ASTEROID INC. 1ST AI SELECTION

DYLAN JAMES RAMSDEN

Contents

Choice of AI

Type

Finite state machine

Reason

Being given the choice of choosing out of 3 AI algorithms to implement for Task 2, much thought was put into choosing one that would work great for my game as well as the games genre.

When selecting the best suited algorithm for the game, these points and aspects about the game were taken into account:

- The game having 3 different sections that need to have their own behaviours based on the state of their game
    - The player
    - Mining ships
    - Destroyer ships
- A procedurally generated game board
    - Spawning mineables in randomly selected positions
- Looking into the future, an algorithm that can efficiently and effectively store data based on game states which will be used as testing data for a neural network.

Based on these game aspects and what is needed from the implemented AI algorithm, the choice to use a finite state machine was made. The way in which the finite state machine satisfies and successfully carries out the highlighted points and aspects about the game is as follows:

- The finite state machine provides 4 states for each of the 3 different sections within the game (the player, mining and destroyer ships). This allows a section to behave differently from the other sections, but how it should successfully, based on the state that the game is in.
- With a procedurally generated map, a state machine (unlike a tree) can dynamically set conditions on states e.g. update miners to only target planets. The finite state machine is also unaffected by a change in size of the map, where it will still operate as planned and efficiently just on a larger or smaller scale.
- With a state machine, that utilizes an evaluation function, data can be recorded on every turn that keeps track of what states and when the states are initiated (e.g. state 1 is initiated when the evaluation function is between 1 and 0.5) that treat the AI the best (in terms of moving it closer to a win).

Asteroid Inc. Finite State Machine

The state machines states and the behaviours for each section within the game will be explained individually based on the state that the game is in.

State 1

Nature of the state: If the finite state machine finds itself in this state, it means that it is in a very good position in terms of resources and beating its opponent. The finite state machine focuses on keeping a consistent lead in resource acquisition.

The player

With the finite state machine having plenty of resources and a very convincing lead-it has some money to spend. The player behaviour gives the state machine the chance to produce 2 ships within a turn. Whether the finite state machine produces 1 or 2 ships is based on a random value. If a ship can be produced, the type of the ship to produce is also based on a random value (either being a mining ship or destroyer ship).

Mining ships

With an abundance of resources, there is no need for miners to prioritize specific types of mineables or even enemy owned ones. Miners will look for any unowned mineable that is closest to them and focus on establishing a mine on them.

Destroyer ships

With no clear need to slow down enemy resource acquisition by targeting their miners, destroyer ships will seek out any enemy ship that is closest to them and focus on destroying it.

State 2

Nature of the state: If the finite state machine finds itself in this state, it means that it has a small but definite lead in resource acquisition. The finite state machine focuses on keeping that lead and creating a larger lead against the opponent.

The player

With the finite state machine still having a lead over its opponent, it still has some leeway to spend money. The player behaviour gives the state machine the chance to produce 1 ship within a turn. Whether or not the finite state machine produces a ship is based on a random value. If a ship is produced, the type of ship to produce is also based on a random value (either being a mining ship or destroyer ship).

Mining Ship

With a lead in resources, but not a prominent one it is vital that resources per a turn is increased as much as possible. Miners will prioritize unowned planets over unowned asteroids to ensure that the finite state machine's resources acquisition is increased at greater values per a turn. The reason planets are prioritized is because they provide greater resources per a turn than asteroids.

Destroyer Ships

With still no clear need to slow down enemy resource acquisition, destroyer ships will seek out any enemy ship closest to them and focus on destroying it.

State 3

Nature of the state: If the finite state machine finds itself in this state, it means that it is in a bad position due to being behind the opponent in resource acquisition. The finite state machine focuses on slowing down enemy resource acquisition while still increasing their own.

The player

With the finite state machine being, not too far, behind in resources against its opponent there is no room for money to be spent without reason. Instead of focusing on training new ships, the player behaviour will focus on saving money by training no new ships until there is a resource lead. The only time a new ship will be trained is if there are no ally miners or destroyers on the board. The finite state machine will focus on having at least 2 of each type at all times.

Mining Ship

With having less resources than the opponent, it is vital that a lead is gained as soon as possible. Miners will prioritize the closest owned enemy mineables over unowned mineables. This will ensure that enemy resources per a turn is gradually decreased while at the same time the finite state machines resources per a turn is increased, which could possibly result in a resource lead for the finite state machine in a few turns.

Although enemy mineables are prioritized, if a mining ship does come into a specific range of any unowned mineable it will momentarily focus on establishing a mine on it to ensure resource acquisition is being increased when possible.

Destroyer Ships

With a clear need to slow down enemy resource acquisition, destroyer ships will prioritize enemy mining ships. This will slow down the rate at which the opponent gains new mineables and give room for the finite state machine to obtain a resource lead.

State 4

Nature of the state: If the finite state machine finds itself in this state, it means that it is in the worst position it could be in due to being very far behind the opponent in terms of resources and resources per a turn. The finite state machine focuses on taking extreme measures to slow down enemy resource acquisition as much as possible.

The player

With the finite state machine being very far behind in resource acquisition against its opponent there is definitely no room to be spending resources. Similar to the behaviour from state 3, the player will focus on spending no resources at all, preventing the creation of new ships by the finite state machine where possible. The only time a new ship will be trained is when there are no ships of a specific type on the board. The finite state machine focuses on having at least 1 of each type of ship on the board at all times.

