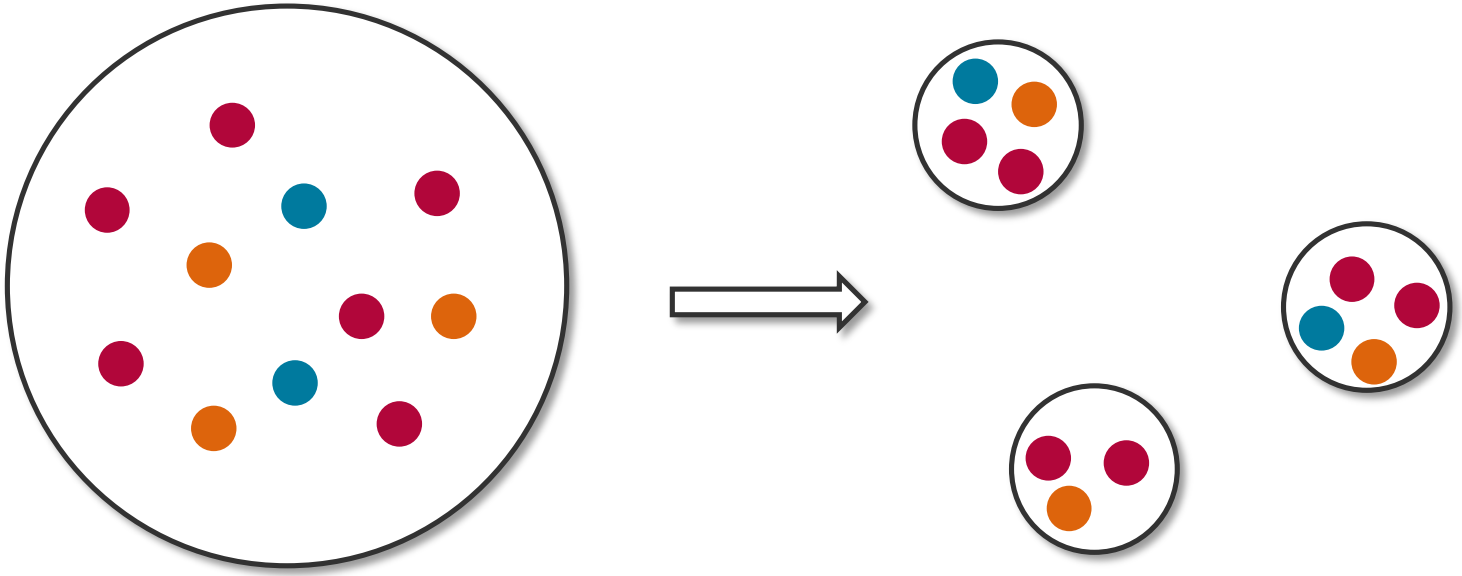

Hasso Plattner Institut
Digital Engineering · Universität Potsdam

Machine Intelligence with Deep Learning
Importance batching for improved training of neural networks

Samik Real, Jonathan Gadea Harder, Johannes Hötter

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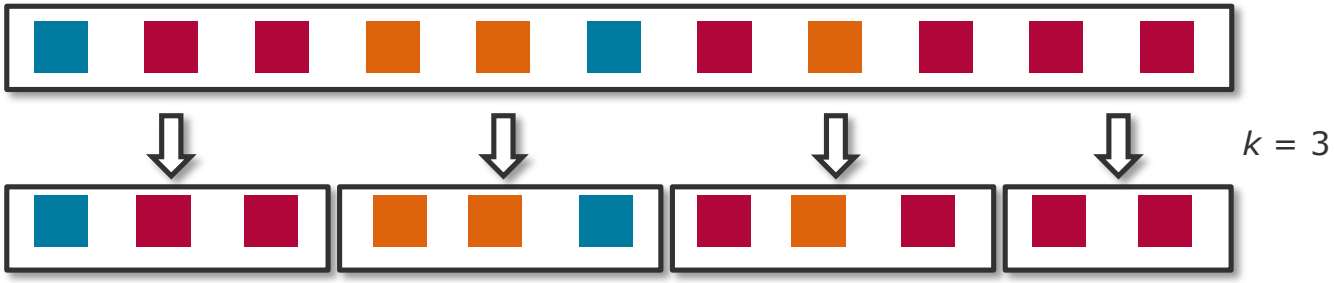
Agenda

1. Introduction to the problem
2. Our current results
   - Fashion-MNIST
   - CIFAR-10
   - CIFAR-100
3. Next steps

Introduction to the problem

- Stochastic learning splits data into multiple batches of a maximum size k
  - For instance: 11 images split into 4 batches with at most 3 samples each



  - Necessary if dataset is too large for RAM
  - Speeds up training and helps model to converge due to added noise
- Usually batches are created randomly

Is there a better approach ?!

