Classical Image Processing – Hands On

Lecture 5

A nice resource:

https://thepythoncodingbook.com/2021/08/30/2d-fourier-transform-in-python-and-fourier-synthesis-of-images/

Task 1: How do sine & cosine waves look in 1D & 2D

Write a function that gets as input: Amplitude, Frequency, Phase and draw it.

Do this for the functions (duplicate for cosine):

a) A * sin(2*pi*f*t+phase)
b) A* sin(2*pi*fx*x+2*pi*fy*y)
c) A* sin(2*pi*fx*x) + B*sin(2*pi*fy*y)

Task 2: Approximating the Square Wave function with sine

Write a function that approximates the square wave till a specific order and draw the approximation.

The approximation is given by:

$$f(x) = \sin x + \frac{1}{3}\sin 3x + \frac{1}{5}\sin 5x + \frac{1}{7}\sin 7x + \frac{1}{9}\sin 9x + \cdots$$

Task 3: Explore the Fourier Transform

Find the FFT function in your favorite environment and use it to see the FT of the following functions:

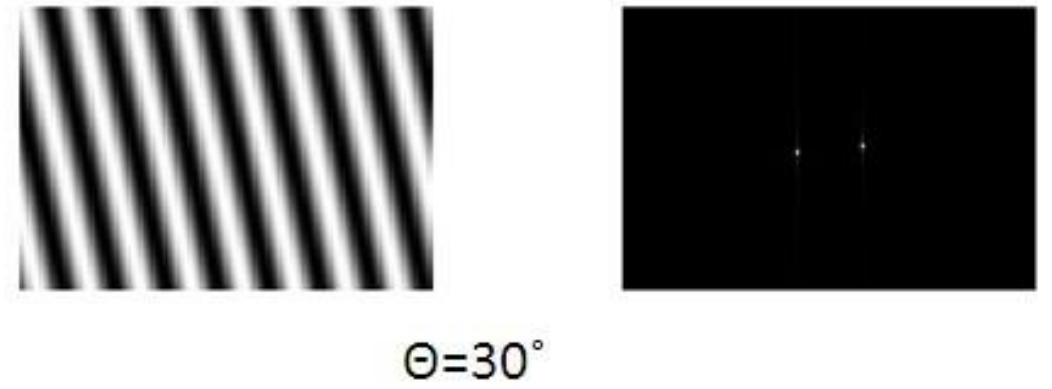
1. A delta function in 1D
2. A sine/cosine wave in 1D
3. A sine/cosine wave in 2D
4. An image

View the real/imaginary values and calculate the amplitude and phase – draw all of these.

Repeat with adding FFTSHIFT

Task 4: Properties of FFT

Create a sine wave with a parameter theta.



Θ=30°

Θ=150°

Validate that when you change theta, the FT also rotates.