From: Joscha Bach <[redacted]>
Sent: Monday, February 19, 2018 9:32 PM
To: Jeffrey Epstein
Subject: Re:
Attachments: signature.asc

Learning is function approximation. It happens by a computable function =hat creates another computable function (which then performs organismic =egulation or whatever we want). Stochastic gradient descent =ackpropagation on ANNs is one example of a computable function that =reates computable functions.

I would try to derive learning theory starting from cybernetic =egulation, then the Good Regulator theorem (regulators need models that =re isomorphic to the system they regulate), and them explain how to =uantify and justify confidence in whether a model is isomorphic to =round truth. The question of whether available observations can be =ranslated into a function in a single step or gradually depends both on =he algorithm and the quality of the model. In principle, one shot =earning requires a model that already captures so much invariance that =ts behavior can be adapted by updating a single latent variable.

> On Feb 19, 2018, at 07:15, jeffrey E. <jeevacation@gmail.com> wrote:
>
> i also see no learning in your system .? .   either it instantaneious. = fixed time and fixed time for each . computation though answer =artilaly known?
>
> On Mon, Feb 19, 2018 at 6:24 AM, Joscha Bach [redacted] =rote:
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>
> As you may have noticed, my whole train of thought on computationalism =s based on the rediscovery of intutionist mathematics under the name =computation".
> =tp://math.andrej.com/wp-content/uploads/2014/03/real-world-realizabil
> ity.=df
>
> The difference between classical math and computation is that =lassically, a function has a value as soon as it is defined, but in the =omputational paradigm, it has to be actually computed, using some =enerator. This also applies for functions that designate truth. For =omething to be true in intuitionist mathematics, you will always have =o show the money: you have to demonstrate that you know how to make a =rocess that can actually perform the necessary steps.
>
> This has some interesting implication: computation cannot be =aradoxical. In the computational framework, there can be no set of all =ets that does not contain itself. Instead, you'd have to define =unctions that add and remove sets from each other, and as a result, you =ight up with some periodic fluctuation, but not with an illegal state.
>
> Intuitionist math fits together with automata theory. It turns out =hat there is a universal computer, i.e. a function that can itself =ompute all computable functions (Turing completeness). All functions =hat implement the universal computer can effectively compute the same =et of functions, but they may differ in how efficiently they can do it. =fficiency relates to computational complexity classes.
> The simplest universal computers known are some cellular automata, =ith Minsky and Wolfram arguing about who found the shortest one. =oolean algebra is Turing complete, too, as is the NAND gate, the lambda =alculus, and almost all programming languages. The Church Turing thesis =ays that all universal computers can compute each other, and therefore =ave the same power.

