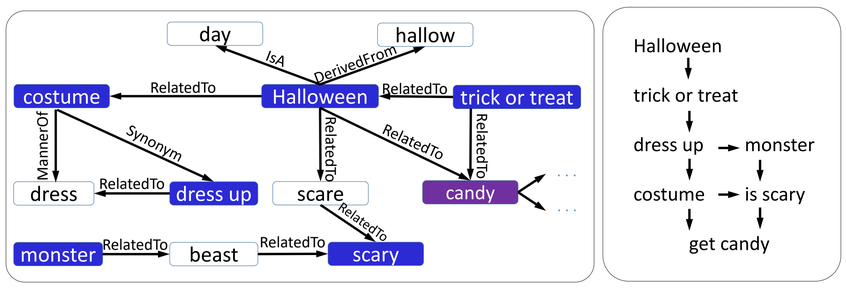


Figure 1: Story Ending Generation Tasks: given a story context consisting of a sentence sequence, generate a one-sentence sequence to conclude the story and complete the plot.

Generating a good ending requires:

- Representing the **context clues** which contain key information for planning a reasonable ending
- Using **implicit knowledge** (e.g., commonsense knowledge) to facilitate understanding of the story and better predict what will happen next.

Method

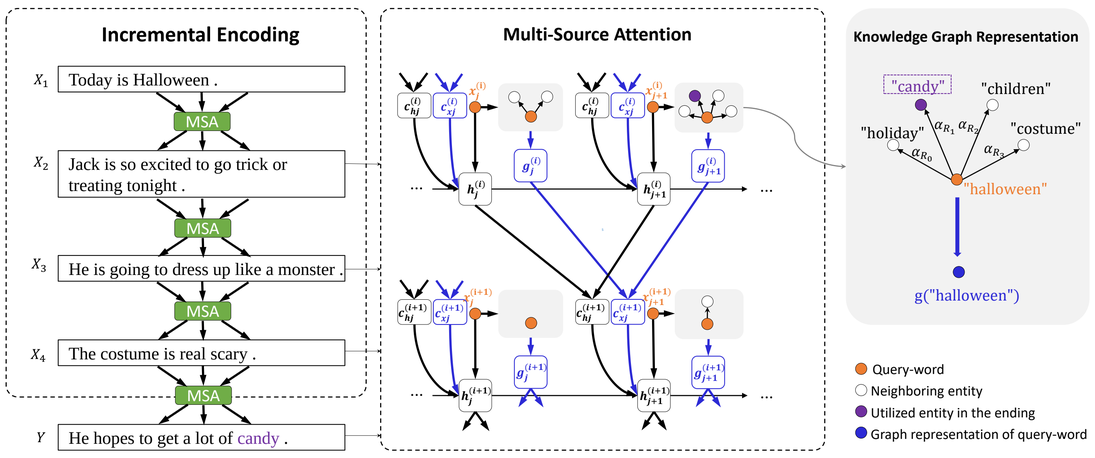


Figure 2: Model overview.

Task Overview:

$$\text{Story Context} \times \text{Commonsense Knowledge} \rightarrow \text{Story Ending}$$

Model: Sequence to Sequence (seq2seq) Framework

- **Encoder-Decoder with Attention:** Common framework to model the mapping from the context to the ending.
- **Incremental Encoding:** Effective to represent the context clues which may capture the key logic information.
- **Multi-Source Attention:** Capture the relationship between words (or states) in the current sentence and those in the preceding sentence, and contains implicit knowledge that is beyond the text.
- **Knowledge graph representation:** Extends (Encodes) the meaning of a word by representing the knowledge graph from its neighboring concepts and relations.
- **Loss Function:** Impose supervision on both the encoding network and decoding network.

