Transferable Multi-Domain State Generator for Task-Oriented Dialogue Systems

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Dialogue History

Usr: I am looking for a **cheap restaurant** in the **centre** of the city.

Sys: There is a cheap chinese restaurant called **Dojo Noodle Bar**.

Usr: Yes please , for **8** people at **18:30** on **Thursday**.

...

Usr: I am also looking for some **entertainment** close to the restaurant.

Sys: Is there any type of attraction you would like me to search?

Usr: Why do not you try an **architectural** attraction.

Sys: **All Saints Church** looks good , would you like to head there?

...

Usr: I also need to book a **taxi** between the restaurant and the church.

Sys: What time would you like the taxi from Dojo Noodle Bar?

Usr: **20:30**, please.

Multi-Domain Dialogue State Tracking

Restaurant: (price, cheap), (area, centre), (people, 8), (time, 18:30), (day, Thursday), (name, Dojo Noodle Bar)

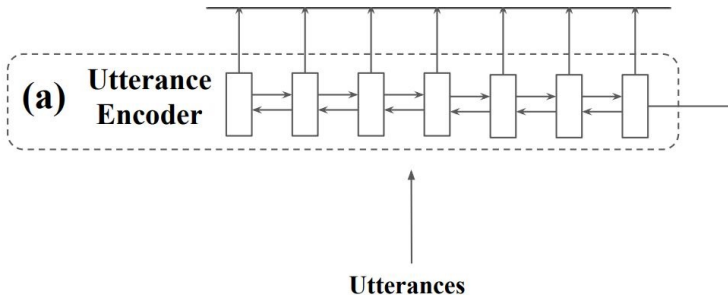*Attraction*: (type, architecture), (area, centre)

Taxi: (leaveAt, 20:30), (destination, All Saints Church), (departure, Dojo Noodle Bar)
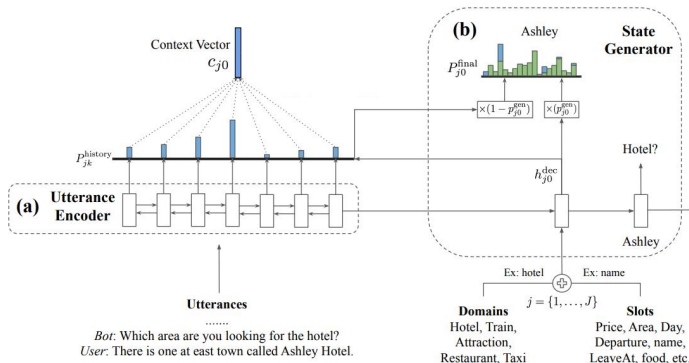
Hotel: | Train:

TRAnsferable **D**ialogue stat**E** generator

(a) Utterance Encoder

Utterances
....
Bot: Which area are you looking for the hotel?
User: There is one at east town called Ashley Hotel.

State Generator
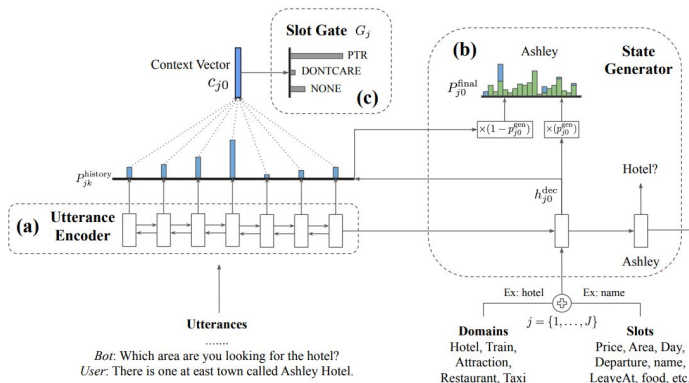
State Generator

$$P_{jk}^{vocab} = Softmax(E(h_{jk}^{dec})^T)$$

$$P_{jk}^{history} = Softmax(H_t(h_{jk}^{dec})^T)$$

$$P_{jk}^{final} = p_{jk}^{gen} P_{jk}^{vocab} + (1 p_{jk}^{gen}) P_{jk}^{history} \tag{1}$$

$$p_{jk}^{gen} = Sigmoid(W1\Delta[h_{jk}^{dec}; w_{jk}; c_{jk}]),$$

$$c_{jk} = P_{jk}^{history} \Delta H_t$$

Slot Gate

$$L_g = \sum_{j=1}^{J} log(G_j(y_j^{gate})^T)$$

$$L_v = \sum_{j=1}^{J} \sum_{k=1}^{|Y_j|} -log(P_{jk}^{final}(y_{jk}^{value})^T)$$

(2)

$$L = \alpha L_g + \beta L_v$$

Dataset

	Hotel	**Train**	**Attraction**	**Restaurant**	**Taxi**
Slots	price, type, parking, stay, day, people, area, stars, internet, name	destination, departure, day, arrive by, leave at, people	area, name, type	food, price, area, name, time, day, people	destination, departure, arrive by, leave by
Train	3381	3103	2717	3813	1654
Valid	416	484	401	438	207
Test	394	494	395	437	195

Results

	MultiWOZ		MultiWOZ (Only Restaurant)	
	Joint	*Slot*	*Joint*	*Slot*
MDBT	15.57	89.53	17.98	54.99
GLAD	35.57	95.44	53.23	96.54
GCE	36.27	98.42	60.93	95.85
SpanPtr	30.28	93.85	49.12	87.89
TRADE	**48.62**	96.92	**65.35**	93.28

Zero-shot

	Trained Single		Zero-Shot	
	Joint	*Slot*	*Joint*	*Slot*
Hotel	55.52	92.66	13.70	65.32
Train	77.71	95.30	22.37	49.31
Attraction	71.64	88.97	19.87	55.53
Restaurant	65.35	93.28	11.52	53.43
Taxi	76.13	89.53	**60.58**	73.92