Exploring the Real World Applications of Cellular Automata and its application to the Simulation of Flocking Behaviour

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Flocking behaviour is seen all around us in nature. Birds flock in the sky, fish flock in the oceans and insects flock and swarm underground. Travelling in flocks provides many advantages for those who partake, these include improved chances of finding food while foraging, easier time finding a mate and most importantly, increased protection from predators.

The first algorithm used in the computer aided simulation of flocking behaviour was the Boids flocking algorithm developed by Craig Reynolds in 1987 [1]. This algorithm has allowed computers to simulate how flocks of autonomous agents react to their surroundings and collectively exhibit behaviour which is much more complex and interesting than the individual agents are capable of. While flocking has been simulated for almost three decades it remains a computationally expensive problem which also scales badly as the number of agents in a given simulation increases.

In this dissertation a new approach has been considered in order to tackle the inefficiency problem which prevents flocking behaviour from being fully utilized in real time applications such as video games. This new approach will take advantage of two-dimensional cellular automata which due to its inherent nature of producing complex behaviour from simple, discrete rule sets is a good candidate on which to develop a new flocking technique. Keeping in mind the increased demand for more complex physical simulations and special effects in real time applications it is the main aim of this dissertation to explore the application of cellular automata to the simulation of flocking behaviour. It is hoped that the new approach will be able to approximate flocking in a similar manner to the Boids algorithm while being efficient enough to use in real time applications. The Boids algorithm will also be implemented on order to provide a benchmark against which to test the new approach.