Name (netid): Your Name (Your Netid)
CS 445 - Project 1: Hybrid Images

Complete the claimed points and sections below.

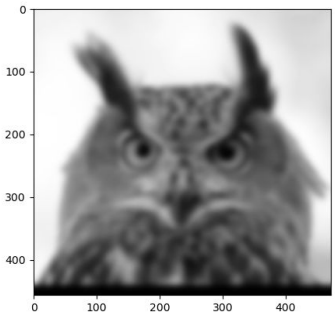
Total Points Claimed	**[ ] / 130**

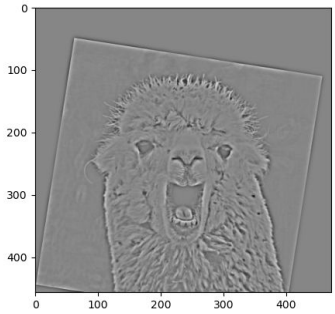
1. Hybrid image main result
    1. Main result and description [ ] / 45
    2. FFT images of main result [ ] / 15
2. Hybrid images: two additional results [ ] / 10
3. Image enhancement tasks (3rd is B&W)
    1. Contrast enhancement [ ] / 10
    2. Color enhancement [ ] / 10
    3. Color shift [ ] / 10
4. Quality of results / report [ ] / 10
5. Color Hybrid Image w/ explanation (B&W) [ ] / 5
6. Gaussian / Laplacian Pyramids (B&W) [ ] / 15

1. Hybrid image main result

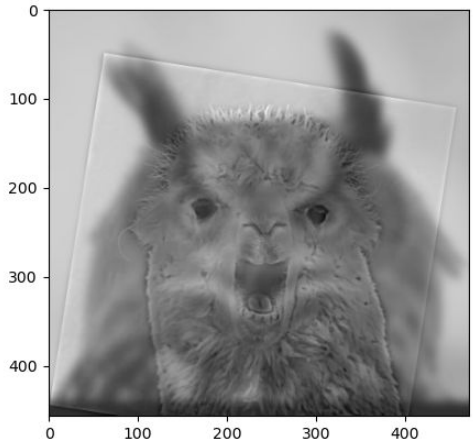
Include

- Original and filtered input images

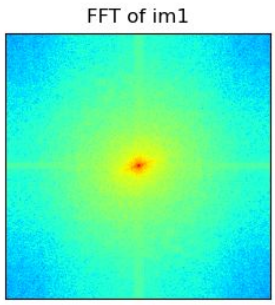


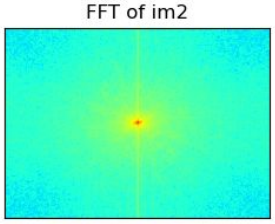
- Hybrid image result



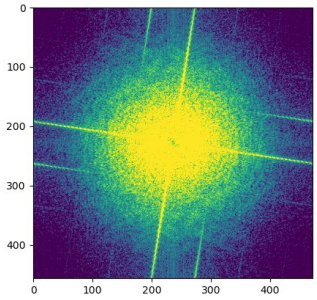
- FFT images of each original and filtered image and the hybrid image

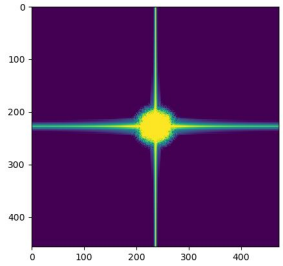
FFT of Original Pictures



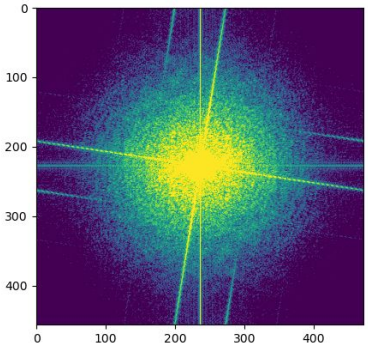


FFT of Filtered Pictures:





FFT of Hybrid Picture:



- Description in a few sentences of how it works using the included images as illustrations. Explain parameter settings and any clever ideas that are incorporated.

