

Is a Computer Smarter than a Fruit Fly (*Drosophila m.*)?

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10th International Conference
SCIENCE & SCIENTIST 2022:
Difference between Artificial
& Natural Intelligence - II





intelligence:

Oxford Advanced
Learner's Dictionary

the ability to learn, understand and think in a logical way about things; the ability to do this well.



the ability to learn or understand or to deal with new or trying situations.



intelligence \neq code



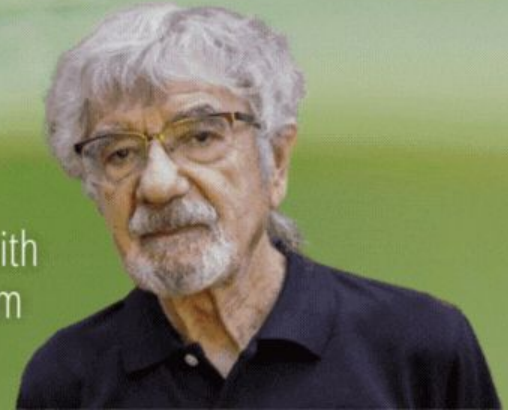
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Function Follows Form — Intelligence Follows Function



- A Fruit Fly's unique lifestyle is specifically adapted to its particular body
- They develop intelligent strategies to navigate life events based upon what their bodies are capable of
- Intelligence gradually develops along with the body, through experience, as a dynamic living unity

Humberto Maturana (1928–2021) was a Chilean biologist and philosopher. Along with Francisco Varela and Ricardo B. Uribe, he was particularly known for creating the term "autopoiesis" describing the self-generating, self-maintaining capacity of lifeforms.

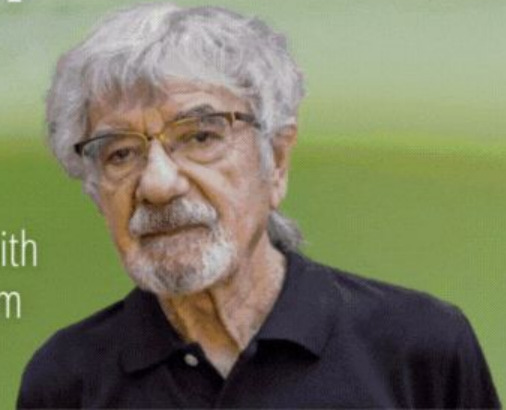


Function Follows Form — Intelligence Follows Function



- A computer has a rigid mechanical body
 - Artificial "intelligence" is programmed or externally applied to the computer
 - Machines can never have intelligence, which requires living experiences (subject-object relations) to develop
- Dualistic thinking is fundamental to computer architecture as hardware and software

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"Form follows function — that has been misunderstood. Form and function should be one, joined in a spiritual union."

: Frank Lloyd Wright (1867-1959), the American architect who designed the Guggenheim Museum in New York City

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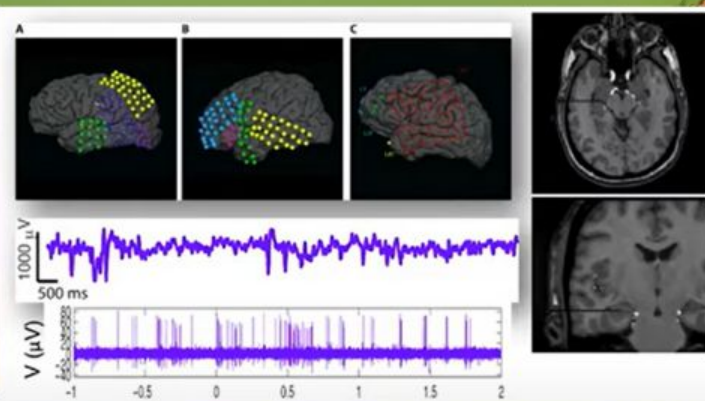
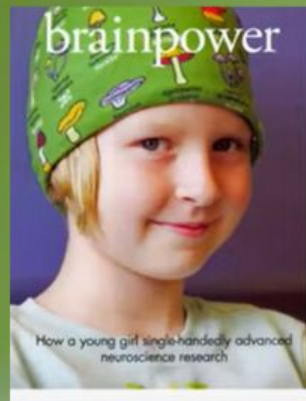
German philosopher G.W.F. Hegel's (1770-1831) dialectic approach explains how mind-body dualism is sublated in the dynamic identity in difference of activity



Neural Networks & Intelligence — Correlation Is Not Causation

- "Neural nets are a means of doing machine learning, in which a computer learns to perform some task by analyzing training examples"
- "Modeled loosely on the human brain, a neural net consists of thousands or even millions of simple processing nodes that are densely interconnected"
- "The point [is] to suggest that the human brain could be thought of as a computing device"

