Machine Learning Homework 2

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I. Introduction

In this report, I will do:
1.Learn two dictionaries respectively for the data in cartoon and texture folder
2.Learn two convolutional dictionaries respectively for the data in cartoon and texture folder.
3.Show the sparse approximations of each image using the learned dictionaries.
4.Perform image separation using the learned dictionaries.

II. Experiment

A. Learn two dictionaries respectively for the data in cartoon and texture folder

First, I built two tensorflow scope: Sparse code part and Diction updating. Use the two placeholders created in each scope to feed my fixed parameters, use tf.get variable to get the variables to be iteratively updated, then use the GradientDescentOptimizer and the loss function to update the variables.

Experimental steps:
1. Use numpy.random to generate random values and feed the placeholder as a fixed value. Make y a partition, flatten each patch, feed the placeholder, and optimize the random production a with the GradientDescentOptimizer.
2. Make the variable a of the previous step sess.run and feed it to the placeholder, and the variable D is updated with the GradientDescentOptimizer.
3. Repeat the above steps until convergence, then change the patch.
4. Repeat the above steps to train all images in the folder.

Experimental paratmeters:
* image shape = 256 x 256
* patch shape = 16 x 16
* dictionary size = 256 x 1024
* learning rate = 0.0001
* train steps for each patch = 1000

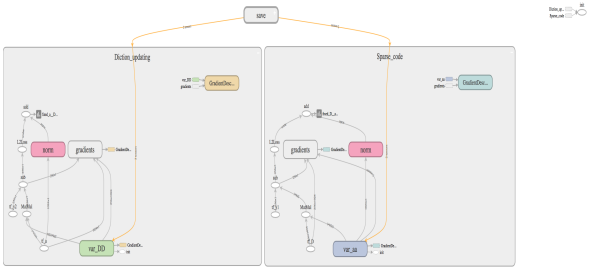

Fig. 1. Tensorflow graph.

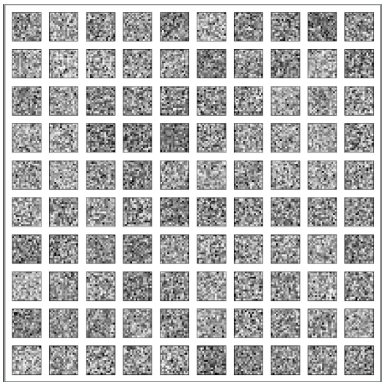

Fig. 2. Cartoon dictionary(top 100).

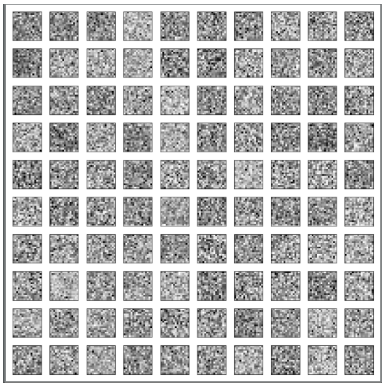

Fig. 3. Texture dictionary(top 100).

B. Learn two convolutional dictionaries respectively for the data in cartoon and texture folder

Conception:

With tf.nn.conv2d, a is treated as input, D is considered as filter, m is treated as depth, and the target is added for all feature maps.

The difficulty currently encountered is how to update the parameters of both, as well as the parameters are too large. Still working hard to solve it.

Experimental paratmeters:

* image shape = 256 x 256
* patch shape = 16 x 16
* dictionary size = 16 x 16
* a size = 256 x 256
* learning rate = 0.0001
* train steps for each patch = 1000

C. Show the sparse approximations of each image using the learned dictionaries

Conception:

Using an architecture similar to the interaction of train a and D, I cut the original image into a patch and feed it into the placeholder, using the first trained D, and optimizing each patch to find a. For each update, the value of less than l in a is set to 0, the purpose is to make a more sparse, then reduce the value of l, and iterate over and over until each patch gets an a. Unlike the training of the first question, this question is an image training a specific to it.

The current difficulty is how do I make a become sparse, in other words how to make the element of a become 0 under the conditions I want, and use this to become a sparse a to optimize. I am still working on this issue.

D. Perform image separation using the learned dictionaries

Conception:

This question is to use the first and second questions to train the D, and then use the third problem train enough to spar a, and then multiply D and a, you can reconstruct the image. Since I have a little problem with the train D of the second question, and the third question how to train enough spar of a spar, I am still unable to reconstruct my images.