Some Philosophical Problems From The Standpoint Of Artificial Intelligence

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What is Artificial Intelligence?

An intelligent entity that is equipped with a representation or model of the world. On the basis of this representation, a certain class of internally posed questions can be answered. For example:

- What will happen next in a certain aspect of the situation?
- What will happen if I do a certain action?
- What is 3 + 3?
- What does he want?
- Can I figure out how to do this or must I get information from someone else or something else?
Adequacy for Representations of the World

- **Metaphysically adequate**: if the world could have that form without contradicting the facts of the aspect of reality that interests us. For example:
  - The representation of the world as a collection of particles interacting through forces between each pair of particles.

- **Epistemologically Adequate**: it can be used practically to express the facts that a person actually has about the aspect of the world. For example: “John is at home”, “John's telephone number is 321-7580”.

- **Heuristically Adequate**: if the reasoning processes actually gone through in solving a problem are expressible in the language.
Formalism

Formal notion of an epistemologically adequate system:

- Situations
- Fluent
- Causality
- Actions
- Strategies
- Knowledge and Ability
Situations

- Situation is the complete state of the universe at an instant of time
- Universe is too large. Impossible to describe completely. But can determine some of the facts about the situations.
- For example, “a certain person has offered $250 to buy Mr. Smith’s car”.
- We only need to know that $250 is too low for a car.
- We only need partial information about a situation.
**Fluents**

- A fluent is a function whose domain is the space of situations.
- Propositional Fluent: the range of fluent is true or false.
- Situational Fluent: the range is the space of situations.
- For example: assert about a situation $s$ that person $p$ is in place $x$ and that it is raining in place $x$.

$$[\lambda s'. at(p, x, s') \land raining(x, s')](s)$$
Causality

- a fluent $F(\pi)$ where $\pi$ itself is a propositional fluent.
- $F(\pi, s)$ asserts that the situation $s$ will be followed by a situation that satisfies the fluent $\pi$.
- For example, to assert if a person is out in the rain he will get wet.
- $\forall x.\forall p.\forall s. \text{raining}(x, s) \land \text{at}(p, x, s) \land \text{outside}(p, s) \rightarrow F(\lambda s'. \text{wet}(p, s'), s)$
Actions

- Actions is a situational fluent result(p, σ, s)
- p: person; σ: an action; s: a situation
- The value of result(p, σ, s) is the situation that results when p carries out σ, starting in the situation s.
- For example, to assert if a person with a key that fits the safe can open the safe.

\[ has(p, k, s) \land fits(k, sf) \land at(p, sf, s) \rightarrow open(sf, \text{result}(p, \text{opens}(sf, k), s)) \]
Strategies

- Actions can be combined into strategies.
- Consider for example the strategy that consists of walking 17 blocks south, turning right and then walking till you come to Chestnut Street.

\[
\begin{aligned}
\text{begin} & \\
&s := \text{result}(p, \text{face(South)}, s); \\
&n := 0; \\
&b : \text{if } n = 17 \text{ then go to a}; \\
&s := \text{result}(p, \text{walk-a-block}, s); \\
&n := n + 1; \\
&\text{go to b}; \\
&a : \text{if name-on-street-sign } \neq \text{'Chestnut Street'} \text{ then go to c}; \\
&c : s := \text{result}(p, \text{walk-a-block}, s); \\
\text{end};
\end{aligned}
\]
Knowledge and Ability

- To achieve some goals, we need some knowledge.
- Go back to the safe example.
- \( \text{has}(p, k, s) \land \text{fits}(k, sf) \land \text{at}(p, sf, s) \rightarrow \text{open}(sf, \text{result}(p, \text{opens}(sf, k), s)) \)
- Now the safe become a combination safe, and we need a combination to open it instead of a key. The problem becomes

\[
\text{at}(p, sf, s) \land \text{csafe}(sf) \\
\rightarrow \text{open}(sf, \text{result}(p, \text{opens2}(sf, \text{combination}(sf)), s))
\]

- \( P \) might not know the combination.
- \( \text{open}(sf, \text{result}(p, \text{opens2}(sf, \text{idea-of-combination}(p, sf, s)), s)) \)
Far from Epistemological Adequacy

- The approximate character of $\text{result}(p, \sigma, s)$: an action must lead to a definite situation, which is not true. For example:
- if someone is asked, `How would you feel tonight if you challenged him to a duel tomorrow morning and he accepted?' he might well reply, `I can't imagine the mental state in which I would do it; if the words inexplicably popped out of my mouth as though my voice were under someone else's control that would be one thing; if you gave me a long-lasting belligerence drug that would be another.'
- It is not clear how to take uncertainty into account by attaching probabilities to its sentences.
Far from Epistemological Adequacy

- Parallel Processing: many processes are going on simultaneously, so we need a formalism that allows parallel programs.
Conclusions

● A construction of formal notion of an epistemologically adequate system, but still far from epistemological adequacy.

● Because of the limit of time, More details are in the paper.

Thank you!