Implementation:

This project uses a linear regression-based algorithm to demosaic a raw image and output it as an RGB image. First, a set of 5 training photos (training_image1 to training_image5) are concatenated together, which allows the algorithm to reach high levels of precision. These training photos are used to find the optimal coefficient matrix to be utilized when calculating missing color components. The coefficient matrix is found using the calculated input and output matrices from the training set and solving the linear least square problem. Then, the linear regression model is applied on the test photo by using the coefficient matrix and computing the demosaiced image by updating the Bayer filter patter. A ground truth image is used for cases where the user wants to calculate and compare the RMSE of the linear regression and MATLAB algorithms. To calculate RMSE, the square root of the immse was taken comparing the demosaiced image to the ground truth image. This calculation determined that the linear regression algorithm consistently outperformed the MATLAB built-in function as its RMSE values was always lower. To increase the performance of the algorithm even further, more training photos can be used to achieve a higher accuracy.

Training Photos:

The training photos used stay constant for all the test cases and are shown below:

Testing:

<u>Inputs:</u>

The two photos below were input to the code, the one on the left as the ground truth for the RMSE calculation and the right as the raw photo to demosaic (test_image).

<u>Outputs:</u>

The output from the linear regression algorithm (left) and the MATLAB built-in function (right) were almost identical and matched the ground truth photo. The RMSE values for both were calculated and are shown in the command line screen capture below. As can be observed, the RMSE value was lower for the linear regression algorithm than the MATLAB built-in function, therefore it achieved more accurate results.
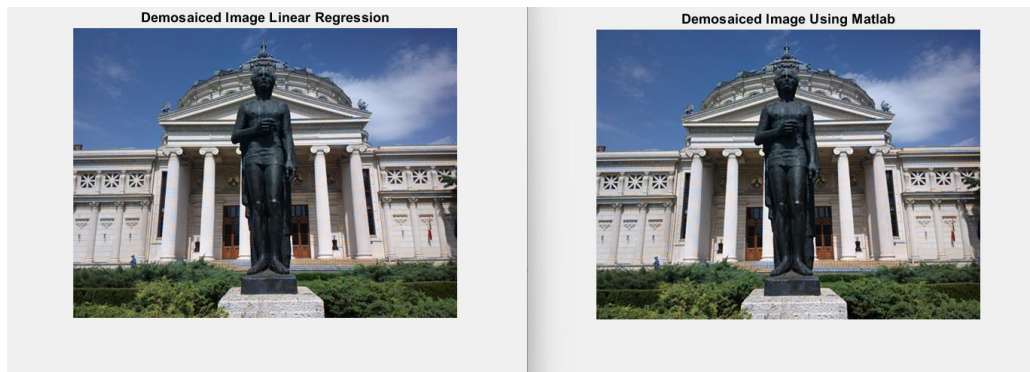
```
rmse =

    1.2240


rmse_matlab =

    1.3964

>>
```
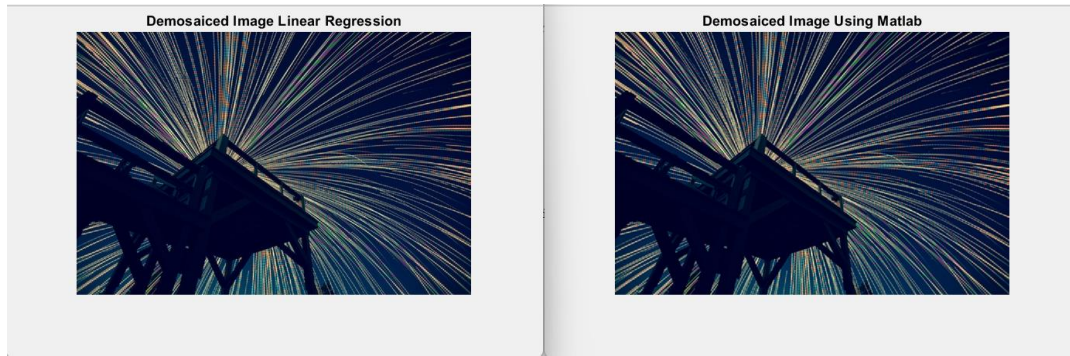
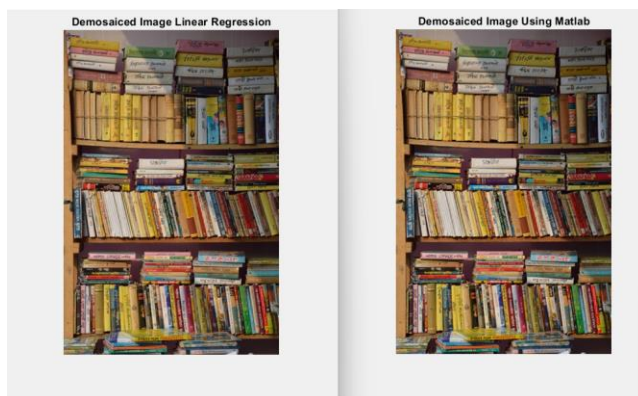Additional tests are as follows:

Input:

Outputs:

Input:

Outputs:

Demosaiced Image Linear Regression

Demosaiced Image Using Matlab