


The slide features decorative geometric shapes. In the top-left corner, there are several overlapping triangles in shades of blue, green, and purple. In the bottom-right corner, there are several overlapping triangles in shades of grey.

# Towards Knowledge-Based Recommender Dialog System



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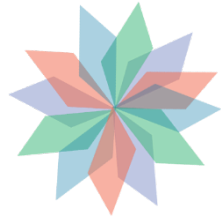
Source: EMNLP-19

Speaker: Pei-Hsuan, Lin

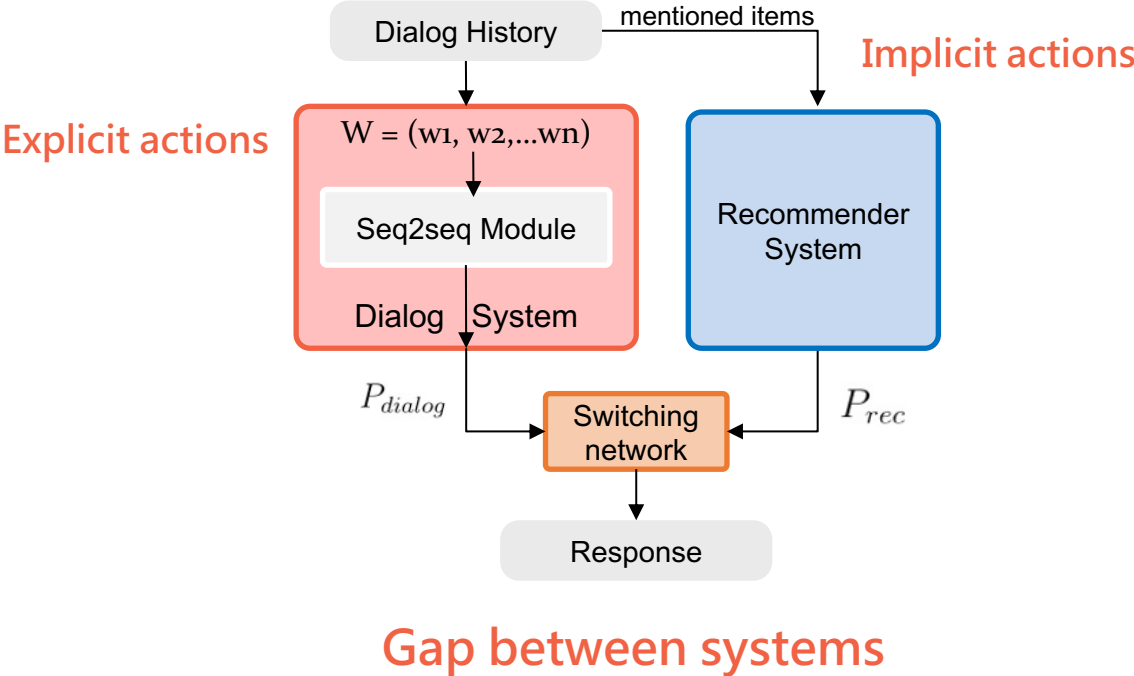
Date: 2021/04/26



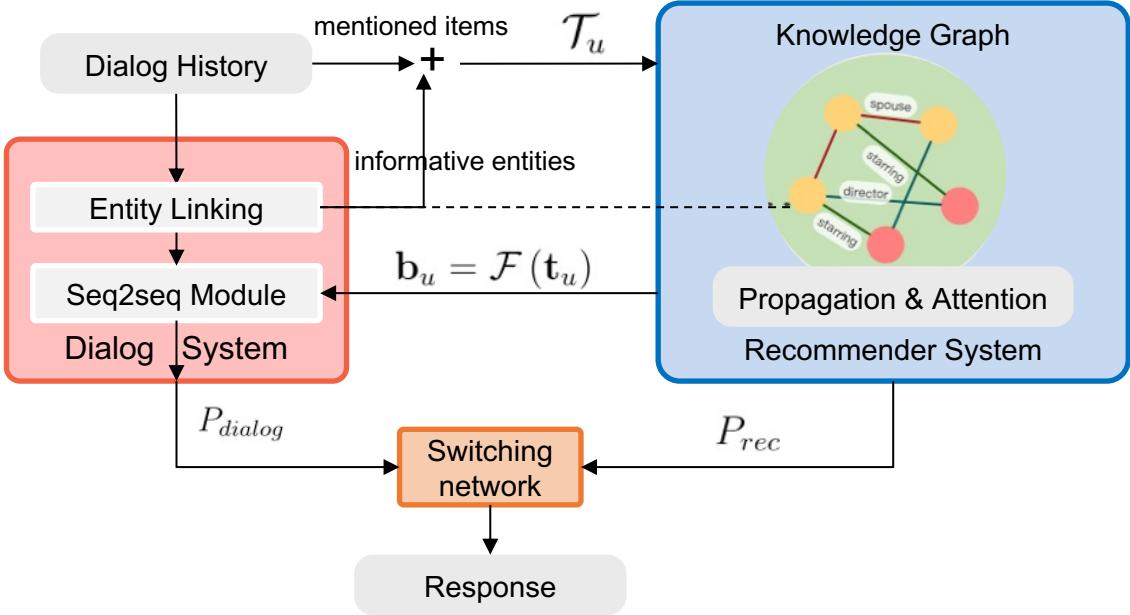
# Introduction



# Introduction - Recommender Dialog system



# Introduction – KG based Recommender Dialog system





# Method



# Method

## Dialog aware Recommender with Knowledge

### 1. Incorporating Dialog Contents



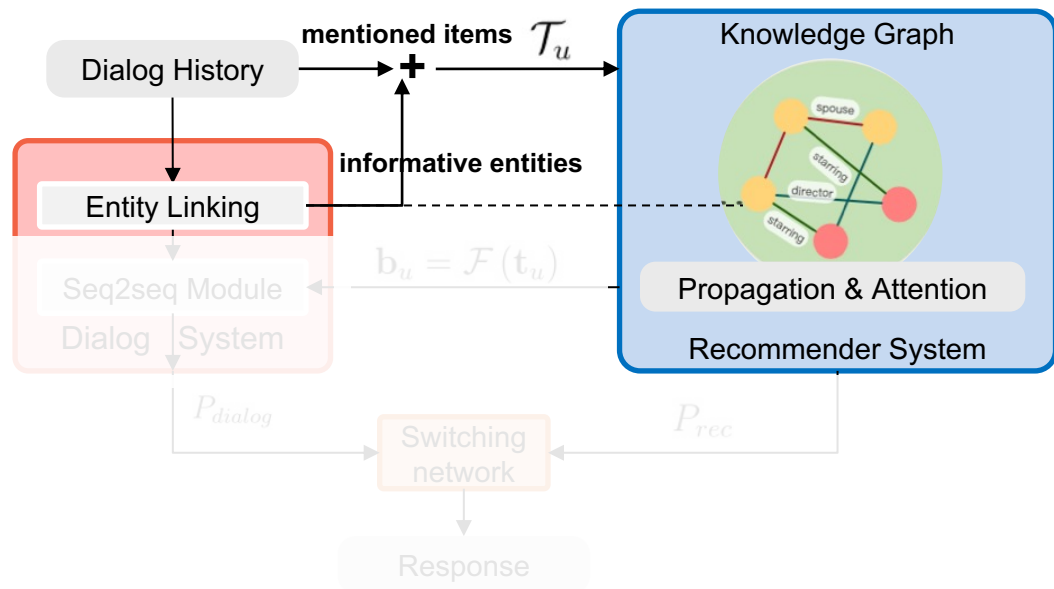
$G = (h, r, t)$  where  $h, t \in \mathcal{E}$  and  $r \in \mathcal{R}$