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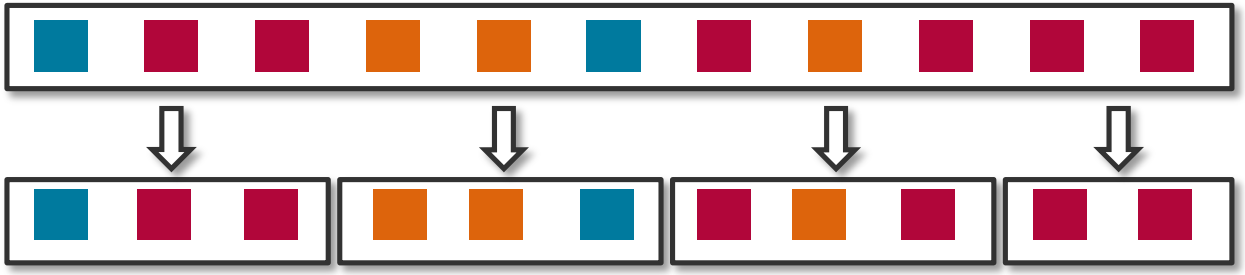
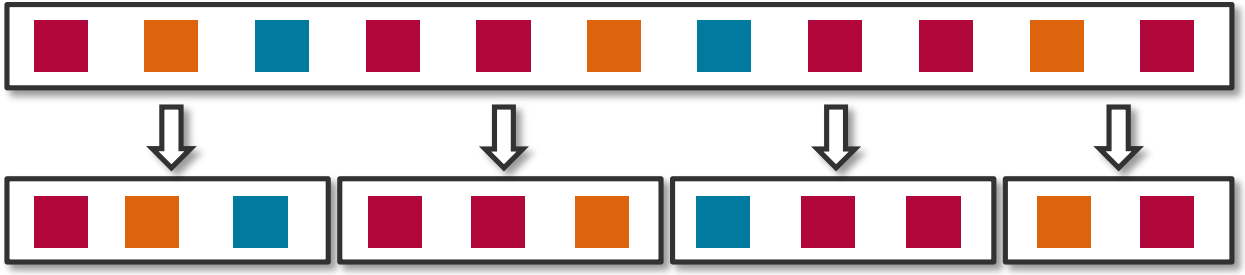
Introduction to the problem

