

1 Problem 1

Suppose that you have an image that consists of 256×256 square pixels of size 0.8mm. Obtain the spatial sampling frequency and the Nyquist frequency. Does the maximum frequency change if the image size is 512×512 while the pixel size is the same?

The spatial sampling frequency is

$$f_s = \frac{1 \text{ sample}}{.08 \text{ mm}} = 12.5 \text{ mm}^{-1}.$$

The corresponding Nyquist frequency, symbolizing the spatial frequency of the smallest resolvable detail, is

$$f_N = \frac{f_s}{2} = 6.25 \text{ mm}^{-1}.$$

If the image size is increased to $512 \times 512 \text{ pix}^2$, but the pixel size remains the same, then the Nyquist frequency also remains the same, since there is no change in the number of samples per unit real space.