

CPSC 535/635 Midterm prep questions

1. Sketch the following functions in the spatial domain and their corresponding Fourier transforms.

(a) $f(x) = \cos(x)$

(b) $f(x) = \begin{cases} 1 & -5 \leq x \leq 5 \\ 0 & \text{otherwise} \end{cases}$

(c) $f(x) = \frac{\sin(x)}{x}$

(d) $f(x) = \frac{1}{\sigma\sqrt{2\pi}} e^{-x^2/2\sigma^2}, \sigma = 1$

(e) $f(x) = \frac{1}{\sigma\sqrt{2\pi}} e^{-x^2/2\sigma^2}, \sigma = 4$

(f) first derivative convolution kernel

(g) second derivative convolution kernel

Note any similarities, differences, patterns.

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3. Choose an image (or several) and use octave/Matlab to apply a variety of image processing operations such as, Gaussian blur (try varying sigma), averaging, derivatives in x and y directions with various amounts of smoothing, Laplacian, gamma correction, histogram equalization, normalization, etc. What do you observe in the output that is characteristic of the corresponding operation?
4. Try implementing the Hough transform and apply to an image of your choice. How might you use the Hough transform to find other “shapes” in an image such as a circle or an ellipse.
5. A camera takes an image, I , of a penny, a dime, and a quarter lying on a white background, not touching one another, their bounding boxes do not overlap. Thresholding is used to successfully create a binary image, B , with **1** bits for the coins and **0** bits for the back-ground. You know the diameters of the coins D_P , D_D , and D_Q for the penny, dime and quarter respectively - $D_Q > D_P > D_D$. Using the morphological operators *dilation* and *erosion*, and pixel-wise logical operators *AND*, *OR*, *NOT*, and *XOR*, show how to produce three binary out-put images: P , D , Q . P should contain just the penny (as **1s**), D should contain just the dime, and Q should contain just the quarter.