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1 Can we approach the growth rules of neural networks in simulated self assembling systems for RC

Many systems are self assembling, but few are as complex in behavior as neural cultures. By understanding what governs the process of self assembling we can apply some of these lessons when designing unorthodox computer architectures, and they may give insight into developmental problems in the brain and possible cures.

1.1 Are some networks more successful in approximating neural culture behavior, are CAs inherently worse than RNNs?

Use simulation on different classes of reservoir with growth rules as search space for growth rules to optimize for target behavior

1.2 Will neural cultures display differences in response to environment (devo)

Run experiments on neural networks submitted to different stimuli, ranging from chaotic to monotonic or even no stimuli. Use measures such as signal compressibility, entropy etc (information theory) to quantify differences in networks.

2 Exploring R-topologies for hitting moving targets in RC.

Working with neural cultures necessitates new methods of RC, however the research questions in this section primarily deals with simpler models of reservoirs such as RBNs where random alterations of the network can be used to simulate neural reservoirs.

2.1 Can a moving target model better interface with evolving reservoirs?

When interfacing with neural cultures there is none of the conveniences of simulated reservoirs. There is no reset button, cultures evolve and may even die. This makes the culture a "moving target", which needs a different approach.

2.2 Can the hidden layer model be applied to reservoirs?

One possible approach to the moving target problem is to add "static" reservoirs which can be computer controlled. Thus even with dynamic behavior they can always be resest to a known configuration. These static reservoirs can then fulfill a role analogous of input and output neurons in artificial neural networks.

3 Method

Proof of concept phase, showing that agents can be enhanced in some meaningful way by utilizing RC systems, both artificial and biological. Tasks to be solved by agents must be classified in complexity needed to solve them. For instance a simple wall avoiding agent requires no memory or self-modification, a simple ruleset will suffice. An agent exploring a cave however will need some sort of memory module to remember where it has been, thus an RC agent solving a maze exploration task shows that RC systems can remember. Even more difficult tasks such as competitive games may require the RC agent to modify its behavior, posing an even more difficult problem-class.

I also take a lot of drugs

4 Lit review

Pretty much just read papers suggested by advisors. The path to the front is short in RC.