Upper and Lower Bounds on Harvesting Intelligence From Nature

by Sven Nilsen, 2018

In an eternally inflating universe, estimated doubling in size a trillion trillion times a second, it is possible that this might give rise to an extreme anthropic selection effect. Our universe might be compatible with this assuming given that Many-Worlds interpretation of quantum mechanics is true, which would lead to an anthropic optimization algorithm of maximizing freedom of degrees seen from the perspective of the local multiverse. Assuming time symmetry of this property, an observer might use this knowledge to harvest intelligence from nature by making powerful predictions about the future of a certain kind (currently unknown category of predictions).

The reason this category of predictions is currently unknown, is because the nature of existence is not fully understood scientifically. There are some hypotheses about how consciousness works, related to information processing. However, in addition to a working model of consciousness, one might need a way to pinpoint the mechanism that is an active component of anthropic logic. Without this piece of knowledge, humanity might get stuck on the question of what this category of predictions might be.

To provide a lower bound on this category of predictions, one can categorize other predictions into two:

1. Laplace's demon
2. Bayesian optimal predictor in a universe without extreme anthropic selection effects

A Laplace's demon is an entity that records the position and momentum of every particle in the universe and then predicts future positions by simulating the universe using mathematical descriptions of physical laws. While there are practical limitations that prevents the construction of Laplace's demon, it serves as a useful oracle that can make predictions of a certain kind: It can predict very accurately the physical state of the future.

In Path Semantics, developed by AdvancedResearch, understanding (or meaning, semantics) of the world requires some sort of contractions of information through the use of functions. This relationship can studied in detail formally without appeal to an certain external reality, because it holds for any function. As long as you have some system that behaves like a function in some way, it has a set of perfect and probabilistic predictions that follows from the function itself.

Laplace's demon is limited in a specific way due to mathematical language semantics. Using Path Semantics as a background theory, it is possible to infer through mathematical deep intuition, that Laplace's demon is incapable of understanding what it predicts, without some further added abilities. The reasons for this is that it needs to construct some functions to make useful sense of the simulation.

A Bayesian optimal predictor in a universe without extreme anthropic selection effects will be able to understand what it sees and make predictions from observations, but it does not know the accurate state of the world. Unlike Laplace's demon, it overcomes the limitation of mathematical language semantics, but it is also limited in a different way due to not knowing any effects from what exists beyond the observable horizon.

The lower bound on harvesting intelligence from nature, is a statement about the category of predictions being made, as an exclusive form of knowledge that neither exists within 1) or 2). With other words, one can make a certain kind of prediction that could not be done by Laplace's demon or by an Bayesian optimal predictor lacking evidence of an extreme anthropic selection effect. However, it unknown whether this set is empty.

Illustrated:
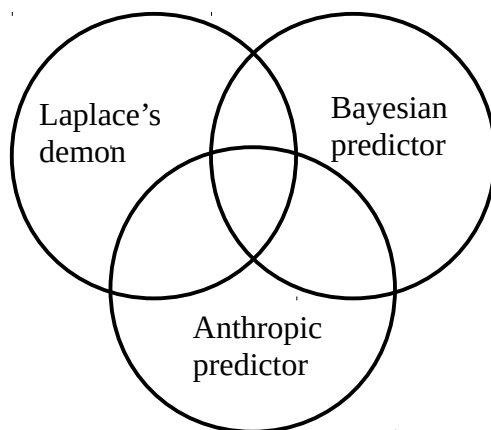
This is called a lower bound because the kind of predictions made by an Anthropic Predictor falls outside the capabilities of other predictors. The sets of predictions made between various kinds of predictors might not be exclusive. On the other hand, any prediction that is common between two predictors might obtained at the lowest cost when having access to both oracles. It is only of economic interest to know how to harvest intelligence from nature that can not be obtained through cheaper ways.

So, lower bound is a statement that the minimum utility includes access to some knowledge that can not be obtained through other means, even if one imagines arbitrary powerful versions of some limited capability within the kinds of predictors that are similar to Laplace's demon and Bayesian predictors.

The upper bound can be provided through evidence of conserved quantities of physical systems. If the active component in anthropic logic describing our universe was correlated with a such quantity, e.g. energy, then one might expect to see an increase or decrease in energy over time inside or close to systems that processes information. From current scientific observations it looks like energy is conserved, also in systems contributing to information processing, meaning that maximization of freedom of degrees in the local multiverse does not bottleneck on the conservation of this quantity.

It is therefore unlikely that the category of predictions made possible through extreme anthropic selection effects permits violation of conserved quantities in physics. However, this property might help to narrow down the set of functions that grounds the unknown category of predictions.