

Proof of Deep Learning Training

Introduction

Skychain will enable parallelized training for each neural network. For example, the neural network developer's server will manage the neural network training, and multiple mining servers will train the neural network on dataset fragments allocated to them and send parameter updates to the managing server, which will apply the updates to the neural network.

The question is, how can the managing server make sure that each mining server properly does its part of the job?

Proof of Deep Learning Training Algorithm

The Skychain team conducted research and developed the Proof of Deep Learning Training Algorithm. For example, we have 50 networked computers for parallelized neural network training and a dataset consisting of 100,000 lines. The learning algorithm with Proof of Deep Learning Training factored in will look as follows:

1. Split DATASET into 100 blocks, each one consisting of 1000 lines
2. For i = 0 to 100
 - a. Take lines from (i * 1000) to ((i * 1000) + 999) from DATASET to produce DATASET(i)
 - b. For j = 0 to 47 // Parallelize
 - i. Take lines from (j * 20) to ((j * 20) + 19) from DATASET(i) to produce DATASET(j)
 - ii. Send DATASET(j) to SERVER(j)
 - iii. Get updated parameters for the neural network $\nabla\omega_j$ from SERVER(j)
 - c. EndFor
 - d. Generate the random number c from 0 to 48, which will be used as an index of a training server
// Executed in parallel with the "For j" loop
 - i. Send DATASET(c) to SERVER(48) and SERVER(49), and then get the parameter updates $\nabla\omega_{48}$ and $\nabla\omega_{49}$ from the respective servers
 - ii. If $\nabla\omega_{48}$, $\nabla\omega_{49}$, and $\nabla\omega_c$ are not the same, then
 1. The server whose result differs from the two other results will be deemed fake and removed from the server list.
 - e. Randomly mix the training servers array
3. EndFor

So the Proof of Deep Learning Training Algorithm works as follows: In each deep learning training iteration, three servers are randomly selected, and the same dataset fragment is sent to each of them. Then the results produced by the three servers (that is, parameter updates) are compared with each other. If the three results are the same, it will be the Proof of Deep Learning Training.

Training servers won't be rewarded for any fake computational work because the results produced by each server will be checked multiple times by comparing them with the results produced by two other randomly selected servers.

Advantages of the proposed algorithm

The proposed algorithm successfully solves the problem of providing the Proof of Deep Learning Training, the neural network training performance is reduced by at most 5 percent!

In this example, 48 servers perform useful training and only 2 servers perform duplicate training for control purposes at any given time. Do the math, and you will arrive at a 5 percent decrease in performance.

Conclusion

The proposed Proof of Deep Learning Training Algorithm has been tested by the Skychain team and proved its effectiveness. We believe that its use will allow Skychain participants to fully trust each other.

Contacts

<https://skychain.global/>