Twitter Thread by Carlos E. Perez



Carlos E. Perez
@IntuitMachine

A children's book written in 1954 inspired by Wiener's Cybernetics that explains some common day analog systems:

Analog computation originally meant the construction of a simulation of another system by means of a mechanical or electrical system that represented the same dynamics as the physical system. That is an analog of what's being simulated.

Nobert Wiener generalized this idea in Cybernetics to describe control systems that through negative feedback promoted stability. https://t.co/15doR3gxUk

W.Ross Ashby argued that negative feedback was insufficient for maintaining the stability (homeostasis) of complex system. Ashby proposed the Law of Requisite Variety. https://t.co/T4KbmZNLpL

These machines that 'seem to think' are examples of what was known as analog computation. Cybernetics, control theory, biology are examples of analog computation. But what does this mean other than being the opposite of discrete/digital computation?

Computation in an abstract sense is the interplay of intention and mechanism. That intention may be homeostasis, perception or action. Analog systems use mechanisms of this world to implement the mechanisms required to fulfill intentions.

This is in contrast with discrete digital systems that operate in a virtual reality distinct from their underlying implementation. The only virtual analog systems we have are the kinds that are simulated using digital systems.

The other distinction of an analog system is that perception and action can be continuous. Said differently, continuity has meaning in an analog system. In fact, I would argue that the basis of meaning is dependent on continuity.

A digital system (language as an example) has meaning as a consequence of standardization. That is, agreed-upon norms of interpretation. Meaning in digital systems is an emergent feature of collective behavior.

Collectives are composed of individuals that create meaning through the observation of continuity in this world. What Peirce identifies as icons and indexes are signs that express continuity. That of a similarity relationship or a causal relationship.

Prior to the emergence of brains, organisms interacted with this world through hardwired mechanisms. This mirrors how analog systems interact with the world through the physical mechanisms of this world.

Brains however introduce an entirely new behavioral repertoire that is divorce from actual mechanics. Brains predict their analog realities through mechanisms that are yet to be understood.

Brains are able to virtualize analog realities in a manner very different from how digital computers virtualize analog reality. (Left to reader why this is obvious)

We have two options of how to brains could be implemented. Brains could be either (1) analog machines that virtualize analog realities or (2) digital machines that virtualize analog realities. The spiking behavior empirical observed appears to indicate that it is of the 2nd kind.

However, Deep Learning appears to allude to an analog machine virtualizing an analog reality. This is difficult to understand, but that is what Deep Learning appears to show.

However, there is a 3rd option. That is, the brain is both digital and analog. Biology employs the strategy of code duality across multiple scales. My expectation is that this is also the brain's strategy.

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