Swapnil Lad
CS 3790 TA: Lu Meng

The Evolution of Learning through Evolution

In his 2015 publication, Rafael Yuste describes the basis of the neuron doctrine and its implications on the development of neural networks. Yuste explains that the modern understanding of these structures is actually more synonymous to an. “ensemble of neurons, rather than individual cells” (Yuste 1). In an attempt to build on these findings, Anthony Zador, in his 2019 article, provides commentary on how the complex nature of learning in neural networks has grown to be built largely on the findings in animal brains and development.

For many decades, researchers believed that the basis of supervised learning should be directly analog to the learning of animals from their experiences in order to mimic complex thought processes. However, Zador further advances this by describing that an animal’s life “experiences represent only a small fraction of the data that contribute to its fitness.” The real basis of learning in an animal is a combination of the events they observe and the generations of evolution, building genetic predispositions and elements such as instinct, reproductive drive, etc. Neural networks of the past that were designed to mirror the learning of animal over its lifetime were therefore incomplete in their construction. In order to accurately encapsulate the entire learning process more accurately, modern ANNs must “mimic both what is learned during evolution and the process of learning within a lifetime.” The major basis for a model of this nature is the use of an optimization process that is able to contain both these aspects of learning.

Zador builds on many of Yuste’s claims by describing the lengths to which neural networks have grown. One of the most critical elements in this is the realization that the research in neural networks has itself evolved though the introduction of biological evolution in modern models.

References

Zador, A.M. A critique of pure learning and what artificial neural networks can learn from animal brains. *Nat Commun* **10,** 3770 (2019). https://doi.org/10.1038/s41467-019-11786-6