
Foreword by David B. Fogel

At a time when biologically inspired machine intelligence tools are becoming crucial to the development of game-playing strategies, Jacek Mańdziuk has written a book that focuses on exactly these tools. His book *Knowledge-free and Learning-based Methods in Intelligent Game Playing* concentrates on games requiring mental ability “mind games” as Mańdziuk describes them. His extensive survey of the literature is aimed mainly on those methods that offer the potential to have a computer teach itself how to play a game starting with very little (or no) knowledge of the game, or to learn how to improve its play based on feedback about the quality of its performance. His perspective is one of a futurist, looking ahead to grand challenges and the computational intelligence methods that may be used to meet those challenges.

To date, the greatest achievements in game play in most standard “mind games” have come from knowledge-intensive methods, not knowledge-free methods. They have come from programming human knowledge into the software, rather than having the software learn for itself. This is true, for example, for Othello, checkers, and chess.

But this is going to have to change because the games that now really challenge us are sufficiently complicated that traditional knowledge-intensive methods will not yield satisfactory results. Computing power alone is unlikely to be the basis for addressing Go, and even if that computational power does become sufficient, we could easily imagine Go on a 190×190 board instead of the 19×19 traditional game, which our modern computers already find vexing. In that case, Monte Carlo tree searches to the end of the game, endgame databases, and opening books based on human grand master knowledge would no longer be very helpful to the computers.

When compared to Go, the games that we humans play in the real world are of far greater complexity. For example, we could look to real-time strategy video games that have thousands of “agents” acting simultaneously, but we could just as well consider, say, the games of economics that are played between nations. Determining which countries should receive favorable trading status and which should have tariffs placed on their goods is a game. Its not

played on a board or a table or a computer, but it is game nonetheless, and the consequences of winning or losing are usually far greater than is found in a contest between, say, two checkers players. I wonder if anyone truly believes that the usual devices of traditional artificial intelligence will ever be very successful in addressing such games. Certainly, I do not believe they will be.

An alternative is to focus on how humans adapt to different challenges, or more generally how any intelligent systems do this. Intelligence then becomes a matter of adapting behavior to meet goals across a range of environments, and we can observe examples not only ourselves, but also in societies (such as ants) and in evolving organisms. Neural networks, evolutionary algorithms, and reinforcement learning take center stage, and here Mańdziuk highlights their application to games including backgammon, checkers, and Othello, with additional remarks toward poker, bridge, chess, Go, and other games of strategy. His perspective is that the key to making major advancements in intelligent game playing comes from capturing our human abilities such as creativity, selective focus, and generalization. His conviction is compelling.

This is a book that is both broad and detailed, comprehensive and specific, and it offers a vision toward the challenges that await us. With the expanding interest in game playing Mańdziuk offers a timely book that will serve the growing games community for years to come. I hope you find it a source of continual inspiration.

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