Modeling Multi-Action Policy for Task-Oriented Dialogues

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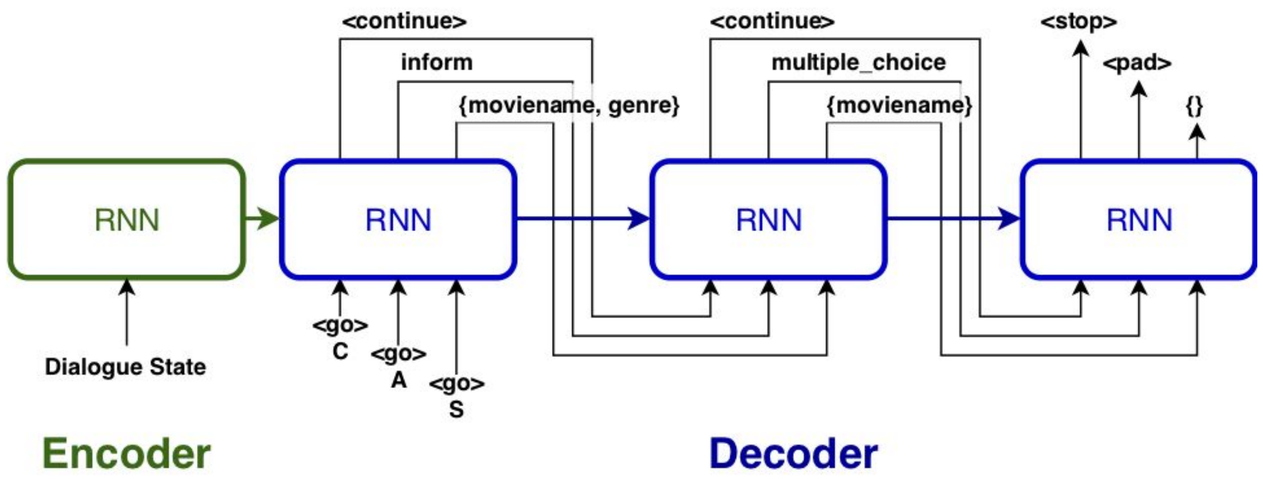
Dialogue act plays a key role in the quality of the interaction with the user. It influences the efficiency of the communication between the user and the agent.

Single act is predicted in most existing policy engines. It limits what an agent can do in a turn, leads to lengthy dialogues, makes tracking of state, context throughout the dialogue harder, and challenges users' patience.

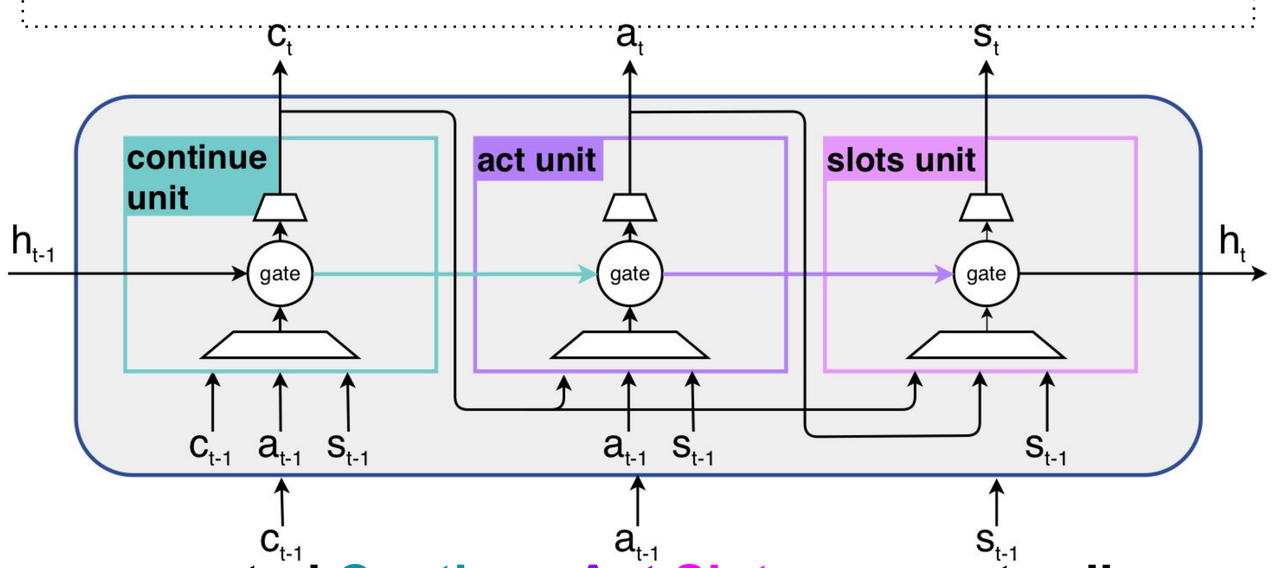
Multi act expands what an agent can do in one turn.

