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EVOLUTION OF NEURAL CONTROLLERS IN REAL MOBILE ROBOTS FOR TASK SWITCHING BEHAVIORS

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Abstract. *An important issue in learning and evolution of neural controllers in simulated environments is their performance in real environments. While evolution and learning of single behaviors using real robots has been conducted in previous approaches, at the best of authors' knowledge there is no previous work on evolution of neural controllers for multiple task performance using real robots. In this paper, we employed multiobjective evolutionary computation to evolve neural controllers using e-puck robots. The tasks are selected such as the sensory inputs of the neural controller are very difficult to build in a simulated environment.*

Keywords: Evolution, Real robot, Task switching

1. **Introduction.** Evolution and learning have given good results for robot learning behaviors [1-3]. Nevertheless, the most of previous approaches are conducted in a simulated environment due to the long time required by both algorithms to converge to the optimal behavior. In order to improve the performance, different approaches have been proposed, such as adding appropriate noise to sensory readings [4,5], switching between simulation and hardware evolution [6], and combining learning and evolution [7]. However, often the optimal neural controllers generated in simulated environment, perform poorly when they are transferred in the real environment. In addition, robots operating in everyday life environments must be equipped with different kind of sensors some of them very difficult to build in a simulated environment, such as light sensors or microphones. In order to overcome the above problems, it would be advantageous to conduct learning of different behaviors using real robots.

In our previous work [8], we evolved neural controllers in a simulated environment for multiple task performance. We evolved neural controllers for the Cyber Rodent robot that has to perform multiple tasks simultaneously. In our simulated environment, random noise was added to the sensory data. In addition, during the hardware implementation, the noise in the calculated angle and the distance was reduced by careful calibration of the camera. However, in recent days, the robots are expected to perform a wide range of tasks, which require a wide of range of sensors and actuators [9,10]. Therefore, developing a robot simulator, which would be very similar with the real robot, is very difficult to be