Project 1a
Iterative Reweighted Least Squares for Logistic Regression

- Implement the IRLS algorithm for logistic regression.
  - Code up a generic implementation.
  - Train it on the first 2 classes of MNIST digits training data.
  - Report classification accuracy on the testing data for the relevant classes.
- Submit your_roll_number_LR.zip containing code and report.txt/pdf explaining your results.
- Due next Monday (March 07, 2016 before 5:30 pm) on \\printsrv.

Project 1b
SGD for Multiclass Logistic Regression

- ▶ Implement the SGD algorithm for multiclass logistic regression.

    - ▶ Code up a generic implementation.
    - ▶ Train it on the MNIST digits training data.
    - ▶ Report classification accuracy on the testing data.

- ▶ Submit your_roll_number_MLR.zip containing code and report.txt/pdf explaining your results.

- ▶ Due on Monday (March 14, 2016 before 5:30 pm) on \\printsrv.

Project 2
Backpropagation for MLPs

- ▶ Implement the backpropagation algorithm for training an MLP.

  - ▶ Code up a generic implementation.
  - ▶ Verify correctness of analytical derivatives.
  - ▶ Understand the experiment and network used for Figure 5.3 in Bishop's book.
  - ▶ Regenerate Figure 5.3 using your implementation.
- ▶ Submit your_roll_number_MLP.zip containing
  - ▶ code,
  - ▶ generated image, and
  - ▶ report.txt/pdf explaining your results.
- ▶ Due Monday (March 21, 2016 before 5:30 pm) on \\printsrv.

Project 3
CNN Implementation

- Implement a Convolutional Neural Network for classification and train it to recognise hand-written digits from the MNIST dataset.
- Due Monday, May 16th, 2016 before 5:30 pm on \\printsrv.
- Submit your_roll_number_CNN.zip.
- Resources
  - http://cs231n.github.io/convolutional-networks/
  - http://ufldl.stanford.edu/tutorial/supervised/ConvolutionalNeuralNetwork/
  - http://cs231n.stanford.edu/slides/winter1516_lecture7.pdf
  - Consult your TA (Sania Ashraf mscsf14m007@pucit.edu.pk).
  - Attend the tutorial(s).

Project 4a
Principal Component Analysis

- ▶ Dimensionality reduction via PCA.
  - ▶ Code up a generic implementation of PCA in function `[evecs,evals]=compute_pca(X)` where `X` is a $D \times N$ data matrix.
  - ▶ Regenerate Figures 12.3, 12.4 and 12.5 in Bishop's book.
- ▶ Submit your_roll_number_PCA.zip containing
  - ▶ code,
  - ▶ generated images, and
  - ▶ report.txt/pdf explaining your results.
- ▶ Due Monday, April 04, 2016 before 5:30 pm on \\printsrv.

Project 5
EM for Gaussian Mixture Model

- Density estimation via Gaussian Mixture Model (GMM).
  - Code up a generic implementation of learning a GMM via the EM algorithm in function
    `[mixing_coefs,means,covariance_mats]=learn_gmm(X,K)`
    where `X` is a $D \times N$ data matrix and `K` is the number of Gaussian components.
  - Regenerate Figure 9.8 in Bishop's book.
- Submit your_roll_number_GMM.zip containing
  - code,
  - generated image, and
  - report.txt/pdf explaining your results.
- Due Monday, May 30, 2016 before 5:30 pm on \\printsrv.

Project 6
Mixture Density Network

- Multimodal conditional density estimation via Mixture Density Network (MDN).
  - Regenerate Figures 5.19 and 5.21 in Bishop's book.
- Submit your_roll_number_MDN.zip containing
  - code,
  - generated images, and
  - report.txt/pdf explaining your results.
- Due Monday, June 06, 2016 before 5:30 pm on \\printsrv.