APRML Assignment-2

Plagiarism: Don't copy your code and plagiarize you assignment.
Database: CIFAR10 (https://www.cs.toronto.edu/~kriz/cifar.html)

Q1: Build a CNN architecture of the following specifications: The architecture of the convolutional layers are [**block1:** [3x3x*x16] x 2], [**block2:** [3x3x*x32] x 2], [**block3:** [3x3x*x64] x 2] (pooling is an optional layer, use according to your requirement). Perform the following tasks to analyse the CNN architecture:

1) Implement a CNN architecture with block1, block2 and block3, followed by 2 FC (Fully Connected) layers and a softmax layer. Apply tanh activation function on all layers.
2) Use or implement Leaky ReLu, Exponential linear unit, Parametric ReLu, and maxout activation function in place of tanh.
3) Implement Dropout and use
   i) After convolutional layers, ii) Between FC layers
4) Implement batch normalization and use after each convolutional layers
5) Use skip connections to build your residual network.

Analyze the CNN performance for each of the above mentioned tasks.
Specifications: Analysis should be based on testing accuracy, training and testing loss per epoch, and gradient of the parameters. Use 100 epochs to train the network.

1) Analyse the accuracy, loss, and gradient while adding block 1, block 2 and block 3
2) Analyse the accuracy, loss, and gradient while applying the above mentioned activation functions
3) Analyse the accuracy, loss, and gradient while changing the dropout probability [0.2, 0.4, 0.6]
4) Analyse the accuracy, loss, and gradient while changing the batchsize [32, 64, 128]
5) For residual network, analyse the accuracy, loss, and gradient with and without projection block or bottleneck block (1x1 convolutional block)

When the network is deep enough then the gradients would not be able to flow till the first layer. In gradient analysis, analyse the gradient of **any variable** from the first layer and plot the gradient value.

Maximum Marks : 50

Bonus: Do something interesting!
Build upon the above given question and investigate, analyze or implement something *different in CNN*. It could be anything you have been wanting to try since long, some interesting analysis, or something inspired from your surroundings. Try to come up with something intriguing and grab the bonus!

Maximum Marks : 10

Deliverable: 1) Accuracy, loss, and gradient should be plotted with respect to each iteration and submitted with your assignment. 2) You are also required to create a report for all five tasks and explain briefly your takeaway for these tasks. 3) Submit all your codes.
Note: Implement your dropout and batch normalization, do not use inbuilt functions for this task. Both the functions should be applicable only for training.