Computer Vision I: project #2 (total 10 points)
Restoration and Inpainting
Due October 27th, 2024, 11:59pm
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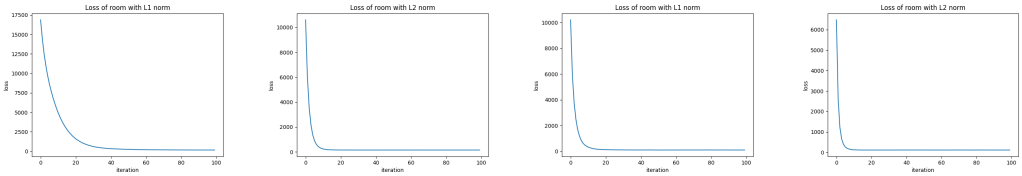
1 Method 1 (Gibbs Sampler)

Experiment setting As for the value of β, I find it has little impact on the final result, and it only influence the speed the loss descent. Therefore I set β to 0.2 in the end. Besides, at first I use the conv layer of torch to calculate the gradient, and find that is extremely slow. Therefore I use numpy in the end, and only consider the four pixels around the target pixel for energy computation, which only cost 90 seconds for 100 sweeps.

Result The figure of the pixels error loss in this experiment is shown below. Since the figures are almost the same, therefore I only show a few of them here.



(a) L1-big (b) L2-big (c) L1-small (d) L2-small

Figure 1: The figure of the loss in the experiment of the picture "room". In the caption, L1, L2 means the kind of norm used for energy calculation; and big, small means the font size of the mask.

The restored picture of the "room" in different sweep steps are shown below:

(a) step0 (b) step3 (c) step6 (d) step9

(e) step12 (f) step15 (g) step18 (h) step21

Some of the final restored result are shown below. since the choice of L1/L2 norm and big/small mask font size make little difference for the final result. Therefore, I only shows some of them here.

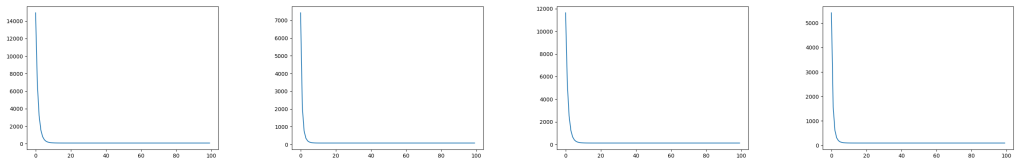
(i) room_L2_big (j) scene_L1_small (k) stone_L2_small

Figure 2: The final result of Gibbs sampling after 100 sweeps

2 Method 2 (PDE)

Experiment setting As for the value of β, I set β to 0.2 in the end, too.
Specially, since the target of this pde method is to optimize alongside the second derivative and get the extremum of the gradient (or in another word: energy), it's not hard to find that to set the second derivative to zero, we have analytical solution and don't need to optimize step by step. The analytical solution is to replace the value of the target pixel by the mean value of the four pixel around it. Therefore, I tried this method for restoring, too, which has a similar efficiency of the pde method.

Result The figure of the pixels error loss in this experiment is shown below. Since the figures are almost the same, therefore I only show a few of them here.



(a) sce-big (b) sce-small (c) stone-big (d) stone-small

Figure 3: The figure of the loss in the experiment of the picture "sce" and "stone". In the caption, big, small means the font size of the mask.

The restored picture of the "sce" in different sweep steps are shown below:

Some of the final restored result are shown below. since the choice of big/small mask font size make little difference for the final result. Therefore, I only shows some of them

(a) step0 (b) step10 (c) step20 (d) step30

here.

(e) room_big (f) scene_big (g) stone_small

Figure 4: The final result of PDE after 100 sweeps

3 Bonus

The three picture used in this project are the KangDe room of Yuanpei dormitory, the stone of Weiming Lake, and the view of Boya tower from the stone boat. The photos I shot are showing below:

(a) room in the basement (b) stone by the lake (c) scene of Boya tower

Figure 5: The final result of PDE after 100 sweeps