Hardesty, Larry. (2017). "Explained: Neural networks." MIT News Office. <https://news.mit.edu/2017/explained-neural-networks-deep-learning-0414>



- "A neural network can learn without receiving explicit instructions"

Fjelland, Ragnar. (2020). "Why general artificial intelligence will not be realized." Nature. <https://www.nature.com/articles/s41599-020-0494-4>

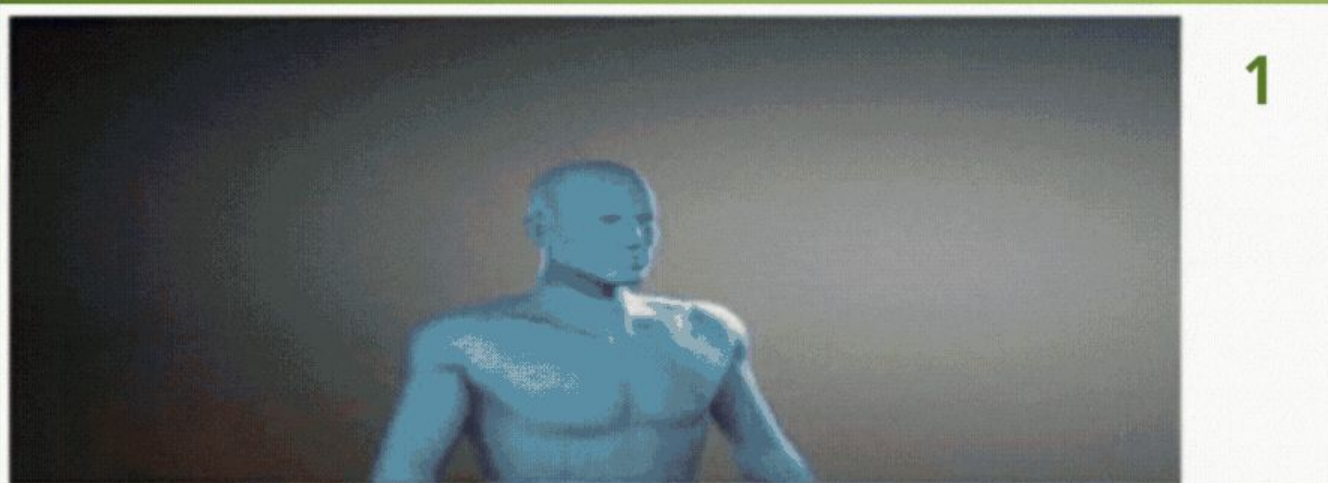
Kreiman, Gabriel. (2021). "HOW BRAIN COMPUTATIONS CAN INSPIRE NEW PATHS IN AI: PART 1" MIT CBMM. <https://cbmm.mit.edu/video/how-brain-computations-can-inspire-new-paths-ai-part-1>

Neural Networks & Intelligence — Correlation Is Not Causation

“*The problem facing the development of expert systems, that is, systems that enable a computer to simulate expert performance (for example medical diagnostics) is that an important part of the expert knowledge is tacit.* If experts try to articulate the knowledge they apply in their performance, they normally regress to a lower level. Therefore, according to Hubert and Stuart Dreyfus, *expert systems are not able to capture the skills of an expert performer.* We know this phenomenon from everyday life. Most of us are experts on walking. However, if we try to articulate how we walk, we certainly give a description that does not capture the skills involved in walking.”

Fjelland, Ragnar. (2020). "Why general artificial intelligence will not be realized." Nature. <https://www.nature.com/articles/s41599-020-0494-4>

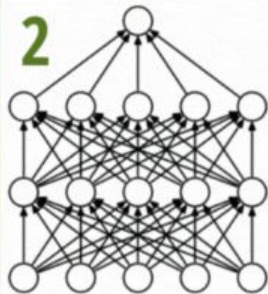
Neural Networks & Intelligence — Correlation Is Not Causation



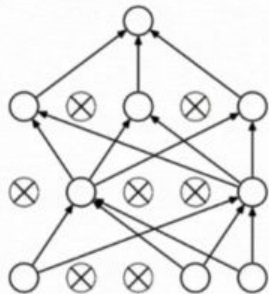
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- Simulating object detection & object classification

1) Boyden, Ed. (2022). "MAPPING, ANALYZING, AND EMULATING BRAIN COMPUTATIONS." MIT CBMM. <https://cbmm.mit.edu/video/mapping-analyzing-and-emulating-brain-computations>



(a) Standard Neural Net



(b) After applying dropout.

