Utilization of the fractal dimension metric in training of dense Neural Networks

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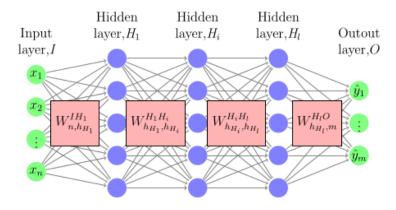
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Abstract

The process of training of Artificial Neural Networks essentially is optimization of the values of the weights $\$ w-{pq} \$ associated with the arcs, connecting the nodes of the layers. This is a process of minimization of the Loss function (maximization of Accuracy function). During the training, the training data set recursively is utilized at subsequent stages, called \textit{Epochs}. The training continues until a satisfactory values of the Loss, Accuracy etc. parameters are reached. The matrices \$ W^{UV}\$ comprising the weights of the arcs connecting the layers \$ U \$ and \$ V \$, can be regarded as gray-scale images of a surface. Starting as random matrices, processed by recursive procedures, they gradually become fractal structures, characterized with respective fractal dimension \$ D_f \$. In the presented article we have made an attempt to utilize the correspondence of \$ D_f \$ with the Loss/Accuracy values, in order to forecast the optimal ending point of the NN training process. Similar conclusions were made for the correspondence between the number of layer's nodes and \$ D_f \$. An attempt to apply statistically more rigorous approach in the determination of the slope of the regression line in Richardson-Mandelbrot plot, was made.

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