ATR's ARTIFICIAL BRAIN ("CAM-Brain") PROJECT: A SAMPLE OF WHAT INDIVIDUAL "CoDi-1Bit" MODEL EVOLVED NEURAL NET MODULES CAN DO WITH DIGITAL AND ANALOG I/O

H. de Garis
ATR-HIP Labs
Japan
degaris@hip.atr.co.jp

A. Buller
Tech. Univ. of Gdansk
Poland
buller@pg.gda.pl

M. Korkin
Genobyte, Inc.
USA
korkin@genobyte.com

F. Gers
IDSIA
Switzerland
felix@idsia.ch

N. E. Nawa
ATR-HIP Labs
Japan
xnawa@hip.atr.co.jp

M. Hough
Stanford Univ.
USA
mhough@cs.stanford.edu

Abstract

This paper presents a sample of what evolved neural net circuit modules using the socalled "CoDi-1Bit" neural net model can do. This work is part of an 8 year research project at ATR which aims to build an artificial brain containing a billion neurons by the year 2001, that will be used to control the behaviors of a kitten robot "Robokoneko". It looks as though the figure is more likely to be 40 million, but the numbers are not of great concern. What is more important is the issue of evolvability of the cellular automata (CA) based neural net circuits which grow and evolve in special FPGA (Field Programmable Gate Array) hardware, at hardware speeds (e.g. updating 150 billion CA cells per second, and performing a complete run of a genetic algorithm, i.e. tens of thousands of circuit growths and fitness evaluations, to evolve the elite neural net circuit in about 1 second). The specialized hardware which performs this evolution is labeled the CAM-Brain Machine (CBM). It implements the CoDi-1Bit model, and was delivered to ATR in May 1999. The CBM should make practical the assemblage of 10,000s of evolved neural net modules into humanly defined artificial brain architectures. For the past few months, the latest hardware version of the CBM has been simulated in software to see just how evolvable and functional individual evolved modules can be. This work reports on some of the results of these simulations, for which the input/output is either binary or analog.