

Xavier Zuvekas  
Computer Vision  
Project 1: Bayer Mosaic

The objective of this project is to implement the idea of Bayer-mosaic color pattern interpolation described in the following paper :

Henrique S. Malvar, Li-wei He, and Ross Cutler, HIGH-QUALITY LINEAR INTERPOLATION, FOR DEMOSAICING OF BAYER-PATTERNED COLOR IMAGES, ICASSP, 2014.

The Python functions are as follows:

### **1. Interpolate\_missing\_values(img, channel)**

fill in the missing pixel values for a given channel in the image. It uses a 3x3 kernel and OpenCV's `filter2D` function to perform a convolution operation over the image.

The kernel used is a 2D Gaussian kernel, where the center pixel has the highest weight (4), and the pixels directly adjacent to the center pixel have a weight of 2, and the corner pixels have a weight of 1.

### **2. demosaic(img)**

The demosaic function is responsible for implementing demosaicing on an image. The image is converted to grayscale, then an empty output image with the same dimensions as the input is created. It assigns the known values of the R, G, and B channels from the grayscale image to the appropriate locations in the output image. The missing values in each channel are then found using `interpolate_missing_values`

### **3. bilinear\_demosaic(img)**

This function is used to perform bilinear demosaicing on an image using OpenCV's built-in function. It first ensures the image is in grayscale. Then, it uses the `cv2.cvtColor` function to convert the image from a Bayer pattern to a BGR image.

### **4. psnr(original\_image, output\_image)**

This function calculates the Peak Signal-to-Noise Ratio (PSNR) between the original image and the output image.

### **5. process\_and\_display\_images(input\_dir, main\_function)**

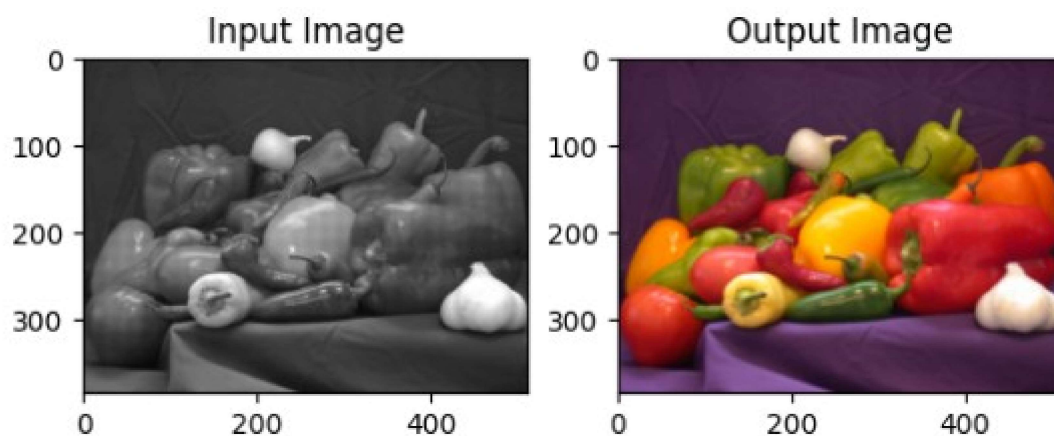
this function reads each image, applies the `main_function` to the image, and then calculates and prints the PSNR of the output image compared to the original image. It also converts the images to RGB for display.

Image Name	PSNR(`demosaic`)	PSNR(`bilinear_demosaic`)
office_4.jpg	30.025	30.135
officeBayer.png	30.509	30.716
onionBayer.png	29.989	30.090
onion.png	27.960	27.966
pearsBayer.png	29.903	29.963
pears.png	29.176	29.319
peppersBayer.png	30.156	30.225
peppers.png	27.678	27.650

From the PSNR values, it can be seen that the quality of the images processed by the `bilinear\_demosaic` function is slightly better compared to the `demosaic` function. The PSNR values are higher for the `bilinear\_demosaic` function for all the images, indicating a higher quality of the demosaicing process.

Despite this, the custom implementation looked more accurate visually, as the bilinear demosaic seemed ‘washed out’ by comparison, losing much of its vividness.

For example the custom implementation produced this image:



Whereas the bilinear demosaic produced:

