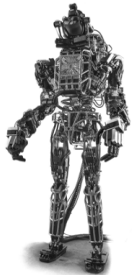COGSCI 300
Intelligence in Machines, and Other Animals

Please turn off and put away all electronics.

Syllabus: find on Web page for Paul Thagard

1

Questions

What is intelligence?

How does current and future machine intelligence compare with human intelligence?

How does animal (and plant?) intelligence compare with with human intelligence?

What is the ethical significance of intelligence?

Is machine intelligence a threat to humanity?

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Assignments

1. 100 word commentaries due at the beginning of each class, weeks 2-12, 10%.

2. 10-page essay, due in class, 40%.

3. 10-page essay, due last day of class, 50%, including proposal.

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What is Intelligence?

Definition: "the ability to learn or understand things or to deal with new or difficult situations".

3-analysis:

Exemplars (standard examples):

Typical features (prototypes):

Explanations:

What intelligence explains

What explains intelligence

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Psychological Theories

1. IQ

2. Sternberg triarchic: analytical, creative, practical

3. Gardner multiple: verbal, musical, mathematical, bodily, interpersonal, intrapersonal, naturalistic, spiritual

4. Other: social, emotional, mating

Discussion Question

Are plants intelligent? Why or why not?

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Mechanistic Explanation

How does a bicycle move?

Parts: frame, wheels, gears, chain, pedals, etc.

Structure: e.g. pedal connected to gear.

Interactions: e.g. pedal moves chain.

Changes: e.g. wheels turn.

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Psychological Explanation

How does a mind work?

Parts: representations, e.g. concepts, image, rules, analogies, emotions

Structure: representations have parts, relations

Interactions: procedures operate on representations

Changes: inferences
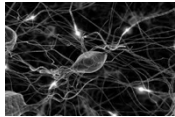
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Neural Explanation

How does a mind work?

Parts: neurons, neural groups, brain areas

Structure: neurons are connected by synapses between axons and dendrites

Interactions: neurons excite and inhibit each other

Changes: inferences are changes in patterns of firing

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Computational Explanation

How does a computer work?

Parts: data structures, e.g. strings, numbers, lists

Structure: data have parts, relations

Interactions: algorithms operate on data

Changes: calculations, inferences

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Machine Intelligence

1956: first AI conference, Dartmouth

1960s: problem solving

1970s: expert systems

1980s: neural networks, machine learning

2000s: statistical approaches, Bayesian robots

Today: deep learning, Google, Facebook

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Advantages of Computers

1. Speed of processing: gigahertz (billions of times per second) vs. neuron firing 200 times

2. Storage: access to millions of pages

3. Transfer: what one computer knows can be downloaded to another

4. Immortality

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Scary Argument

1. Machines will eventually achieve human level intelligence (Moore's law, etc.).

2. Then they will quickly achieve superintelligence, much superior to humans.

3. Superintelligent machines will dominate humans and supersede them.

4. So machine intelligence is evil.

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Why is AI slow?

1. Lack of understanding of basic intelligent capacities of humans, e.g. reasoning, language.

2. Limitations of machines: emotions, creativity, consciousness.

3. Limited speed and storage capacity.

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Discussion Question

How big a threat to humanity is the development of artificial superintelligence?

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Basic Computer Ideas

1. Computer program = data structures + algorithms

2. Data structure = representation, e.g. number, string, list, object

3. Algorithm: step-by-step mechanical procedure for accomplishing some task

4. Search: efficiently work through a space to solve a problem

5. Parallel processing: do many things at once.

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