>
> I suspect that it is possible that the Church Turing thesis is also a =hysical law, i.e. it is impossible to build physical computer that can =alculate more than a Turing machine. However, that conflicts with the =raditional intuitions of most of physics: that the universe is =eometric, i.e. hypercomputational. The fact that we cannot construct a =ypercomputer, not just not in physics, but also not mathematically =where we take its existence as given when we perform geometry), makes =e suspect that perhaps even God cannot make a true geometric universe.
>
> How can we recover continuous space from discrete computation? Well, =pacetime is the set of all locations that can store information, and =he set of all trajectories along which this information can flow, as =een from the perspective of an observer. We can get such an arrangement =rom a flat lattice (i.e. a graph) that is approximately regular and =ine grained enough. If we disturb the lattice structure by adding more =inks, we get nonlocality (i.e. some information appears in distant =attice positions), and if we remove links, we get spatial superposition =some locations are not dangling, so we cannot project them to a single =oordinate any more, but must project them into a region).
>
> On the elementary level, we can define a space by using a set of =bjects, and a bijective function that maps a scalar value to a subset =f these objects. The easiest way of doing might be to define a typed =elationship that orders each pair of objects, and differences in the =calar are mapped to the number of successive links of that relationship =ype. We can use multiple relationship types to obtain multiple =imensions, and if we choose the relationships suitably we may also =onstruct operators that relate the dimensions to each other via =ranslation, rotation and nesting, so we derive the properties of =uclidean spaces.
>
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>
> To get to relativistic space, we need to first think about how =nformation might travel through a lattice. If we just equalize value =ifferentials at neighboring locations, we will see that the information =issipates quickly and won't travel very far. To transmit information =ver large distances in a lattice, it must be packaged in a way that =reserves the value and a momentum (in the sense of direction), so we =an discern its origin. A good toy model might be the Game of Life =utomaton, which operates on a regular two dimensional lattice and =llows the construction of stable, traveling oscillators (gliders). In =ame of life, only the immediate neighbor locations are involved, so =liders can only travel in very few directions. A more fine grained =omentum requires that the oscillator occupies a large set of adjacent =attice locations. SmoothLife is a variant of Game of Life that uses =ery large neighborhoods and indeed delivers stable oscillators that can =ravel in arbitrary directions.
> I think I have some idea how to extend this toy model towards =scillators with variable speed and more than two dimensions. It may =lso possible to show that there are reasons why stable traveling =scillators can exist in 1d, 2d and 3d but not in 4d, for similar =easons why stable planetary orbits only work in 3d.
>
> To give a brief intution about a traveling oscillator as a wavelet: =hink of a wavelet as two concentric circles, one representing the =eviation above zero, the other one the deviation below zero. They try =o equalize, but because the catch up is not immediately, they just =witch their value instead. (This is the discretized simplification.) =ow displace the inner circle with respect to the outer one: the =rrangement starts to travel. Making the pattern stable requires =istorting the circles, and probably relaxing the discretization by =ncreasing the resolution. The frequency of the wavelet oscillation is =nversely related to how fast it can travel.
>
> You can also think of a wavelet as a vortex in a traveling liquid. The
> =ortex is entirely generated by the molecular dynamics within the
> liquid =which are our discrete lattice computations), and it does not
> dissolve =ecause it is a stable oscillator. The vortex can travel
> perpendicular =o the direction of the fluid, which is equivalent to
> traveling in =pace. It cannot go arbitrarily fast: the progression of
> the liquid =efines a lightcone in which each molecule can influence
> other =olecules, and which limits the travel of every possible vortex.
> Also, =he faster the vortex moves sideways, the slower it must

> oscillate, =ecause the both translation and state change depend on
> sharing the same =nderlying computation. It will also have to contract
> in the direction =f movement to remain stable, and it will be
> maximally contracted at the =order of the light cone. (The contraction
> of a vortex is equivalent to =iving it a momentum.)
>
> An observer will always have to be implemented as a stable system =apable of state change, i.e. as a system of vortices that interact in =uch a way that they form a multistable oscillator that can travel in =nison. From the perspective of the observer, time is observed rate of =tate change in its environment, and it depends on its own rate of =hange, which in turn depends on the speed of the observer. This gives =ise to relativistic time. Also, the observer does not perceive itself =s being distorted, but it will normalize itself, and instead perceive =ts environment around itself as being distorted. As a result, the =bserver will always have the impression to travel exactly in the middle =f its light cone. This model seems to recover Lorentz invariance, but =ith a slight catch: it seems to me that while speed of light is =onstant and there is no preferred frame of reference wrt acceleration, =he resolution of the universe changes with the speed of the observer. =o idea if this is a bug or a feature, or if it will be neutralized by =omething I cannot see yet before I have a proper simulation.
>
> Obviously, all of the above is just a conjecture. I can make a =onvincing looking animation, and I am confident that many features like =imultaneity etc. will work out, but I don't yet know if a proper =umeric simulation will indeed work as neatly as I imagine.
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> > On Feb 18, 2018, at 09:00, jeffrey E. <jeevacation@gmail.com> wrote:
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> > i want to hear more on your views on projection spaces. . also =eel free to put some more meat on the bones of the thinking re lorentz =ransformations
> >
> > --
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