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MODELING INTELLIGENCE

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ROMsys Ltd applies computer and socio-technical analytical skills and techniques to the human mind toward understanding how intelligence works, may be modeled and ultimately, recreated.

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Introduction

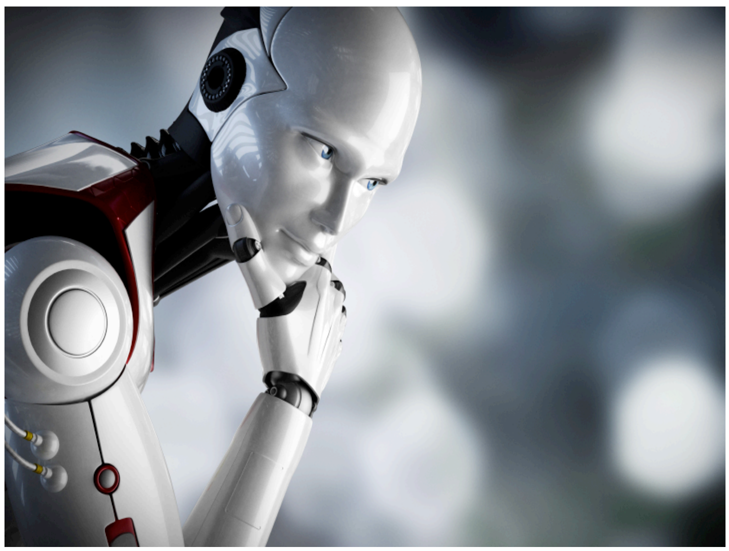
Why bother modeling intelligence? One reason is that intelligence is arguably the most complex and unpredictable thing in our environment and is an important part of what makes up society, which we all have to live with. A big problem with modeling intelligence is that you are trying to use something to understand it, which seems likely to be quite difficult. However, if you can use models of models, 'meta models', and understand the characteristics of these, then this becomes possible.

Another reason for understanding intelligence is that society is faced with many problems, and intelligent understanding of these is a critical need. "Work smarter, not harder" is arguably the basis for social success, and being able to add AI (Artificial Intelligence) and AGI (Artificial General Intelligence) into that offers far more possibilities to be smart. A companion AGI may become considered a fundamental human right.

The Model

An effective way to model intelligence may be to apply pattern recognition algorithms. Pattern recognition is often seen as an important part of AI, but some added value may be gained by applying it to not only sense data, but also a number of abstractions, and meta data, of such.

Self-awareness and consciousness are often considered difficult problems. However, pattern recognition of the sensory feedback from self-initiated actions might be the clue to distinguishing 'self' from 'other'; a sense of self-identity. This can also explain why tools may be treated as extensions to the body, as can things like motorcars.



The question of purpose can also be considered a difficult problem. However, pattern recognition of (past) self-initiated behaviour might allow purposes to be deduced. This might also apply to planned, future behaviour, which is based on memories of previous acceptable (maybe even 'moral'), actions. Planned behaviour can be tested against the implied moral patterns that can be deduced from it. Purpose can be seen as part of self-identity, a carrying forward of patterns seen in past behaviour into planned, future behaviour.

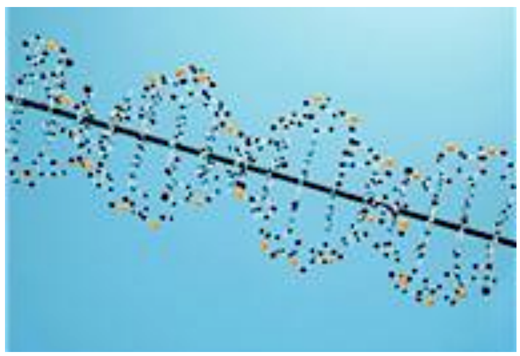
If abstractions and meta data is considered to be 'indexing' into memories of past behaviour, then pattern recognition can be applied to these also. This might be the source of such things as philosophies or sciences. The deduced pattern then itself becomes an abstraction, an index. Complex behaviour might require multiple levels of abstraction, and it is likely that there are limits on how complex a model or pattern is that a human mind can handle at once, as well as human limits on the number of inter-relationships and levels of abstraction.

