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Topics in SWE: Project Progress Report

a. *Overview*

The topic of my project is **NPC population control in video games**. I am testing different proposed methods for NPC population control, such as the ones presented in [1]. I am focusing on a prey-predator simulation given different approaches (machine learning and other mathematical methods, some of which can be found in the resource you provided as a response to my proposal). As of now, I have a working set-up that will be the base for all future experiments (more details about this in sections *d, e*).

b. *Value to user community*

The prospective user community is game developers, with a focus on indie game developers or smaller game studios. My project aims to compare and test different methods for NPC population control, which can be a valuable technology in many games. It is particularly important, as the player has to feel immersed in the game and be faced with a familiar, realistic world. Therefore, there cannot be too many NPCs or too few, but rather the exact amount the game developer intended, no matter a player's actions or play style.

c. *Research questions*

1. Is machine learning really needed for NPC population control, or do prey-predator related mathematical models suffice?
2. How can the machine learning methods used for ant-food models be extended to another level of prey-predator relationships (food - ant - anteater)? Are they as efficient?

d. *Demo*

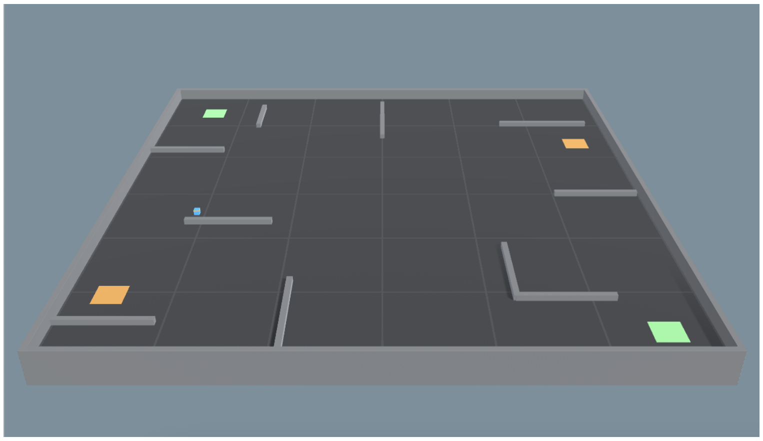
For the demo, I plan on recording some different set-ups of the game (one using ML, one without, a version with only 2 instances - ant & food - and one with 3). I will present my work while these recordings are playing, noting the different behaviors and strategies that determined them.

e. Code & progress

You can find my code here: https://github.com/mariabrbz/npc-population. I am using Unity to develop a playable game/A-life simulation. I am also using their ML API, which has been very (even though it had a steep learning curve).

So far, I have a working set-up that will be the basis for all of my future experiments. I coded the premise of the game, an environment with food pick-up and drop-off areas and I trained agents to behave as NPCs. I did this using a combination of reinforcement learning and imitation learning. To help me achieve this, I read a lot of the ML Agent API documentation and did a lot of experimentation with different parameters.

I have also been researching the types of interactions I want the game to allow (the prey-predator model). I am feeling quite confident that I will have some interesting results for the demo.



The image above is my current set-up, with food pick-up areas in orange and drop-off areas in green. The set-up is very minimalistic, with the NPC ants being represented by cubes. The player ant will be a cube but of a different color. Food level will vary in the zones to keep the NPC population at a certain level. I took the elements presented in [1], but I was much less focused on game complexity/graphics.

f. Related papers

1. ANFIS-Based NPC Population Control in Video Games
2. Deep Variational Autoencoders for NPC Behaviour Classification
3. Evolving NPC Behaviours in A-life with Player Proxies