Deep Learning for ECE EECE-580G

Tf.data - Data augmentation

tf.data

tf.data

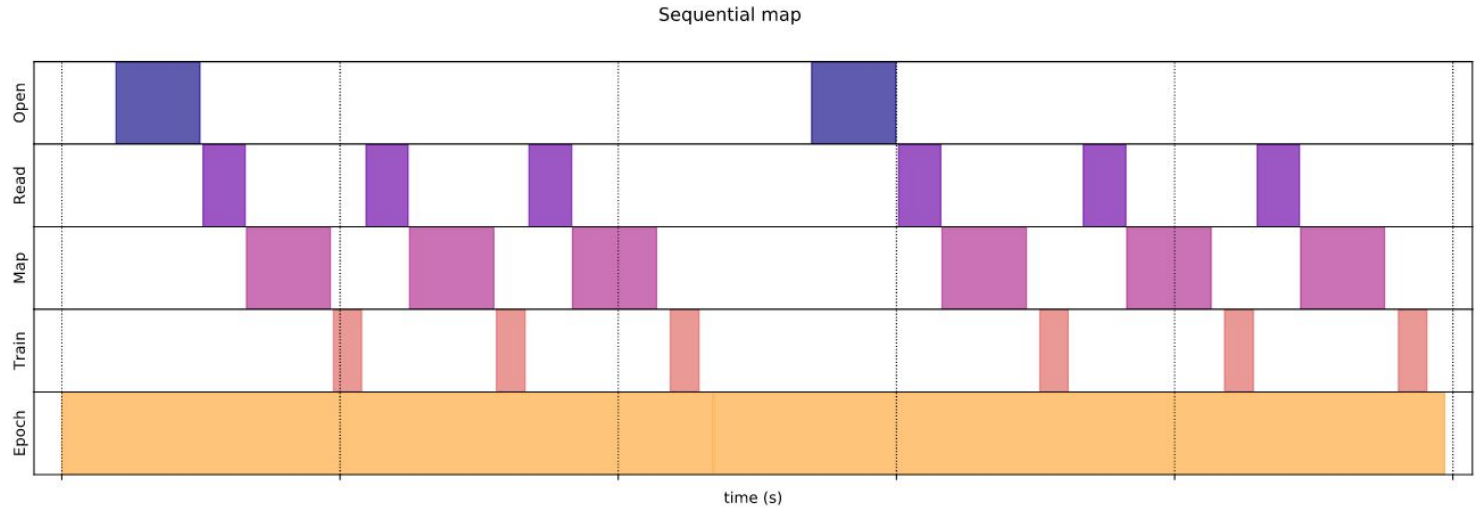
— — —

- Enables to build complex input pipelines
- Optimized for training/inference speed

Why do we need tf.data?

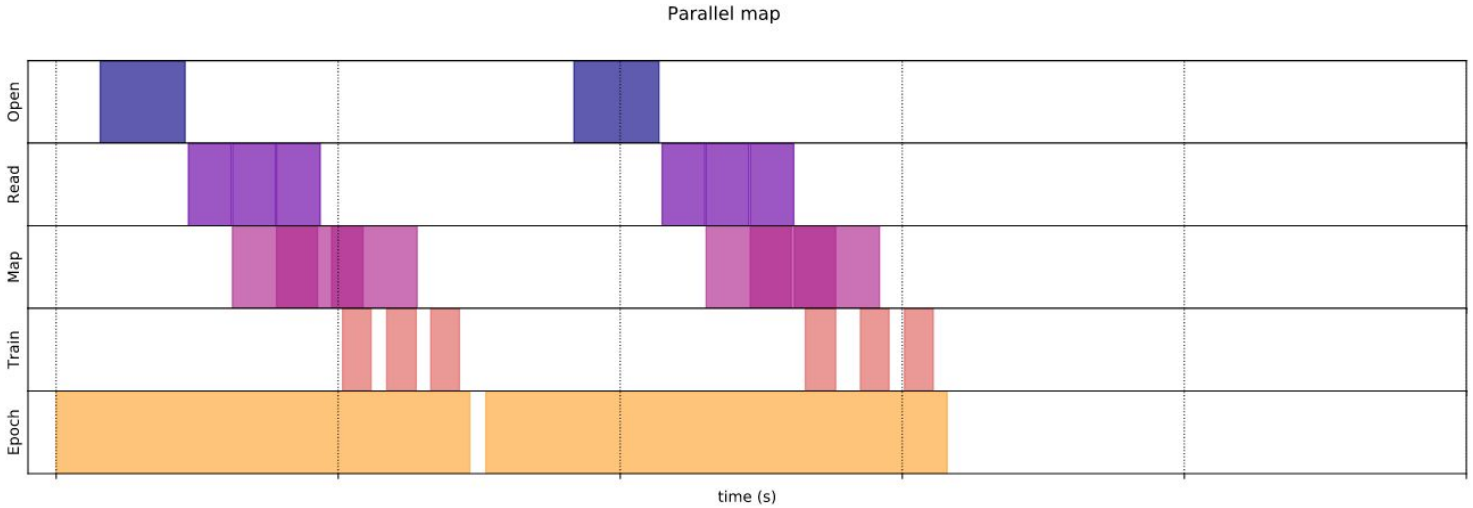
- We cannot always fit `x_train` in a numpy array in memory…
- We need to only load images in batches
- At each iteration of SGD/Adam/… read and process the images on the fly
- Need to optimize the input pipeline to speed-up the process

