| Technische Universität München<br>WS 2016 Fakultät für Informatik | Prof. Dr. N. Navab, Ph.D.<br>December 14 , 2016 |
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## Exercise Sheet: Machine Learning in Medical Imaging

**Problem 1:** Auto-encoding MNIST examples

You are provided with MNIST dataset as 'mnist.mat'. It has 2 matrices, 'fea' of size 70,000x784, i.e. 70,000 examples of hand written digits of size 28x28. 'gnd' is the class label 0-9 (10 classes). Use the sample code Autoencoder.py and modify accordingly. You may use any other open source Autoencoder code for the purpose. Split the data into Training and Testing as 80-20%.
Tasks:

1. Choose a decent Learning Rate and Report Convergence.
2. Report the behavior (Loss Curve) with varying number of Hidden units (say 50,100) and intuitively discuss the results.
3. Add some noise to the input and compare the behavior with the previous one.
4. Visualize the learnt weights.

**Problem 2:** Auto-encoding Retinal Fundus Images

You are provided with DRIVE retinal dataset as 'DRIVEdata.mat'. It has 2 matrices, 'DataMatrix' of size 40,000x625, i.e. 40,000 retinal image patches of size 25x25 centered at a vessel or background. 'Labels' is the class label '0 1' or '1 0' (2 Classes binary Encoded, vessel and background). Split the data into Training and Testing as 80-20%.
Tasks:

1. Autoencode the Data with 50 hidden units selecting a decent learning rate for convergence.
2. Use the 50 dimensional learnt features to train a Random Forest and a Logistic Regression Classifier (Use any inbuilt or open source code for Random Forest and Logistic Regression).
3. Compare their performance on the 20% testing data and report them.
4. Visualize the learnt weights.