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, …})

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         |
| – Ut. 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