Advanced Tools Results

**Tools**

The main code is taken from the smart boats git hub project, with some modifications to the agent weight calculation formula. A new feature is also added to the project, such as walls and hiding spots.

**Walls**

Walls will block the line of sight of the agent, and also block their path, so agents cannot see past walls or walk through them, this will bring some change in the targeting of the agent, because of this, agents will be programmed to avoid walls

**Bushes / hiding spots**

Hiding spots can be used by cats only to get away from dogs, they are more inclined to go to a bush if they are being chased / a dog is close by, otherwise the cats will not be attracted to bushes. The bush itself do not have a function to “Hide”, this function is replaced by randomly teleporting the cat randomly away from the bush, inside a pre determined range. I do not implement the ability to “hide” because the simulation timer. The timer will continue to tick while cats are hiding, resulting them in not getting much benefit from the bush, teleporting them away randomly increases the chances of them escaping the dogs while also taking much less time than waiting inside the bush.

**Evaluation**

the main way to evaluate the agents performance will be their end points every cycle/generation. Only the highest performing points will be taken.

**Experiment**

10 simulations have been done, each one about 30 minutes for each simulation (if nothing if stated), the baseline for the simulations are :

- 5 simulation time

- 0.5 mutation factor

- 8 mutation chance

- 3 agent speed

- 8 agent sight

Sebuah gambar berisi garis, Font, tipografi, deasin

Konten yang dihasilkan AI mungkin salah.Simulation 1 (baseline)

The blue line represents the cat, the orange line represents the dog. This simulation is done for 1 hour, and has gone through 785 generation of cats and dogs, the time for each simulation is set to 5, and the baseline mutation factor is 0.5, with 8 mutation chance. This will be used as the baseline experiment. The table shows that the more generation passed, the worse dogs perform against the cats, this can be resulted in the random mutations of speed reduction in dogs.

Simulation 2 (only cats can mutate)

Sebuah gambar berisi Font, tipografi

Konten yang dihasilkan AI mungkin salah.

This simulation will show the effects of mutation to an agent, by deactivating the mutations on the dogs, they will be unchanged by the generations. The result shows that the mutations do not benefit the cats at all, even having a dip in performance in the 57th generation, the dogs in the other hand is fluctuating between performing averagely to performing badly, this is resulted by the mutations in cats, if the cats get a bad mutation, the dogs win, but if the cats get a good mutation, they will win.

Sebuah gambar berisi teks, Font, garis, cuplikan layar

Konten yang dihasilkan AI mungkin salah.Simulation 3 (only dogs mutate, simulation time to 7)

The third simulation will only allow dogs to mutate, other than that the time per simulation is also increased to 7. This increase in time decreases the generation count in 30 minutes, but will allow each mutation to impact more on the performance of the agents. The table shows that the mutations do not benefit the dogs at all, resulting in an average decrease in performance, the cats in the other hand performed better than usual. This is caused by the dogs inability to catch the cats.

Simulation 4 (only cats mutate, simulation time to 7)

Sebuah gambar berisi teks, Font, cuplikan layar, tipografi

Konten yang dihasilkan AI mungkin salah.

This simulation is the opposite of simulation 3, only allowing the cats to mutate and the dogs stay stagnant. The table shows that the cats averagely performed worse the longer the simulation goes, the dogs performed a little better than average.

Simulation 5 (only dogs mutate, simulation time to 5)

Sebuah gambar berisi Font, tipografi, deasin

Konten yang dihasilkan AI mungkin salah.

Simulation 5 is the opposite of simulation 2, only dogs is allowed to mutate, this results in generally worse performance in dogs, but a very stable performance for the cats. this fluctuations might be caused by the random state of the movement of the agents.

Simulation 6 (no mutations, simulation time to 3) Sebuah gambar berisi teks, cuplikan layar, garis, Plot

Konten yang dihasilkan AI mungkin salah.

This simulation shows the random nature of mutations, without any mutations the two agents is performing very consistently, the cats do not have a single fluctuation in the 559 generations. While the dogs consistently performed to 15 points and in rare occasions reach 20 points.

Simulation 7 (simulation time to 5, mutation chance to 4)

Sebuah gambar berisi teks, cuplikan layar, diagram, garis

Konten yang dihasilkan AI mungkin salah.because of the mutations generally bring only downsides to the agent, the chance for a mutation to happen is halfed. The result is an increase in performance for the dogs, but a major decrease in performance for the cats.

Simulation 8 (only cats mutate, 4 mutation chance)

Sebuah gambar berisi teks, diagram, garis, cuplikan layar

Konten yang dihasilkan AI mungkin salah.

This simulation follows a very similar pattern to simulation 7, the cats Is impacted negatively by the mutations, resulting in the dogs having an easier time catching the cats, resulting them having higher points.

Simulation 9 (only dogs mutate, 4 mutation chance)

Sebuah gambar berisi teks, cuplikan layar, garis, diagram

Konten yang dihasilkan AI mungkin salah.this table shows the opposite of simulation 8, the cats thrive from the bad mutations given to the dogs, resulting them performing better.

Simulation 10 (mutation chance 16, 1 hour)

Sebuah gambar berisi teks, tipografi, deasin

Konten yang dihasilkan AI mungkin salah.

On all the simulations, mutation shows that it only brings downside to the agents, but in this case, the mutations benefit both the agents. Both performing averagely better than average, but the mutations also bring some fluctuations to the performance of the agents, both fluctuate from performing very well to very poor.

Conclusion

The random nature of mutations can severely affect the performance of the agents, most of the time, mutations bring only negative impact to the agent, but in rare times, mutations bring benefits to the agents, as can be seen on simulation 10. the addition of hiding spots and walls also bring some change to the simulations. Hiding spots allow cats with lower speed to escape dogs, allowing them to win the highest point, and having their gene continue, this in result will negatively impact the overall performance of cats. The mutations generally impact the cats more than the dogs, the cats can only get points by finding chickens, any negative mutations to this ability will be a big negative impact to their performance, dogs in the other hand will have some rare occasions where cats run into them, giving them more points and letting them win in the generation. This is why even when in having a big disadvantage compared to the cats(worse performance is 5 points), they generally still perform better than the cats worse performance (4 points).