Formula for Max Neuron Growth Estimates

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Introduction

This is the formula I've (re)derived on at least three occasions in the last year. It is for calculating the maximum of neuron growth in a neural network.

Formula

$$n_{i+1} = (2^{n_i} - 1) + n_i | n_0$$

Where, n is the number of nodes from the prior generation, or those which exist to generate output nodes from.

Implications

The fact is this formula has a very small domain of possibly *useful* values. Why? Because it grows quite quickly. The example I begin with is always a single neuron to start with, which yields the table of growth below.

Generation	Input Neurons (n_i)	Output Neurons (n_i+1)
0	1	2
1	2	5
2	5	36
3	36	68719476771
4	68719476771	2.542… * 10^20686623794 + + 68719476770

Now, most calculations of any meaningful will end there, as any computer scientist might point out: a number to such a large magnitude will cause an overflow resulting from not enough memory to allocate for it without a specialized numeric type. If you

would like to consider *how big* that 4th generation output is though, consider that the order of magnitude for estimated *atoms in the universe* is within the ballpark of 10^80 in contrast to this 10^20686623794.

This ridiculous number clearly illustrates however that the *possibilities of these neurons* in terms of *unique structures* is nigh-endless for all practical concerns, as we are *very unlikely* to stop at just 5 layers (4 generations) of neuron.