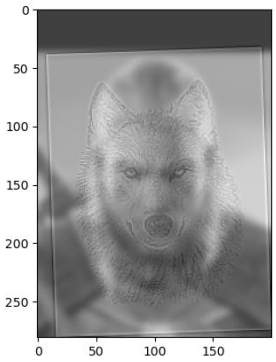
A hybrid picture is composed of two components: low-spatial scale by filtering one image with a low-pass filter and high spatial scale by filtering another image with a high-pass filter. Low-frequency information is mostly the shape of the item and high-frequency information contains the details of the object(like texture). High-frequency information will capture humans' attention in the short distance, while low-frequency information does the opposite. In my example, I used a Gaussian filter to smooth the picture and achieve my low-frequency picture. Meanwhile, subtract the low-frequency information from the original picture would return us the high-frequency information. Combing these two parts together, I got the hybrid result.

- All results must be based on your own images (can be from web with attribution, but not provided samples)

2. Hybrid image additional results

Include

- At least two additional results (may not use provided samples). For each, include the input and hybrid image (do not need to show filtered or FFT images)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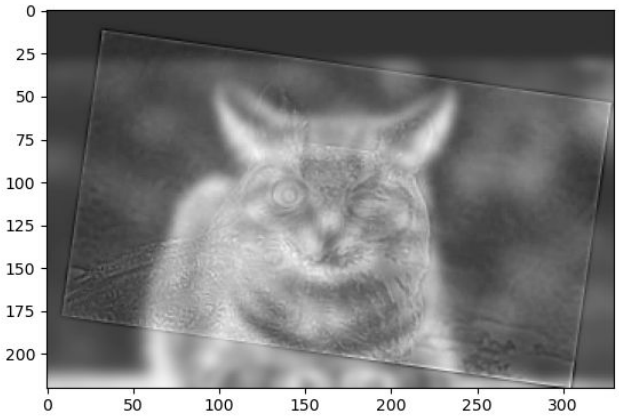
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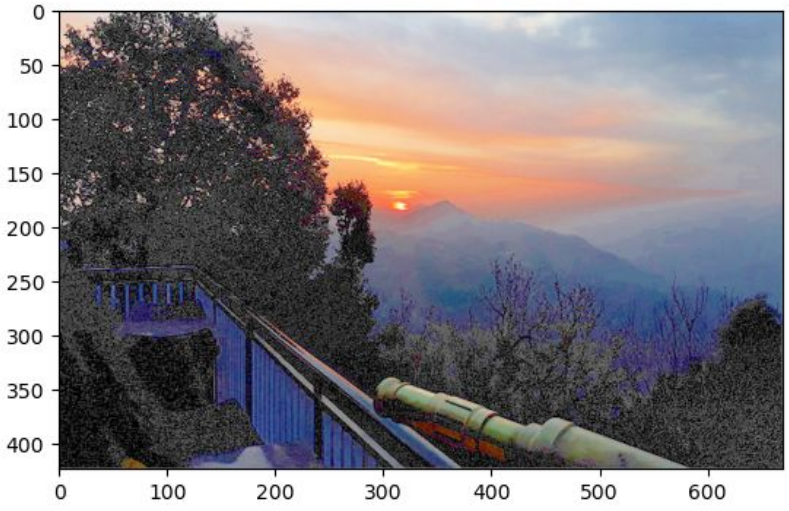
3. Image enhancement tasks (2 required, 3 for B&W)

Include

- For at least two out of three enhancement tasks (each is worth 10 points), display original image, modified image, and explanation of how the image was modified

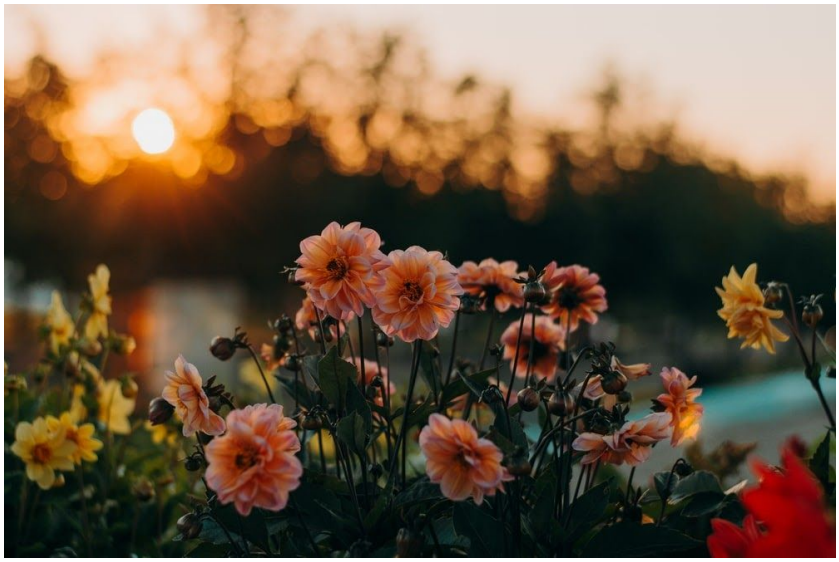
Contrast Enhancement used the idea of histogram equalization. Basically, a histogram represents how many pixels have each value. We calculate the histogram of the picture and redistribute the pixels in the picture based on the overall value. Thus, the pixel values in the entire picture will be “balanced”, spreading on a better range and the contrast of the picture will be improved.

