

Learning to Ask Questions in Open-domain Conversational Systems with Typed Decoders

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Asking Questions in Chatbots

- Asking **good** questions requires **scene understanding**

Scene: Dining at a restaurant

我昨天晚上去聚餐了
I went to dinner yesterday night.



Differences to traditional QG

- ⊙ Key differences to **traditional** question generation (eg., reading comprehension):
 - ◆ **Different goals**: Information seeking vs. Enhancing interactiveness and persistence of human-machine interactions
 - ◆ **Various patterns**: YES-NO, WH-, HOW-ABOUT, etc.
 - ◆ **Topic transition**: from topics in post to topics in response

Motivation

- ◎ A good question is a natural composition of
 - ◆ **Interrogatives** for using various questioning patterns
 - ◆ **Topic words** for addressing interesting yet novel topics
 - ◆ **Ordinary words** for playing grammar or syntactic roles

Example 1:

User: I am too fat ...

Machine: **How about** climbing **this weekend?**

Example 2:

User: Last night, I stayed in KTV with friends.

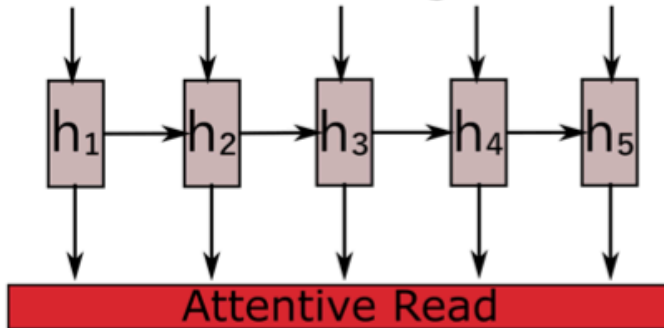
Machine: **Are you** happy with your singing?

1. Manually collected about 20 **interrogatives**
2. The **verbs** and **nouns** in a question are treated as **topic words**
3. All the other words as **ordinary words**

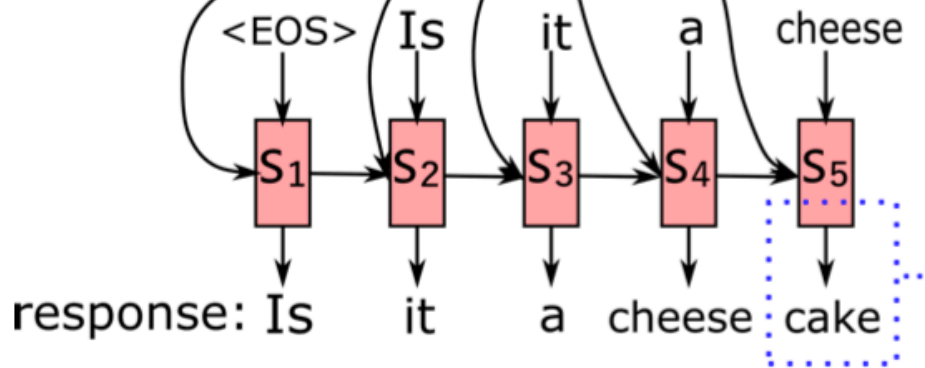
Encoder-Decoder

Encoder:

post: The cake tastes good <EOS>

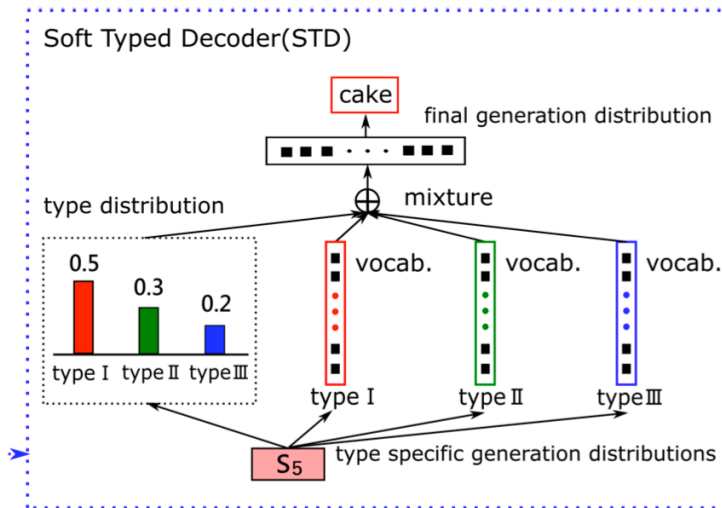


Decoder:



Soft Typed Decoder (STD)

- **Assumes**
 - each word has a **latent type** among the set {interrogative, topic word, ordinary word}.
- **Soft Typed Decoder (STD)**
 - estimates a word type distribution over latent types in the given context
 - then computes type-specific generation distributions over the entire vocabulary for different word types
- **Why soft:word type is latent** because we do not need to specify the type of a word explicitly. each word can belong to any of the three types.



$$\mathcal{P}(y_t | y_{<t}, X) =$$

$$\sum_{i=1}^k \mathcal{P}(y_t | ty_t = c_i, y_{<t}, X) \cdot \mathcal{P}(ty_t = c_i | y_{<t}, X),$$

- ty_t denotes the word type at time step t
- c_i is a word type

Hard Typed Decoder (HTD)

