PLENARY SPEAKER

MODELS OF LEARNING AND EVOLUTION: WHAT DO THEY HAVE IN COMMON?

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Keywords: replicator equation, Bayesian models, Hebb synapse, reinforcement, adaptation.

ABSTRACT

In the past several scholars have noted some relationship between learning and evolution and various levels of abstraction. William James was wondering about the possible role of a process analogous to evolution of natural selection in the brain, whereby adaptive answers to complex problems might arise. Changeux and Edelman were considering selectionist approaches to brain dynamics during its development: while their approach has been experimentally validated, replicator dynamics has not been entertained by them. The first question is then whether true evolutionary dynamics can unfold in the brain (evolution in learning). On the flip side of the coin Richard Watson has raised the idea whether associative, reinforcement and deep learning dynamics could play a role in the evolution of ecosystems, developmental genetic regulatory networks and evolutionary transitions in individuality (learning in evolution). A third, potentially unifying theme is the analogy between Bayesian inference and the discrete-time replicator equation: here the question is whether similar algorithms could realize either of them in some natural systems.

I shall review the relevant concepts and mathematical formulations behind these ideas. Open questions will be raised that, if answered positively, could entail that there will ultimately be only one unified theory including evolution and learning as subcases.

Acknowledgements: This project is supported by the Templeton World Charity Foundation (Learning in evolution, evolution in learning) and by funded by National Research, Development, and Innovation Office Grants NKFI-K119347 and GINOP-2.3.2-15-2016-00057.