

Utility Based AI for a First-Person Shooter

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The Problem

Most AI behavior can be predictable after playing the game a few times. This reduces the chances of replayability and possibly the amount of entertainment the player is experiencing over time. Research has been done using other AI techniques to solve this problem (McPartland 2013)

The Solution – Dual Utility

My solution is to create AIs that use Dual Utility Reasoning which is a technique in Utility Based AI. This is to make them behave differently so they don't react the same way when experiencing the same changes to the environment (Dill 2015).

The actions are all separate classes which are then stored in another class called a bucket, these buckets contain actions specific to their specialisms such as health (Graham 2020).

Each bucket and action is accessed using a factory pattern which allows the enemy to check its utility. It may pick the action with the highest score or pick one at random (Graham 2020). Figure 2 & 3 shows every child class and the base class it inherits from. Figure 1 shows how the decision-making process works when finding the smallest utilities.

Practice Based Research

I experimented with four different ways for the AI to make decisions:

- picking both the smallest score and weight.
- picking both the weight and score randomly.
- picking the weight at random and the smallest score.
- picking the smallest weight and a random score.

I also experimented with different equations to calculate the weights:

- Linear equation.
- Quadratic equation.

Picking the smallest weight and a random score shows the best results, in terms of making it more unpredictable, but it would make stupid decisions at times and slow at making decisions. Picking the smallest weight and score has shown to be very good and faster at making decisions but is more predictable.

Conclusion & Improvements

The AIs did show promise due to its ability to make decisions and perform actions. However, I feel like it didn't fully solve the problem I proposed (this may be due to bad time management and an incomplete understanding of Dual Utility). A picture of the game is shown in figure 4.

If I were to improve, I would:

- Use Dictionaries instead of factory patterns to permanently store buckets and actions when organizing them.
- Spend more time experimenting with different ways it makes decisions.
- Use the standard Utility Based AI technique instead of Dual Utility Reasoning.

Bibliography

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GRAHAM, David ". 2020. 'An Introduction to Utility Theory'. In Anonymous *Game AI Pro 360*. (1st edn). CRC Press, 67-80. MCPARTLAND,

Michelle. 2013. 'Beaten by Bots – Training AI for First-Person Shooter Games'. Available at: <http://theconversation.com/beaten-by-bots-training-ai-for-first-person-shooter-games-11176>. [Accessed Mar 7,].

Fig1: Oates, Max. 2020. Decision making Flow chart

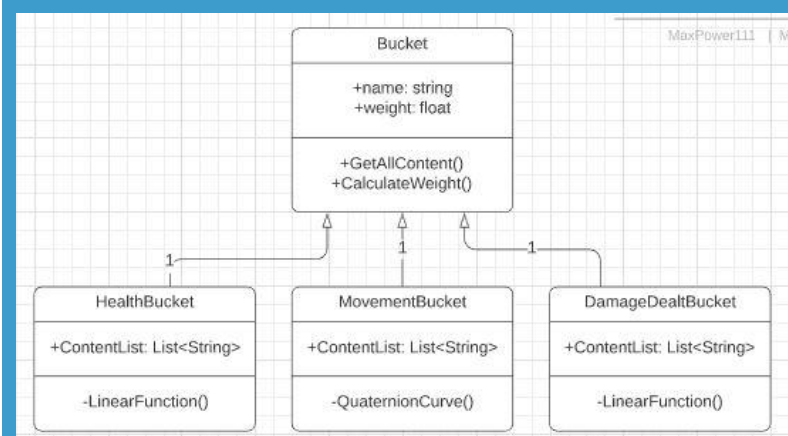
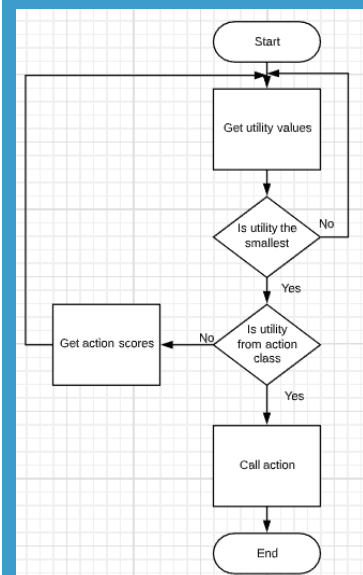


Fig2: Oates, Max. 2020. UML Diagram of bucket classes

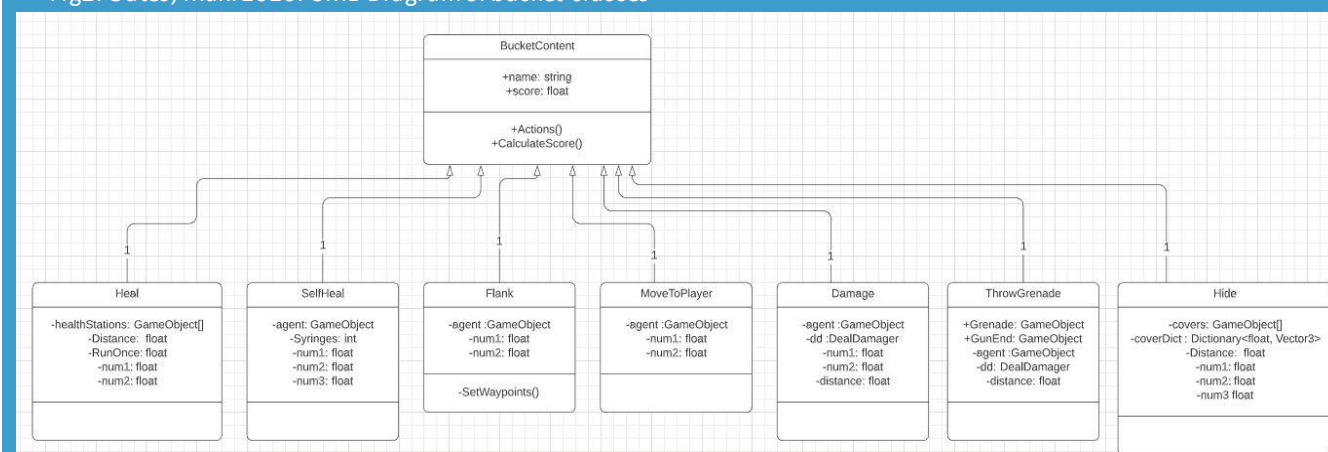


Fig3: Oates, Max. 2020. UML Diagram of action classes



Fig4: Oates, Max. 2020. Example of gameplay