EE7374 – Digital Image Processing

Homework 4

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1. Completed MATLAB code for `PMDiffusion.m`.
2. Completed MATLAB code for `HWK4_Diffusion.m`.
3. Read references [1,2] and comment on the principal motivation of Perona and Malik's paper.
   I) Causality: Any feature at a coarse level of resolution is required to possess a (not necessarily unique) "cause" at a finer level of resolution although the reverse need not be true. In other words, no spurious detail should be generated when the resolution is diminished.
   2) Homogeneity and Isotropy: The blurring is required to be space invariant.
4. For a fixed end time T_{end}, experiment with different values of K in PM diffusion and observe the impact on filtering, specifically edges.
   Include screenshots of images and edge maps for the **cameraman** and **colored chips** images. Comment on your observations. Is there a preferred value of K for each image?
   Cameranman:
   K = 0.04

K = 0.1


t=0.100000
t=0.400000
t=1.600000
t=6.400000


t=0.100000
t=0.400000
t=1.600000
t=6.400000

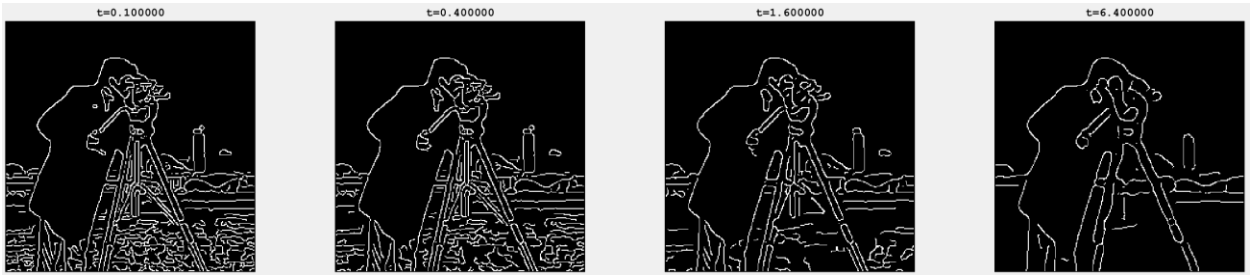
K = 1


t=0.100000
t=0.400000
t=1.600000
t=6.400000


t=0.100000
t=0.400000
t=1.600000
t=6.400000

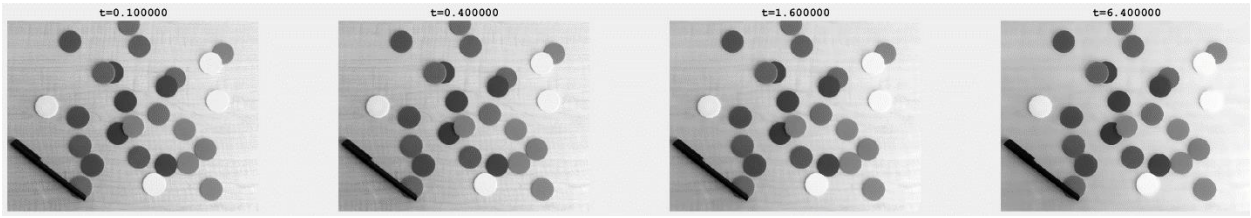
K = 10

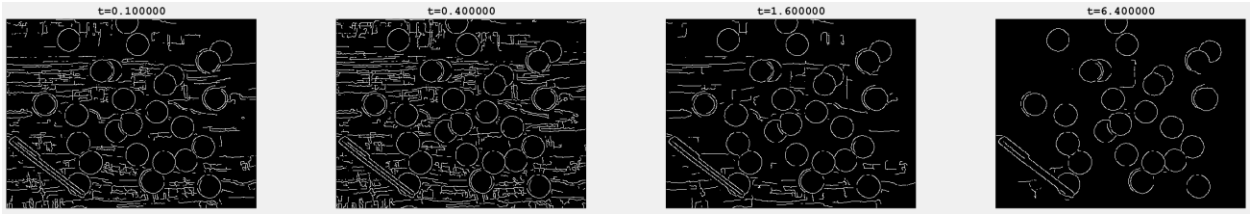

t=0.100000
t=0.400000
t=1.600000
t=6.400000



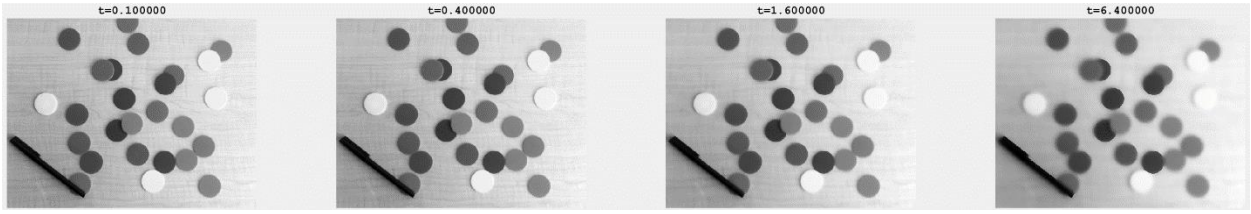
colored chips:

