An Office Scenario Dataset for Benchmarking Observation-equivalent Entities

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Abstract

This dataset consists of simulated plans and observations of agents in an office environment. The unique property of this data set compared to other datasets is that multiple agents are acting in the same space, which cannot be distinguished given the observations (i.e. the observations are non-identifying). For each of 36 different initial settings, 20 plan have been randomly sampled, i.e. this dataset consists of 720 plans in total. Additionally there is a webservice[1], that enables you to generate your own dataset.

1 General Information

Objective: Enable benchmarking human behavior recognition algorithms with respect to the observation-equivalence

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[1] URL of the webservice: `https://ccbm.informatik.uni-rostock.de/observation-equivalence`

[2] URL of the chair's website: `http://mmis.informatik.uni-rostock.de`

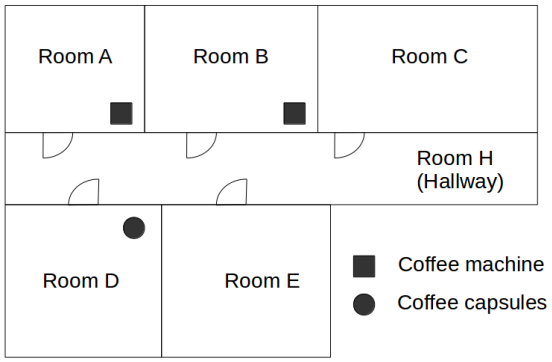

Figure 1: The environment of the scenario. It starts with all agents being in room A. The position of coffee machines and coffee capsules can vary for the different simulation runs.

2 Problem Description

The scenario consists of up to 6 agents in an office environment with the following properties:

- There are five rooms (A to E) and a hallway (H). All rooms are connected via the hallway.
- There are 1 to 6 agents (the number of agents can vary for different plans), 2 coffee machines and 10 coffee capsules.
- At the beginning, all agents are in room A. The location of the coffee machines and the capsules can vary for different plans, see below.
- Agents can walk from a room to the hallway or from the hallway to a room.
- When an agent is at the location of the capsules, she can pick up a capsule.
- When an agent is at the location of a coffee machine, she can insert the capsule (if she holds one), or make a coffee (if the coffee machine contains a capsule).
- Agents can hold at most one item (capsule or coffee) at a time.
- The goal is that all agents are having a coffee.
- All rooms contain presence sensors that detect if at least one agent is present. Therefore, each observation is a 6-tuple of binary values. The observations are accurate, i.e. no sensor errors are modeled.
- The agents act after each other, i.e. there are no parallel actions.

The environment of the scenario is illustrated in Figure 1.

3 Model Parameters

The scenario includes the following variable parameters:

- Agents: 1-6
- Position of the coffee machines:
  1 (both room A), 2 (room A, room B), 3 (room B, room C)
- Position of the coffee capsules:
  1 (room A), 2 (room D)

4 Simulation

The data is sampled from the state space of a Labeled Transition System (LTS) that is built from the problem descriptions in the form of a human behavior model. That includes in particular the following steps:

- The behavior model (consisting of domain description (`001-d.ccbm`) and problem description (`002-Agents-X-CMPos-Y-CapsulePos-Z/problem-description.ccbm`)) was used to synthesize a LTS.
- The LTS is searched to assign each state a goal distance (the minimal number of actions necessary to reach a goal state).
- Plans are randomly sampled from the LTS (taking the goal distance into account for the action selection distribution).
- Observations are computed for each plan (in each step of the plan, the state and therefore the observations are known).

5 Folder Structure

For each combination of parameters, there is a folder named
`002-Agents-X-CMPos-Y-CapsulePos-Z`
where

- `X` is the number of agents,
- `Y` is the position of the coffee machines, and
- `Z` is the position of the capsules.

This folder has subfolders `plans` and `observations` which contain a detailed plan and the corresponding observations respectively as well as a file `info.txt` which at the end states the random seeds. The contained files are named `plan-i.txt` and `observation-i.txt` where `i` is the random seed that is used to generate the plan. Thus, plans and observations with the same index correspond to each other, i.e. for `plan-1234.txt`, the file `observation-1234.txt` contains the corresponding observations.

6 File Format

The formal (PDDL-)description of the domain can be found in the file `001-d.ccbm`. It formally describes the predicates (binary world state variables), actions, constants (existing objects) and object types of the domain.

A particular scenario consists of this domain description as well as a problem description which is contained in the file `002-Agents-X-CMPos-Y-CapsulePos-Z/problem-description.ccbm`. The latter consists of a number of agents, a list of predicates that is true in the initial state (e.g. positions of agents, coffee machines, number of capsules etc.) and a the goal (all agents holding a coffee).

The plan files `plan-i.txt` contain a list of actions, e.g.

(take-capsule person1 ra) (replenish person1 capsule cb ra) (get-coffee person1 cb ra)

An action may contain parameters, e.g. the action `(take-capsule person1 ra)` means that `person1` took a capsule in room A. In the observation file, each line corresponds to a line in the plan: Line `l` in the observation file is an observation that has been observed after action `l` has been performed. Each observation is a list of 6 binary variables `(ra,rb,rc,rd,re,hw)` describing if an agent has been present room A, B, C, D, E or the hallway H. For example, the observation

`1 0 0 1 0 1`

means that agents are present at rooms A and D and at the hallway H.