

Response Generation by Context-aware Prototype Editing

Presenter: Yong Jiang

Motivation

- Response generation approaches:
 - Retrieval-based approaches
 - Generative approaches
- Retrieval-based approaches: deterministic
- Generative approaches: “safe response” problem
- So it may **not be necessary** to generate a response from scratch.

Approach

- Retrieve a response from training data: prototype
- Edit it to avoid the “safe response” problem

Context	My friends and I went to some vegan place for dessert yesterday.
Prototype context	My friends and I <u>had Tofu and vegetables at a</u> vegan place <u>nearby</u> yesterday.
Prototype response	Raw green vegetables are very beneficial for your health.
Revised response	Desserts are very bad for your health.

Approach in Detail

- Training: Jaccard Distance of response: $0.7 > \text{distance} > 0.3$
 - for distance > 0.7 : nearly identical
 - for distance < 0.3 : not related

Prototype-Editing

(a) Prototype Selector

Current context: My friends and I ~~went to some~~
vegan place for ~~dessert~~ yesterday.

Prototype context: My friends and I had Tofu and
vegetables at a vegan place nearby yesterday.

Prototype response: Raw green vegetables are
very beneficial for your health.

Input →

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Prototype-Editing

(a) Prototype Selector

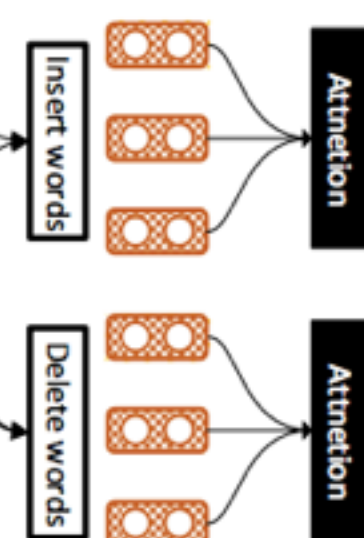
Current context: My friends and I ~~went to some~~
vegan place for dessert yesterday.

Prototype context: My friends and I had Tofu and
vegetables at a vegan place nearby yesterday.