Map items to  $G$   
Entity linking Dialog contents



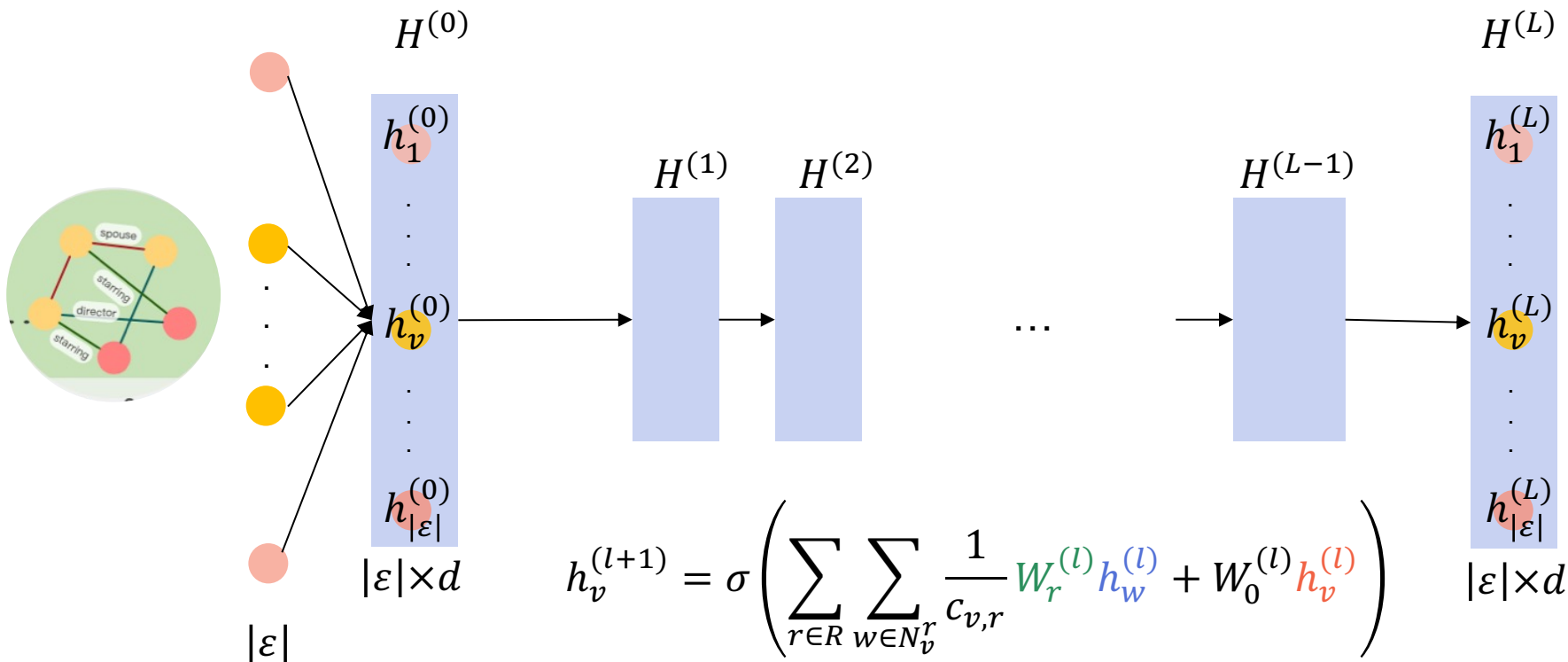
$\mathcal{T}_u = \{e_1, e_2, \dots, e_{|\mathcal{T}_u|}\}$ , where  $e_i \in \mathcal{E}$



# Method

## Dialog aware Recommender with Knowledge

### 2. Relational Graph Propagation



# Method

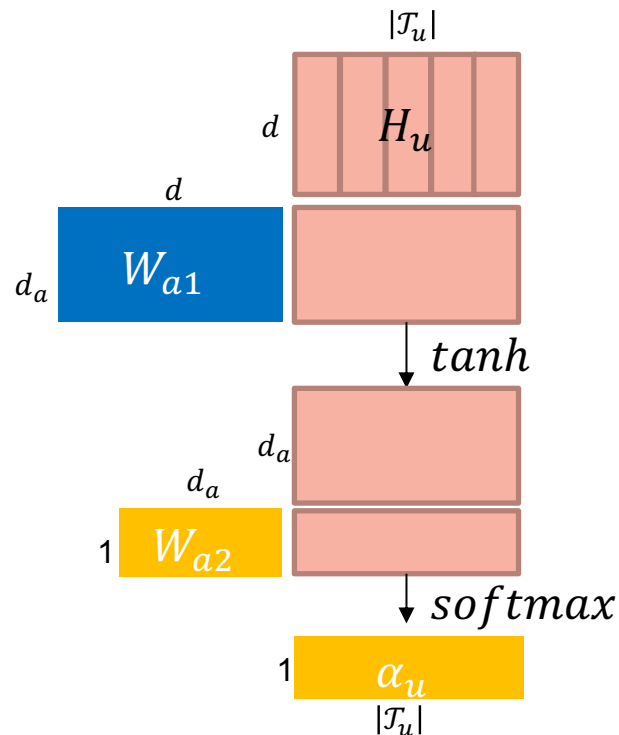
## Dialog aware Recommender with Knowledge

### 3. Entity Attention

Look up from  $H$

mentioned items + informative entities =  $\mathcal{T}_u = (e_1, e_2 \dots e_{|\mathcal{T}_u|}) \longrightarrow H_u = (h_1, h_2 \dots h_{|\mathcal{T}_u|})$

$$\alpha_u = \underset{1 \times |\mathcal{T}_u|}{\text{softmax}} \left( \underset{1 \times d_a}{W_{a2}} \tanh \left( \underset{d_a \times d}{W_{a1}} \underset{d \times |\mathcal{T}_u|}{H_u^T} \right) \right)$$





# Method

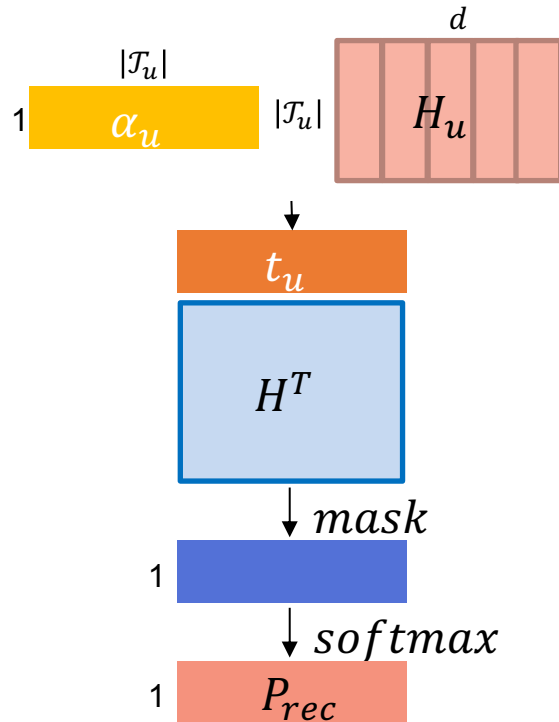
## Dialog aware Recommender with Knowledge

### 3. Entity Attention

$$\alpha_u = \underset{1 \times |\mathcal{T}_u|}{\text{softmax}} \left( \underset{1 \times d_a}{w_{a2}} \underset{d_a \times d}{\tanh(W_{a1} H_u^T)} \right) \underset{d \times |\mathcal{T}_u|}{} \underset{d}{H_u}$$

$$t_u = \underset{1 \times |\mathcal{T}_u|}{\alpha_u} \underset{|\mathcal{T}_u| \times d}{H_u}$$

$$P_{rec} = \underset{1 \times |\varepsilon|}{\text{softmax}} (\underset{1 \times d}{\text{mask}} (\underset{d \times |\varepsilon|}{t_u H^T}))$$

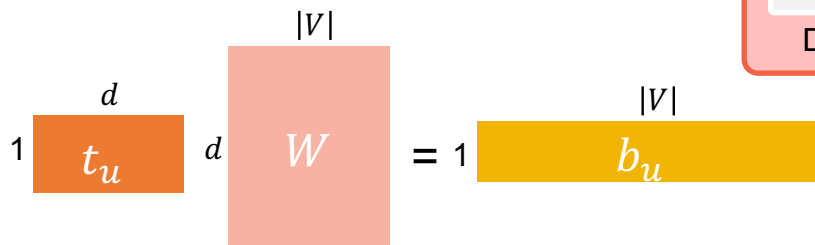


# Method

## Recommendation aware Dialog

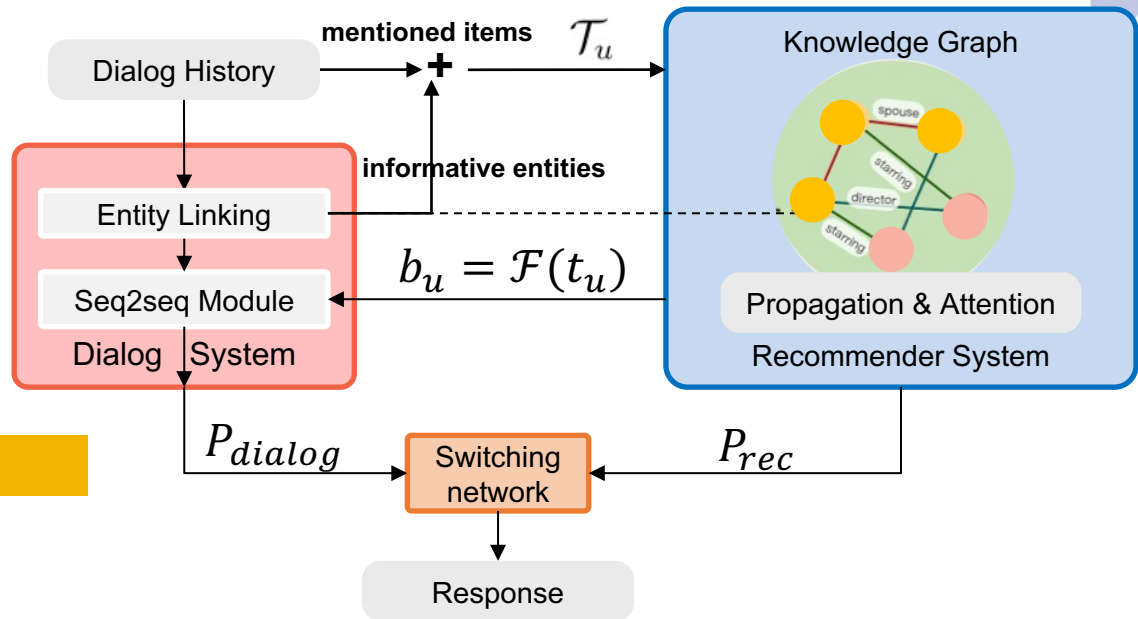
$$b_u = \mathcal{F}(t_u)$$

$$\mathcal{F} : \mathbb{R}^d \rightarrow \mathbb{R}^{|V|}$$



$$P_{dialog} = \text{softmax}(W_0 + b + b_u)$$

$|V| \times d$      $|V|$      $|V|$





# Experiments



# Experiments

Datasets – Recommendation through DIALog (REDIAL)  
Knowledge – DBpedia

**conversationId:** an integer

**initiatorWorkerId:** the recommendation seeker

**respondentWorkerId:** the recommender

**messages:** a list of Message objects{messageId, text, timeOffset, senderWorkerId}

**movieMentions:** a dict mapping movie IDs mentioned in this dialogue to movie names

**initiatorQuestions:** a dictionary mapping movie IDs to the labels supplied by the initiator.  
{suggested:[0,1], seen:[0,1,2], liked:[0,1,2]}

**respondentQuestions:** a dictionary mapping movie IDs to the labels supplied by the respondent.  
{suggested:[0,1], seen:[0,1,2], liked:[0,1,2]}