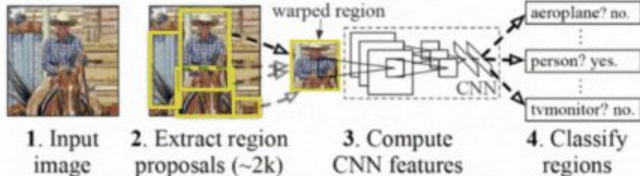
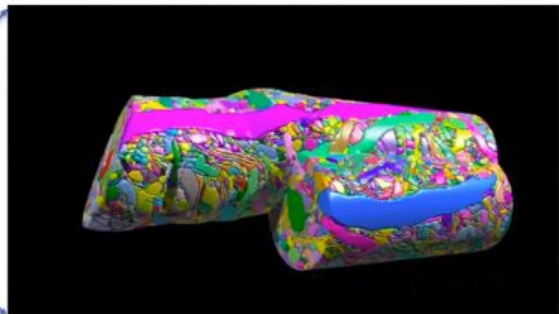


Figure 1: Object detection system overview. Our system (1) takes an input image, (2) extracts around 2000 bottom-up region proposals, (3) computes features for each proposal using a large convolutional neural network (CNN), and then (4) classifies each region using class-specific linear SVMs. R-CNN achieves a mean

2) Roig, Gemma. (2016). "Deep Neural Networks." MIT. https://cbmm.mit.edu/sites/default/files/documents/deep_neural_networks_tutorial.pdf

Neural Networks & Intelligence — Correlation Is Not Causation

Connectomics!



See Jeff Lichtman's talk

Kasthuri et al, Nature 2015



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BMM Summer Course 2021

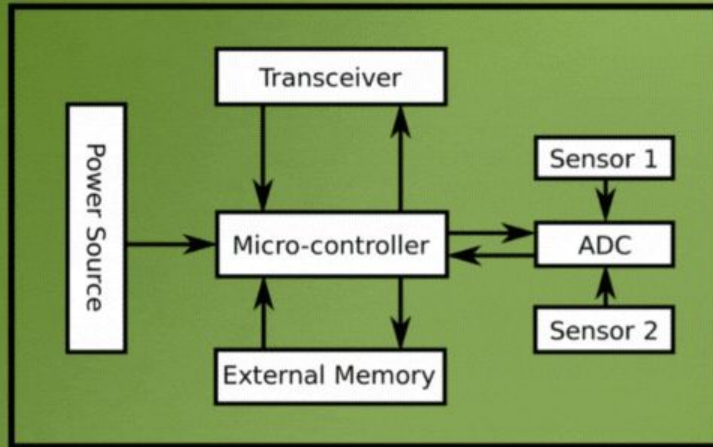
How brain computations can
inspire new paths in AI: Part 1

Gabriel Kreiman

Harvard University
Children's Hospital Boston

Kreiman, Gabriel. (2021). "HOW BRAIN COMPUTATIONS CAN INSPIRE NEW PATHS IN AI: PART 1" MIT CBMM. <https://cbmm.mit.edu/video/how-brain-computations-can-inspire-new-paths-ai-part-1>

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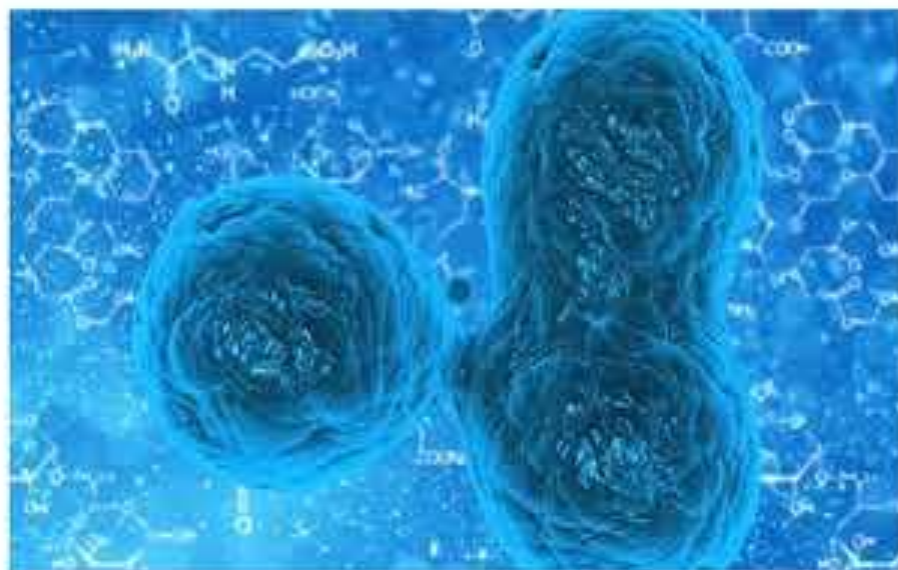
Drosophila m.

- Multi-sense perception
- Aerial navigation
- Decision making
- Reproduces itself
- Internal memory
- Internal power source
- Consumes a few microwatts of power

Sensor Node

- Limited sense capacity
- External memory
- External power source
- Consumes 1 milliwatt of power (1000x more than *Drosophila*)





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