Games and Agents Project Proposal

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1 Project Goal

We will be using Project Malmo as framework to build our agents. It is a platform specially made for experimentation with Artificial Intelligence. More specifically to make an AI learn how to make sense of complex environments and how to interact with its environment. This not only includes learning on its own, but also learning from others, whether they are human or agent. Project Malmo uses Minecraft as its basis and has been extended with an agent-based framework, which is what we will be using. The agents can send commands to the client to change the movement and actions of characters in the game.

Our aim for this project is to use Project Malmo to create a duo of rule-based agents that can run through a obstacle course, within the Malmo / Minecraft environment. Within this obstacle course, the agents will be separated from each other and will each have to run their own course, although at certain points they will cross paths and/or be able to exchange resources to help each other. The obstacles will consist of various things involving a need for teamwork, such as navigational tasks, puzzles, and hazards. Completing these tasks will be done by gathering resources possibly necessary for creating a solution, and coordination between the two agents to make their actions viable. The two agents will need to work together in order to reach the exit, and we will try make sure that it won’t be possible for a single agent to remain stuck while the other finds the exit. During a run, the agents have to make constant decisions based on the environment.

The sensory input of the agents will be the observational data provided by Malmo. Initially, we plan on providing the agents with full knowledge about the environment in advance. This will help them plan routes more easily. It will also aid us in being able to focus more on the actual tasks at hand to make sure these will work. If we achieve everything we want within a reasonable time and have some time left, we will remove the environment knowledge from the agents and try to add exploratory behaviour. This will certainly change agents behaviour as more communication will be necessary between the agents, in order to make both aware of the map.

\[https://github.com/Microsoft/malmo\]
2 Agent and AI Aspects

- Basic (goal oriented) navigation: necessary for the agent to 'go places'. Apart from the pure navigational aspect, the agent will also need to determine its goals, both long-term and short-term, decide which goals to achieve first, and subsequently navigate to, and complete these goals. It is likely that certain goals will require more than simply moving towards something and standing either in the neighbourhood or on top of it, which brings us to...

- Environment reading / altering (building / destroying blocks): 'knowing' the situation the agent is in, and interaction with the environment. The latter of which is done by (among others) mining blocks, chopping down trees, and other forms of gathering resources. These resources can then be used together with specific tools in order to craft all sorts of items. Knowing the environment is also an important issue for the agent, as it will need to know what things in the environment can be manipulated, in what ways, what the consequences of this will be, and whether environmental objects could be used for certain goals, such as crafting a bridge to cross a river.

- Communication / cooperation: as the agents will be separated from each other and be required to run their own course, yet still need each other to make progress at certain points, communication and cooperation are a must. The agents will need to communicate about multiple things such as the availability, or lack of, resources they will think to be in need of to make progress. But also in cases where an agent is hold back by a gate that the other agent will need to open by standing on a pressure panel, or pushing a button. Making decisions about which things have priority will be a challenge here.

- Some form of learning: this point is not yet distinctively decided. Reinforcement learning would be a good idea, but we’d need to have a clear picture of how we’d implement this; what would be the rewarding factor for performing an action complementing the goal the agent is trying to achieve? More importantly, when would a certain action be classified complementary? In the case of chopping wood it could be whenever the agent swings its axe against a tree, but what if it needs to build a staircase?
3 Planning

Our planning is the following:

10-20th May

- Get familiar with the Malmo platform. This means following tutorials and/or reading the documentation.
- Search and get familiar with relevant papers that we can implement in our AI solution.

20-30th May

- Creating a testing environment where we can test an agent.
- Get basic AI working in the testing environment.
- First prototype and report.

30th May - 20th June

- Expand AI and environment.
- Add cooperation to multiple agents.
- Refine / testing.

20th June

- Present.

20-25th June

- Refine / testing.

25-30th June

- Evaluation.
- Write report.

30th June

- Deadline.