Assignment 4

Deadline: 4th of May 2023

Problem 1: Recent advances in deep learning have enabled significant progress in many domains, including computer vision, natural language processing, and speech recognition. However, despite the impressive capabilities of modern GPUs, they are still far less powerful and efficient than the human brain. In this problem, you will investigate the similarities and differences between the human brain and the most advanced GPU, NVIDIA's A100. Your goal is to understand the fundamental principles of neural computation and compare the performance of these two systems in terms of:

1. Computational power, use as many HGX A100 units to fit the same number of Cuda cores as the number of brain neurons (assume 1 biological neuron = 1 hardware Cude core).
2. Calculate the energy needed in both cases. Do not forget to calculate the power consumption by:
   a. units of HGX A100
   b. Air-conditioning for the whole building.
   c. Lighting and other electricity uses
3. The weight of the human brain w.r.t. the manufactured brain, and take into account:
   a. HGX A100 units weight
   b. Air-conditioning units' weight
   c. Other stuff weight like racks …etc.
   d. Building weight
4. If you know that it is reported that the hardware represents only 17% of any useful and complete IT system, what will be the total cost of hardware equivalent to a human brain?
5. add any other issue of comparison you think is important.

You will explore different metrics and benchmarks to quantify these systems' capabilities and evaluate each approach's strengths and limitations. Your output should be in a written report and a presentation showing your findings and providing insights into the future of deep learning and AI research."

Problem 2: If you know that the trainable parameters in the hardware = the synapses that connect neural cells together. Assume that each neuron is connected on average to about 10,000 other cells. Compare the human brain and the ChatGPT base hardware (GPT-3: 175 billion parameters)