Code is available at:
https://leishu02.github.io



user msg	Hi! I'm looking for good thriller. Are there any playing right now?
agent msg	Yes, there are! The Witch, The Other Side of the Door, and The Boy are all thrillers. Would you like to find tickets for a showing for any of them?
agent acts	inform(moviename=The Witch, The Other Side of the Door, The Boy; genre=thriller) multiple_choice(moviename)

Input: dialogue stat and database queried result
Output: a sequence of tuples (continue, act, slots)



Multi act prediction can be casted as:

a **multi-label classification**, a **sequence generation**

We propose to generate a **sequence of tuples (continue, act, slots).** It maintains the dependency among the acts and reduces the recurrent steps.

gated Continue Act Slot recurrent cell

The whole gCAS decoder is recurrent-of-recurrent!

annotation	inform(moviename=The Witch, The Other Side of the Door, The Boy; genre=thriller) multiple_choice(moviename)
classification	inform+moviename, inform+genre, multiple_choice+moviename
sequence	'inform' '(' 'moviename' '=' ';' 'genre' '=' ')' 'multiple_choice' '(' 'moviename' ')' '⟨eos⟩'
cas sequence	(⟨continue⟩, inform, {moviename, genre}) (⟨continue⟩, multiple_choice, {moviename}) (⟨stop⟩, ⟨pad⟩, {})

domain	total	train	valid	test	acts	slots	pairs
movie	2888	1445	433	1010	11	29	90
taxi	3093	1548	463	1082	11	23	63
restaurant	4101	2051	615	1435	11	31	91

domain & speaker	1 act	2 acts	3 acts	4 acts
movie user	9130	1275	106	11
movie agent	5078	4982	427	33
taxi user	10544	762	50	8
taxi agent	7855	3301	200	8
restaurant user	12726	1672	100	3
restaurant agent	10333	3755	403	10

	Entity F_1			Success F_1		
	movie	taxi	restaurant	movie	taxi	restaurant
Classification	34.02	49.71	28.23	70.41	**84.45**	39.97
Seq2Seq	39.95	63.12	60.21	77.82	75.09	55.70
Copy Seq2Seq	28.04	62.95	59.14	77.59	74.58	58.74
CAS	48.02	59.16	54.70	76.81	78.89	65.18
gCAS	**50.86**	**64.00**	**60.35**	**77.95**	81.17	**71.52**

	Act									Frame								
	movie			taxi			restaurant			movie			taxi			restaurant		
method	$\mathcal{P}$	$\mathcal{R}$	$\mathcal{F}_1$	$\mathcal{P}$	$\mathcal{R}$	$\mathcal{F}_1$	$\mathcal{P}$	$\mathcal{R}$	$\mathcal{F}_1$	$\mathcal{P}$	$\mathcal{R}$	$\mathcal{F}_1$	$\mathcal{P}$	$\mathcal{R}$	$\mathcal{F}_1$	$\mathcal{P}$	$\mathcal{R}$	$\mathcal{F}_1$
classification	84.19	50.24	62.93	92.20	55.48	69.27	79.71	33.94	47.60	63.91	18.39	28.56	65.87	44.31	52.98	49.63	12.32	19.74
Seq2Seq	73.44	73.62	73.53	77.52	69.29	73.17	65.66	66.01	65.83	42.88	24.81	31.43	57.12	50.32	53.51	39.97	25.40	31.06
Copy Seq2Seq	67.56	73.61	70.46	73.99	69.21	71.52	64.93	65.69	65.31	41.90	23.12	29.80	51.66	50.23	50.93	36.96	27.22	31.35
CAS	70.46	76.08	73.16	79.85	72.54	76.02	65.40	72.43	68.73	43.12	31.60	36.47	51.66	54.29	52.94	33.72	25.45	29.01
gCAS	73.08	75.78	**74.41**	79.47	75.39	**77.37**	68.30	74.39	**71.22**	42.24	35.50	**38.58**	53.77	56.24	**54.98**	36.86	32.41	**34.49**

	example 1	example 2
groundtruth	request(date; starttime)	inform(restaurantname=; starttime =) multiple_choice(restaurantname)
classification	request+date	[]
Seq2Seq	'request' '(' 'date' ';' 'starttime' ')'	'inform' '(' 'restaurantname' '=' ')' 'multiple_choice' '=' 'restaurantname' ')'
Copy Seq2Seq	'request' '(' 'date' '=' ')'	'inform' '(' 'restaurantname' '=' ';' ';', ';', '=', ';' 'starttime' '=' ')'
CAS	request {}	inform {restaurantname}
gCAS	request {date; starttime}	inform {restaurantname} multiple_choice{restaurantname}