- **Difference**

- STD: the type of a word is **implicit**
- HTD: the type of a word is **explicit**. Generates a word with the highest type probability

- **Dataset**

- words in the entire vocabulary are dynamically classified into three types

- **Process**

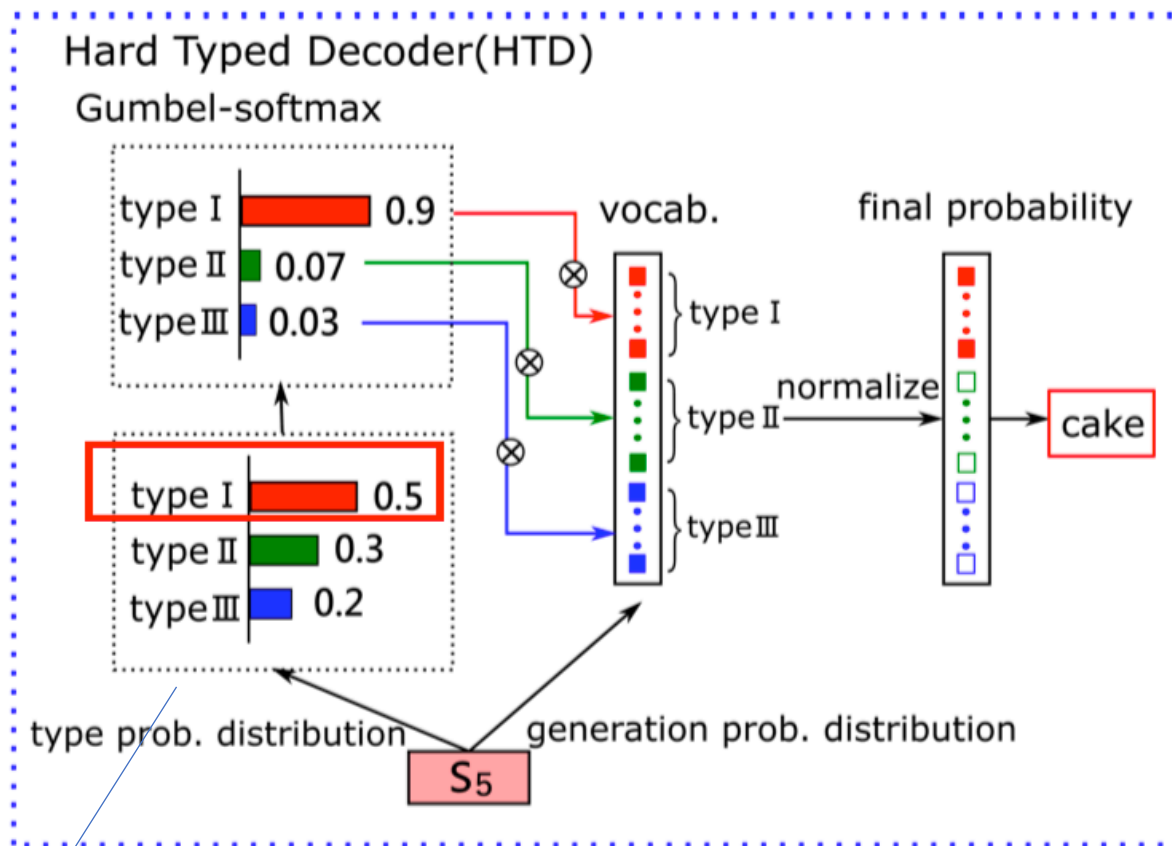
$$c^* = \arg \max_{c_i} \mathcal{P}(ty_t = c_i | y_{<t}, X),$$

$$\mathcal{P}(y_t | y_{<t}, X) = \mathcal{P}(y_t | ty_t = c^*, y_{<t}, X).$$

- **Problem**

- may lead to severe grammatical errors if the first selection is wrong.
- *argmax* is discrete and nondifferentiable

Hard Typed Decoder (HTD)



如果使用 argmax , 会变成1, 0, 0

Case study

Post:	我喜欢小动物(I like little animals)					
Response:	你(you)	喜欢(like)	兔子(rabbit)	吗(<i>particle</i>)	?	_EOS
Interrogative	0.09	0.02	0.01	0.85	1.00	0.01
Topic word	0.26	0.35	0.71	0.14	0.00	0.02
Ordinary word	0.65	0.63	0.28	0.01	0.00	0.97

Post: 我们昨天去唱歌了
We went to karaoke yesterday.

Seq2Seq: 什么时候?
When?

MA: 你怎么知道我是在问
How did you know I am questioning you?

TA: 什么?
What?

ERM: 什么情况?
What happened?

STD: 去哪里唱歌?
Where did you sing karaoke?

HTD: 你们几个人唱歌?
How many people were singing with you?

TODO

1. PC-Lab

1. Dataset labeling

2. Paper reading :

- Behaving more interactively:

1. *Perceiving and Expressing Emotions (AAAI 2018)*
2. *Proactive Behavior by Asking Good Questions (ACL 2018)*

3. Controlling sentence function (ACL 2018)

4. Topic change (SIGIR 2018)

- **3.Reinforcement Learning Group**

- Lecture 1: Introduction to Reinforcement Learning

Thanks!