

## SOME SUGGESTION ABOUT THE CODE

1- Note that the formGmat function that's on the webpage creates a G matrix that's of size  $(A-B-1) \times B$ . If you multiply this matrix with h kernel, you will get an image row of size  $(A-B-1)$ . Note that the original image has A elements in a row, so in order to keep the dimensions consistent, remove  $(B-1)/2$  elements from both ends like below:

`ithRow = OrigImg( i,((B-1)/2+1):A-(B-1)/2)`

This copies the ith row of the image to ithRow.

2- A lot of people calculated the average of h(the kernel for a single row) for different rows in order to find the optimal h for all of these rows in the first assignment; What you've got to do is instead calculate  $\tilde{G}_r^T \tilde{G}_r$  and  $\tilde{G}_r^T f_r$  for each row (where r is row number) and then use

$$\hat{\hat{G}} = \sum_r \tilde{G}_r^T \tilde{G}_r$$

$$\hat{\hat{F}} = \sum_r \tilde{G}_r^T f_r$$

$$h = \hat{\hat{G}}^{-1} \hat{\hat{F}}$$

To see why this is so, remember that the optimal h for all rows would minimize the sum of errors for each row. So our error function is the sum of errors for each row. Since the minimization is done by setting the gradient of the error function to zero, the optimal h will satisfy  $\hat{\hat{G}} * h - \hat{\hat{F}} = 0$

3- Now what you need to do for the second assignment is to generalize this to 2D kernels.

You can generate the  $H^*$  matrix (formed by the concatenation of  $H_{n-2} H_{n-1} H_n H_{n+1} H_{n+2}$  for a kernel size of 5) for a group of rows and use this to compute 2D h kernel.

4-To see how the kernel works in your image you're going to convolve it with the whole image.. Remember h is a vector of  $B^2$  elements. You have to turn this into a  $B \times B$  matrix. Now when we're convolving, you have to flip the kernel both horizontally and vertically, so we have a small problem here. We're taking care of horizontal flip when we reverse the image row order. (Remember a row of  $\tilde{G}$  matrix goes like  $g(n) g(n-1) \dots g(k+1) g(k)$ ) we also have to reverse the order of rows of the kernel.) So if the kernel is like

$$h = \begin{bmatrix} a \\ b \\ c \\ d \\ e \\ f \\ g \\ i \\ j \end{bmatrix} \quad \text{hmat} = \begin{bmatrix} g & i & j \\ d & e & f \\ a & b & c \end{bmatrix}$$

Now just use conv2 with blurred img, and hmat

4- Please email your code to [sancar\\_adali@brown.edu](mailto:sancar_adali@brown.edu), so that I can better understand how your code works.

5 – Try to use for loops when possible so your code is simple. This will make your code easier to read and it will be easier to get rid of problems in your code.