

Creating Artificially Intelligent Agents in Minecraft

Stuart Marples
Computer Science
Heriot Watt University

Aim: To create an artificially intelligent agent in Minecraft that will learn how to complete a task while attempting to achieve the highest score possible.

Method: The task was to collect 20 apples in a 20 x 20 arena while avoiding death by the enemies. The agent was judged objectively against 3 rule based systems in terms of the number of apples collected, the final total reward and the time taken to complete the task.

The task had 2 parameters:

- If apples are placed randomly through training or in the same position.
- 2) If enemies are able to spawn or not.

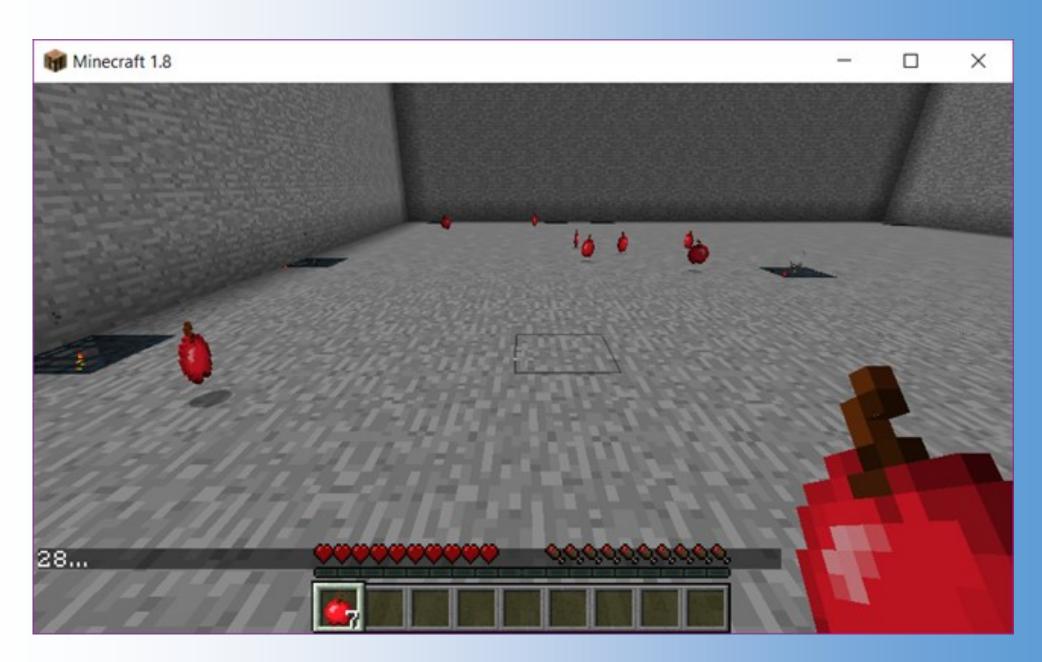


Figure 1: The Agent Attempting to Complete a Task

Reinforcement Learning

A Reinforcement Learning agent is defined as a Markov Decision Process (MDP) consisting of:

- 1) S which is a set of finite states.
- 2) A which is a set of finite actions.
- 3) R which is the immediate reward for travelling from state S to state S'using action a.
- 4) α which is the learning factor.
- 5) β which is the discount factor.

After training, the agent learns the optimal actions for each state to maximise the reward for the tasks using Q-Learning.

RESULTS: The agent showed an optimal learning curve through training. This resulted in the best or second best results over the various tasks.

	Apples Collected		Total Reward		Time Finished		
	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation	Completion Rate
Agent							7%
	16.50	2.09	1373.3	734.03	23.79	1.27	
Mob_fun							7%
	16.40	2.29	2159.2	662.18	23.75	1.26	
Random							0%
	10.53	3.06	-2033.6	1006.20	24.09	0.04	
Lawnmower							0%
	14.83	1.21	1162.1	292.50	24.09	0.02	

Table 1: Results of the Agent and Baseline Systems for Task 1

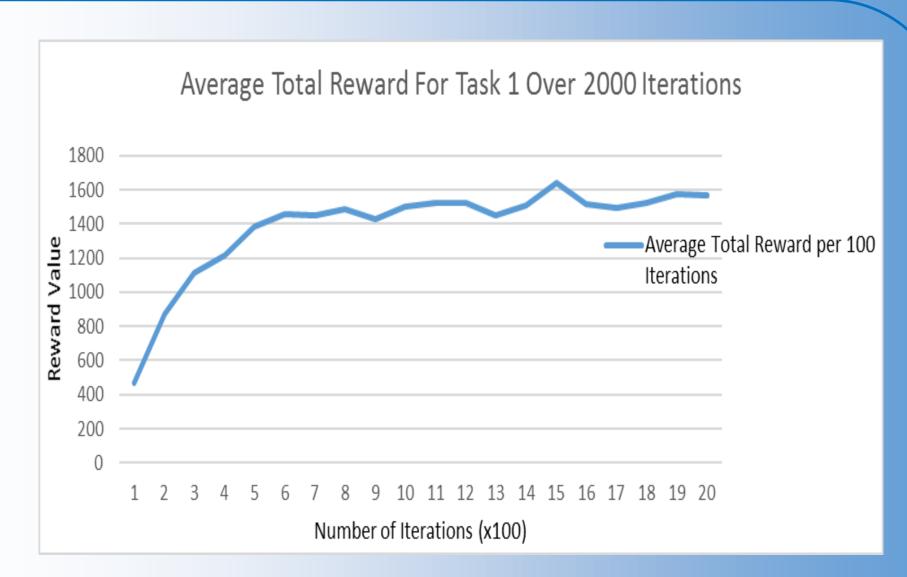


Figure 2: Learning Curve After 2000 Iterations of Training For Task 1