# Experiments



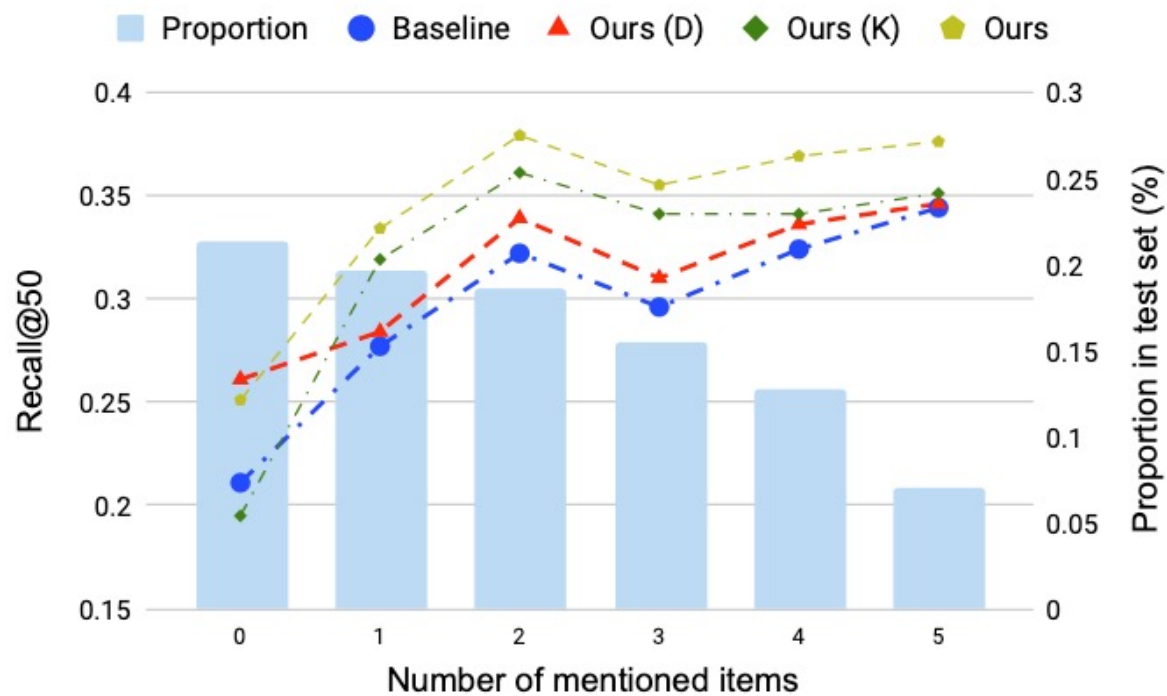
Model	R@1	R@10	R@50
REDIAL	$2.3 \pm 0.2$	$12.9 \pm 0.7$	$28.7 \pm 0.9$
<b>KBRD (D)</b>	$2.7 \pm 0.2$	$14.0 \pm 0.6$	$30.6 \pm 0.7$
<b>KBRD (K)</b>	$2.6 \pm 0.2$	$14.4 \pm 0.9$	$31.0 \pm 1.2$
<b>KBRD</b>	<b><math>3.0 \pm 0.2</math></b>	<b><math>16.3 \pm 0.3</math></b>	<b><math>33.8 \pm 0.7</math></b>

# Experiments



Model	PPL	Dist-3	Dist-4	CSTC
REDIAL	28.1	0.11	0.13	1.73
Transformer	18.0	0.27	0.39	-
<b>KBRD</b>	<b>17.9</b>	<b>0.30</b>	<b>0.45</b>	<b>1.99</b>

# Experiments



# Experiments



Movie	1	2	3	4	5	6	7	8
Star Wars	space	alien	sci-fi	star	sci	robot	smith	harry
The Shining	creepy	stephen	gory	horror	scary	psychological	haunted	thriller
The Avengers (2012)	marvel	superhero	super	dc	wait	batman	thor	take
Beauty and the Beast	cute	disney	animated	live	music	child	robin	kids





# Conclusion



# Conclusion

KBRD bridges the gap between the recommender system and the dialog system via knowledge propagation.  
Also, the two systems benefit each other.

