SIM: A Slot-Independent Neural Model for Dialogue State Tracking

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Introduction

- Dialogue state tracking (DST) is an important component in task-oriented dialogues
- Previous DST model architectures are dependent on dialogue slots
- Model size soars when the number of slots increases
- We put forward the Slot-Independent neural Model (SIM) which has a model complexity *independent* of the number of slots
- SIM achieves state-of-the-art results on WoZ and DSTC2 datasets with only **20%** of the size of previous models

Formulation

Slot-value Pairs

- Dialogue state tracking semantically decodes user's utterance into slot-value pairs
- *Goal* slots indicate category, e.g. area, food, and the values specify the constraint
  - Ex. (Food, American)
- *Request* slots refer to requests, and the value is the demanded category
  - Ex. (Request, phone)

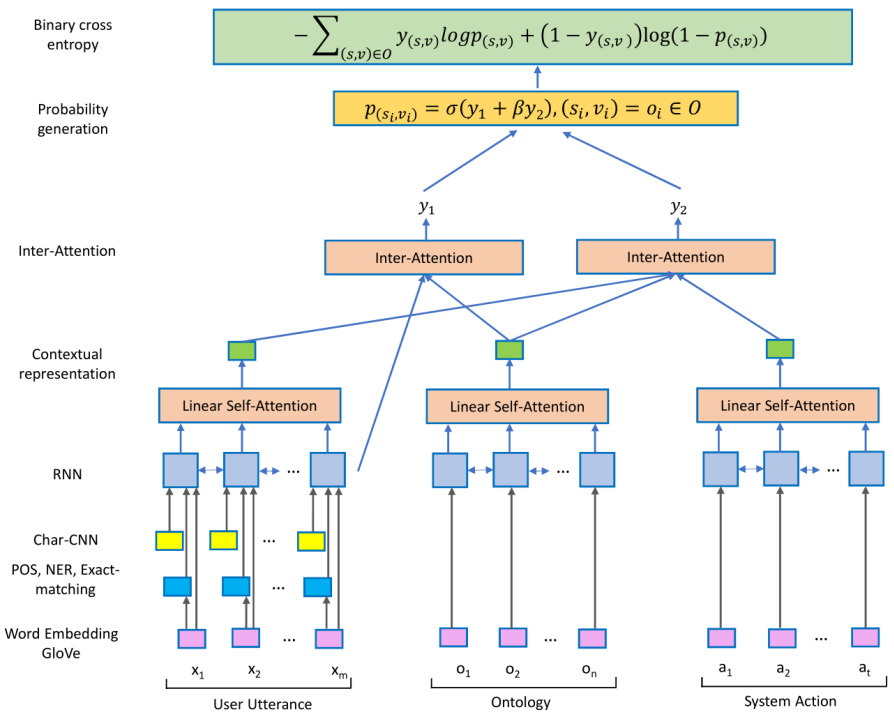
System Actions

- Dialogue system's reply from the previous round
- Also in the form of a set of slot-values

Ontology

- All possible slots S and associated values $V(S), s \in S$
  - Ex. (Food, {American, Chinese, …}), (Area, {South, East, …})

Model



Main Result

Model	WoZ		DSTC2	
	Joint goal	Turn request	Joint goal	Turn request
SMDST	/	/	70.3%	/
Delex. Model + Semantic Dictionary	83.7%	87.6%	72.9%	95.7%
Neural Belief Tracker (NBT)	84.2%	91.6%	73.4%	96.5%
LSBT	85.5%	/	/	/
GLAD	88.1%	97.1%	74.5%	**97.5%**
SIM	**89.5%**	**97.3%**	**74.7%**	96.2%

Experiments

Datasets

- Wizard of Oz and DSTC2
- Both are restaurant reservation tasks
- WoZ has 4 slots and 94 values, with a train+dev set of 800 dialogues and a test set of 400 dialogues
- DSTC2 has 5 slots and 220 values, with a train+dev set of 2118 dialogues and a test set of 1117 dialogues

Ablation Study

Model	Joint Goal	Turn Request
SIM	89.5	97.3
–Var. dropout	88.6	97.1
–Char. CNN	88.3	97.0
–Utt. features	87.1	97.1

Model Size

Model	WoZ	DSTC2
SIM	1.47M	1.47M
GLAD (Zhong et al., 2018)	6.41M	7.69M

Conclusion

- Proposed Slot-Independent neural Model (SIM) for dialogue state tracking
- Incorporated better feature representations to reduce model size
- Achieved superior or comparable results on WOZ and DSTC2, compared with previous models.
- For future work, we plan to design general slot-free DST models which can be adapted to different domains during inference time

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