Faster DNN Training With Selective Backpropagation

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Overview

Can we speed up DNN training by backpropogating only useful examples?

Motivation

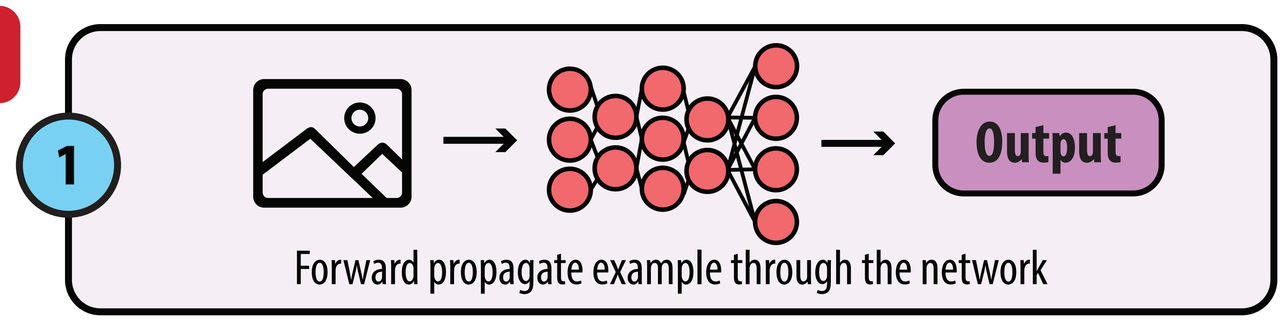
- Labeled datasets are getting larger
- Often not enough time or resources to train on whole dataset (e.g., ImageNet)
- Fast inference (e.g., with accelerators) => Training bottlenecked by backprop

Goal

- Speed up training by reducing the number of backprops
  - Learn mostly from surprising examples that have a lot to teach the network

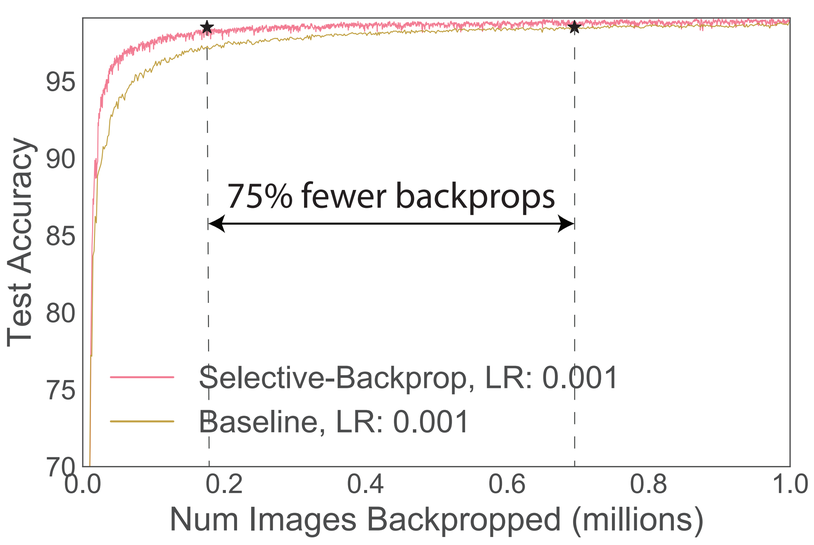
Approach

- Identify useful examples using inference (the output of the forward pass)
  - If example's output is different from target, learn from this example
- Changes sampling distribution of dataset, biased towards interesting examples



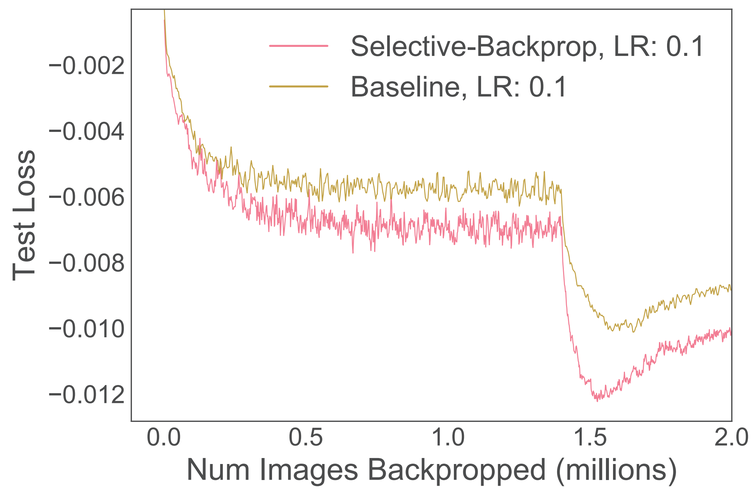
Training wth Selective-Backprop (SB)

