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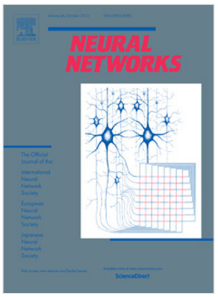

Born to learn: The inspiration, progress, and future of evolved plastic artificial neural networks

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Born to Learn: the Inspiration, Progress, and Future of Evolved Plastic Artificial Neural Networks

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Abstract

Biological neural networks are systems of extraordinary computational capabilities shaped by evolution, development, and lifelong learning. The interplay of these elements leads to the emergence of biological intelligence. Inspired by such intricate natural phenomena, Evolved Plastic Artificial Neural Networks (EPANNs) employ simulated evolution in-silico to breed plastic neural networks with the aim to autonomously design and create learning systems. EPANN experiments evolve networks that include both innate properties and the ability to change and learn in response to experiences in different environments and problem domains. EPANNs' aims include autonomously creating learning systems, bootstrapping learning from scratch, recovering performance in unseen conditions, testing the computational advantages of particular neural components, and deriving hypotheses on the emergence of biological learning. Thus, EPANNs may include a large variety of different neuron types and dynamics, network architectures, plasticity rules, and other factors. While EPANNs have seen considerable progress over the last two decades, current scientific and technological advances in artificial neural networks are setting the conditions for radically new approaches and results. Exploiting the increased availability of computational resources and of simulation environments, the often challenging task of hand-designing learning neural networks could be replaced by more autonomous and creative processes. This paper brings together a variety of inspiring ideas that define the field of EPANNs. The main methods and results are reviewed. Finally, new opportunities and possible developments are presented.

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