CS-GY 9223-E: Deep Learning Feb 12, 2018

Homework 2

Due: Sunday, 25th February 2018, 11:55 PM
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Homework TA: Monil Shah

Homework 2 guidelines:

Participate in an in class Kaggle competition.: Click here for Kaggle Link
Upload your code to NYU classes.
In this assignment, you are required to create a Convolutional Neural Network using TensorFlow. Your network will be trained on the CIFAR10 dataset and will learn to classify images into 10 categories: airplane, automobile, bird, cat, deer, dog, frog, horse, ship, truck. More information about setting up and using TensorFlow can be found here: https://www.tensorflow.org

Using TensorFlow, implement a Convolutional Neural Network to classify images in CIFAR10 provided in homework 1.
Your model must have at least the following:

- At least two Convolutional Layers followed by normalization and pooling layers.
- Activation function ReLU.
- Optimizer: Gradient Descent.
- At least one fully connected layer followed by softmax transformation.

There are several techniques to improve the performance and generalization of the Convolutional Neural Network. The objective is to try different methods to tweak the performance of your model and observe how the performance changes.

Following are a few suggestions which you may try for the purpose of this challenge:

- Modify architecture :
  - Change number of Convolution layers
  - Try a different kernel size
  - Change number of fully connected Layers
- Change the activation function
- Try a different optimizer

- Data Augmentation
- Add dropout

Your techniques need not be limited to just these. You must try at least two different methods and document any significant observations.

Submission

- Submission format for the in class Kaggle competition:

  For each student in the competition, submission files should contain two columns: ’id’ ’label’. The data is split into training and testing. The testing image names are given. id will have consecutive values from 0 to # of testing samples, following the order of the test data. label column should have predicted label of the test samples corresponding to test_submit.csv
  Note: download ’test_submit.csv’ to see the format of your submission file.

- You must also submit a jupyter notebook or a python script containing the code which was used to submit the file in the Kaggle competition.

  Submit HW2-uni.zip file that contains the following files named in the specified way:

  - Submit an iPython notebook ”hw2-uni.ipynb” showing the training process, particularly training loss and training accuracy.
  - Save the predictions y pred to files ”ans-uni.npy”. The numpy array should contain the unnormalized scores from the network, so the shape should be (num classes, test size).

  For generating the y-pred npy files, you are required to follow the order of test data as mentioned in test list.txt file.
  This will be the same order as produced by the helper function ”def get files(folders)” in homework 1.

  - Submit a report consisting of the following: – Name and Uni of your group members
  - The architecture, training and test accuracies of the CNN.
  - Duration of training.
  - Size of training data if you performed data augmentation.
  - Documentation of the steps you performed along with the observations made.

Include in your report the TensorBoard screen shots of the following:

- Total Training loss
- Training Accuracy
- Histogram of weight gradient of the convolution layers.
- Histogram of weight gradient of the last fully connected layer.

Please make sure to label them correctly.

Kaggle Competition Instructions

- This is an Kaggle inClass Competition and restricted to students with the link provided in this Homework.
- All Students must submit to leaderboard with display name as netid (ex. vsb259).
- In Kaggle first form a team and then submit your results,
  see https://www.kaggle.com/wiki/FormingATeam
- All students must form team names as their netID pairs for example abc123-def456
- Assignment name on NYU classes: Homework 2, should be of same format as Homework 1
- There may be 2 submissions for evaluation on Kaggle per day.
- No late submissions will be accepted.

Notes:
Please ensure to normalize the input data before feeding it into the neural network.