Carbon footprint driven deep learning model selection for medical imaging.

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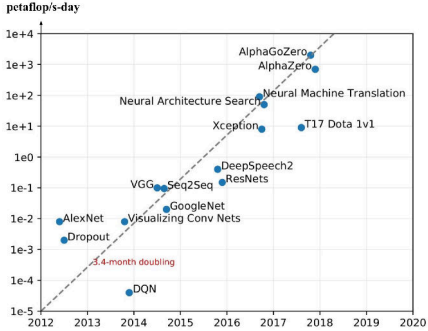
- SOTA performance across domains with Deep learning
- Large datasets & bigger models
- 300,000-fold increase in ML compute in $\approx$ 6 years!
- Similar trend in MIDL literature
- Training & inference are resource intensive
- DL model selection from large hyperparameter space is tedious & expensive
- Increasing carbon footprint is a growing concern



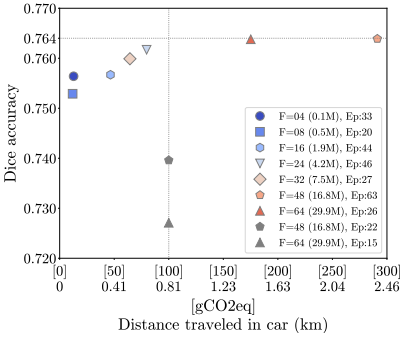
Source: `https://openai.com/blog/ai-and-compute/`

Objective

Incorporate **carbon footprint into the optimization objective** when performing model selection in addition to standard performance metrics

Experiments & Results

- Estimate carbon footprint of training models using Carbontracker[0]
- Lesion segmentation in LIDC-IDRI thoracic CT dataset
- 2D U-net of increasing complexity; Increasing init. # filters: $F = [4, 8, 16, 24, 32, 48, 64]$
- Dice accuracy + gCO2eq.



Comparison of multiple U-net models of varying complexity and their corresponding performance and training carbon footprint

Conclusions

- 1% Dice improvement for 1500% increase in carbon footprint
- More complex models do not necessarily translate to improved performance
- Constraining model selection based on carbon footprint makes for fairer model comparison

[0] Carbontracker: Tracking and Predicting the Carbon Footprint of Training Deep Learning Models. LFW Anthony, B Kanding, R Selvan. ICML Workshop on Challenges in Deploying and monitoring Machine Learning Systems

Let's make MIDL (both the domain and conference) more sustainable

Check out the following resources!

- Carbontracker: `https://github.com/lfwa/carbontracker/`
- Interested in making neuroimaging research more sustainable? Check out: `https://neuropipelines.github.io/`
- raghav@di.ku.dk
- Do visit us at the poster for more discussions.