1. Moire patterns are common in medical radiography and industrial images as shown in image_1.jpg and image_2.jpg. This problem studies how to reduce Moire patterns while properly preserving the salient features for diagnosis. Download the images image_1.jpg and image2_2.jpg. Each of these images is corrupted by a clearly visible Moire pattern.
    a. For each image, apply an N×N median filter. Adjust the window size N so that the Moire pattern is removed as much as possible while salient features are properly preserved. Report your choice of N, submit the filtered image, and comment on the quality of the filtered image.
    b. For each image, compute its 2D Discrete Fourier Transform (DFT) (and submit an image showing the DFT magnitude with the DFT zero frequency components at the centre (use fftshift)). A log display may be most appropriate. Clearly identify and label the frequency components that correspond to the Moire pattern.
    c. For each image, design a notch filter (band reject filter) so that the frequency components for the Moire pattern are suppressed as much as possible while other frequency components are preserved. Apply your notch filter to the image's DFT and submit an image showing the filtered DFT magnitude. Display and submit the filtered image in the spatial domain. Compare the quality of the result to that of the filtered image from part (a).
2. Download the images Blocks.jpg and Chess.png. Using an appropriate spatial or frequency domain filter, extract the edges in the images. For Blocks.jpg, the result should have only the edges of the block. For the Chess.png, the blocks of the chess board need to be extracted.
3. Image blurring is a very common problem experienced by each of us either due to motion of the object while taking a photograph or due to shaking of the camera. It is envisaged to develop an automated blur detection algorithm based on any of the topics covered (e.g., spatial filters or domain transformations). The input to the algorithm will be an image (you could use blur1.jpg and blur2.jpg as sample files) and the output will be a scalar value showing percentage of blur (i.e., if the image is having no blur should return 0 and if the image appears to be fully blurred, should output 100).
4. Image Contrast Enhancement is an interesting problem to be addressed and is particularly important for high dynamic range imaging systems such as X-rays or computed tomography (CT). Direct contrast enhancement approaches such as contrast stretching, or histogram equalization or gamma correction may not work all the time and image processing engineers employ multi-resolution approaches such as Laplacian Pyramid or Wavelet tree to come up with gamma correction at different levels as illustrated in the below reference:

    Pieter Vuylsteke and Emile P. Schoeters "Multiscale image contrast amplification (MUSICA)", Proc. SPIE 2167, Medical Imaging 1994: Image Processing, (11 May 1994);

    Consider a low contrast image as given in ContrastSample.TIFF **(acquired from an actual industrial CT machine and don't share outside of IIT Palakkad)** and develop an automated image contrast enhancement algorithm to enhance the results. A sample expected contrast improved image is as shown in ContrastOutput.jpg.