
Introduction to Multimedia

Homework 1

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Q1: DCT image compression

(a) The table shows the lists of PSNR values. If the number is larger, the reconstructed images has less difference with original images. Obviously, n=8 get the highest value because none of data in 8*8 pixel blocks are eliminated.

However, it should be "INF" instead of 39~68. I look up the matrix table, there are a little difference. One possibility is the conversion between "int" and "double".

cat1.png	n=2	n=4	n=8
build-in psnr()	2.729439e+01	3.564602e+01	6.820546e+01
psnr_imple()	2.729439e+01	3.564602e+01	6.820546e+01
cat2_gray.png	n=2	n=4	n=8
build-in psnr()	2.547226e+01	2.922452e+01	4.878895e+01
psnr_imple()	2.547226e+01	2.922452e+01	4.878895e+01
cat3_LR_DCT.png	n=2	n=4	n=8
build-in psnr()	2.088408e+01	2.242330e+01	3.941740e+01
psnr_imple()	2.088408e+01	2.242330e+01	3.941740e+01

Files:

*cat1_DCT_2.jpg, cat1_DCT_4.jpg, cat1_DCT_8.jpg,
cat2_gray_DCT_2.jpg, cat2_gray_DCT_4.jpg, cat2_gray_DCT_8.jpg,
cat3_LR_DCT_2.jpg, cat3_LR_DCT_4.jpg, cat3_LR_DCT_8.jpg*

(b) Same meaning as above.

cat1.png	n=2	n=4	n=8
build-in psnr()	2.729439e+01	3.564602e+01	6.820546e+01
psnr_imple()	2.729439e+01	3.564602e+01	6.820546e+01
cat2_gray.png	n=2	n=4	n=8
build-in psnr()	2.547226e+01	2.922452e+01	4.878895e+01
psnr_imple()	2.547226e+01	2.922452e+01	4.878895e+01
cat3_LR_DCT.png	n=2	n=4	n=8
build-in psnr()	2.088408e+01	2.242330e+01	3.941740e+01
psnr_imple()	2.088408e+01	2.242330e+01	3.941740e+01

Files:

*cat1_DCT_YIQ_2.jpg, cat1_DCT_YIQ_4.jpg, cat1_DCT_YIQ_8.jpg,
cat2_gray_DCT_YIQ_2.jpg, cat2_gray_DCT_YIQ_4.jpg, cat2_gray_DCT_YIQ_8.jpg,
cat3_LR_DCT_YIQ_2.jpg, cat3_LR_DCT_YIQ_4.jpg, cat3_LR_DCT_YIQ_8.jpg*

(c) No difference between (a) and (b). In (b), color module is changed before DCT and change it back to RGB after DCT compression, and get PSNR values.

Q2. Dithering



Random dithering



Average dithering



Error diffusion dithering

Random Dithering is not recommended. There is so much noise and cat's hair cannot be seen clearly compare with other two dithering. There is no big difference between average and error diffusion in this case. In theory, Error diffusion can distribute errors to the whole image, it can be shows more details.

Q3. Image Convolution

cat1.png	3X3	5X5	7X7
build-in psnr()	3.386060e+01	3.162394e+01	3.139908e+01
psnr_imple()	8.200245e+01	7.976093e+01	7.953552e+01
cat2_gray.png	3X3	5X5	7X7
build-in psnr()	2.933215e+01	2.816989e+01	2.805983e+01
psnr_imple()	7.746296e+01	7.630070e+01	7.619063e+01
cat3_LR_DCT.png	3X3	5X5	7X7
build-in psnr()	2.303717e+01	2.242027e+01	2.237251e+01
psnr_imple()	7.119235e+01	7.057400e+01	7.052610e+01

Files:

cat1_3.jpg, cat1_5.jpg, cat1_7.jpg

cat2_gray_3.jpg, cat2_gray_5.jpg, cat2_gray_7.jpg

cat3_LR_3.jpg, cat3_LR_5.jpg, cat3_LR_7.jpg

cat1.png	1	5	10
build-in psnr()	3.162394e+01	2.771111e+01	2.760863e+01
psnr_imple()	7.976093e+01	7.584507e+01	7.574252e+01
cat2_gray.png	1	5	10
build-in psnr()	2.816989e+01	2.561451e+01	2.554654e+01
psnr_imple()	7.630070e+01	7.374531e+01	7.367735e+01
cat3_LR_DCT.png	1	5	10
build-in psnr()	2.242027e+01	2.092954e+01	2.089550e+01
psnr_imple()	7.057400e+01	6.908091e+01	6.904680e+01

Files:

cat1_5_s1.jpg, cat1_5_s5.jpg, cat1_5_s10.jpg

cat2_gray_5_s1.jpg, cat2_gray_5_s5.jpg, cat2_gray_5_s10.jpg

cat3_LR_5_s1.jpg, cat3_LR_5_s5.jpg, cat3_LR_5_s10.jpg

If n is larger -> less PSNR value -> larger difference between original image (much more blur).

If sigma is larger -> less PSNR value -> larger difference between original image (much more blur).