Six Wires
CS 4395.001
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October 31, 2022

Analysis of

Transferable Dialogue Systems and User Simulators

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Problem Summary

A problem associated with training dialogue systems is the lack of training data. To combat this issue, they test and see if they can generate training data from interactions between a dialogue system (*DS*) and user simulator (*US*). If this were possible, it would reduce the reliance of real-world data and allow for quicker startup of an algorithm instead of having to wait for data. In this test, they use reinforcement learning centered around rewards. There are two problems explored in this paper: 1) how adaptable the domain is, and 2) single-to-multiple domain transfer. There were concerns about the data being relevant, which they route around using transfer learning. In pre-training, they used two agents running off of rich multi-domain datasets, and allowed them to interact using natural language and performed supervised learning. The dialogue system and user simulator both have dialogue managers, but instead of using a dialogue state tracker like the dialogue system, the user simulator maintains a user goal state, and works towards those goals.

After being pre-trained using a corpus and supervised learning, the DS and US models are trained using reinforcement learning. Each model and actor has it's own reward system, so that each has a goal to work towards, which simultaneously drives the dialogue forward between the simulators. To optimize the learning, they used a policy gradient to adjust the rewards the longer the model has been training. The models were then compared to previous benchmark experiments. Following the benchmarking, they found that they had produced competitive results to the benchmark values.

Prior Work Summary (related work)

Previously, the authors have worked on end-to-end dialogue systems using reinforcement learning for optimization. They had worked on dialogue systems for years but this was the first time a user simulator was involved. There has been differend approaches to building user

systems over time, and the authors had explored many of these previously, which led them to doing this research paper.

Unique Contributions

As stated above, the introduction of this technology allows for quicker training of models, since we are now able to generate natural dialogue data from an algorithm. In my internship, a large bottleneck that we experience in training is the need to wait for more data to be available. If more people have access to data generated by transferable dialogue systems, they'd be able to circumvent this bottleneck. I could see this technology being used for training of therapy chatbots, training for interviews, and much more! Since the model is able to be transferred using domain adaptation we could use these models to create simulated dialogue around any subject of our choosing. I believe that the addition of this technology to the computer science meta will open the door for other ML and AI algorithms to have quicker startups. Additionally, the experiments were important in "learning complex behaviors of user simulators" (Tseng et al., ACL 2021).

Author's Evaluations

To evaluate the models that they had created, Tseng et al. performed multiple different experiments. The first experiment that they performed was comparing their different models to the pre-existing benchmarks set by SimpleTOD*, MoGNet, and more. Following these experiments, they performed Domain Adaptation. They ran the model on multiple different domain subjects, and supervised how they had performed. Following the experiments, the team performed error analysis across the user simulator and dialogue system. The target of this analysis was to "understand the improved success rate in transfer learning" (Tseng et al., ACL 2021).

Citation Analysis

According to Google Scholar, this article has been cited 22 times across different sources. As I stated above, this technology will be incredibly useful in being able to create knowledge bases about topics that may have less naturally occurring data sets. By creating a dialogue system

that can discuss any topic given, new projects can use this technology to jumpstart their needed data.

Citations

Transferable Dialogue Systems and User Simulators (Tseng et al., ACL 2021)