Dynamic Games with Neurosimulators and Grid Computing: 
The Game of Two Cars Revisited

Hans-Jörg von Mettenheim*    Michael H. Breitner†

Institut für Wirtschaftsinformatik der Universität Hannover
Königsworther Platz 1, D-30167 Hannover, Germany
http://www.iwi.uni-hannover.de
phone +49 511 762 4978, fax +49 511 762 4013

Abstract

The famous game of two cars is a pursuit-evasion dynamic game. In the extended version presented in this paper a correct driver (evader) on a freeway is faced with a wrong-way driver (pursuer), i.e., a person driving on the wrong side of the road. The correct driver tries to avoid collision against all possible maneuvers of the wrong-way driver and additionally tries to stay on the freeway. The game is not fully solvable. The state-space is cut by diverse singular manifolds, e.g., barriers, universal and dispersal manifolds. In the following, Stackelberg games are computed for several positions in the state-space. The resulting trajectories are then employed to synthesize optimal strategies with neural networks. They output the turn rate and velocity change rate for evader and pursuer. A grid computing version of the neurosimulator FAUN is used. It allows significantly shorter computation times. Additionally it is possible to harness the power of the cluster of the School of Economics which has free computation time. The need of an external computation-only cluster or an expensive supercomputer is therefore reduced. Power saving is also implemented as the grid computing version allows to wake up and shut down the computers automatically. The resulting neural networks approximate the Stackelberg strategies very satisfyingly. Neural networks combined with grid computing can be a relevant alternative for the (fast) solution of otherwise not (fully) solvable dynamic games.

Keywords: Dynamic game; artificial neural networks; parallel computation; synthesis of optimal strategies; game of two cars; grid computing.

*Phd student, mettenheim@iwi.uni-hannover.de
†Full Professor for Business Administration and Information Systems Research, breitner@iwi.uni-hannover.de