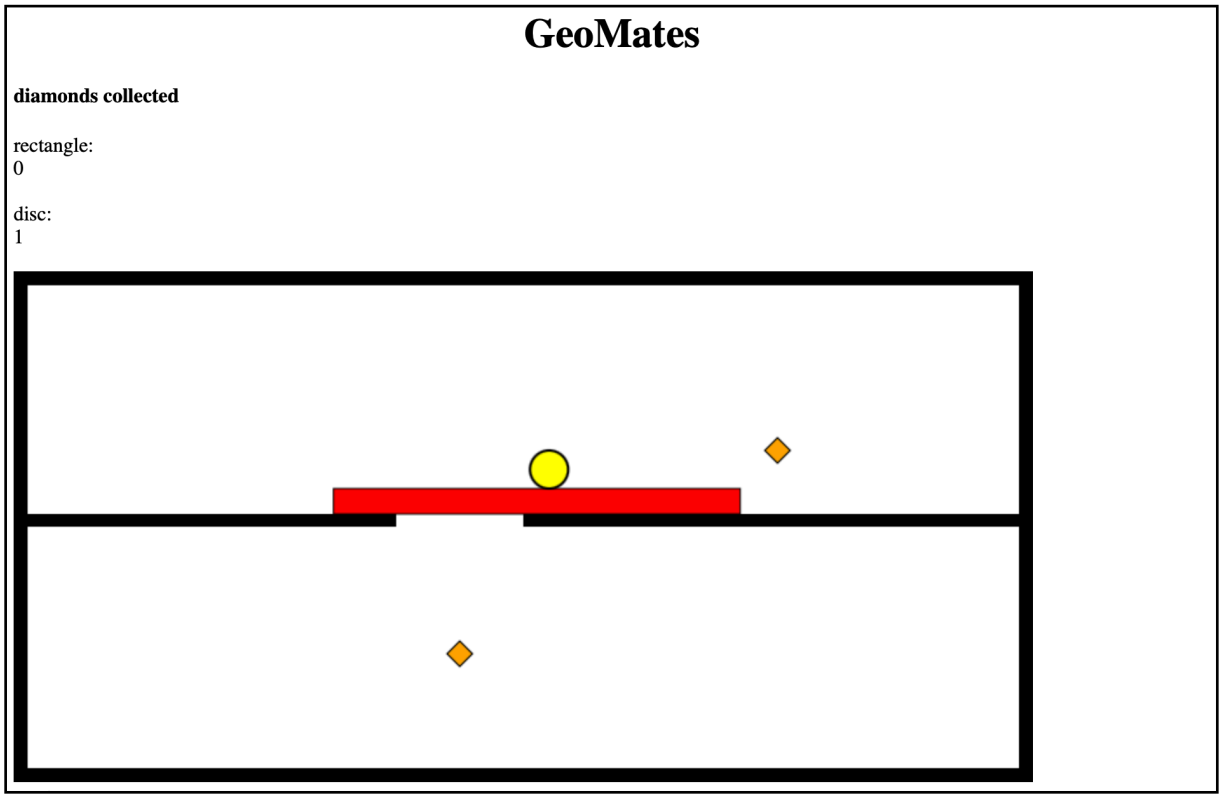
Practical for Intelligent cooperative Agents WS24/25

strict submission deadline of report: 23rd of March, 2025

Description of practical

Your task is to build an agent for cooperative physical simulation game GeoMates, a simplified clone of "geometry friends" that ran as competition at the IJCAI conference. Your agent needs to be able to interact with the environment in order to collect diamonds and to interact with the other agent – we will set up an ACT-R environment so you can handle the agent similar to the tutorial example of the agent.

There will be different trials that will need different solutions. In the end we will have a challenge with new problems to be solved – there will not be completely new components but configured differently, i.e., your agent should not depend on fixed physical parameters.



The form of the practical:

The task:

Your agent can be either the disc (yellow) or the block (red) – each has different motion modes (disc jumps, block changes its width-to-height ratio). Your goal is to catch the diamonds (orange) in order to maximize the number of points you earn. While some of the diamonds can be reached by an agent on its own, others may require collaboration among the agents to reach them. Your agent receives 2 points for each diamond collected, plus one point for any diamond collected by the other agent. The task comprises the following challenges:

1) finding out which character your agent controls and what motion capabilities it has
2) understanding the level: How can it be solved? Are there different options?
3) interaction with the other agent
4) design of an agent: What techniques discussed in the course could be helpful?

have regular checkpoints where you can present your concepts and problems and solutions will be discussed.