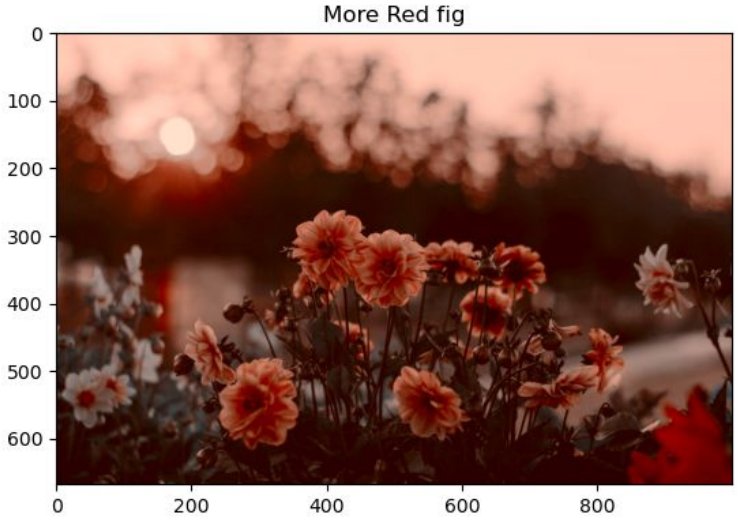


Color Enhancement makes use of HSV color space. In our case, we only want to focus on S(saturation) because S contributes to the brightness of the color in the picture. Therefore, I

firstly transfer the original picture from RGB to HSV and extract the S channel specifically. Then I modified the value in S channel based on user-input data and finally merge the S channel back to the picture, representing the picture again.

Color Shift makes use of LAB color space. In LAB, L contributes to the lightness of the picture, a is a color component ranging from green to red and b is another color component ranging from blue to yellow. Therefore, as I want to make the figure redder, I adjust the value in a channel. When I want my picture to contain less yellow, I adjust the value in b channel.

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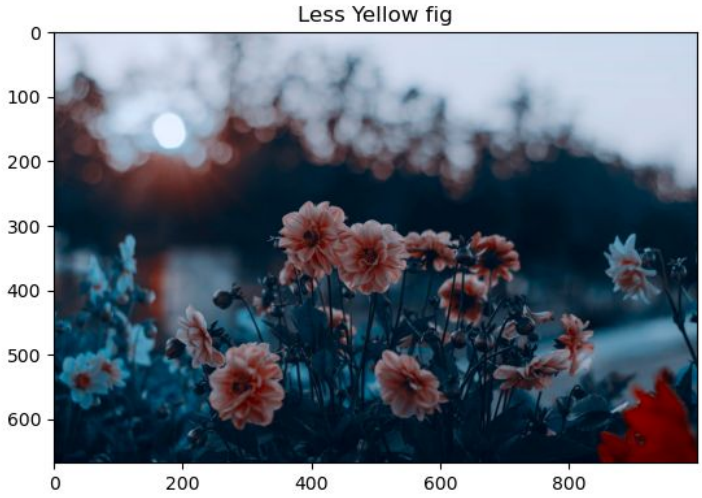


4. Quality of results and report

Nothing extra to include.

