Deep Learning with Stacked AEs & RBMs

DD2437 - Artificial Neural Networks & Deep Architectures - Lab 4

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This lab will examine two different artificial neural network structures, Auto Encodes (AE) and Restricted Boltzmann Machines (RBM). Their effectiveness in a learning task and the effect of the layer depth of the models will be tested and evaluated.

1 Feature learning

In this first task shallow versions of both models are trained as benchmarks for the later deeper versions. The dataset used is a subset of the MNIST dataset containing 28×28 images of handwritten digits from 0 to 9 together with correct labels of the written digit. All the pixel values has for simplicity's sake been converted to binary values via simple thresholding.

1.1 Hidden unit size

The input size hyperparameter for both of the models is decided by the shape of the data. In our case we require $28 \times 28 = 784$ input nodes, one for each image pixel. We do however have a choice in the number of hidden units, n_{h}.

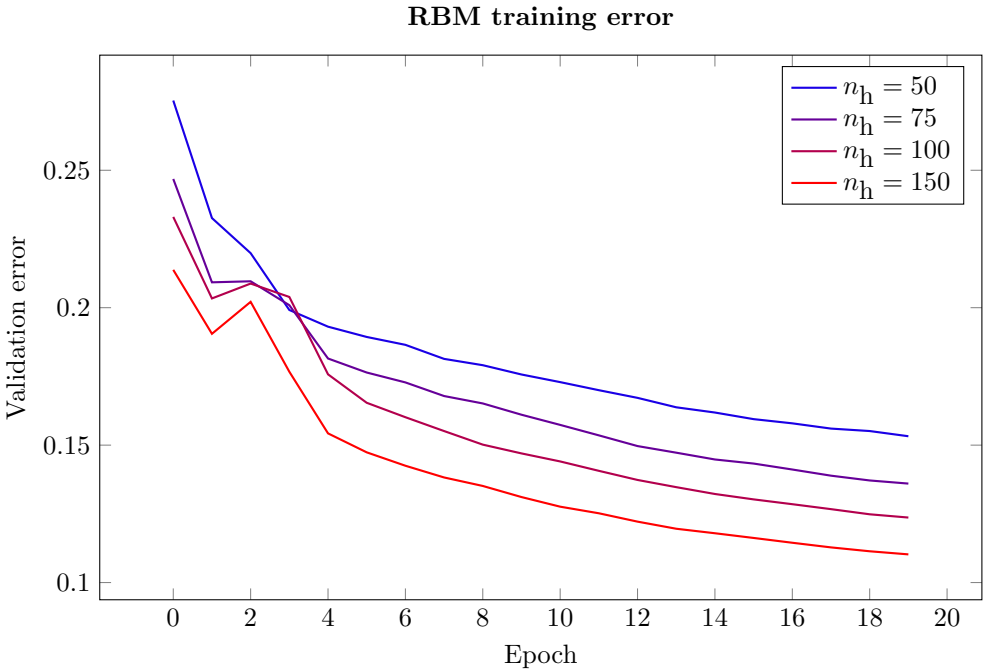


Figure 1: Error curves on the validation set for the RBM.

1.2 Learned features

We can examine the learned weights of each model to get an idea how the models are learning. By reshaping the weight vectors back into 28×28 grids each hidden units weights can be represented as images where each pixel value corresponds to the strength of that weight from the given pixel to the hidden unit.

