Lab 9: Carbon footprint
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The goal of this lab is for you to estimate the carbon footprint of your class project.

Group name: Triple Fighting

Group members present in lab today: Songhao Jia , Zongyue Zhao, Jiajun Bao

1: Inference
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1. Plug your device into the Kill-a-watt and run inference using your model to get a measurement of the energy draw. What is its baseline energy draw, and how does that compare to running inference?

- Baseline energy draw: 2.9 W
- During Inference (with GPU): 5.4 W

2. Multiply energy drawn by inference time to get an estimate of energy required per inference (you can average over input size).
- Inference Time (with GPU): 30.8 ms (per sample)
- Inference Energy drawn: 166.3 mW*s (per sample)

3. Multiply this by the carbon intensity of the location of your device. You can use [this resource](https://www.epa.gov/egrid/power-profiler#/).
- CO2: 1067.7 lbs/MWh * (166.3 * 10^-9 / 3600) MWh = 4.93 *10^-8 lbs (per sample)

4. Please include at least this estimate in your final project report.

2: Training
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1. Did your project require training a model? If so, compute that estimate as well. If you used cloud resources, you can use [this tool](https://mlco2.github.io/impact/#compute) to help estimate. Otherwise, try to use the methods discussed last class for estimating carbon footprint due to training. Show your work and explain.

We trained our model on our own server. Based on the logs, we have trained roughly 10 times of total model,each training costed average 1.01h and the average power consumption for our GPU is 310 watt. Since there are other components, like CPU, memory, etc, in the sever using power, we estimated the average power consumption for our server is 400 watt. Based on the previous data, we calculated the carbon intensity as follow:

- CO2: 1067.7 lbs/MWh * (400 * 1.01 * 10 / 10^6) MWh = 4.31 lbs (total training)

3: Extra

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1. Everything else: Do you have logs you can use to estimate the amount of energy + carbon that went in to all project development? Other ways of estimating? Was your device plugged in and running for the entire semester?

I believe that there are some ways to estimate the all energy + carbon for our project development.

a. We kept our device running for the entire semester, we can calculate the energy with its standby power and the time for semester.
b. Using our laptop for coding and survey also cost power. We can estimate it with the time cost for this course and the average power consumption for our laptop.
c. Running the classroom also cost energy. We can calculate the energy consumption of the entire classroom by estimating the power of the electrical equipment in the classroom and the duration of the class.

After we have the total energy consumption, we can calculate carbon footprint.

2. Supply chain / lifecycle analysis: Can you estimate the additional footprint due to manufacturing hardware? Lifetime energy use of your project if it was deployed in the real world?

Supply chain: Based on a report from Microsoft, average smartphone requires 55 Kg of CO2 to manufacture. I believe manufacturing jetson nano would share same power consumption as average smartphone, so we believe the carbon footprint for Jetson Nano would roughly be 55kg of CO2.

Lifecycle analysis: Based on our previous analysis, we need (400 * 1.01 * 10 / 10^6) MWh for a single detection. Let's assume that we need to detect 1000 people per day and the pandemic will be end in two years, then the total energy consumption would be:

(166.3 * 10^-9 / 3600) MWh * 1000 * 365 * 2 = 33.72 Wh.

3. If you have a Pi or Jetson 4GB: Compare Kill-a-watt measurements to command line energy measurements, and discuss.

Sorry but our board is Jetson 2GB. We could not do such measurements.