- How we created batches so far:
  - Freezing the data

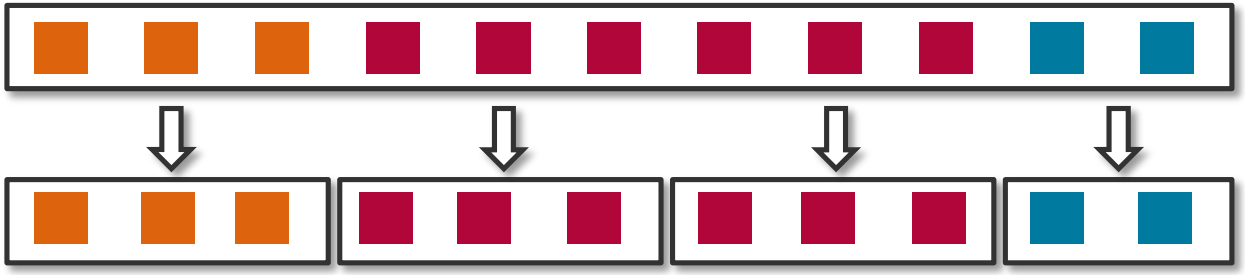


  - Shuffling the data

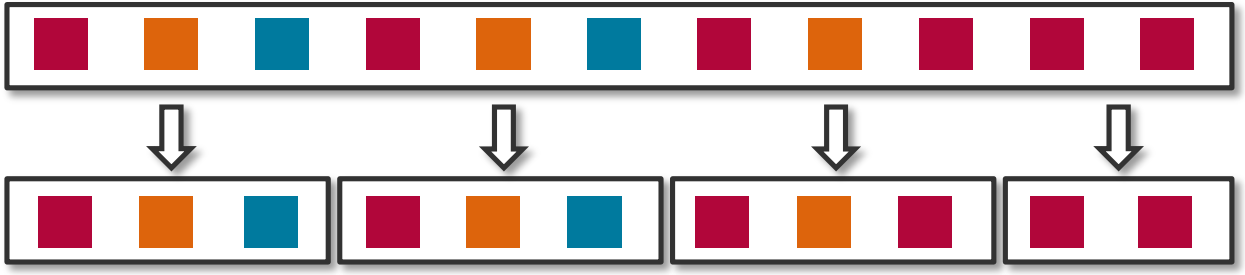


Introduction to the problem

- How we created batches so far:
  - Sorting the data homogeneously



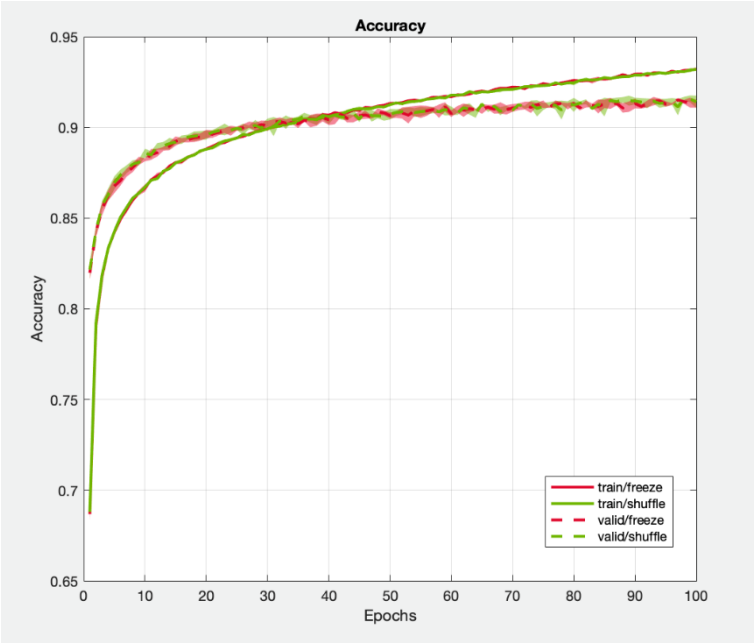
  - Sorting the data heterogeneously

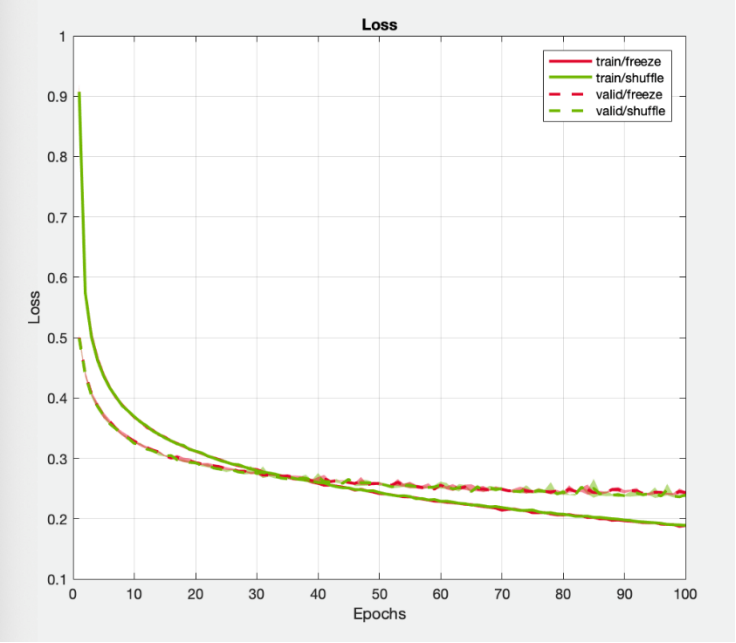


Our current results

- 1st experiment: Fashion-MNIST
  - 70,000 gray-scale 28x28 images (6:1 train/test split) with 10 classes
- Model used: Custom convolutional neural network
  - 4 layers: 3 conv layers + 1 FC layer
  - Conv layers: 64, 128, 64
  - filter sizes: 2x2
  - activation: PReLU
  - Max Pooling (2x2) after every conv layer
  - Dropout (0.5) used on FC layer