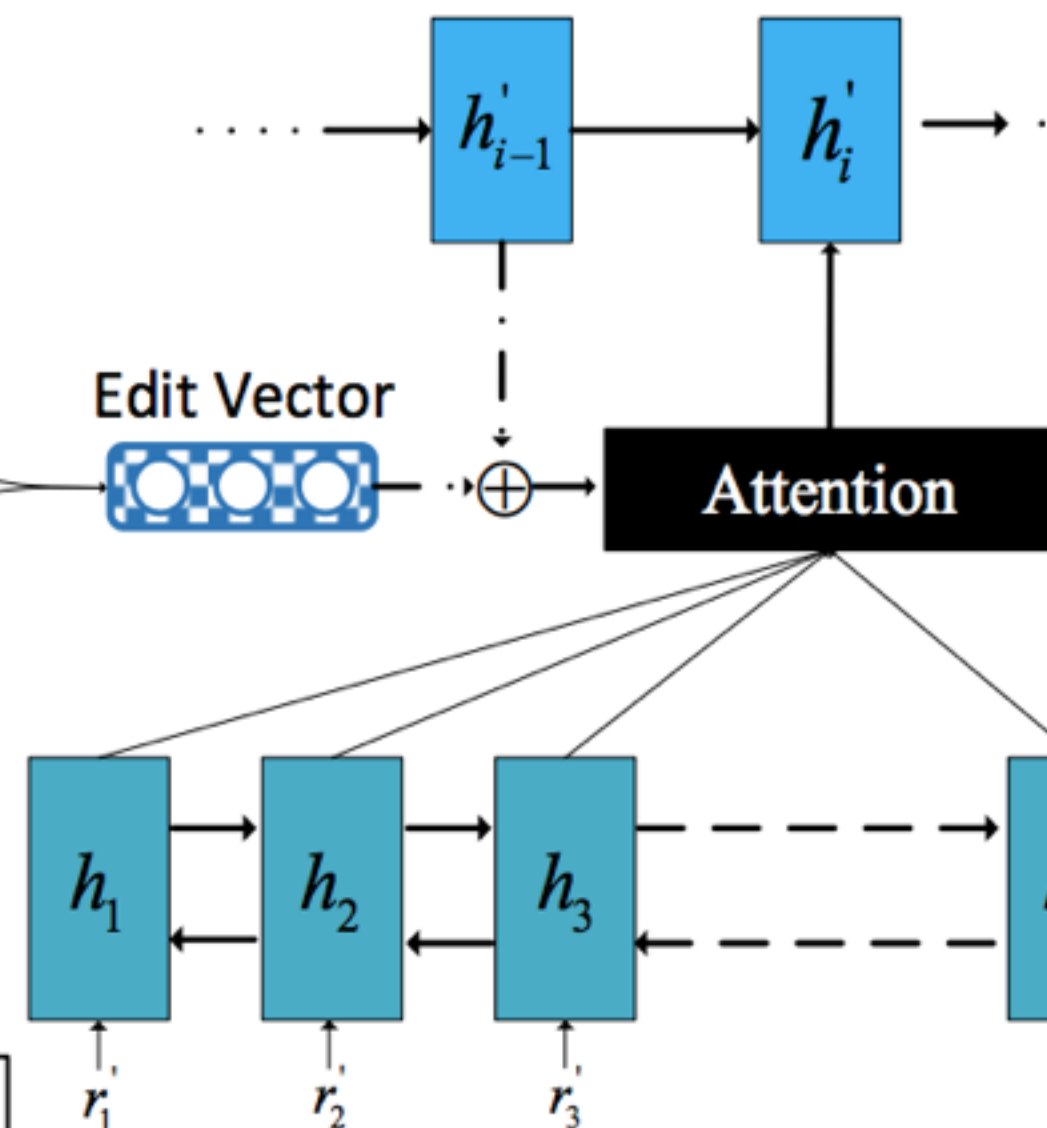
Prototype response: Raw green vegetables are
very beneficial for your health.



(b) Neural Editor



Edit Vector



Experiments

- Dataset
 - 20 milion human-human context-response pairs
 - 19,623,374 pairs for training
 - 10,000 pairs for validation
 - 10,000 pairs for testing
- Baselines:
 - S2SA: Seq2Seq with attention
 - S2SA-MMI: (Li et al. 2016)
 - CVAE
 - Retrieval: retrieval-default; retrieval-rerank

Experiments

- Systems
 - Edit-default
 - Edit-I-Rerank
 - Edit-N-Rerank
- Evaluation Metrics
 - Embedding Average/Extrema/Greedy
 - Diversity
 - Originality
 - Fluency

Results

Table 2: Automatic evaluation results. Numbers in bold mean that improvement from the model on that metric is statistically significant over the baseline methods (t-test, p-value < 0.01).

	Relevance			Diversity		Originality	Fluency
	Average	Extrema	Greedy	Distinct-1	Distinct-2	Not appear	Avg. Score
S2SA	0.346	0.180	0.350	0.032	0.087	0.208	1.90
S2SA-MMI	0.379	0.189	0.385	0.039	0.127	0.297	1.86
CVAE	0.360	0.183	0.363	0.062	0.178	0.745	1.71
Retrieval-default	0.288	0.130	0.309	0.098	0.549	0.000	1.95
Edit-default	0.297	0.150	0.327	0.071	0.300	0.796	1.78
Retrieval-Rerank	0.380	0.191	0.381	0.067	0.460	0.000	1.96
Edit-1-Rerank	0.367	0.185	0.371	0.077	0.296	0.794	1.79
Edit-N-Rerank	0.386	0.203	0.389	0.068	0.280	0.860	1.78

Analysis

- Edit Type Analysis:

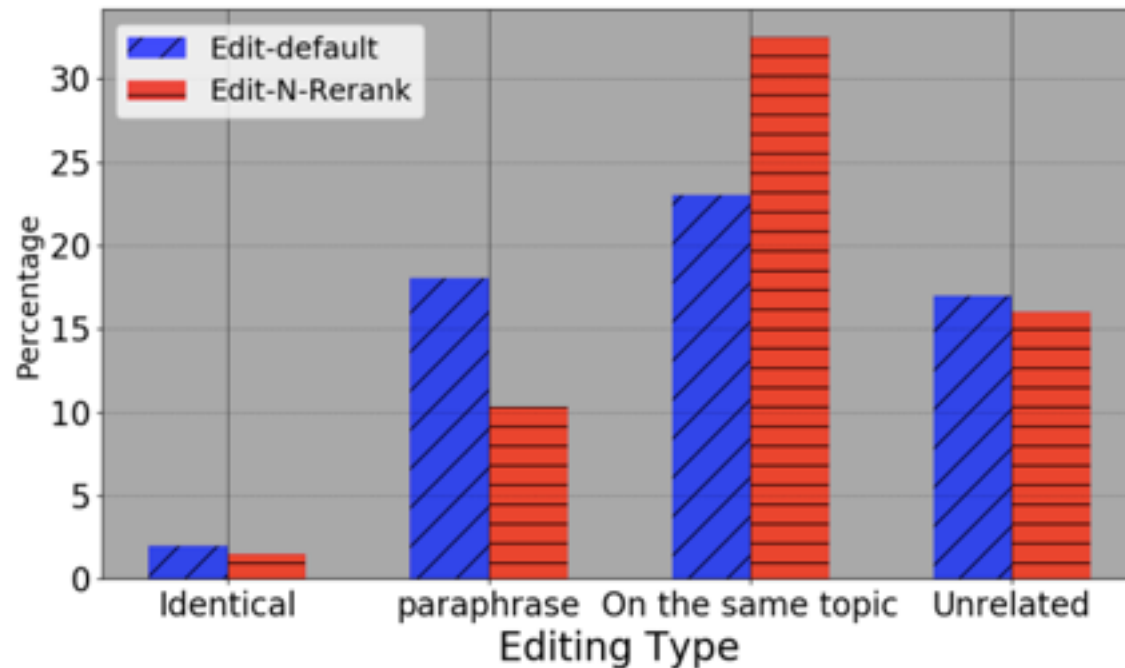


Figure 2: Editing Ratio. The different between paraphrase and on the same topic is that a response in “on the same topic” category introduces or deletes contents to its prototype response.

- Case Study:

Table 3: Case Study. We show examples yielded by Edit-default and Edit-Rerank. Chinese utterances are translated to English here.

Insertion case	
Context	身 在 国 外 寂 寞 无 聊 就 化 妆 When I feel bored and lonely abroad, I like makeup.
Prototype context	无 聊 就 玩 If I feel bored, I will play something.
Prototype response	嗯 OK.
Revised response	嗯 我 也 喜 欢 化 妆 OK. I love makeup too.
Deletion case	
Context	我 比 较 常 吃 辛 拉 面 I often eat spice noodles.
Prototype context	我 在 台 湾 时 候 常 吃 辛 拉 面 和 卤 肉 饭。 When I lived at Taiwan, I often eat spicy Noodles and braised pork rice.
Prototype response	我 也 喜 欢 卤 肉 饭。 I love braised pork rice as well.
Revised response	我 也 喜 欢。 I love it as well. (In Chinese, model just deletes the phrase “braised pork rice” without adding any word.)
Replacement case	
Context	纹 身 有 没 有 办 法 全 部 弄 干 净 Is there any way to get all tattoos clean
Prototype context	把 药 抹 头 发 上 能 把 头 发 弄 干 净 么 Is it possible to clean your hair by wiping the medicine on your hair?
Prototype response	抹 完 真 的 头 发 干 净 很 多 After wiping it, hair gets clean much.
Revised response	抹 完 纹 身 就 会 掉 很 多 After wiping it, most of tattoos will be cleaned.