Goal-Oriented Chatbot Dialog Management Bootstrapping with Transfer Learning

Vladimir Ilievski, Claudiu Musat, Andreea Hossmann, Michael Baeriswyl
1 IC School, EPFL, Switzerland
2 Artificial Intelligence Group, Swisscom

Goal-Oriented (GO) Chatbots

Three key elements:
1. Goal: help users achieve a predefined goal
2. Domain: e.g. movie booking
3. Slots and intents:
   - inform(date = 'tomorrow')

Low in-domain data availability

- Non-trivial data requirements
- Limited in-domain data
- Obtaining and labeling in-domain data is hard
  - Leverage domain similarity
  - Transfer the knowledge from one SOURCE domain to another TARGET domain

Contributions
1. Training GO chatbots with less data: models trained with transfer learning achieve better performance
2. Better GO chatbots: positive effect when all domain data is available
3. Transfer learning is complementary to the warm-starting technique

Model of the RL-based GO Chatbots

RL agent: DON based

Simulate dialogues: fill the experience replay buffer

Train the Deep Q-Net

results

No shared slots and actions

Share common information =⇒ Transfer the knowledge

Intuition

Dialog state depends on the type of slots

Domain 1: Movie Booking
- I
- want
- to
- book
- tickets
- for
- Titanic
- for
- today
- somewhere
- in
- London
- B-City

Domain 2: Restaurant Booking
- O
- Where
- B-City, London
- B-Food, Indian
- B-Food, Italian
- B-Food, Chinese
- B-Date, tomorrow
- B-Date, right

Transfer Learning

- Source Domain User Utterance
  - Which theater can I book 3 tickets for Titanic?
  - request(book, max_people=3, movie=Titanic)

- Target Domain User Utterance
  - Can I book 3 tickets for Titanic?
  - request(book, max_people=3)

- Domain 1: Movie Booking
- Domain 2: Restaurant Booking

Share common information =⇒ Transfer the knowledge

Semantic Frames: set of slot-value pairs

Relaxed model: no NLU and NLG units
  =⇒ semantic frame level execution

How?

- Without Transfer Learning
- With Transfer Learning

Domain extension

SOURCE: Movie booking
TARGET: Restaurant booking

 SOURCE: Movie booking
TARGET: Tourist info

Results

Total of 120 training user goals and 32 testing user goals

Subset of n user goals: (5, 10, 20, 30, 50, 120)

Train faster

Train with less data

DATA SUBSET

Train on source domain

Train on target domain

Compare performance