Robot Arena

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We propose a simulated arena environment populated by autonomous "bots." These bots have one primary goal - destroy the other bots while remaining alive.

The bots have limited percepts. They can only see in one direction per clock tick. The only information they can get from their sight is the type, distance, and unique ID of any entities in their line of sight, and the distance to a wall in that direction. They can also keep track of their own energy stores, damage, and speed.

Taking actions takes energy. A bot can change its speed (and direction) and fire bullets. Energy regenerates slowly. Changing a bot's aim does not consume energy, and is independent from movement direction. Being hit by a bullet increases the damage to a bot, until it is destroyed at some high damage value. Bullets travel at sub-instant speed, and thus can be dodged by advanced bots.

To increase the performance of the bots, they will be programmed with variability in mind. Various parameters, some of which might include high-level values such as aggressiveness, risk aversion, and agility, and low-level attributes like maximum range to fire and energy conservation, will be programmed into the bots' basic behavior algorithms. These parameters will then be optimized through successive application of genetic algorithms.

The GA fitness function will be based on the score a bot receives during a round. Bots will gain points by damaging and destroying other bots and surviving over time. A bot will lose points if it takes damage or is destroyed, or repeatedly uses up its energy stores.

If possible within the time limits, the complexity of the problem will be increased by adding solid obstacles to the arena. This gives an opportunity for the use of pathfinding to avoid obstacles and memory to keep track of what's behind an obstacle.

The problem and solution will be programmed in C++ using MIT's GAlib [1]. A graphical interface, to allow direct observation of the bots' behavior, will be written in Java and interfaced through sockets. The arena and basic bots will be written first, then the graphical interface. Next the bots will be parameterized, then genetic algorithms will be implemented to optimize the parameters.

References

[1] http://lancet.mit.edu/ga/