Technical details:

You can obtain the Geomates environment by cloning our repository https://gitlab.isp.uni-luebeck.de/hai/geomates (please use git to ease receiving updates as we may need to fix bugs). The Readme document explains how to install the software, please read it carefully before posting questions. We provide source code and a docker file for virtualization.

There will be a dummy Act-R agent as starting point. You are allowed to include external components as well (e.g., a PDDL planning system, theorem prover, etc.). In the agent code, there is an example of how regular code or external software can be connected. In order to allow us running your agent, the following requirements must be met for any agent that goes beyond pure Act-R:

- software must be able to run in standard *nix environments
- only free-to-use external software also available as source code allowed (e.g., no Matlab, no proprietary software)
- being able to provide a docker container for your agent

Timetable:

1. Find a group of up to three. In case you want to work by your own – that is ok but will not be credited → advice is to work with others (find people that have similar available time slots for getting into exchange frequently to organize your work)
   Due to limited resources for providing guidance, we will face difficulties to assist students that want to work individually on the project; be advised to work in groups.
2. First, try the task by yourself and report to each other how you do the task and then discuss how you want your agents to work on the task. Review the topics discussed in class. There are a lot of different possibilities, but likely no approach that can be realized in the given time will master all situations. Discuss which will offer the best compromise for the project, in your groups' opinion.
3. Prepare a written exposé/concept of your approach (including the team members) of about one to two pages by **2025-02-12** (it can be reused for your project report). Upload the exposé to Moodle. The exposé should address the following questions:
   a. What is the main idea of your agent, i.e., what are the main principles according which the agent will work on the task and how do they relate to course topics? (e.g., which Act-R mechanisms or AI techniques will it include)
   b. How will the agent decide to approach the diamonds, how will it plan actions?
   c. How will the agent try to collaborate?

   d. What will the agent learn? (e.g., who am I, was my action successful, how the other agent responds)
   e. How do you plan to evaluate your agent? What are levels in which the agent is expected to perform particularly well?
   f. working in the group: How will you work together in the group and implement the agent? How will you organize the exchange so you can organize and coordinate your work as to make sure everybody knows how the agent works and how it can be improved? What might be challenges for the group work?
   g. Give a rough breakdown of your project in terms of work packages you will tackle.
4. We will provide feedback to your concept in written form or in a video call.
5. Submit your final agent by **11th of March** (preferably a draft version earlier to validate the software is running on our server). We will run a competition on 20th of February by pairing your agents randomly and challenging them with unseen levels (a live stream is planned).
6. Submit your final project report **by 23rd of March.** Your project report should not exceed 10 pages, it may be augmented by a video presentation. The report should include:
   a. a description from how your agent works (e.g., taken from the exposé);
   b. reflections on how the project evolved (e.g., unanticipated complications);
   c. experimental results achieved with your agent (e.g., performance in levels)

The challenge will be on 3rd of March

Grading of the final agent and report handed in at the end will be based on the following criteria:

1. appropriateness and difficulty of the concepts selected for your agent: the approach you develop should be well thought through, consider relevant aspects, and be realistic to achieve;
2. clarity of technical description with exactly all details that are relevant;
3. the agent is running and is able to solve some of the problems (either in isolation, better in cooperation);
4. development of own levels for evaluating the strengths and weaknesses of your agent;
5. the evaluation and analyses of the agent behavior, also reflecting your initial goals.

Agent performance in the challenge is not part of the grading. We acknowledge that some ideas will be more difficult to implement than others. Therefore, we will balance the expectations on discussion, experimentation, and analysis with the effort required to implement a specific approach. A winning agent without a good description and analysis will not give you a better grade than a mediocre agent based on a well-justified concept and in-depth analyses.

The challenge:

In addition to some problems provided, we will give you during the practical, we will add new problems (not too different) that the agents need to solve.

1) The agent by itself
2) The two agents together
3) A combination of agents from different groups