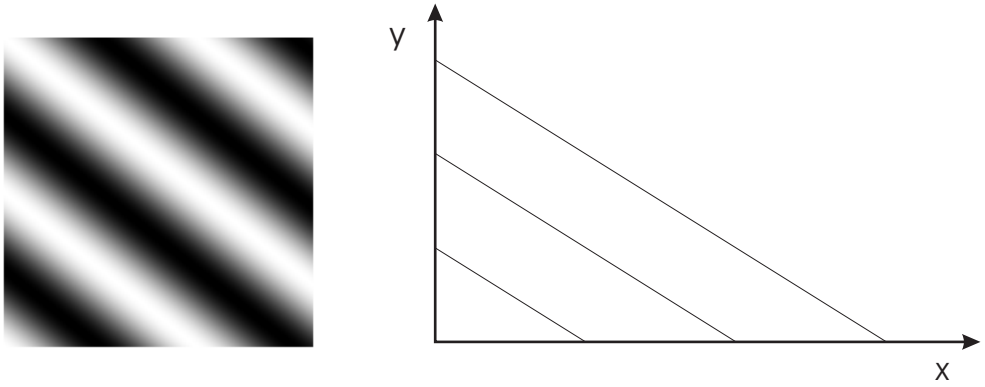
WS 2019/20	Exercises Digital Image Processing	Task No. 4

Periodic patterns - spatial frequencies in digital image processing

Task 4.1 *Wavenumber vector*

a) Describe the following periodic pattern using the wavenumber vector.



What is the relationship between the wavenumber vector $\vec{k} = [k_x, k_y]^T$ and the wavelength λ of this pattern? Interpret the importance of the wavenumber vector components!

b) Implement a function that produces an image with a periodic pattern generated by the wavenumber vector $\vec{k} = [k_x, k_y]^T$ and the phase angle ϕ.

Task 4.2 *Sampling*

a) What condition must be fulfilled by sampling an image signal?

b) Write a function that sample an image at sampling interval r.

c) Produce images with the wavenumber vectors $\vec{k_1} = [0.21, 0.22]$ and $\vec{k_2} = [0.21, 0.24]$. Sample the images with the following sampling intervals.

$$\begin{aligned} r_1 &= 4 \\ r_2 &= 5 \end{aligned}$$

Which qualitative error exists? How does it occurs?

d) What can be done to reduce aliasing effects caused by under-sampling a natural images?