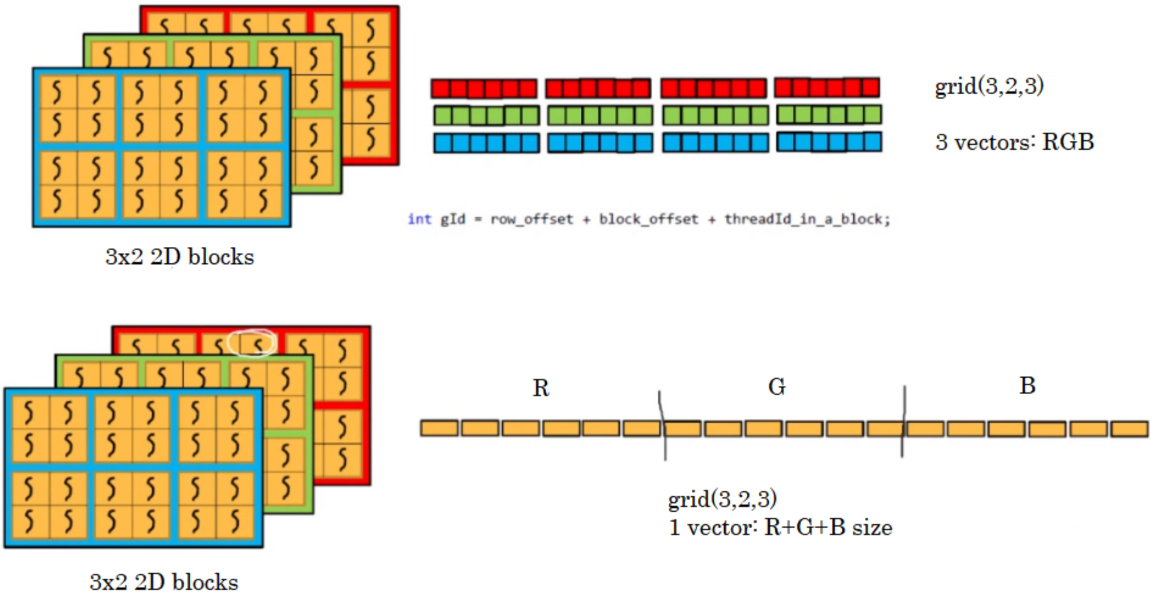
RGB Image Manipulation: Other Options

Now, instead of processing the complement of the RGB image by reading from 3 vectors of information, let's try and read from a single vector that holds R, G and B vectors in one: vecSize x 3 this time.



```
int gId = row_offset + block_offset + threadId_in_a_block;
```

Figure 1: img

Solution

```
#include "cuda_runtime.h"
#include "device_launch_parameters.h"

#include <stdio.h>
#include <stdlib.h>
#include <opencv2/opencv.hpp>

__host__ void checkCUDAError(const char* msg) {
    cudaError_t error;
    cudaDeviceSynchronize();
    error = cudaGetLastError();
    if (error != cudaSuccess) {
        printf("ERROR %d: %s (%s)\n", error,
           cudaGetErrorString(error), msg);
    }
}

__global__ void complement(uchar* RGB) {

    // locate my current block row
    int threads_per_block = blockDim.x * blockDim.y;
    int threads_per_row = threads_per_block * gridDim.x;
    int row_offset = threads_per_row * blockIdx.y;

    // locate my current block column
    int block_offset = blockIdx.x * threads_per_block;
    int threadId_inside = blockDim.x * threadIdx.y + threadIdx.x;

    // locate my current grid row
    int thread_per_grid = (gridDim.x * gridDim.y * threads_per_block);
    int gridOffset = blockIdx.z * thread_per_grid;

    int gId = gridOffset + row_offset + block_offset + threadId_inside;
    int C = gridDim.x * 32;
    int R = gridDim.y * 32;
    RGB[gId] = 255 - RGB[gId];
}

using namespace cv;
int main() {

    Mat img = imread("antenaRGB.jpg");

    const int R = img.rows;
    const int C = img.cols;

    Mat imgComp(img.rows, img.cols, img.type());
    uchar* host_rgb,* dev_rgb;
    host_rgb = (uchar*)malloc(sizeof(uchar) * R * C * 3);

    cudaMalloc((void**)&dev_rgb, sizeof(uchar) * R * C * 3);
    checkCUDAError("Error at malloc dev_r1");

    // matrix as vector
    for (int k = 0; k < 3; k++){
        for (int i = 0; i < R; i++) {
            for (int j = 0; j < C; j++) {
                Vec3b pix = img.at<Vec3b>(i, j);

                host_rgb[i * C + j + (k * R * C)] = pix[k];

            }
        }
    }
    cudaMemcpy(dev_rgb, host_rgb, sizeof(uchar) * R * C * 3, cudaMemcpyHostToDevice);
    checkCUDAError("Error at memcpy host_rgb -> dev_rgb");

    dim3 block(32, 32);
    dim3 grid(C / 32, R / 32, 3);

    complement << < grid, block >> > (dev_rgb);
    cudaDeviceSynchronize();
    checkCUDAError("Error at kernel complement");

    cudaMemcpy(host_rgb, dev_rgb, sizeof(uchar) * R * C * 3,
       cudaMemcpyDeviceToHost);
    checkCUDAError("Error at memcpy host_rgb <- dev_rgb");

    for (int k = 0; k < 3; k++) {
        for (int i = 0; i < R; i++) {
            for (int j = 0; j < C; j++) {
                imgComp.at<Vec3b>(i, j)[k] = host_rgb[i * C +
                   j + (k * R * C)];
            }
        }
    }


    imshow("Image", img);
    imshow("Image Complement", imgComp);
    waitKey(0);

    free(host_rgb);
    cudaFree(dev_rgb);

    return 0;
}
```