Implementation:

This code uses a linear regression-based algorithm to demosaic a raw Bayer image and output it as an RGB image. This is accomplished by using a set of 5 training photos (training_image1 to training_image5) to find the optimal coefficients to be used in the demosaiacing algorithm when predicting missing color components. Using 5 training photos concatenated together, the algorithm reaches high levels of precision. Once the coefficient matrix is found from the training images, it is used to determine missing color components from the testing images even without ground truth values to compare to. The ground truth value is simply used for cases when the user wants to calculate the RMSE if the linear regression and matlab algorithms. To calculate RMSE, the square root of the immse was taken comparing the testing image to the ground truth. 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:

Inputs:

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).

Outputs:

Demosaiced Image Linear Regression   Demosaiced Image Using Matlab

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.
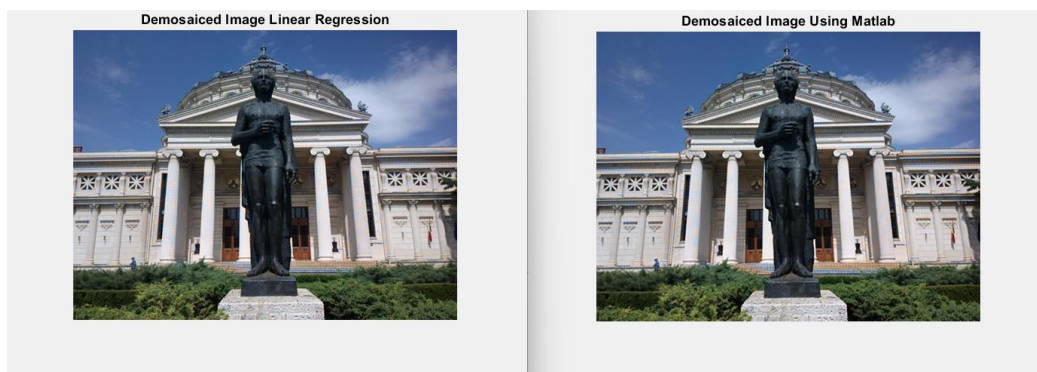
```
rmse =

    1.2240


rmse_matlab =

    1.3964

>>
```
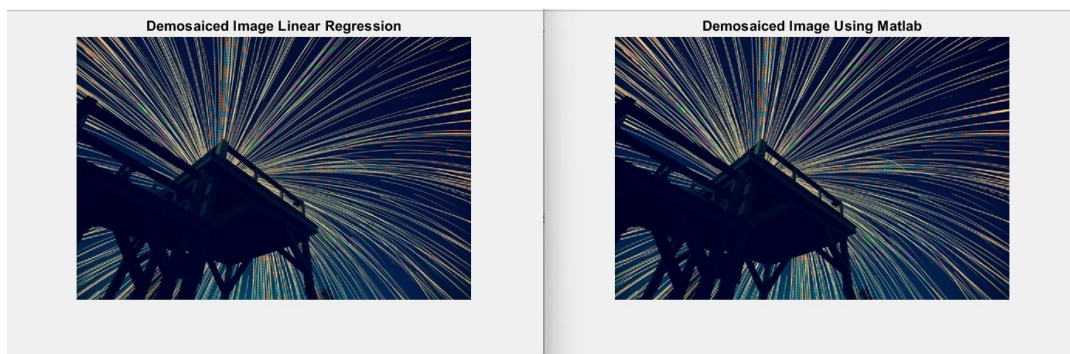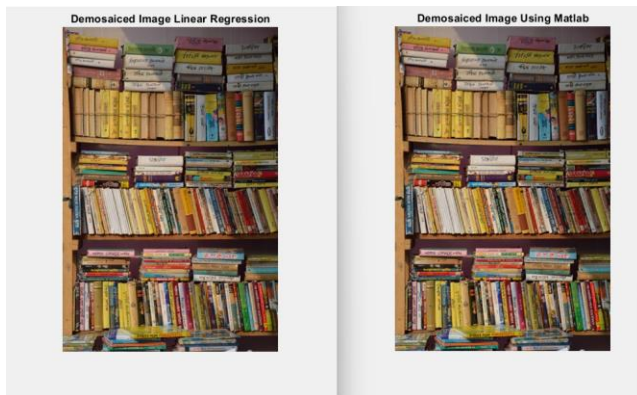
Additional tests are as follows:

Input:

Outputs:

Input:

Outputs:

Input:

Outputs:

Demosaiced Image Linear Regression

Demosaiced Image Using Matlab

Input:

Outputs:

Demosaiced Image Linear Regression

Demosaiced Image Using Matlab