Definition of important 2D functions: Jinc function

The jinc function is defined as:

$$\text{jinc}(r) \triangleq \frac{J_1(\pi x)}{2x}$$

where J_1 is a Bessel function of the first kind. A Bessel function of the nth kind is a solution of the differential equation:

$$x^2 \frac{d^2y}{dx^2} + x \frac{dy}{dx} + (x^2 - n^2)y = 0$$

- A special property of the 2D jinc function is that it contains all 2D frequencies equally up to a cutoff.
- As we will see later, the jinc function is the Fourier transform of the radial rect function.

Maximum sampling rate in an image with square pixels

- As a consequence, the maximum frequencies present in an image sampled using square pixels occur **along the diagonals**.
- A digital camera is thus able to capture the largest amount of fine detail along the diagonals.
- If an image contains $N = 1280$ columns and $M = 980$ rows, and we define the width of the image to be 1 distance unit, then the highest frequency present in the image is:

  $$\rho_{\max} = \sqrt{(u_s/2)^2 + (v_s/2)^2} = \sqrt{640^2 + 640^2} = 905.1 \text{ cycles/distance unit}$$

  and the highest frequency sinusoids that can be sampled are:

  $$\cos(2\pi\rho_m ax\,(x \pm y) + \phi)$$

  where $\rho_{\max} = 905.10$ cycles / distance unit.