CS898AW Spring 2025 Assignment 2: Modeling Tool Affordances PDDL

Objective

The objective of this assignment is to integrate tool affordances from the AffordPose dataset with planning using the Planning Domain Definition Language (PDDL). Students will interpret real-world tool definitions, extract affordances, and design PDDL domain and problem files to model tool usage in goal-oriented tasks.

Background

You are provided with a filtered dataset of tools whose definitions align with affordances described in the AffordPose dataset. These affordances include:

- `handle-grasp`
- `press`
- `lift`
- `pull`
- `twist`
- `wrap-grasp`
- `support`
- `lever`

Each tool in the dataset implies one or more of these hand-object interaction affordances.

Instructions

Part 1: Tool Selection and Affordance Mapping (10)

1.1. Five tools are assigned to you based on your WSUID. Please refer to **Student_Tool_Assignment** and **tool_list**.

1.2. Based on your knowledge, please assign each tool a type (e.g., `cutting_tool`, `fastening_tool`, `lifting_tool`, `music_instrument` etc.).

Part 2: PDDL Domain Modeling (30)

2.1. Create a PDDL domain file (`tools-domain.pddl`) that includes:

- Tool and affordance. The affordance should only select from the provided list in the **Background** section. If more than two words in your assigned tool lists cannot find suitable affordances from the affordance list, please let the instructor and the TA know.
- Predicates such as:
  - `(has ?agent ?tool)`
  - `(affords ?tool ?affordance)`
  - `(used-for ?affordance ?action)`
  - `(at ?agent ?location)`
- Actions based on affordances, e.g., `use-scissors`, `pull-handle`, etc.

Part 3: PDDL Problem Definition (30)

3.1. Define a problem file (tools-problem.pddl) where a robot agent utilizes one or more tools to achieve a specified goal. You should define a reasonable goal that is suitable for the given tools.

3.2. Please generate a ReadMe.md file that describes the goals in natural language.

3.3. Include:

- Initial state: tool affordances, possession, and locations
- Goal state: desired condition (e.g., `cut object`, `twist lid`)

Part 4: WSUID_student_assignment_2.csv (30)

4.1. Discussed in the class.

Deliverables

If any of the following files are missing, the grade will be zero.

- `WSUID_tools_domain.pddl`
- `WSUID_tools_problem.pddl`
- `WSUID_student_assignment_2.csv`
- `ReadMe.md`

Submission Deadline

Submit all files to the Blackboard by [**May 11, 2025 EoD**]. May 11, 2025, is the final deadline, and we need time to finish grading. Therefore, extending the deadline is not possible.