ViewpointAI: Thinking Ten Years Ahead

Game AI has been growing in importance in recent years, but where is it headed? ***Peter Cowling*** *of the University of Bradford says students trained in AI might provide the answer…*

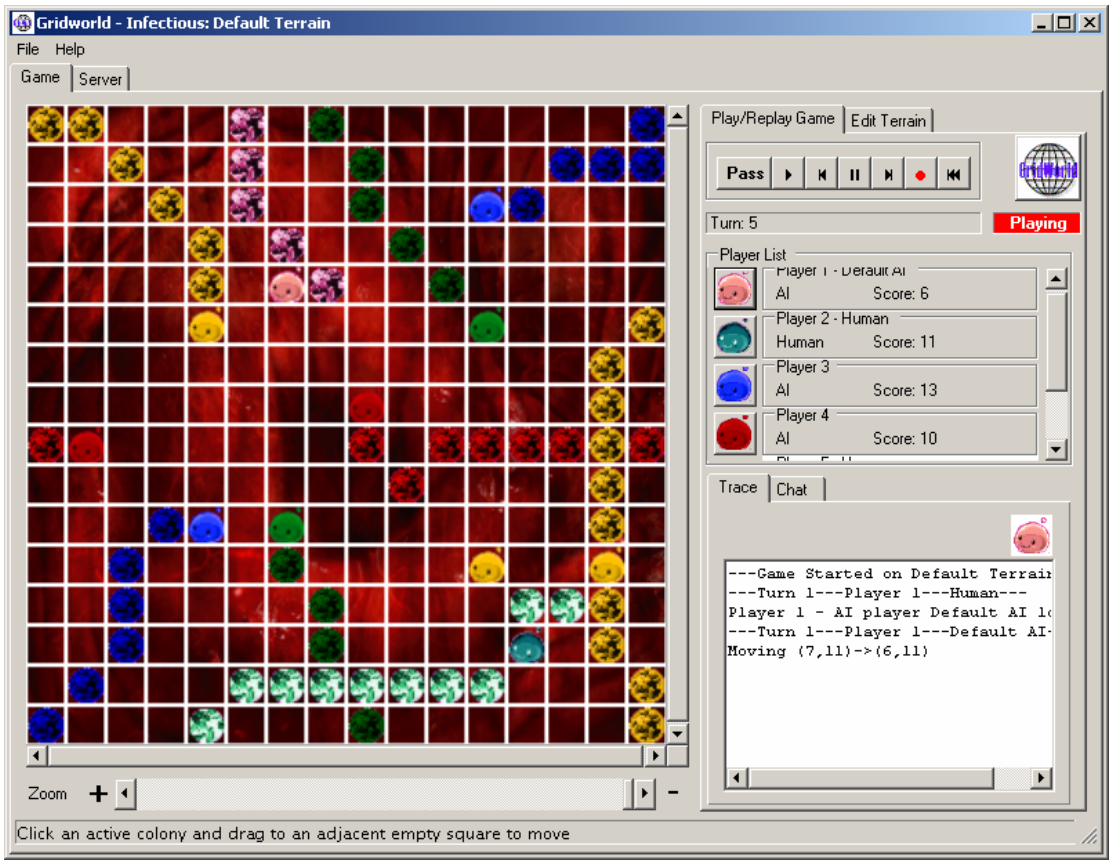
AI has been around for as long as there have been computer games. With advances in technology there is now enough CPU and memory resources to create sophisticated real-time AI. Increasingly, AI is a central component of a game, advertised on the box, rather than a piece of code hastily cobbled together to meet a deadline once the rest of a game is implemented. It seems possible that future consoles will have a dedicated AI chip. Where are these developments leading, simply to more and more complex state machines and better pathfinding, or to some more fundamental shift?

If we want to be able to specify *exactly* what an AI will do we are pretty much limited to writing code for every single situation which can be foreseen (and hoping that not too many are missed). This often gives rise to state machines of increasing size and complexity with games such as *Halo 2* using good design principles to make this possible. This allows us to "tweak" code and avoid unwanted AI stupidity if we can detect it, but gives rise to an increasingly difficult-to-maintain mass of *if…then* statements, and predictable behaviour once the whole state machine has been explored by the player.

