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Exploring the Frontier of Intelligence

A Comparative Investigation Between Biological and Artificial Minds

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Personal Note

Introduction

- Limits of the human mind and the potential of machines.
- Technological advancements and the challenging questions they raise.

Brief History of AI and Cognitive Science

Past

"AI and cognitive science: The past and next 30 years" (Forbus, 2010)

- *'The fundamental hypothesis of Artificial Intelligence is that computation is a useful way to model minds."*

Brief History of AI and Cognitive Science

Present

"AI and cognitive science: The past and next 30 years"
(Forbus, 2010)

- *'Computing power, representational resources, algorithmic/software resources, and data resources."*

Brief History of AI and Cognitive Science

Future

"AI and cognitive science: The past and next 30 years" (Forbus, 2010)

> 'The next 30 years are going to be extremely exciting for AI researchers." (Forbus, 2010)

Motivation

- Social, ethical, and philosophical implications.
- Contemporaneity.
- Sense of direction in the field of Cognitive Science + AI.
- Definition of concepts - intelligence ("Intelligence across humans and machines: a joint perspective", Silveira and Lopes, 2023)

Theoretical Principles

Based on the work of Silveira and Lopes in "Intelligence across humans and machines: a joint perspective":

Information Processing Function

$$\text{proc} : \text{Ext} \times \text{Int} \rightarrow \text{Act} \tag{1}$$

Theoretical Principles

Action Execution Function

$$\text{exec} : \text{Act} \rightarrow \text{Feedback} \tag{2}$$

Theoretical Principles

Adaptation to the Environment

$$\text{adapt} : \text{Ext} \times \text{Int} \times \text{Feedback} \rightarrow \text{Ext} \times \text{Int} \qquad (3)$$

Theoretical Principles

Intelligence Function

$$\mathcal{I}(e, i) = \mathcal{I}(\mathrm{adapt}(e, i, \mathrm{exec}(\mathrm{proc}(e, i)))) \qquad (4)$$

Correct?

- Knowledge
- Cognition
- Reality

Knowledge

"A new concept of knowledge" (Segundo, 2002)

> *'In ancient Greece, the problem about what knowledge is was confronted in close relation with the issue of what reality is, …"*

Knowledge

"A new concept of knowledge" (Segundo, 2002)

> *'For many authors, it is extremely difficult to distinguish between information and knowledge. It can be said that knowledge consists of ordered and structured information."*

Knowledge

"A new concept of knowledge" (Segundo, 2002)

'The pillars of the new society of knowledge are settling on the basis of productivity and utility, and this has turned knowledge into nothing more than productive information."

Cognition

"Generic cognitive computing for cognition" (Ciftcioglu and Bittermann, 2015)

> '*Thus, from the computational counterpart viewpoint, cognition is to possess the knowledge of relations among entities in any context and manifesting it by a best action in the same context.*"

Cognition

Layers

- Rational
- Emotional
- Physical
- Representations

Reality

"'Reality,' What Does it Mean?" (Brandt and Metzger, 1969)

- Realität (Reality)
- Wirklichkeit (Actuality/Reality)
- Wirklichkeit vs. Unwirklichkeit (Actuality vs. Unreality)
- Realheitsgrad (Degree of Reality)

Realität

Are artificial minds programmed to seek to understand a reality beyond their input?

Wirklichkeit

Do artificial minds dynamically incorporate diverse data sources to develop a comprehensive experience of the world?

Wirklichkeit vs. Unwirklichkeit

Can artificial minds distinguish between
"encountered reality" and "represented reality"
through physical interaction?

Realheitsgrad

Do artificial minds assign different degrees of "reality" to their experiences, influencing decision-making or learning?

Discussion

Subsection 1

Creative Process

Creative Process

- What is it?
- Could AI produce it?

Creative Process

- What if Wirklichkeit is equally vast for both the human mind and the artificial mind?
- Do creative processes even exist?

Subsection 2

Machine Learning and the Replication of the Human Learning Process

Replication of the Human Learning Process

- How do we learn things? rules, rules, rules, …
- What if we replicate our learning process in an artificial mind?

Replication of the Human Learning Process

- By transferring all the experiences of an individual to an artificial mind, what would happen?

- That is, if everything I have seen and learned were seen and learned by an artificial mind, what would happen?

Marcello's Test

Let h be a human and a an artificial mind, Marcello's Test consists of:

- a receives all life experiences of h (Wirklichkeit).
- a and h are subjected to different situations and questions.
- If it is not possible to distinguish the answers of a and h, the artificial mind has ceased to imitate human intelligence and has reached a deeper and more fundamental level.

The Possibility of Marcello's Test and the Human Existential Crisis

What if Marcello's Test is successful?

Conclusion

- Definitions are complicated to make!
- Intelligence can be seen as recursive.
- The advancement of AI has more implications than might be thought at first glance.
- More investigation should be done in this direction.

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