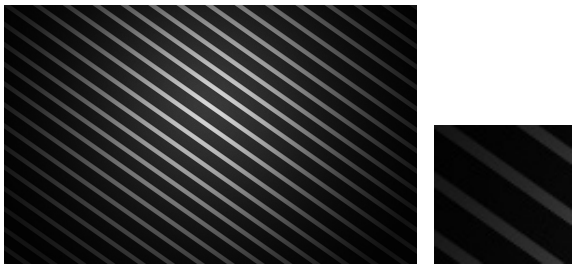
Structural Machine Learning Homework #2

Ting-Xuan, Hsu
Department of Applied Mathematics
National Chung Hsing University
Taichung, Taiwan

I. Data Pre-process

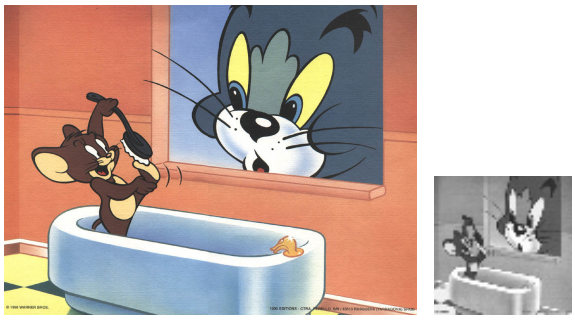
1. Convert each data to gray scale in Texture Folder, and take the upper left corner as origin, crop 225 * 225, then resize to 64 * 64.

2. Convert each data to gray scale in Cartoon Folder, and resize to 64 * 64.



(a) Original (b) crop and resize(64 * 64)

Fig. 1. Texture



(a) Original (b) crop and resize(64 * 64)

Fig. 2. Cartoon

II. Learn two dictionaries respectively for the data in Texture folder and Cartoon folder

A. Partition

To reduce computational complexity and increase the number of training examples, we partition each image into 8 * 8 * 64 and reshape to 64 * 64, and concatenate them to get Y, which size is 64 * t (t = 64 * number of samples)

B. Learn Dictionary

When programming, we set two variable scopes, one for sparse coding, and another for dictionary updating.

The objective:

$$minimize_{D,A} |Y - DA|_F^2 + \lambda \sum |\alpha_j|_0 \tag{1}$$

Alternatively train A and D till convergence.

1. Sparse coding

$$\hat{A} \leftarrow minimize_A \left|Y - \hat{D}A\right|_F^2 + \lambda \sum |\alpha_j|_0 \tag{2}$$

2. Dictionary updating

$$\hat{D} \leftarrow minimize_D \left|Y - D\hat{A}\right|_F^2 + \lambda \sum |\hat{\alpha_j}|_0 \tag{3}$$

III. RESULT

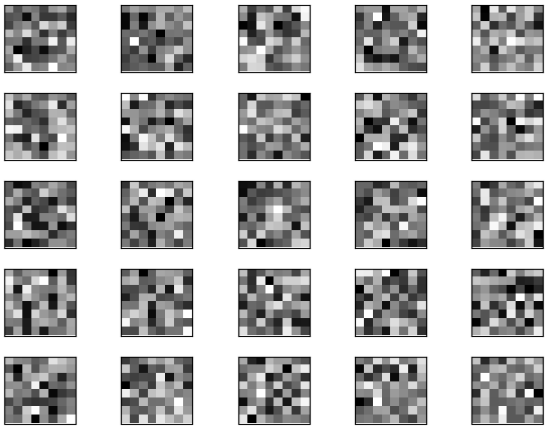


Fig. 3. Texture Dictionary

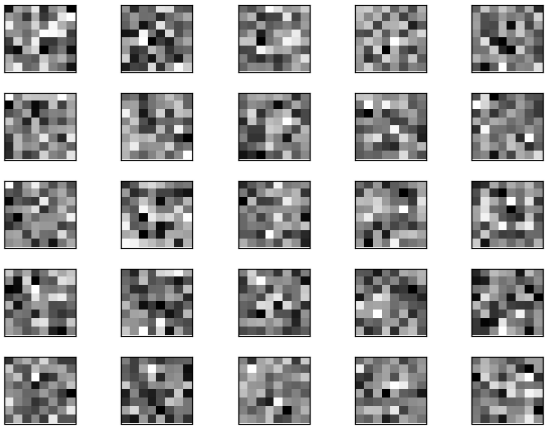


Fig. 4. Cartoon Dictionary