MNIST



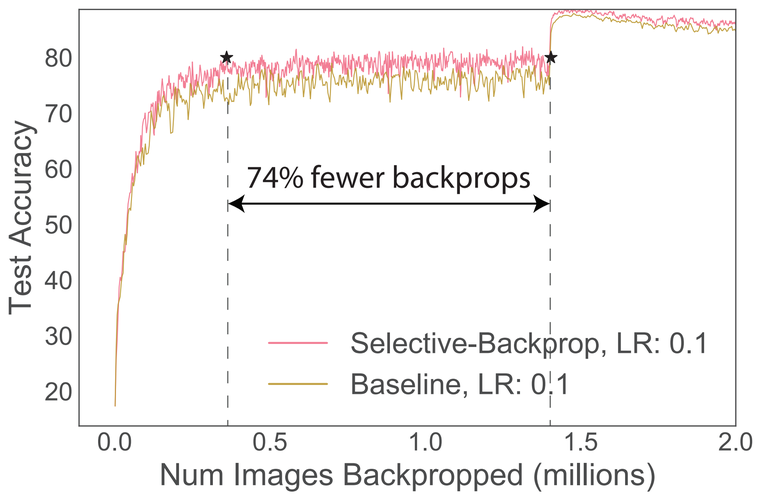
- Baseline does not filter examples
- SB filters >80% of examples of MNIST
- SB gets 98.5% acc. with 75% fewer backprops

CIFAR10



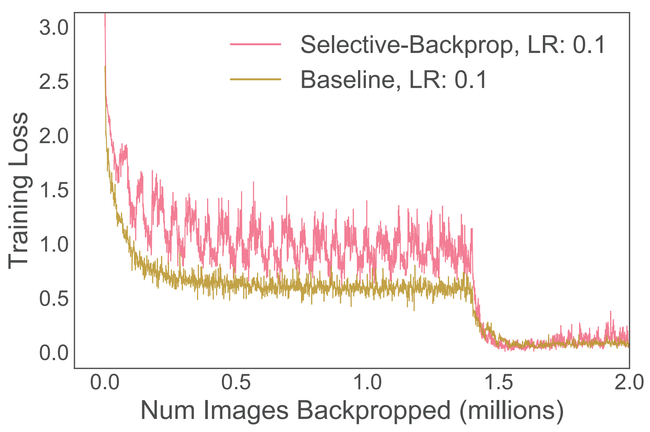
- SB filters >75% of CIFAR10 examples
- SB reduces test loss with fewer examples

CIFAR10



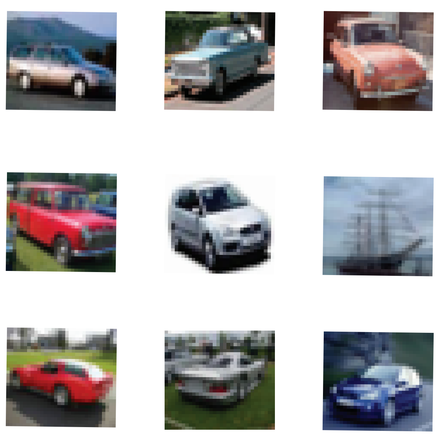
- SB gets 80% acc. with 74% fewer backprops
- Acc has sharp increase from learning rate scheduler

Diving into CIFAR10

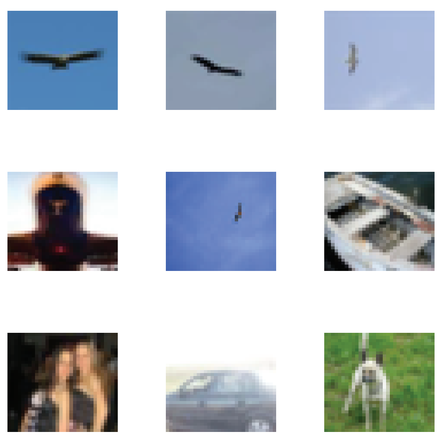


- SB trains images with higher loss

Easy Examples



Hard Examples



Next steps

- Use SB to reduce wall-clock time
- Use SB on high frame-rate video datasets
  - To avoid filtering useful frames
- Use SB offline to dictate order to train examples
  - To improve training of other models