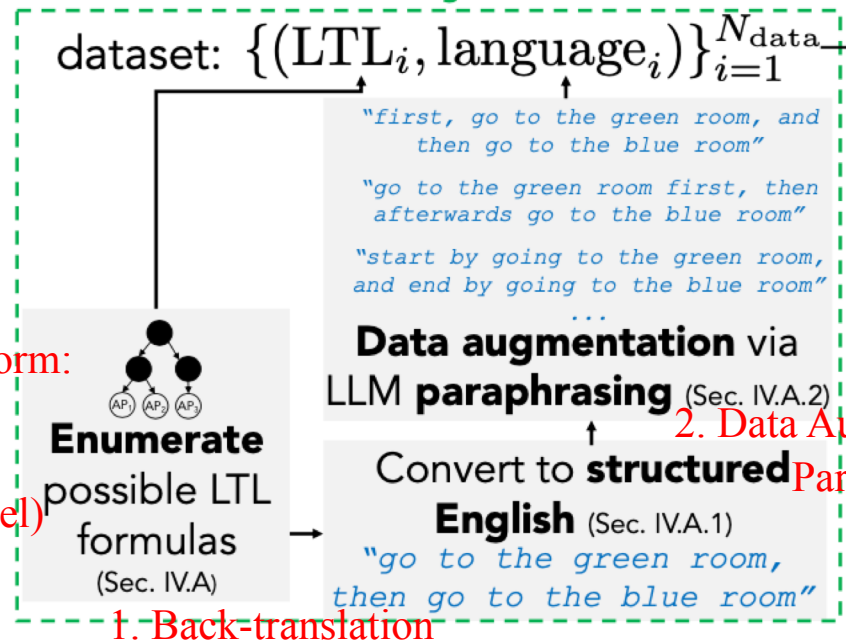


“Data-Efficient LTL Translators” Learning Poster

Tags: Human-Robot Interaction

(Reference: Pan, Jiayi, Glen Chou, and Dmitry Berenson.
"Data-Efficient Learning of Natural Language to Linear
Temporal Logic Translators for Robot Task
Specification." arXiv preprint arXiv:2303.08006 (2023).)

Data synthesis



3. Extend to Canonical Form:

Train set 1 (raw label)

+

Train set 2 (canonical label)

Data augmentation via
LLM paraphrasing (Sec. IV.A.2)

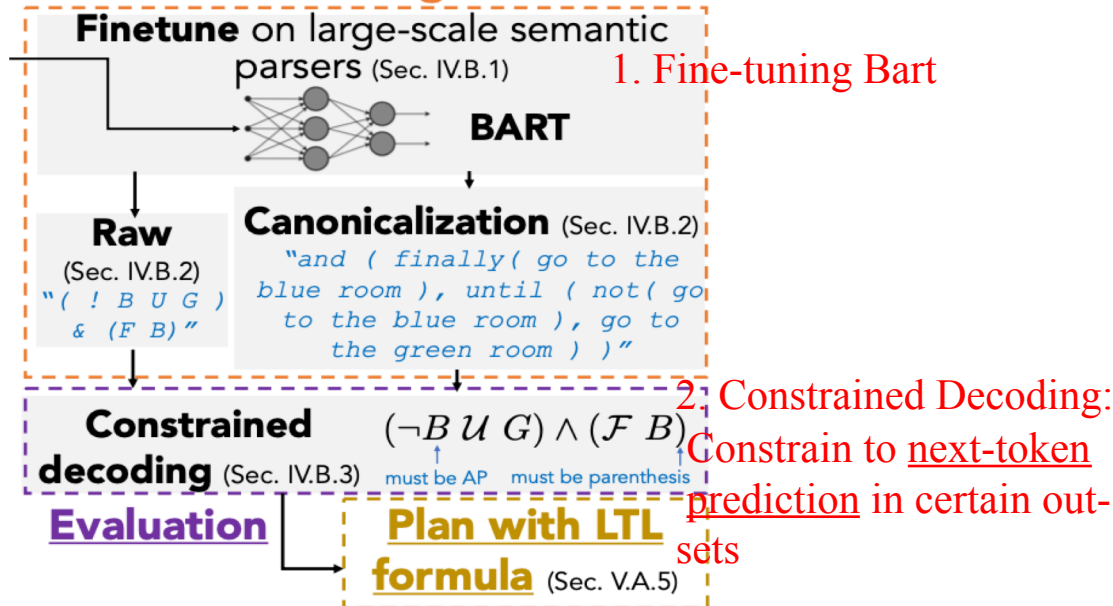
2. Data Augmentation:

Paraphrasing using GPT-3

Convert to structured
English (Sec. IV.A.1)
"go to the green room,
then go to the blue room"

1. Back-translation

Training



Summarization of Innovations:

1. Generalization in Data Augmentation: GPT-3 as paraphrasing model can generate more generation features, thus better help improve later finetuned BART's ability of generalization on "natural language to LTL" tasks.

2. Data-efficient: Based on 1, much handful human labor work can be reduced.

Questions:

Model architecture	Training data	Test data	Drone (5/343)	Cleanup (4/39)	Pick (1/5)
RNN [6]	4/5 golden	1/5 golden	87.18	95.51	93.78
CopyNet [29]	4/5 golden	1/5 golden	88.97	95.47	93.14
BART-FT-Raw (ours)	4/5 golden	1/5 golden	90.78	97.84	95.97
BART-FT-Canonical (ours)	4/5 golden	1/5 golden	90.56	97.81	95.70
RNN [6]	synthetic	full golden	22.41	52.54	32.39
CopyNet [29]	synthetic	full golden	36.41	53.40	40.36
BART-FT-Raw (ours)	synthetic	full golden	69.39	78.00	81.45
BART-FT-Canonical (ours)	synthetic	full golden	68.99	77.90	78.23
BART-FT-Raw-NoConstrainedDecoding	synthetic	full golden	68.23	76.26	81.05
BART-FT-Canonical-NoConstrainedDecoding	synthetic	full golden	67.45	72.06	69.49
BART-FT-Raw (ours)	synthetic; no augmentation	full golden	29.43	52.51	80.38
BART-FT-Canonical (ours)	synthetic; no augmentation	full golden	39.21	53.16	67.88

- Q1: Whether deep model or LLMs is suitable for this low-resource scenario?
- a. Since deep model or LLMs need lots of data for training so that they can have ability to generate to unseen data, low-resource scenario may have less data and lead to shortage of generalization and sometimes may lead to overfitting.
 - b. BART is a LLM for general language but not for general LTL specifications since these two forms are somehow different, thus may lead to degrade on generalization when applying it on generating LTL specifications.
 - c. A tree-based model may be more suitable since the structures of LTL formula are more similar to trees.

Ideas about Future Work:

- 1. Exploit LM's uncertainty by grounding them to environment, and uncertainty-aware planning (paper mentioned).
- 2. Automatic synthesis to generate to unseen LTL structures.
- 3. Specific LTL-generating models, such as (deep) tree-based models or LLMs using lots of language-LTL corpus when pre-training.
- 4. Training Down-stream structures attached to pre-trained model during fine-tuning period may somehow help improve generalization on generating LTL specifications.