5. Color hybrid result (B&W)

Include

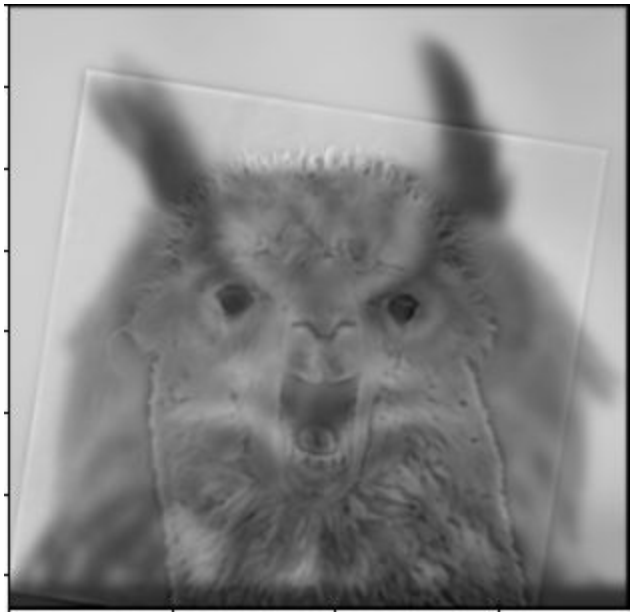
- Original images, hybrid image
- Explanation of method: Is it better to use color for the low-pass, the high-pass, or both?

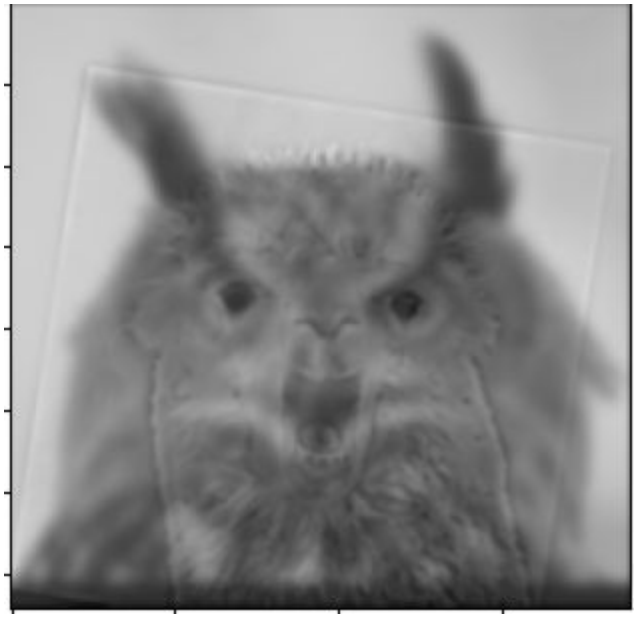
6. Gaussian and Laplacian Pyramids (B&W)

Include

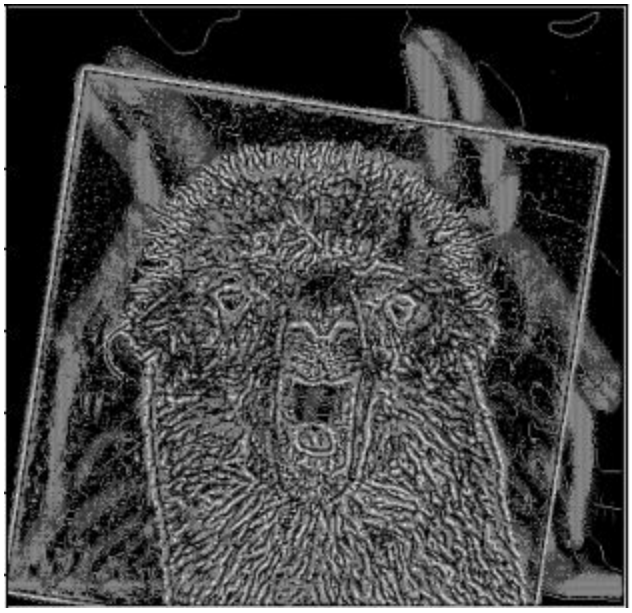
- Gaussian pyramid of main hybrid image result (can be one row of images)
- Laplacian pyramid of main hybrid image result (another row of images)

GaussianPyramids:





LaplacianPyramids



Acknowledgments / Attribution

List any sources for code or images from outside sources

https://opencv-python-tutroals.readthedocs.io/en/latest/py_tutorials/py_imgproc/py_histograms/py_histogram_equalization/py_histogram_equalization.html

https://stackoverflow.com/questions/31998428/opencv-python-equalizehist-colored-image

www.google.com