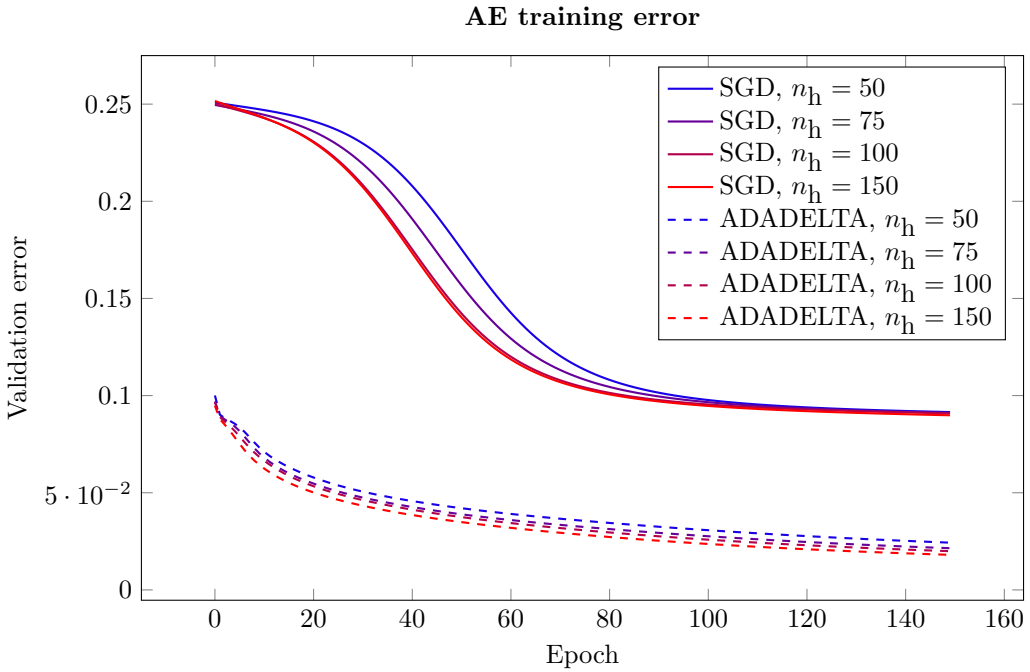
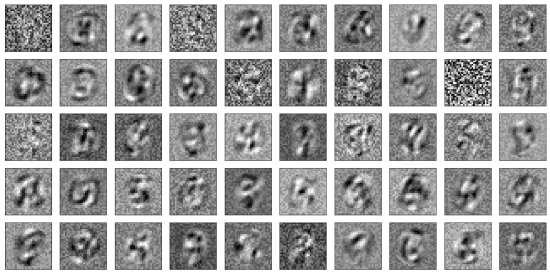
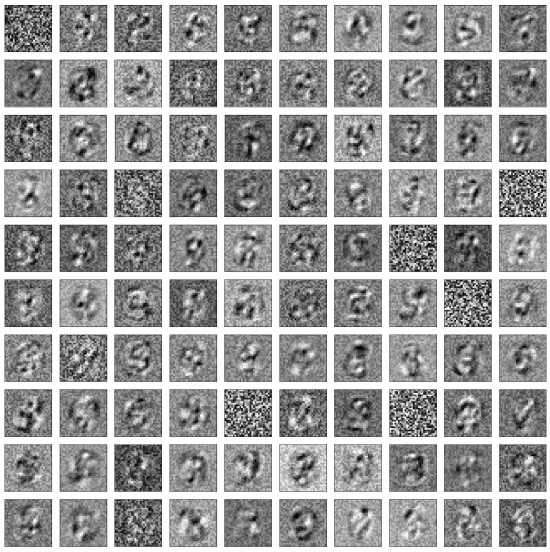


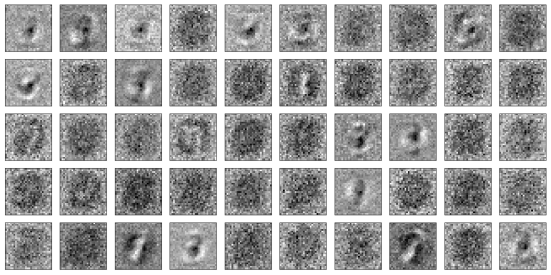
Figure 2: Error curves on the validation set for the AE, with .



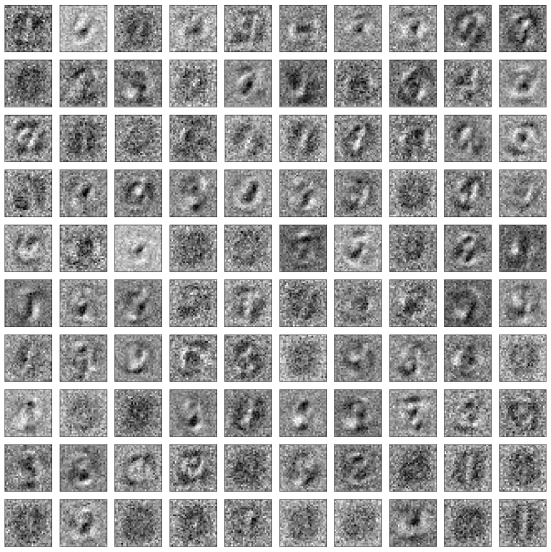
(a) AE weights, 50 hidden units.



(b) AE weights, 100 hidden units.



(c) RBM weights, 50 hidden units.



(d) RBM weights, 100 hidden units.