EE5601: Representation Learning, Fall 2020 (34)

Indian Institute of Technology Hyderabad
HW 2, Assigned: Thursday 05.11.2019. 35 points
Due: Friday 13.11.2019 at 11:59 pm.

Notes:

- The name of your Jupyter notebebook submission should follow the convention `roll-no-hw2.ipynb`.
- The MNIST database can be downloaded from `http://yann.lecun.com/exdb/mnist/`.

1. Implement a multilayer perceptron. Specifically, implement the back-propagation algorithm to learn the weights of a perceptron with 2 input nodes, 2 hidden nodes and 1 output node. Train your network to learn the following binary operations:

   (a) XOR (5)

   (b) AND (5)

   (c) OR (5)

   Experiment with the number of training samples N and see how its affects performance. Add noise to the labels to generate more samples. Your code should make the number of nodes a configurable parameter.

2. Now, implement an autoencoder with the sparsity constraint. Build on your MLP implementation from the previous question. Choose your network size appropriately (meaning a size that you can train and test on your computer without running into memory issues). You can train your network on the MNIST database (and downsample to 14×14 if required). (10)

3. Implement a variational autoencoder. Ensure you generate z using the reparameterization technique so that backpropagation can work. Train on the MNIST database. You can downsample the images to 14×14 to make your optimization converge faster. Again, build on your previous MLP implementation. (20)