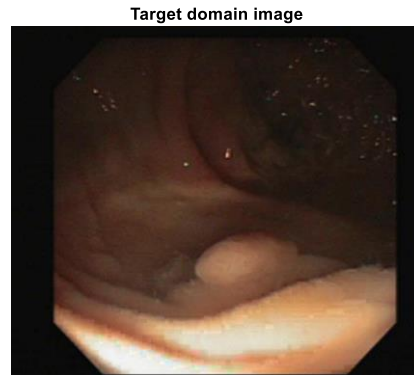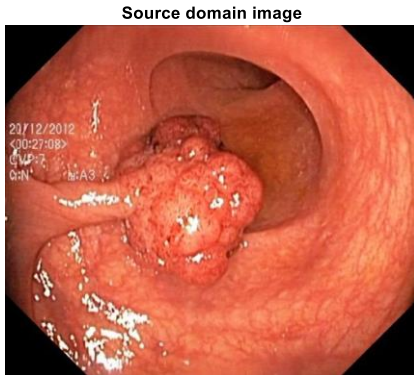**CSE377 Spring 2023 Homework 6 – Frequency Filtering for Image Domain Adaptation (10 pts)**

Due April 7 2023 11:59PM via Brightspace.

1. (1pt) Load two input polyp images 'src_medical.jpg' and 'trg_medical.jpg' as $f_{src}(x, y)$ and $f_{trg}(x, y)$, respectively. Show the input images.

Source domain image   Target domain image

2. (3pt) Calculate the Fourier transform of these two images:
$$F_{src}(u, v) = \mathcal{F}(f_{src}(x, y))$$
$$F_{trg}(u, v) = \mathcal{F}(f_{trg}(x, y))$$
Calculate and show the spectrums of the two images in the frequency domain, i.e., $|F_{src}(u, v)|$ and $|F_{trg}(u, v)|$.

Calculate and show the phases of the two images in the frequency domain, i.e., $|\phi_{src}(u, v)|$ and $|\phi_{trg}(u, v)|$.
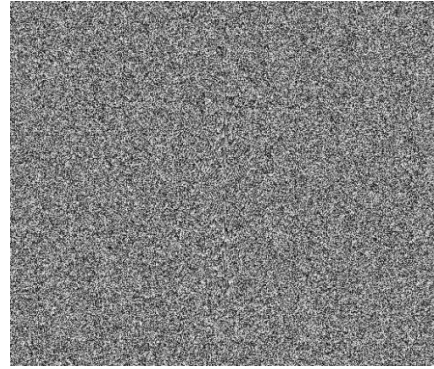
Note, the polyp images are color images with red, green, and blue channels. The red channel is visualized below.

Source spectrum of red   Target spectrum of red
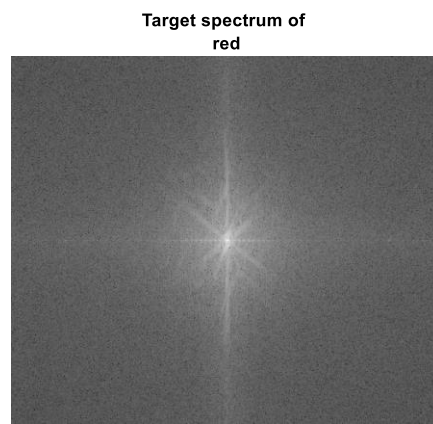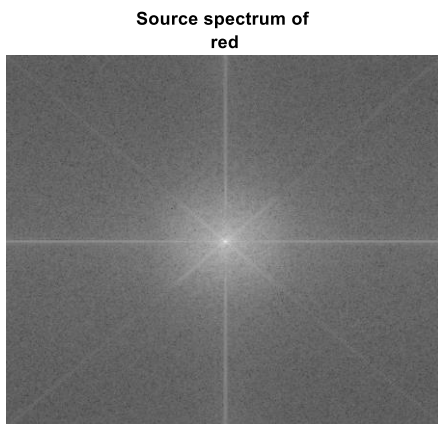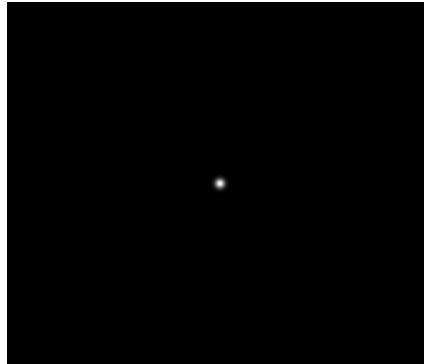
Source phase of red
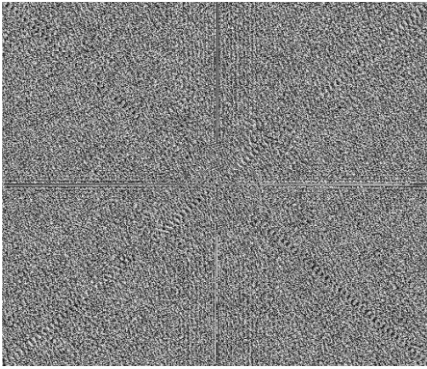
Target phase of red

3. (1pt) Create and show a Gaussian Low-pass filter $H_{Lp}(u, v)$ with standard derivation D_0.

Gaussian Low-pass filter

4. (1pt) Create and show a Gaussian High-pass filter $H_{Hp}(u, v)$ with standard derivation D_0.
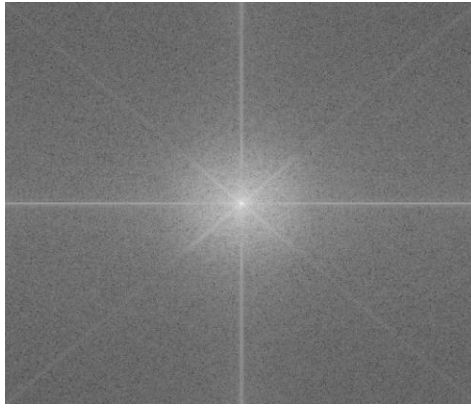
Gaussian High-pass filter

5. (1pt) Apply the high-pass filter to the source image and the low-pass filter to target image to blend the two images' spectrums:

$$|G(u, v)| = |F_{src}(u, v)|H_{Hp}(u, v) + |F_{trg}(u, v)|H_{Lp}(u, v)$$
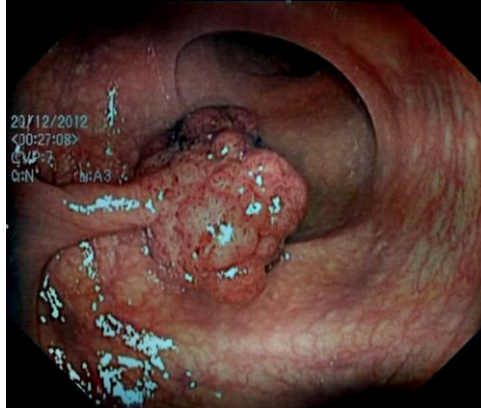
Show $|G(u, v)|$.

Source-adpat-to-target, spectrum of
red

6. (3 pts) Convert the domain adapted source image to the spatial domain and visualize it.

$$f_{src \to trg} = \mathcal{F}^{-1}(|G(u,v)|e^{\phi_{src}(u,v)})$$

Source domain image adpapted to the target domain

Note, the math notations are consistent with the lecture slides.