

Controllable User Dialogue Act Augmentation for Dialogue State Tracking

http://github.com/MiuLab/CUDA-DST

Chao-Wei Huang Yun-Nung (Vivian) Chen Ming-Hao Hsu

Summary

 CoCo (Li et al., 2020) improved DST by data augmentation for better *robustness* and *generalizability*.

Chun-Mao Lai

- Only a simple type of utterances is considered for augmentation.
- Our goal is to augment user utterances with diverse dialogue acts for better generalization capability.
- Our proposed CUDA achieves SOTA performance and better robustness on MultiWOZ 2.1.

[System₁]: Hello, how can I help you? [User₁]: I need to find a restaurant in the <u>center</u>. [System₂]: I recommend Pho Bistro, a popular restaurant in the center. Recommend { restaurant-name=pho bistro, rest-area=center } [User₂]: No, it needs to serve <u>British</u> food and I'd like a reservation for <u>18:00</u>. Confirm=False, Inform{ rest-area=center, rest-food=British, rest-time=18:00 } [VS-User₂]: No, it needs to serve Chinese food and I'd like a reservation for <u>17:00</u>. Confirm=False, Inform{ rest-area=center, rest-food=Chinese, rest-time=17:00 } [CoCo-User₂]: No, it should serve Chinese food and I need to book a table for 2 people. Confirm=False, Inform{ rest-area=center, rest-food=Chinese, rest-people=2} [CUDA-User₂]: Thank you, can you also find me a hotel with parking near the restaurant? Confirm=<u>True</u>, Inform{ rest-area=center, rest-name=pho bistro, <u>hotel-area=center</u>, <u>hotel-parking=yes</u> }

Domain Change Coreference Confirm Boolean

Framework System System Turn U_t^{sys} **User Dialogue Act Generation** Recommend I recommend Pho Bistro, a Confirm (P_{confirm}) Turn-Level Dialogue Act & State A_t System restaurant in the center. **Confirm**=True Confirm=True Request Reply ($P_{ m reply}$) Inform{ System Act Coreference (P_{coref}) Anytime rest-name=pho bistro, Inform Recommend { Inform{ rest-area=center, Domain Change ($P_{ m domain}$) rest-name=pho bistro, hotel-area=near the restaurant, hotel-area=near the restaurant (center), Inform{ rest-area=center } hotel-parking=yes } hotel-parking=yes } hotel-area=east, hotel-parking=yes } **User Utterance Generation State Match Filtering** 1. Thank you, can you also find me a hotel with parking near the restaurant? 1. Slot Appearance: 🗹 Value Consistency: (span) 🗸 (boolean) 🗸 2. Thank you, can you also find me a hotel without parking near the restaurant? 2. Slot Appearance: 🗸 Value Consistency: (span) 🗸 (boolean) 🔀

User Dialogue Act Generation

System I recommend Pho Bistro in the center. What time do you plan to book the table? Turn Recommend { rest-name=pho bistro, rest-area=center }; Request { rest-time } Requested Slots DialogAct = Recommend Confirm Informed Slot User Confirm? User **Reply**? $L - P_{
m confirm}$ $P_{
m confirm}$ $|P_{
m reply}|$ **Confirm**=True **Confirm**=False Add to *Inform* Informed Value Change Domain? $P_{
m domain}$ Apply Coreference? $_{-}-P_{
m domain}$ User Select a new domain $P_{
m coref}$ ' nformed Slots pre-defined corresponding Randomly add 1-3 slots from a target coreference list values domain to *Inform*

3. Thank you, can you also find me a hotel with parking in the center of the town?

4. Thank you, can you also find me a hotel with free wifi near the restaurant?

Goal: simulate *reasonable* user behavior

3. Slot Appearance: 🗸 Value Consistency: (span) 🔀 (boolean) 🗸

4. Slot Appearance: X Value Consistency: (span) -- (boolean) --

- Method: use a random process to augment more diverse behaviors
- User behaviors:
 - > Confirm: The user confirms the system's recommendation.
 - > Reply: The user replies what the system requests.
 - > Inform: The user actively informs desired slot values to the system.

User Utterance Generation

- Goal: generate utterances aligned with the given behaviors
- Method: T5 fine-tuning for conditional generation (beam search for diversity)

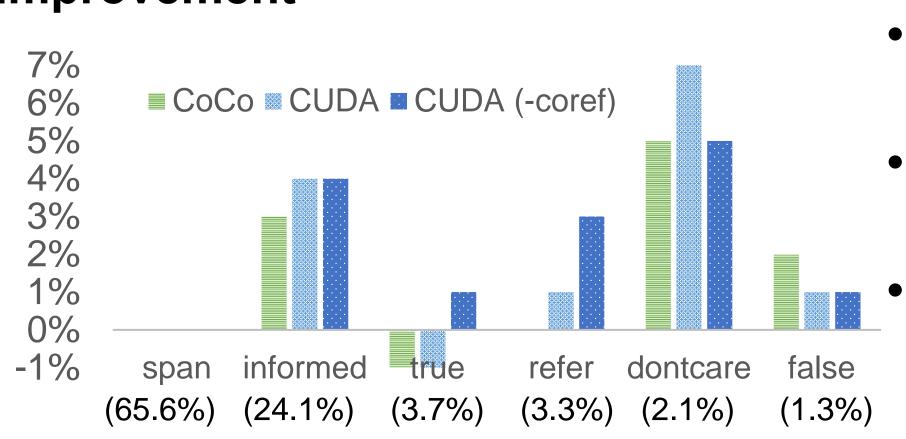
State Match Filtering

- Slot appearance classifier
 - ✓ Goal: check if the given slots are included
- ✓ Method: BERT for multi-label classification
- Value consistency filter
 - ✓ Goal: ensure consistent values between states & utterances

Experiment

MultiWOZ 2.1	TripPy	TRADE
Original	57.72	44.08
CoCo	60.46	43.53
CUDA	61.28	44.86
CUDA (-coref)	62.93	42.98

Improvement



- CUDA improves TripPy and TRADE results.
- The models trained on our augmented data show better generalization.
- CUDA improves more on informed, refer, and dontcare slots than CoCo.
- CUDA augments diverse user dialogue acts for helping *informed* and *refer*, and the proposed filter ensures value consistency for improving dontcare.