Rule KA1 - nearest interpolation

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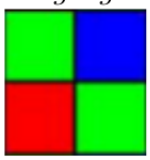
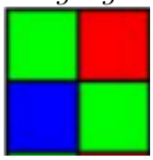
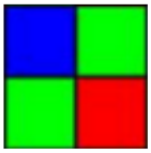
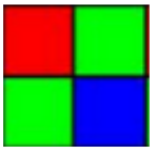
I. Sampling Grid

Lets name our bayer layer (given as input to our function) as xb , so from now on we will refer to our bayer layer as xb . Xb is a $M_o x N_o$ matrix whose values belong in the interval $[0, 1]$.
Since the desired size of output image may differ from either the M_o or the N_o ,in order to create the output image we must first create a sampling grid . According to the sampling grid each **pixel***(we will explain what a pixel is later on this document)* of the output image will be corresponded to a cell of xb , in order to determine it's own value. Later on this document we will demonstrate some rules in order to create the sampling grid.

II. Sampling method - nearest

It must be mentioned that bayer layer contains the color percentage for only one color (red, green or blue) . On the other hand , as said before from one cell of xb , we want to create the hole information for one pixel . A pixel is a triad of three colors percentage , so we can imagine a pixel as a $1x1x3$ matrix , whose values belong in the interval $[0, 1]$. Below you can see the four different patterns for a bayer layer , in our case we know that our pattern is the 'grbg'

1. *gbrg* 
2. *grbg* 
3. *bggr* 
4. *rggb* 

So lets suppose that our sampling grid points to the first cell of xb (grbg pattern) , well is it possible to determine a pixel out of only one cell? No, because every cell in xb contains information about only one color .But since we know the pattern of xb and we "stand" on a cell that refers to green value, we may determine green value of pixel from this cell , and then move one cell to the rigth cell to determine the blue value of pixel, and once cell downwards to determine the red value . This sample method is the simpliest one and it's named **nearest**.

III. Sampling Rule KA1

(works properly only if the desired dimensions of output image are smaller than these of xb)
Lets suppose that the pair of coordinates (i, j) refers to our output rgb matrix ,while the pair (I, J) refers to xb (bayer layer), then ,the desired sampling points are :

$$I = \frac{i * \frac{M_o}{M} - \frac{M_o}{M} + 1 + i * \frac{M_o}{M}}{2}, \quad \kappa\alpha\iota \quad J = \frac{j * \frac{N_o}{N} - \frac{N_o}{N} + 1 + j * \frac{N_o}{N}}{2} \tag{1}$$

This sampling grid is not our rule KA1 , cause it will result image-1 (as shown below) , where there it is possible to determine the coordinates (I, J) in a way that the do not match any cell of xb (they wont have integer values) .
In order to avoid such problems we determine the **Rule KA1** :

$$I = i - \frac{1}{2}\frac{M_o}{M} + \frac{1}{2} \qquad ,\gamma\iota\alpha \qquad i \in [1, \frac{M}{2}]$$

$$I = i + \frac{1}{2}\frac{M_o}{M} - \frac{1}{2} \qquad ,\gamma\iota\alpha \qquad i \in [\frac{M}{2} + 1, M]$$

and respectively the same for J coordinates. **.[KA1]**

Applying (when input is an ($8x8$) bayer matrix , for desired M = 4 and N = 4) the first euqations will result image-1 ,while rule KA1 will result image-2 (sampling grid is appears as the black points on the bayer matrix)

image 1

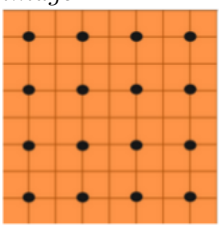
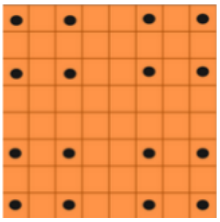


image 2



IV. The function nearest-Rule-KA1

It is the function that applies KA1 rule and nearest method in order to create a MxNx3 rgb image as result . The function works properly when bayer layer (given as input) is created in accordance grgb pattern . If another pattern is used then you must manually change the values of w array (check the script) and the function will be able to produce correct results .

Just to mention that this is func is for demonstration purposes only , if you are using matlab check out how the **demosaic** works .