AN INTRODUCTION TO THE RELEARNING CYCLE INDEX i_{ReL} AND THE AVERAGE SPLIT FUNCTION $\bar{f}_{ReL}$ OF THE SOURCE ENERGY EXPLOITATION BY AND FOR THE NEURAL NETWORKS.

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Abstract. We define the relearning cycle index i_{ReL} and the average split function $\bar{f}_{ReL}$ of the source energy exploitation by and for the neural networks. We propose an optimized learning strategy which depend on a fixed relearning cycle index i_{ReL} and a fixed average split function $\bar{f}_{ReL}$. In practice, this theory may explain why the communist politics in Russia and in China faced strong difficulties at the 20th century and why the private companies politics in Western countries faced critical difficulties at the beginning of the 21th century. We conclude with some critical hints for the future relearning cycles of the source energy exploitation by and for the neural networks.

The relearning cycles of the source energy exploitation by and for the neural networks should have a guaranteed increasing efficiency at each new cycle. One way to achieve that target is to plane to allocate a larger amount of resources by a factor i_{ReL} to the next relearning cycle. Moreover, each relearning cycle of the source energy exploitation by and for the neural networks should optimized the final energy production (in flop units where the performance in FLOPS per Watt can be optimized as well) over an arbitrary large time with a confidence level of 99% about or more. If the final energy production in FLOPS unit increase exponentially over time, the relearning cycles have a constant time length.

Between 1800 and 1990, the number of years in good health after the high education level progress from 5 years (20 years $\rightarrow$ 25 years) to 20 years (25 years$\rightarrow$ 45 years). The population have been multiplied by 6. The percentage of people beyond the high education level has been multiplied by a factor 50 about. The access to the relevant information have been multiplied by a factor between 5 and 20 about (from 10% about with a local library in 1800 to 100% with internet in 1990). The access to the relevant information processing with the help of calculators (human or artificial) have been multiplied by a factor between 5 and 20 about (calculating by hand relevant information processing took 90% of the time about in 1800 and 0% of the time in 1990). Therefore, the relevant world brain activity has been increased exponentially by a factor between 30 000 and 480 000 about. Finally, the relevant world brain activity have increased in average per year between 5.5% and 7.0% about.

From those historical facts, if we take $i_{ReL} = 1.05$ as a convenient relearning cycle index. The relearning cycles have an ideal time length between 0.7 years and

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0.9 years between 1800 and 1990. We remark that the mandatory annual general meeting from private company politics in Western countries were well adapted with respect to the ideal time length of the relearning cycles during that period (except in the mini linear regime between 1910 and 1940). And we remark that the five-year plans of the communist politics in Russia and in China were not well adapted with respect to the ideal time length of the relearning cycles during that period.

$$(1990 - 1800)\, Log\,(1.05) = t_{ReL}^{Max} Log\,(30\ 000)$$

$$(1990 - 1800)\, Log\,(1.05) = t_{ReL}^{Min} Log\,(480\ 000)$$

$$(1990 - 1800)\, Log\left(i_{ReL}^{Max}\right) = Log\,(30\ 000)$$

$$(1990 - 1800)\, Log\left(i_{ReL}^{Min}\right) = Log\,(480\ 000)$$

Finally, the number of years in good health beyond high education level, the percentage of people beyond the high education level, the access to the relevant information and the access to the relevant information processing with the help of calculators (human of artificial) have completely flatten from 1990. Therefore, the ideal time length of the relearning cycles have suddenly increased by a factor 10 about or more. Therefore, the five-year plans of the communist politics in China were suddenly well adapted and the mandatory annual general meeting from private companies politics in Western countries were suddenly critically in-adapted.

From now, the ideal time length of the relearning cycles is 10 years about or more.

Remark 1: Until now, only the relevant brain activity growth is relevant, the power calculation by itself is not relevant until we can simulate neural networks larger than human brains and therefore the final energy production in FLOPS would be much more meaningful.

Remark 2: Until the human brain activity is the relevant neuronal network activity, the ideal time length of the relearning cycles can not be longer than 20 years and being consistent with the average human life expectancy in good health beyond the high education level. For the relearning cycles beyond 20 years and with no simulated neural networks sufficiently large, only genetically modified humans with longer average human life expectancy in good health beyond the high education level can meet those criteria.

From my previous articles, we have to include the class of the universal goals in the learning processes. To achieve that, we have to define an average split function f_{ReL} which separate in two part the allocated resources. One part for the relearning cycles of the source energy exploitation by and for the neural networks and another part for the learning processes with respect to the class of the universal goals.

If the final energy production in FLOPS unit increases exponentially with a constant rate of expansion, it means that we have not detected the finitude of our environment and the relearning cycles of the source energy exploitation by and for the neural networks should be the only one priority with an average split function $\bar{f}_{ReL}$ equal to 1. Below the exponential growth, we define the average split function $\bar{f}_{ReL}$ with respect to a decreasing rate of expansion r_Z:

$\bar{r}_Z = \frac{1}{\bar{E}_f}\frac{d\bar{E}_f}{dt}$ and $\bar{a}_Z = \frac{1}{r_Z^2}\frac{dr_Z}{dt}$

$\bar{f}_{ReL} = \frac{1}{1+\alpha|a_z|^\beta} UnitStep\left(-a_Z\right) + UnitStep\left(a_Z\right)$

where $\alpha \sim 1 \sim \beta$ and $\int_0^t \bar{E}_f(t') - E_f(t')\ dt' = 0$ and $\bar{E}_f(t) = E_f(t)$ and we choose $\bar{E}_f$ to minimize:

$E_{ReL}(t) = \int_0^t \bar{f}_{ReL}(t')\bar{E}_f(t')\ dt'$

or to maximize:

$E_{CUG}(t) = E(t) - \int_0^t \bar{f}_{ReL}(t')\bar{E}_f(t')\ dt'$.

At some times t, $\frac{dE_{CUG}}{dt}$ may be greater than $\frac{dE_f}{dt}$ and a debt in favor of E_{CUG} is created.

The procedure with the minimization of a new function $\bar{E}_f$ is required to remove the artifacts from an oscillating derivative function $\frac{E_f}{dt}$.

To conclude this article, with a polynomial average growth $\bar{E}_f(t) = t^n$, the average split function $\bar{f}_Z$ is:

$\bar{f}_Z = \frac{n^\beta}{\alpha + n^\beta}$

We remark than the average split function $\bar{f}_{ReL}$ approaches 1 like in the exponential growth case with an arbitrary large n.

We remark also that the average split function $\bar{f}_{ReL}$ is $1/(1+\alpha)$ in the linear regime and $1/2$ in the linear regime with $\alpha = 1$.

From now, since we change suddenly from an exponential regime to a linear regime, $\frac{dE_{CUG}}{dt}$ is greater than $\frac{dE_f}{dt}$ and a debt in favor of E_{CUG} is created. Moreover, during this transition period between both regimes, the resources allocated to the relearning cycles of the source energy production by and for the neural networks should be zero. Finally, after this transition period between both regimes, the resources allocated to the relearning cycles of the source energy production by and for the neural networks should be $1/(1+\alpha)$ or one half in the case of $\alpha = 1$.