Experiments

Dataset

ROCStories corpus:

- Each story consists of five sentences, our task is to generate the ending given the first 4 sentence
- 90,000 for training and 8,162 for evaluation
- Average length of $X_1/X_2/X_3/X_4$ is 8.9/9.9/10.1/10.0/10.5

ConceptNet:

- Only retrieve the relations whose head entity and tail entity are noun or verb, meanwhile both occurring in SCT.
- Retain at most 10 triples if there are too many for a word.
- Average number of relations for each query word is 3.4

Evaluation

Automatic Metrics: **Perplexity**(PPL),**BLEU-1/BLEU-2**

Manual Metrics:

- **Grammar**(Gram.):Whether an ending is natural and fluent. Score 2 is for endings without any grammar errors, 1 for endings with a few errors but still understandable and 0 for endings with severe errors and incomprehensible.
- **Logicality**(Logic.):Whether an ending is reasonable and coherent with the story context in logic. Score 2 is for reasonable endings that are coherent in logic, 1 for relevant endings but with some discrepancy between an ending and a given context, and 0 for totally incompatible endings.

Model	PPL	BLEU-1	BLEU-2	Gram.	Logic.
Seq2Seq	18.97	0.1864	0.0410	1.74	0.70
HLSTM	17.26	0.2459	0.0771	1.57	0.84
HLSTM+Copy	19.93	0.2469	0.0783	1.66	0.90
HLSTM+MSA(GA)	15.75	0.2588	0.0809	1.70	1.06
HLSTM+MSA(CA)	12.53	0.2514	0.0825	1.72	1.02
IE (ours)	11.04	0.2514	0.0813	**1.84**	1.10
IE+MSA(GA) (ours)	9.72	0.2566	0.0854	1.68	**1.26**
IE+MSA(CA) (ours)	**8.79**	**0.2682**	**0.0936**	1.66	1.24

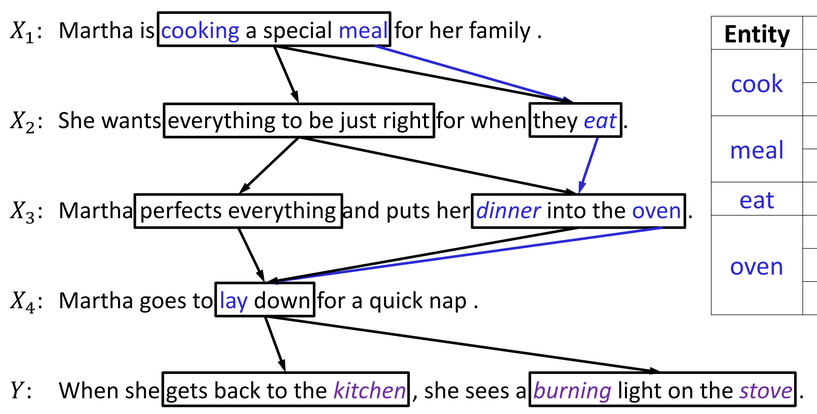
Table 1: Automatic and manual evaluation results.

Case Study

Context:	Martha is **cooking** a special **meal** for her family.
	She **wants everything to be just right** for when they eat.
	Martha **perfects everything** and puts her **dinner** into the **oven**.
	Martha goes to **lay down** for a quick **nap**.
Golden Ending:	She **oversleeps** and runs into the **kitchen** to take out her **burnt dinner**.
Seq2Seq:	She was so happy to have a ***new cake***.
HLSTM:	Her family ***and her family*** are very happy with her **food**.
HLSTM+ Copy:	**Martha** is happy to be able to ***eat her family***.
HLSTM+ GA:	She is happy to be able to **cook her dinner**.
HLSTM+ CA:	She is very happy that she has made a new **cook** .
IE:	She is very happy with her **family**.
IE+GA:	When she gets back to the **kitchen**, she sees a **burning light** on the **stove**.
IE+CA:	She realizes the **food** and is happy she was ready to **cook** .

Table 2: Generated endings from different models. **Bold** words denote the **key** entity and event in the story. *Improper* words in ending is in *italic* and proper words are underlined.

Attention Visualization



Entity	commonsense knowledge
cook	(cook, AtLocation, *kitchen*)
	(cook, HasLastSubevent, *eat*)
meal	(meal, AtLocation, *dinner*)
	(meal, RelatedTo, *eat*)
eat	(eat, AtLocation, *dinner*)
oven	(oven, AtLocation, *stove*)
	(oven, RelatedTo, *kitchen*)
	(oven, UsedFor, *burn*)

Figure 3: An example illustrating how incremental encoding builds connections between context clues.

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