Our current results





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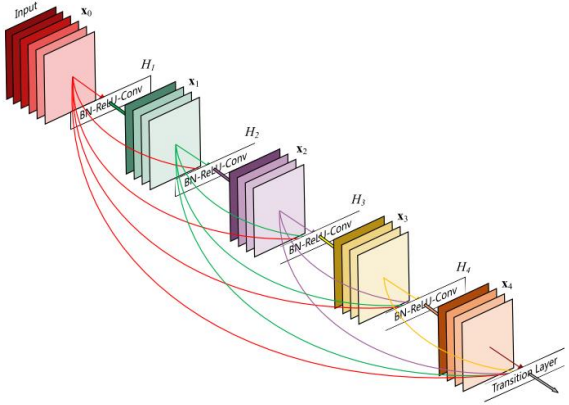
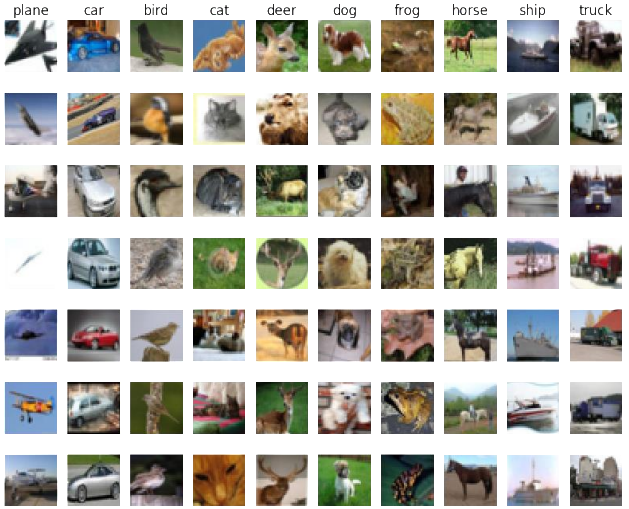
Our current results

- 2nd experiment: CIFAR-10
  - 60,000 32x32 rgb images (i.e. 3x32x32 tensors) with 10 classes, uniformly distributed along all images
  - Model used for classification: ResNet with 18 layers





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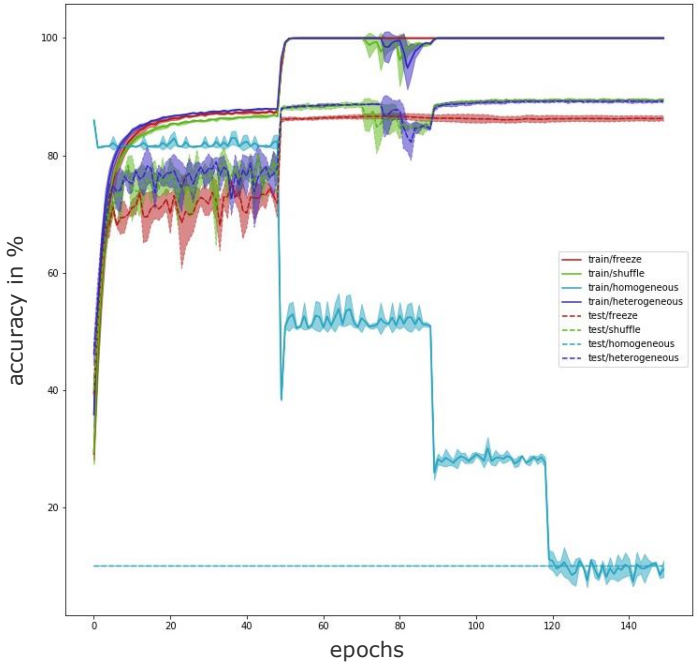
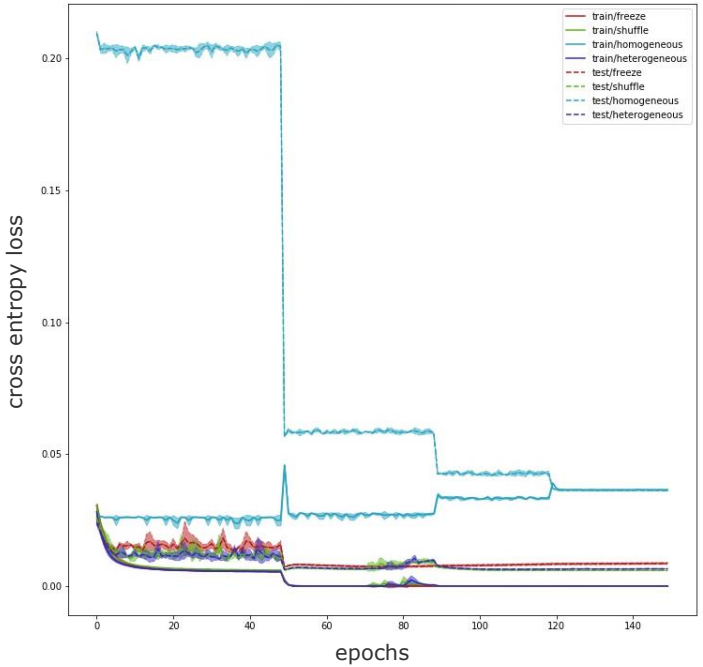
Our current results

