

Evolving Neural Arrays

A new mechanism for learning complex action sequences

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Abstract

Incremental evolution has proved to be an extremely useful mechanism in complex actions sequence learning. Its performance is based on the decomposition of the original problem into increasingly complex stages whose learning is carried out sequentially, starting from the simplest stage and thus increasing its generality and difficulty.

The present work proposes neural array applications as a novel mechanism for complex actions sequence learning. Each array is composed by several neural nets obtained by means of an evolving process allowing them to acquire various degrees of specialization. Neural nets constituting the same array are organized so that, in each assessment, there is only one in charge of its response.

The proposed strategy is applied to problems presented by obstacle evasion and target reaching as a means to show the capability of this proposal to solve complex problems. The measurements carried out show the superiority of evolving neural arrays over traditional neuroevolving methods that handle neural network populations – SANE is being particularly used as a comparative reference due to its high performance.

Neural array capability to recover from previous defective evolving stages has been tested, evincing highly plausible final successful outcomes – even in those adverse cases.

Finally, conclusions are presented as well as some future lines of work.

Key Words: Evolving Neural Nets, Learning, Complex Actions Sequence Learning, Incremental Evolution, Genetic Algorithms.

1 Introduction

Evolving Neural Networks (ENN) are a particular case of artificial neural networks (ANN), where the adaptation is carried out by training and, mainly, by evolution [15]. Evolution has been applied to define several aspects of the neural network: to obtain connection weights, architecture designs, initial parameters values, learning rules, etc. [16]. The common practice implies taking the best individual of the last generation leaving aside all those neural networks that have an inferior fitness value.

However, from the biological point of view, the brain's activity does not seem to come up from a single neural network. The studies carried out in humans by Jackson and Penfield in the '50s, revealed the existence of a significant functional allocation in the cerebral cortex. Later, other neuronal centers have been discovered in the brain related to emotions and the intellectual activities [13]. In this way, it is likely that the brain is composed by many different parallel and distributed systems that carry out well-defined functions. Thus, the emulation of the human brain by means of several artificial neural networks might be suitable.

