On AGI architecture

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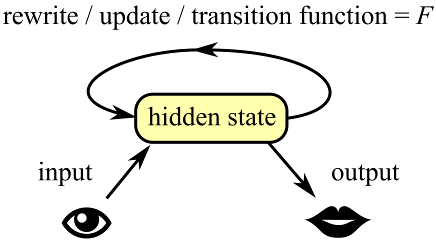
Hello friends ☺️
I have made some intermediate progress recently, which I share below, and also hope to find collaborators.

The simplest AGI architecture

- AGI recurrent

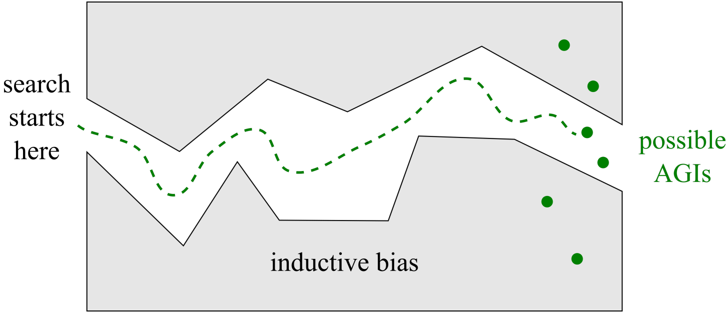


(1)

- Bellman
- Transition function F
- no free lunch inductive bias

No free lunch (NFL)

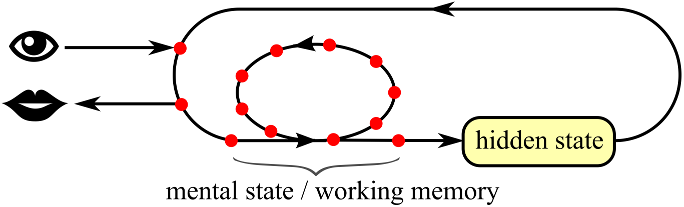
- no free lunch
- AGI bias



(2)

- F (sparse) (deep)
- bias 😖

- working memory ($\bullet$) (101010)

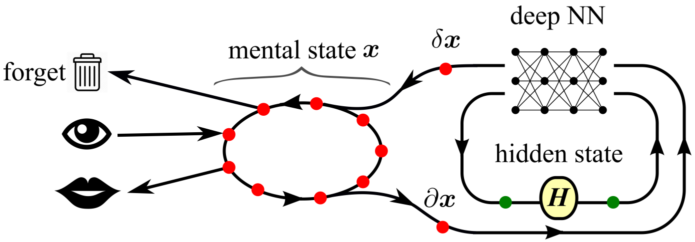


(3)

-
- BERT BERT
- BERT AGI BERT

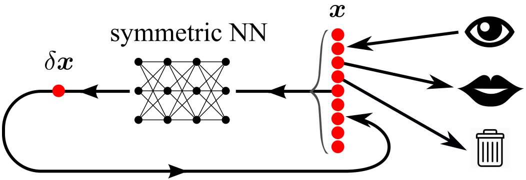
$$\square \xrightarrow{\text{loop 1}} \square \xrightarrow{\text{loop 2}} \boxed{\text{mental state}} \tag{4}$$

- (3)



(5)

- symmetric NN



(6)

- (5) (6) 😖

- **Bellman**

$$\boxed{\text{Bellman}} \qquad S_t(x) = \max_u \{L(x,u) + \gamma S_{t+1}(x)\} \tag{7}$$

- Bellman **Hamilton-Jacobi** 1970s Kalman Pontryagin Hamilton-Jacobi-Bellman (HJB)

$$\boxed{\text{Hamilton-Jacobi}} \qquad \frac{\partial S(x,t)}{\partial t} = -H \tag{8}$$

- Lagrangian L Hamiltonian H

$$L = \text{K.E.} - \text{P.E.} \quad , \qquad H = \text{K.E.} + \text{P.E.} \tag{9}$$

K.E. = kenetic energy, P.E. = potential energy.

-

- Hamilton-Jacobi Schrödinger exact $\Psi = e^{-i\hbar S}$

$$\boxed{\text{Hamilton-Jacobi}} \quad \frac{\partial S}{\partial t} = -H \quad \Rightarrow \quad i\hbar\frac{\partial \Psi}{\partial t} = H\Psi \quad \boxed{\text{Schrödinger}} \tag{10}$$

- (quantization) [Field 2010]
- AI Hilbert Schrödinger
- Schrodinger (imaginary time) (diffusion)

$$\boxed{\text{wave eqn.}} \quad \frac{\partial \Psi}{\partial t} + i\Delta\Psi = 0 \quad \leftrightsquigarrow \quad \frac{\partial u}{\partial t} + \Delta u = 0 \quad \boxed{\text{heat eqn.}} \tag{11}$$

- AI discrete Laplacian Δ discrete Schrödinger operators graph graph
- 😖

Topos

Topos Lawvere 1950s
topos (objects)

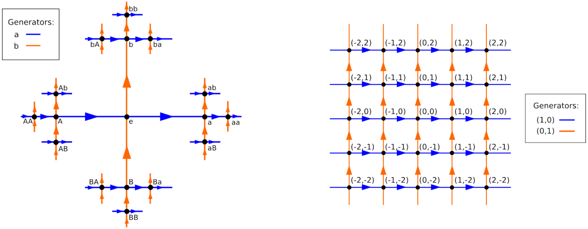
- Cartesian product $A \times B$ $A \wedge B$
- exponentiation $A \longrightarrow B = B^A$ $A \Rightarrow B$
- subobject classifier $A \hookrightarrow B$ $A \subseteq B$

Topos relation graphsalgebras

F $U \xrightarrow{F} V$ exponentiation V^U U, V $A \times B$ embed $A \times B = B \times A$ Abel

(permutation invariance)

- Word2Vec Poincaré disc / hyperbolic space [Nickel and Kiela 2017]
-   vectors hyperbolic space
- F_2 Cayley   Cayley



(12)

- F_n Cayley hyperbolic disc F_n Abelianization $F_n^{\mathrm{Ab}} \cong \mathbb{Z}^n = \mathbb{Z} \times \ldots \mathbb{Z}$ n- grid
- (representation theory) Abel   1- F_n^{Ab} n 1-

- $\mathbb{Z}^n$ fractal fractals
- weights-sharing permutation invariant (= Symmetric NN)
- activation function = polynomial
- 1-2 = 2
- sparse bias
-

Field, JH (2010). “Derivation of the Schrödinger equation from the Hamilton-Jacobi equation in Feynman’s path integral formulation of quantum mechanics”. In: *European Journal of Physics*.

Nickel, Maximillian and Douwe Kiela (2017). “Poincaré embeddings for learning hierarchical representations”. In: *Advances in neural information processing systems*, pp. 6338–6347.

☺️