Change of accuracy over epochs



Change of loss over epochs



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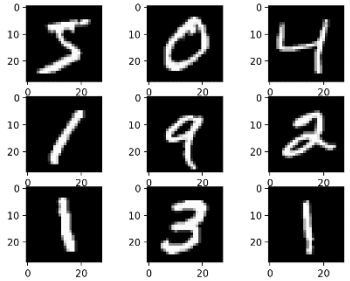
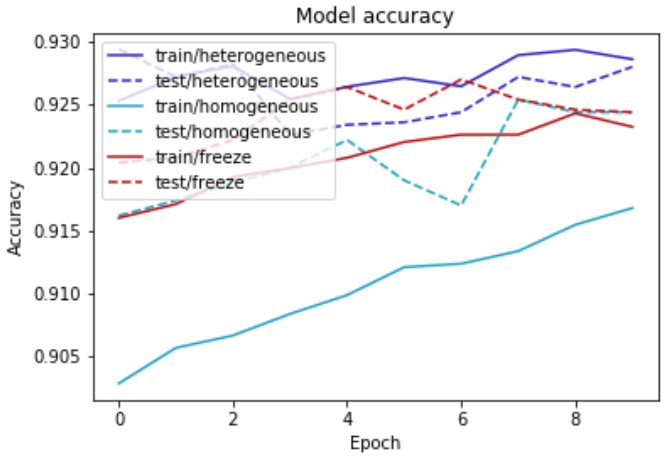
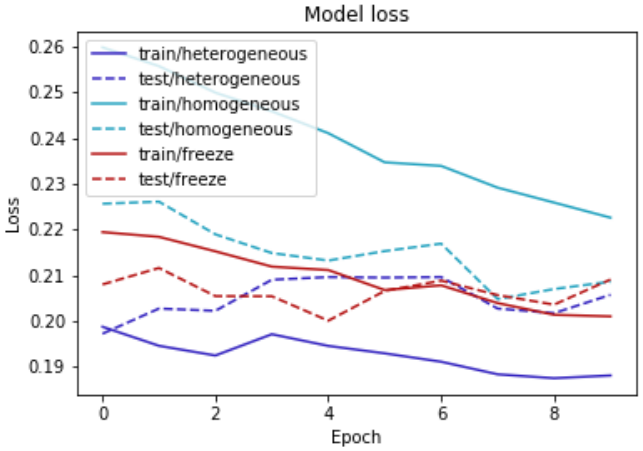
Our current results

- 3rd experiment: MNIST
  - 70,000 gray-scale 28x28 images (6:1 train/test split) with 10 classes
- Model used: Custom convolutional neural network
  - 3 layers: 2 conv layers + 1 FC layer
  - Conv layers: 64, 32
  - filter sizes: 2x2
  - activation: ReLU in conv layers+ softmax in FC layer
  - Max Pooling (2x2) after every conv layer
  - Dropout (0.3) used on conv layer, Dropout (0.5) used on FC layer



Our current results





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Next steps

- Implementing the weighted random sampling method

Algorithm D, a definition of WRS

Input : A population V of n weighted items
Output : A set S with a WRS of size m
1 : For $k = 1$ to m do
2 : Let $p_i(k) = w_i / \sum_{s_j \in V-S} w_j$ be the probability of item v_i to be selected in round k
3 : Randomly select an item $v_i \in V - S$ and insert it into S
4 : End-For

- Experimenting with different ideas to sort the data for training
  - Sorting the data by the computed loss of each input globally
  - Sorting the data by the computed loss of each input per class
- Creating batches of dynamic sizes (i.e. increasing/decreasing *k*)

Thank you
for your attention!

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