Task 2 – DFT & Filters (2 Questions)

- 1. Design and implement a program that allows the user to:
  - Browse for a grey scale image file to open and show the image (*Img*)
  - Text file that contains a 2D kernel (*h*). Each line represents one row of the kernel and the values in each row are separated by some delimiter. The values in this file can be edited in any text editor. The kernel size should be recognized automatically when opening the file.
  - "Apply Filter" to convolve *Img* with *h* using:
    - matlab function, show result.
    - your *for* loops (not matlab functions), show result.
    - DFT properties (move to FT domain, do your processing, and return back. The return should be the convolution result), show result.

- Notes:
  - User should be able to subtract any of the results from each other to show their difference is zero.
  - Prepare at least 3 images to be used for your demo.
  - Prepare ready kernel files to be used for:
    - Low, hi, band-pass filters.
    - Edge detector (two gradient based, two Laplacian based, and two of your choice)
    - Be prepared to design some filters upon request during your demo. You should be able to plugin your filter design into a text file and see the result on the spot.

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- 2. Design and implement a program that allows the user to open an image, show it beside its Fourier transform then be able to apply the following functions in one domain and recognize the corresponding effect in the other domain:
  - Multiply the image by a smaller 2D rectangle, also multiply it with a smaller 2D hamming window.
  - Image is stretched/shrinked in x or y direction.
  - Image is mirrored around x and around y axis.
  - Zero the phase of the FT. Also, zero the magnitude of the FT.
  - Image is multiplied by a cos function in the x direction, a sin function in the y direction, and both. Both cos and sin function should have some appropriate frequency). Also, rotate the whole image with some arbitrary angle (with and without the cos/sin multiplication).
  - Increase the FT FOV with factor 2, put the original FT in the center and zero pad the around area.
- Notes:
  - To clarify each effect, please design some synthetic image that can clearly demonstrate the effect. The image can be any combination of simple object(s). Again, your synthetic image should demonstrate the effect without a lot of explanation! So, please spend some time thinking about what this image should look like.
  - Remember that FT consists of magnitude and phase. Some effect might show up in one or both of them.
  - For each effect, you need to show the original Image/FT and the effect result in order to compare. i.e. don't replace the effect result on top of the original FT.
  - If FT is not obvious, use the log function to make the effect clearer.