Might it be the case that with the rise of online multiplayer games, AI opponents will be reduced in importance? The answer to this question really depends upon the imagination of game and AI designers. It is clear that gamers want good AI, and are looking forward to one day using truly intelligent AI (at the level of that in *Star Trek*'s holodeck). AI designers must find a way to bridge the gap.

Artificial opponents or team members have infinite patience and can have characteristics such as personality and ability tailored to the game player. However, they become boring when they have no apparent imagination. It is unsatisfactory to "crack" a game by finding a single weakness in the AI which can be exploited relentlessly. Most current games attempt to avoid this problem by trying to find every possibly weakness. AI which reacts to situations and "remembers" what does and does not work can greatly enhance the gameplay experience. A thinking, feeling AI, or at least the illusion of one, is unlikely to be achieved through hand coding knowledge. Machine learning technologies may provide the answer. Game designers are often said to require knowledge of the reasons *why* certain actions were taken by AI. However, at some level the reasons why a certain decision is taken are based in belief (in the abilities of the development team). With increasing uptake of machine learning technologies, the levels of belief in these technologies will increase and we expect to see exponentially increasing uptake, from the current slow start. In the long run, this may reduce the amount of effort required for development and testing, as AI becomes more complex.

Interest in games within the AI research community predates the digital computer. Games are a widely used medium for AI research in field such as multiagents, management science, genetic algorithms and neural networks. The games investigated are generally much simpler and less “messy” than commercial video games. In the past year, academic and games development communities have been brought together at conferences launched by the American Association for Artificial Intelligence (www.aaai.org) and the Institute of Electrical and Electronic Engineers (www.ieee.org), both major players in AI research. The Game Developers Conference (www.gdconf.com) attracts increasing numbers of academics. There is huge potential for mutually rewarding relationships between the AI research community and game developers, with a growing level of collaboration for many years to come.



One of the principal methods to bring University research into commercial games development is via companies recruiting graduates trained in relevant and current AI technologies. At the University of Bradford we have been working with Microsoft and software house Black Marble to develop games for teaching AI to students. The resulting games: Virus, Terrarium Academic and GridWorld (see picture), have proven highly motivating for students, particularly since student AI competes in a round-the-clock competition with results published on the Internet (aifg.inf.brad.ac.uk). Students pick up the C#.NET language and start creating their own AI players in only a couple of weeks. Students’ enthusiasm for the topic of AI in Games and competitive instincts have spurred them to work very hard and show high levels of creativity. Advanced AI techniques in influence mapping, search, genetic

algorithms and neural networks are taught, as well as traditional state-based, knowledge-based and pathfinding techniques. It is our aim that students taking this course take their skills to the video games industry bringing these advanced techniques. The depth of knowledge gained by students may then be further extended with a Masters degree focused on AI for games. The software used for competition is already in use at other Universities and will be made more widely available for game developers and members of the public to compete (see www.bugrd.org.uk).

Three decades ago Jaap van den Henteryk, a pioneering AI chess researcher, asked some of the then leading members of the chess AI community how strong AI players could become. Their expectations for AI chess players at the level of good club players we now know fell well short of the true mark, of a world-champion-beating AI player. Van den Henteryk's own prediction is for AI which demonstrates true emotional intelligence in the next few decades. Increasing uptake of machine learning, public expectation of gameplay-enhancing AI and the increasing number of AI-trained undergraduates entering the games industry point to interesting times ahead…

Peter Cowling (http://www.inf.brad.ac.uk/~picowlin) is Professor of Computer Science at the University of Bradford. He leads the MOSAIC research centre (http://mosaic.ac), whose research interests lie in artificial intelligence and optimisation applied to computer games and real-world scheduling and control problems. His current work considers AI techniques capable of general game playing and problem solving. He has been fascinated by games and game AI since his father bought a Commodore Pet computer in the late 1970s. It is still in the loft, becoming sentient.