4102 Assignment 1

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Part 1 Theory questions

1. The time complexities are O(n^2) and O(n) separately
2. A)False B)False C)False, The median filter is a nonlinear digital filterD)False,any filter is not a weighted sum of pixels is a nonlinear filter,but the gaussian filter has weighted
3. The image will become more and more blurred until all of pixels will be come same color,and that would be the color for average of whole image
4. It is possible,convolving the image with the new kernel will always get the same result as convolving it with each kernel by order.
5.
6. Obtain normal equations:

   $A^T Ax = A^T b$

   Compute $A^T A$ and $A^T b$

   $$A^T A = \begin{bmatrix} 1 & 0 & 1 \\ 0 & 1 & 1 \end{bmatrix} * \begin{bmatrix} 1 & 0 \\ 0 & 1 \\ 1 & 1 \end{bmatrix}$$

   $$= \begin{bmatrix} 1*1+0*0+1*1 & 1*0+0*1+1*1 \\ 0*1+1*0+1*1 & 0*0+1*1+1*1 \end{bmatrix}$$

   $$= \begin{bmatrix} 2 & 1 \\ 1 & 2 \end{bmatrix}$$

   $$A^T b = \begin{bmatrix} 1 & 0 & 1 \\ 0 & 1 & 1 \end{bmatrix} * \begin{bmatrix} 1 \\ 1 \\ 0 \end{bmatrix}$$

   $$= \begin{bmatrix} 1*1+0*1+1*0 \\ 0*1+1*1+1*0 \end{bmatrix}$$

   $$= \begin{bmatrix} 1 \\ 1 \end{bmatrix}$$

   Reduce the augmented matrix[$A^T Ax \quad A^T b$]for equations

$$\begin{bmatrix} 2 & 1 & |1 \\ 1 & 2 & |1 \end{bmatrix}$$

$$= \begin{bmatrix} 1 & 0 & |1/3 \\ 0 & 1 & |1/3 \end{bmatrix}$$

The general least square solutions are:

x_1 =⅓

x_2 =⅓

Then we got x = $\begin{bmatrix} 1/3 \\ 1/3 \end{bmatrix}$