**Assignment – 1**

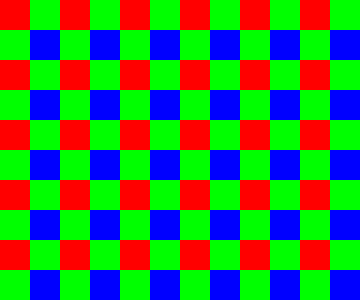
**Elkhan Ismayilzada**

**Task 1 –** To solve task 1, I tried to extract pattern from Bayer image, and as can be seen from the example Bayer picture, there is a clear pattern to extract channels. Red channel has values in odd columns and rows whereas Blue channel has values in even columns and rows and Green channel has values in even columns when rows are odd and odd columns when rows are even. Overall, following masks array can be deduced per each channel.

repmat([1 0; 0 0],h/2,w/2) – red channel mask

repmat([0 1; 1 0],h/2,w/2) – green channel mask

repmat([0 0; 0 1],h/2,w/2) – blue channel mask

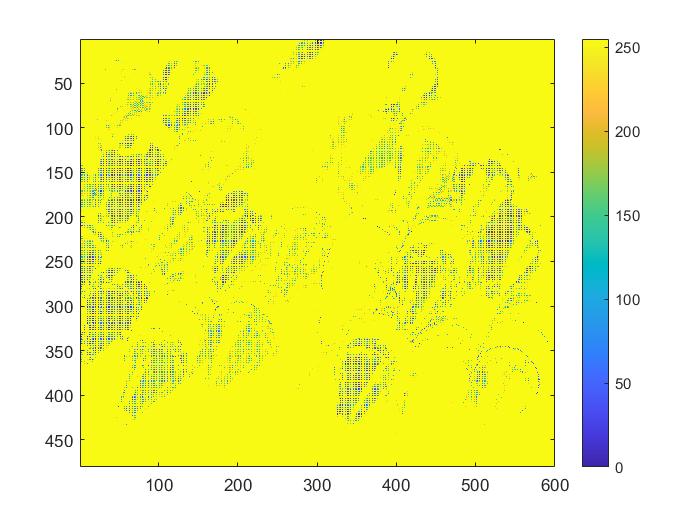
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**Task 2 –** For designing the filter, I fill missing channels by averaging four neighboring known channel values. Therefore, filters are as follows

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| |  |  |  | | --- | --- | --- | | **0.25** | **0** | **0.25** | | **0** | **0** | **0** | | **0.25** | **0** | **0.25** | | |  |  |  | | --- | --- | --- | | **0** | **0.25** | **0** | | **0.25** | **0** | **0.25** | | **0** | **0.25** | **0** | | |  |  |  | | --- | --- | --- | | **0.25** | **0** | **0.25** | | **0** | **0** | **0** | | **0.25** | **0** | **0.25** | |

**Filter for R Filter for G Filter for B**

**Task 3 –** As expected, there is huge difference between original and reconstructed image and the map of squared differences can prove it.



Mean and max errors are **29286**, **192035** respectively.

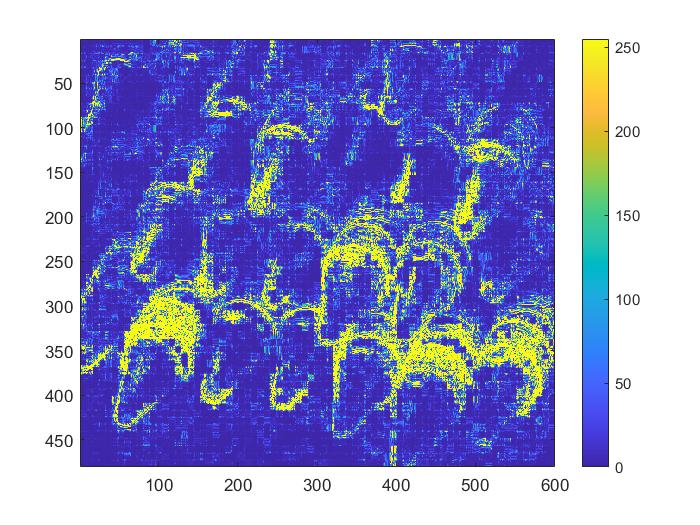
To fix this issue, instead of only averaging, it is better to use weighted average where the values close to center pixel have more weight than those that are from it and center pixel has the highest weight. As an example, I used following filters

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| |  |  |  | | --- | --- | --- | | **0.25** | **0.5** | **0.25** | | **0.5** | **1** | **0.5** | | **0.25** | **0.5** | **0.25** | | |  |  |  | | --- | --- | --- | | **0** | **0.5** | **0** | | **0.5** | **1** | **0.5** | | **0** | **0.5** | **0** | | |  |  |  | | --- | --- | --- | | **0.25** | **0.5** | **0.25** | | **0.5** | **1** | **0.5** | | **0.25** | **0.5** | **0.25** | |

**Filter for R Filter for G Filter for B**

And I got following reconstructed image.



It is very close to the original image, hence the map of squared differences

And mean, max errors are **203.2237** and **53345** respectively.