**Towards Artificial General Intelligence with Neural Cellular Automata**

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Cellular Automata (CA) are interesting models of computation, where the actual information processing, transmission of information and storage are massively distributed and parallelized, and each component of the system interacts only locally with the closest neighbors. One such example of CA is the Game of Life, which is proven to be computationally universal. Another example, in the case of a continuous CA is Lenia [1]. A recent work by Google is Growing Neural Cellular Automata (NCA) [2], a continuous CA where neural networks are trained to control the growth process of given shapes, and to regenerate when damaged. Our follow-up work uses NCA for reinforcement learning [3]. Cellular substrates may constitute an “AI generating algorithm” [4].

In this project, the goal is to extend such works. Several directions are available for different groups:

* NCA that can produce long-term emergent dynamics
* NCA as an embodied AI agent (brain and body)
* Adaptation and local learning in NCA
* Novelty search in NCA

[1] Chan, Bert Wang-Chak. "Lenia: Biology of Artificial Life." <https://chakazul.github.io/lenia.html> (an example video here <https://vimeo.com/440386996>)

[2] Mordvintsev, Alexander, et al. "Growing neural cellular automata." Distill 5.2 (2020): e23. <https://distill.pub/2020/growing-ca/>

[3] <https://avariengien.github.io/self-organized-control/>

[4] <https://arxiv.org/pdf/2101.07627.pdf>