Naive input pipeline



Source: https://www.tensorflow.org/guide/data_performance

Pre-fetching + parallel processing

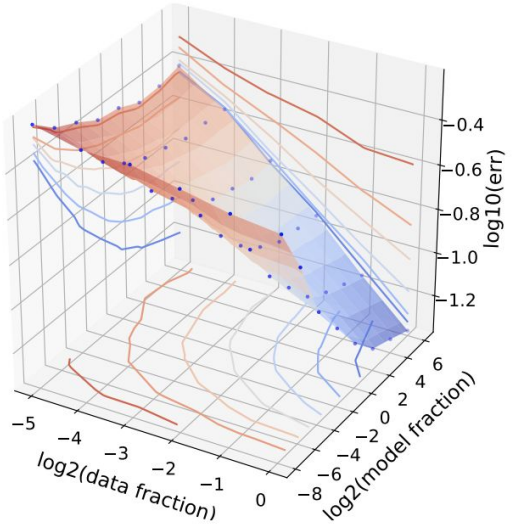


Source: https://www.tensorflow.org/guide/data_performance

Data augmentation

Image augmentation

- Both model size (deeper neural nets) and dataset size are important
- Collecting more training data is expensive, especially for complex tasks such as image segmentation, image forensics, etc.
- We need to work with what we have to increase the dataset size



(b) CIFAR10 error (top1) landscape.

Source: [A Constructive Prediction of the Generalization Error Across Scales]

Image augmentation

- Apply various transformations to the image
- While making sure the transformation does not destroy the information of interest
- i.e. a parrot is still a parrot if the image undergoes Gamma correction, Motion blur, etc.

Demo

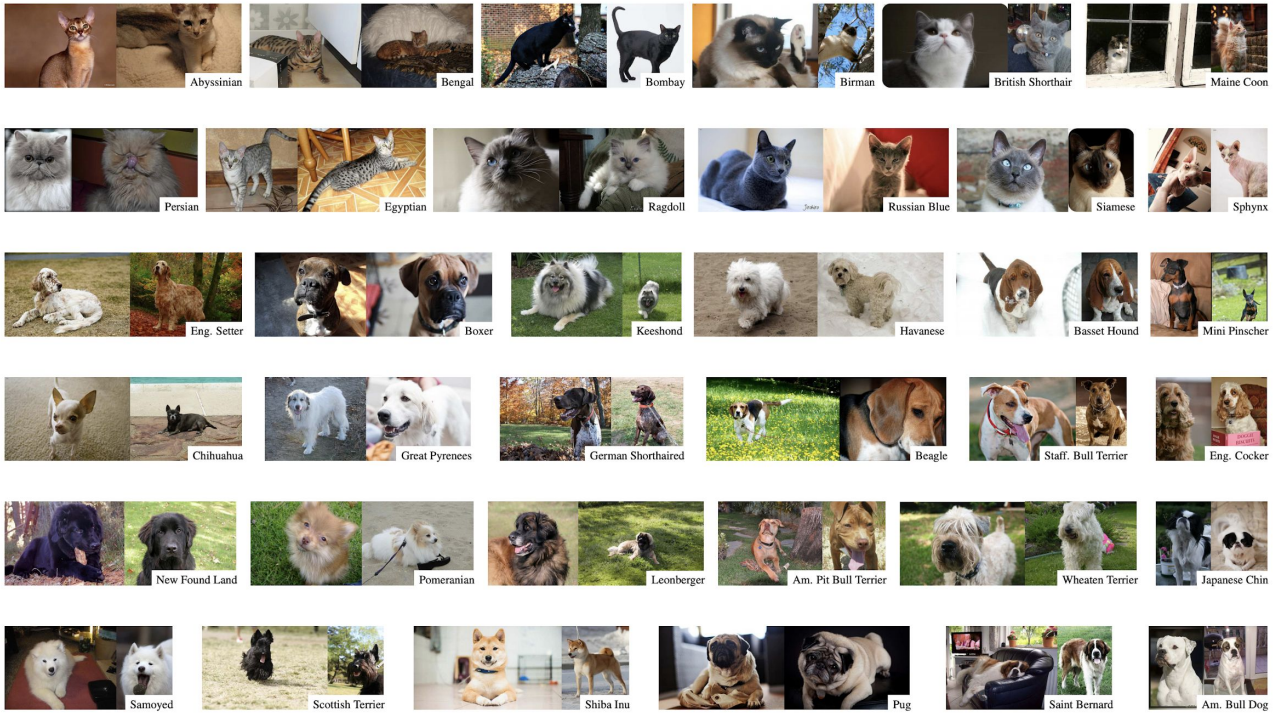
Albumentations

Source: Albumentations

Example

- Oxford pets dataset
- Many classes, not enough samples per class
- This is usually the case in DL
- Need data augmentation!

>> Colab



Source: kaggle

Augmentations in other domains

Audio data

- https://www.tensorflow.org/io/tutorials/audio
- Park, Daniel S., et al. "Specaugment: A simple data augmentation method for automatic speech recognition." arXiv preprint arXiv:1904.08779 (2019).
- Frequency masking, time masking, injecting noise, noise trimming, etc.

Language data

- Simulate keyboard typos, synonyms, spelling mistakes from a bank of usual spelling mistakes, etc.
- https://github.com/makcedward/nlpaug (has also audio augmentations)

End