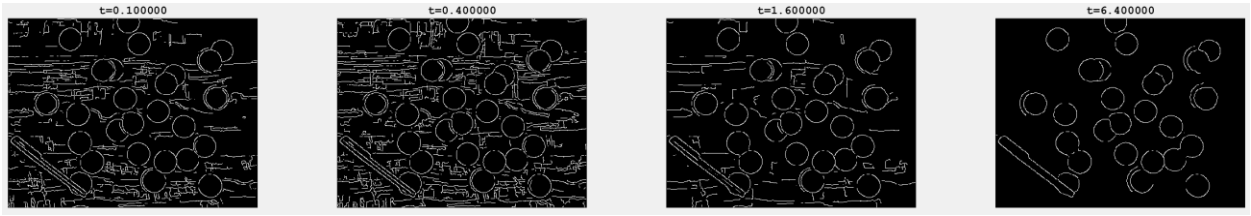
K = 0.04:



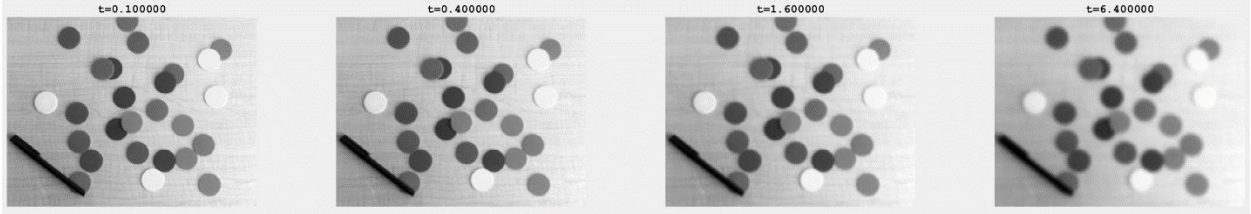


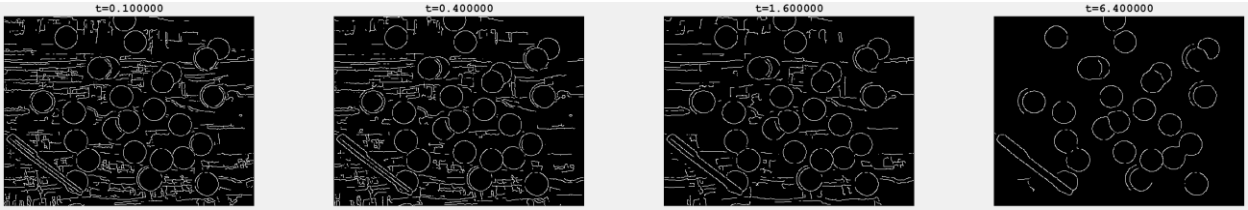
K = 0.1:



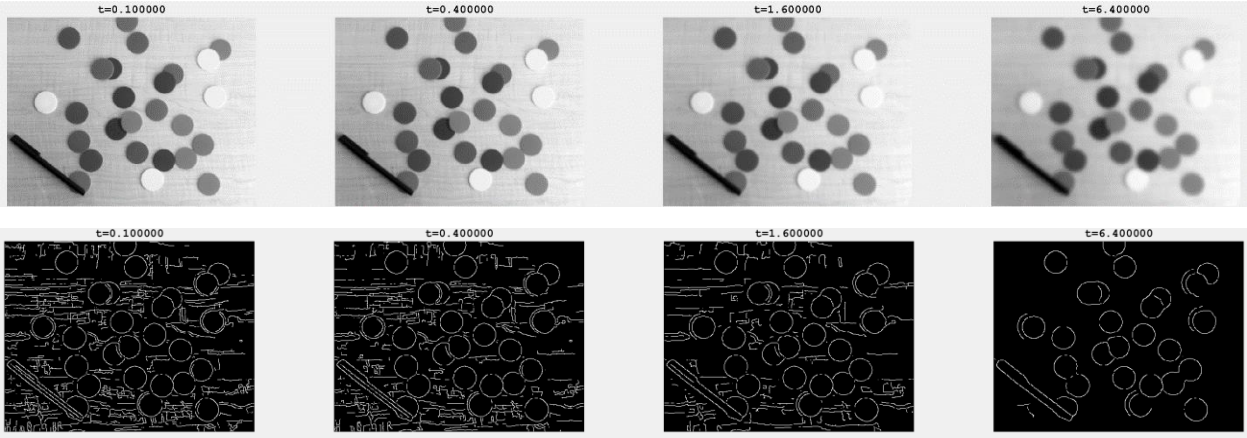


K = 1



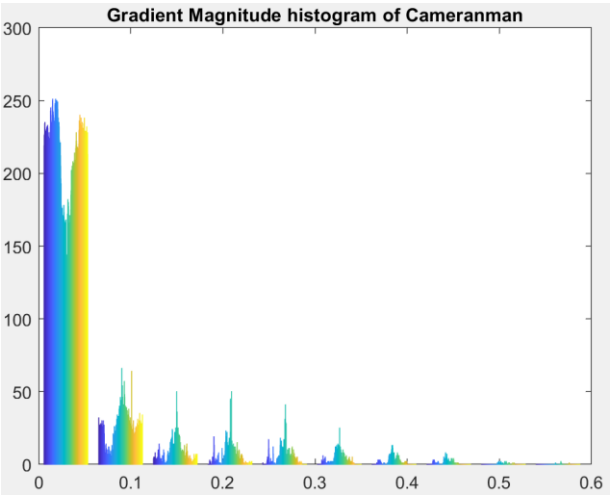


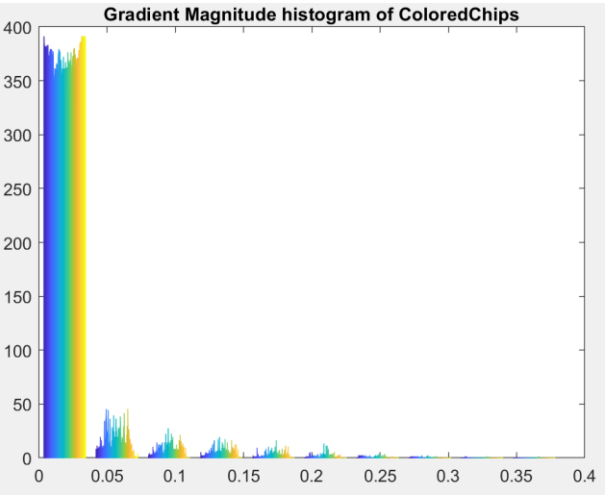
K =10:



According to [3], for the points where |ux| < K, which corresponds to lost in the material. For the points where |ux| > K, on the contrary, which generates an enhancement in the material. So we need to find value distribution of gradient magnitude using histogram.

From the histogram of gradient magnitude of two images below, we can see that most elements of Cameranman are less than 0.1 and so as Colored Chips. So if we choose value of K more than 0.1, the results would be good.





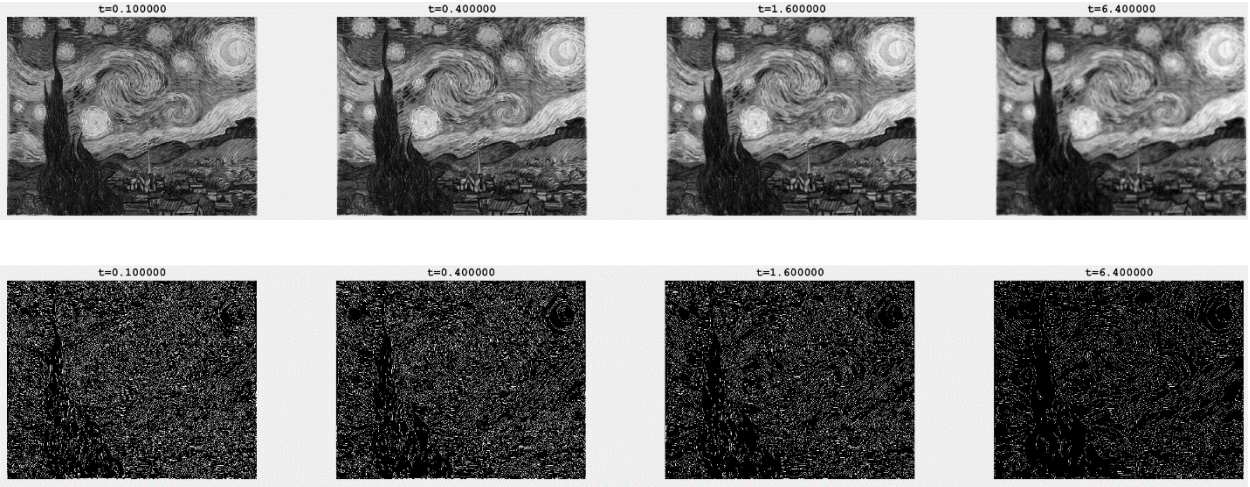
5. For a fixed end-time T_{end} compare the output of Isotropic and PM diffusion. Include screenshots of images and edge maps.

   Isotropic diffusion:

   PM diffusion with K = 1:

6. Experiment with 2 other images of your choice. Explain your motivation for choosing these images.

   First, I choosed starry-night-reference to verify that if this filter has a good effect on strong lines image. To enhance effect, I choose K = 30. And from below result images we can see that PM diffusion can only get limited effect on strong lines image.



Second image is Einstein's photo, I choose this image to verify the effect of PM diffusion on face image. I choose K = 1 and found that PM diffusion gets very good results on face image.