Mining Ships

With the finite state machine being very far behind the opponent in terms of resource acquisition, it is vital that the opponents resource acquisition is slowed down immensely. Miners will prioritize in taking over the opponent's biggest resource sources, their planets. By doing so the opponent will be left with only asteroids which will drastically decrease their resource acquisition.

Although enemy planets are prioritized, if a mining ship does come into a specific range of any unowned/enemy minable it will momentarily focus on establishing a mine on it.

Destroyer Ships

With a definite need to slow down the opponent's resource acquisition, it is vital that destroyers prioritize destroying mining ships (following a very similar behaviour to state 3) to prevent the opponent from gaining more resources per a turn than they already are.

State initiate values

Easy difficulty

1 >= STATE 1 > 0.2

0.2 >= STATE 2 > -0.6

-0.6 >= STATE 3 > -0.8

-0.8 >= STATE 4 > -1

Intermediate difficulty

1 >= STATE 1 > 0.4

0.4 >= STATE 2 > -0.1

-0.1 >= STATE 3 > -0.6

-0.6 >= STATE 4 > -1

Hard difficulty

1 >= STATE 1 > 0.6

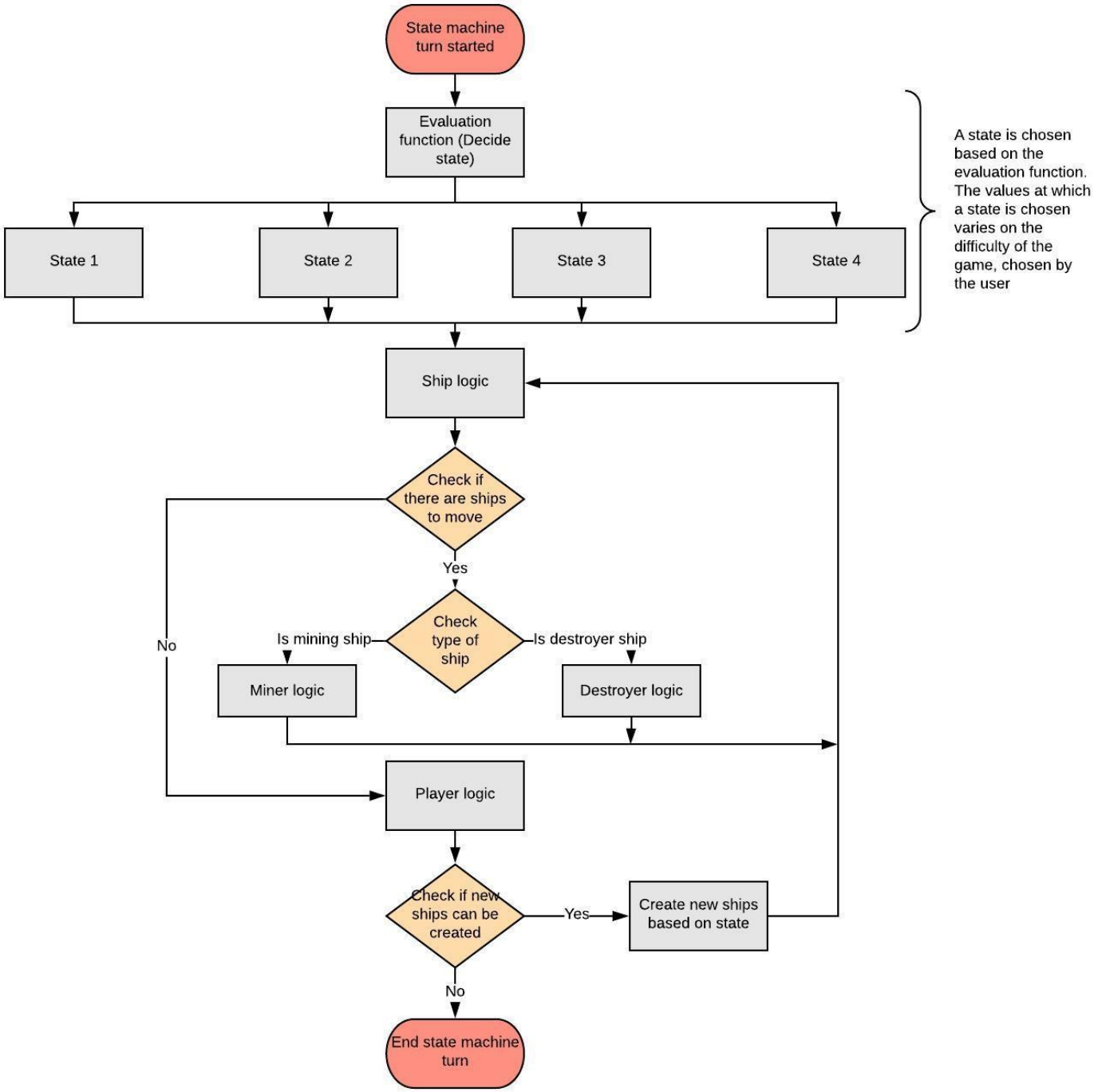
0.6 >= STATE 2 > 0.1

0.1 >= STATE 3 > -0.6

-0.6 >= STATE 4 > -1

Visual Representation of Finite State Machine

(A JPEG of this diagram is included in the file in case there is a difficulty to read it)



Changes

- There has been a small balancing update on the random generation of the game board
    - Mineables are now set to spawn apart from each other and attempt to be evenly separated and dispersed around the game board.
- NB! Note on some cases of starting a game (very rarely), the board does not load properly due to a null object error.
    - If this does occur, just access the pause menu in game and click restart.