If an AGI is required to have specific purposes, then these can be patterns that are clearly recognisable from memory. This could include 'morals'. An AGI is pre-loaded with experiences that imply a sense of self, purpose and acceptable behaviour based on pattern recognition.

An Evolutionary Perspective

Assuming you believe in evolution, any living being that exists has developed as a result of evolutionary pressures. They have been selected on the basis that they survived. This means that they have interacted with their environment in an effective way, so as to survive and reproduce, on at least a group if not an individual basis.

Single-celled organisms and those with no nervous system are still responsive to their environment, in sometimes quite complex ways, implying an element of short-term memory. Those with nervous systems and longer-term memory are capable of far more complex behaviour. Memory allows an organism to model its environment, and model itself in terms of previous interactions with that environment.



Credit: MS Clipart

Intelligence can be considered a powerful tool for effectively handling the environment. Nucleic acids and DNA can be considered a sort of memory of previous generations' effective interactions. Epigenetic changes to DNA provide shorter-term memories of responses, maybe back to the maternal grandparent. It is believed long-term memory during an individual's lifespan is stored using an epigenetic mechanism, which makes sense from an evolutionary standpoint; reuse of an existing mechanism. Memory is the raw material used by intelligence.

Intelligence, which is predictive rather than just reactive, is arguably what has given creatures with more sophisticated nervous systems an evolutionary advantage. Being able to predict the behaviour, not just of the environment, but other creatures that have a predictive ability ('expectations'), then becomes in itself, useful. This also allows complex pack or group behaviour, which can adapt to change rather than being 'hard-wired' in the (epi-) genetics.

Planning is the activity that goes with prediction and is displayed by many creatures. The simplest form of planning is to get ready for action when it is predicted to be likely, and this, rather than simply reacting, tends to be quicker and possibly makes more effective use of resources (if the prediction is accurate enough). More complex, longer-term planning involves predicting the behaviour of the environment or other creatures, then exploiting this.

Alarm calls and other forms of communication allow information to be passed on to other members of a group, so the group more effectively interacts with the environment. Group interests can conflict with individual ones, so sophistication is to use communication to lie or misinform. This, in turn, leads to attempts to predict misinformation, or punish it so the liar can predict the consequences of getting caught lying.

All of the above is based on models of the environment, which includes a model of 'self' as the directly controllable part of the environment and sometimes 'others', who in themselves have models, the results of using that needs to be modeled.

Maps, Models and Meta Data

A map or a model is not the thing it describes; it is very important not to forget this, as mental shorthand may blur the distinction. A map must contain less information than the thing it is a map of; otherwise it would be that thing. It cannot be completely accurate even in the parts of the thing that it describes as there must be a time delay caused by making or keeping updated maps. The question is: "Is this a good enough map?".

If the world, the environment, is considered to be data or sense data, then any model or map must be simpler, and even in its simpler form, inaccurate. The model is meta data, data about data. If there is a model of a model, a meta model, then this is meta data about meta data, and is again simpler than what it describes. This increasing simplification means you don't get the 'infinite mirrors' problem; the point where a further meta model is pointless quickly arrives.

Data implies an inactive thing to many people, but one form of meta data can be rules describing the behaviour of the data. Rules can change, so there are in turn, meta rules which describe this process of rule change - these are (of necessity), simpler than the rules.

Creating a model is a process of abstraction - a thing is defined as separate from its environment; the 'figure' is separated from the 'ground' (background). Models are created because they are (potentially) useful things of interest. In abstracting some information must necessarily be thrown away. The abstraction process may be turned into a set of more general rules, so the model becomes a general description of a class of things, rather than one specifically. Naming things is also an abstraction process.

Meta data can be treated as data, and even altered. However, altering meta data breaks the relationship between it and its data, or, at least creates a new and different set of meta data for that data. Meta data and the ways in which it can be manipulated needs to be understood as that is what models are built from.

Summary

Sensory input, manipulative output, a memory, and a modeling and pattern recognition capability may be the main components needed to understand how intelligence might work.

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