Symbolic vs. Subsymbolic AI

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Symbolic vs. Subsymbolic

Explicit symbolic programming
Inference, search algorithms
AI programming languages
Rules, Ontologies, Plans, Goals...

Bayesian learning
Deep learning
Connectionism
Neural Nets / Backprop
LDA, SVM, HMM, PMF, alphabet soup...
# Symbolic vs. Subsymbolic

<table>
<thead>
<tr>
<th>Symbolic Advantages</th>
<th>Subsymbolic Advantages</th>
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<tbody>
<tr>
<td>Introspection more useful for coding</td>
<td>More robust against noise</td>
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<tr>
<td>Easier to debug</td>
<td>Better performance</td>
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<tr>
<td>Easier to explain</td>
<td>Less knowledge upfront</td>
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<tr>
<td>Easier to control</td>
<td>Easier to scale up</td>
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<tr>
<td>Not so Big Data</td>
<td>Big Data</td>
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<tr>
<td>More useful for explaining people’s thought</td>
<td>More useful for connecting to neuroscience</td>
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<tr>
<td>Better for abstract problems</td>
<td>Better for perceptual problems</td>
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Henry Lieberman • MIT
What’s the goal of AI?

To have computers do things, that, if people did them, we would consider intelligent

(subject to “Disappearing AI”)

To explain how human intelligence works, and reproduce it in computers
What is the appropriate level for describing intelligence?

We’re just bags of chemicals.... Can we explain intelligence in terms of chemistry?

We’re just a bunch of connected neurons.... Can we explain intelligence in terms of wiring?

We’re just information processors... Can we explain intelligence in terms of information?

We’re just \{math, bio, genetic, social, \ldots\}
Symbolic vs Subsymbolic
Newell & Simon: The Physical Symbol System Hypothesis

Physical symbol system

From Wikipedia, the free encyclopedia

See also: Philosophy of artificial intelligence and Data system

A physical symbol system (also called a formal system) takes physical patterns (symbols), combining them into structures (expressions) and manipulating them (using processes) to produce new expressions.

The physical symbol system hypothesis (PSSH) is a position in the philosophy of artificial intelligence formulated by Allen Newell and Herbert A. Simon. They wrote:

"A physical symbol system has the necessary and sufficient means for general intelligent action."

— Allen Newell and Herbert A. Simon

This claim implies both that human thinking is a kind of symbol manipulation (because a symbol system is necessary for intelligence) and that machines can be intelligent (because a symbol system is sufficient for intelligence).
Reconciling approaches

Top down vs. bottom up

Bits of the other approach are seeping into both sides

![Diagram showing the reconciliation of top-down and bottom-up approaches]

- Few to Many causes
- Small to Large scale of effect
- Easy, Linear, Statistical vs. Intractable
- Traditional Computing vs. Classical AI
- Ordinary Qualitative Reasoning vs. Symbolic Logical Reasoning vs. Case Based Reasoning
- Connectionist Neural Network Fuzzy Logic vs. Analogy Based Reasoning Society of Mind

Find Better Representation!
Peace!