Deep Learning **Summer Term 2024**

`http://ml3.leuphana.de/lectures/summer24/DL`
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Exercise 5

Due on: Thursday, 30.05.2024

Task 13 PyTorch DataLoader

(i) Implement and test a transform operation that

  (a) does a random crop on CIFAR10.

  (b) adds random noise* on MNIST

  (c) does a random vertical flip on FashionMNIST†.

(ii) Define a custom dataloader for the two moons data set we used in an earlier task.

  Bonus: Train a classifier on it and visualize the prediction.

Task 14 Gradients

(i) Construct a classifier on MNIST, FashionMNIST, or CIFAR10 using only fully connected linear layers. Use at least four layers.

(ii) Show the norm of the gradients per layer after each epoch.

(iii) Experiment with sigmoid and ReLU activation functions.

(iv) Test batch normalization by applying it

  (a) after the linear layer and before the non-linearity.

  (b) after the non-linearity.

(v) Try (a) no input normalization, (b) input normalization, and (c) adding 100 to the input without any normalization. Furthermore, you can try changing the initialization of the weights. What happens, e.g., when weights are initialized with zeros?

What are the effects?

Hint: If it takes too much time to train, restrict the task to a binary classification problem. You can also consider scaling down MNIST by applying the following transformations: `T.CenterCrop(20)` followed by `T.Resize(8)`.

*use a Gaussian with zero mean and some standard deviation

†FashionMNIST is a data set like MNIST that shows fashion items like shoes, pants, etc.