# A Generic Dialog Agent for Information Retrieval Based on Automated Planning Within a Reinforcement Learning Platform

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## Introduction

With easy availability of large data sets online, a common business problem is to allow users to search them for information. However, this information is inaccessible to a lot of people as they are unaware of query languages used for searching through data. Our work harnesses the power of dialog systems to help the user search for information using natural language. We make use of a planner to adapt to the content structure of the data source and retrieve results, thereby, making the dialog agent generic. However, PDDL based planning needs models and one would want to learn plans over time. Hence, RL based plan generation is also desirable. We show a system which can do this and demonstrate the viability of our approach on large datasets of UNSPSC (D1), ICD-10 (D2), and a small phone directory (D3).

## Problem

The need for having a dialog system for easy retrieval of information from large data sources has been established. However, the current approach for building a chatbot is learning based which

- require large training data
- once trained and deployed, there is no control over the flow of conversations
- hard to scale

## Contribution

We present a generic and controlled dialog system interleaved with planning and RL for information retrieval. The major contributions are

- Incorporating planning based dialog response generation in a RL based dialog framework.
- Demonstrating a general, planning based approach for creating chatbots for information lookup
- Exploring multiple RL and planning integration strategies.
- Creating a test-bed to evaluate conversations between user and the chatbot

## Example

Figure 3 shows the sample conversation between the user and the proposed system. The detailed demonstration is available at - https://youtu.be/X2l7eW6dyBc.

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## Approach

Figure 1 shows main components - ParlAI Core, Planner, and an Executor. The ParlAI core provides the interface for the dialog agent to interact with the user. The Planner, along with ParlAI core. helps in IntentIdentification. The policy learnt helps in automatic source selection based on the user's query. The Planner then generates a plan for the Executor, to perform Information Retrieval from the selected data source. The system has been evaluated using various. metrics such as accuracy, intent recognition and task length. Figure 2 captures the evaluation of the system.

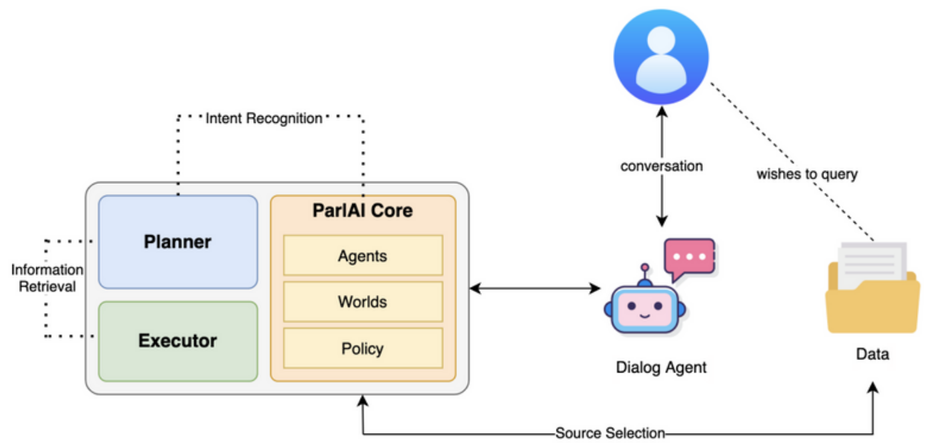


Figure 1. Proposed System Architecture

| | | Data Source | Queries Tested | Completed Queries | Accuracy |
|---|---|---|---|---|---|
| User's Query | In-Scope | D1 | 20 | 20 | 100% |
| | | D2 | 20 | 20 | 100% |
| | | D3 | 5 | 5 | 100% |
| | Out-of-Scope | D1 | 10 | 10 | - |
| | | D2 | 10 | 10 | - |
| | | D3 | 3 | 3 | - |

Figure 2. System Evaluation

```
Enter [DONE] if you want to end the episode, [EXIT] to quit.
08:30:20 | creating task(s): internal:dpbot
Enter Your Message: hello
[DpbotAgent]: hey
 I am DialogPlan, here to help you query a directory (UNSPSC / ICD10).
 If you want to exit, type Bye!
 Type PROCEED to continue
Enter Your Message: proceed
[DpbotAgent]: Enter the name of the directory you want to query
Enter Your Message: i want to query unspsc
[DpbotAgent]: Directory exists.
 The dataset contains 4302 types of commodities distributed over 826 classes which are further distributed over 173 families.
  User can proceed to query.
Enter Your Message: i want the code for pliers
[DpbotAgent]: The pliers doesn't have an exact match.
I will assist you by further disambiguating your query
Choose the most desirable family from above:
1. Transportation services equipment -- 1 matches found
2. Hand tools -- 2 matches found
3. Dental equipment and supplies -- 1 matches found
4. Surgical products -- 1 matches found

Enter Your Message: 4
[DpbotAgent]: Surgical pliers is associated with code - 42292303
```

Figure 3. Information Lookup on UNSPSC.
The user is searching for *pliers.*

## Future Work

The future steps involve

- Exploring more interleaved RL and Planning strategies for dialogs
- Performing a comprehensive evaluation of the approach.

For any queries/comments, please contact:

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