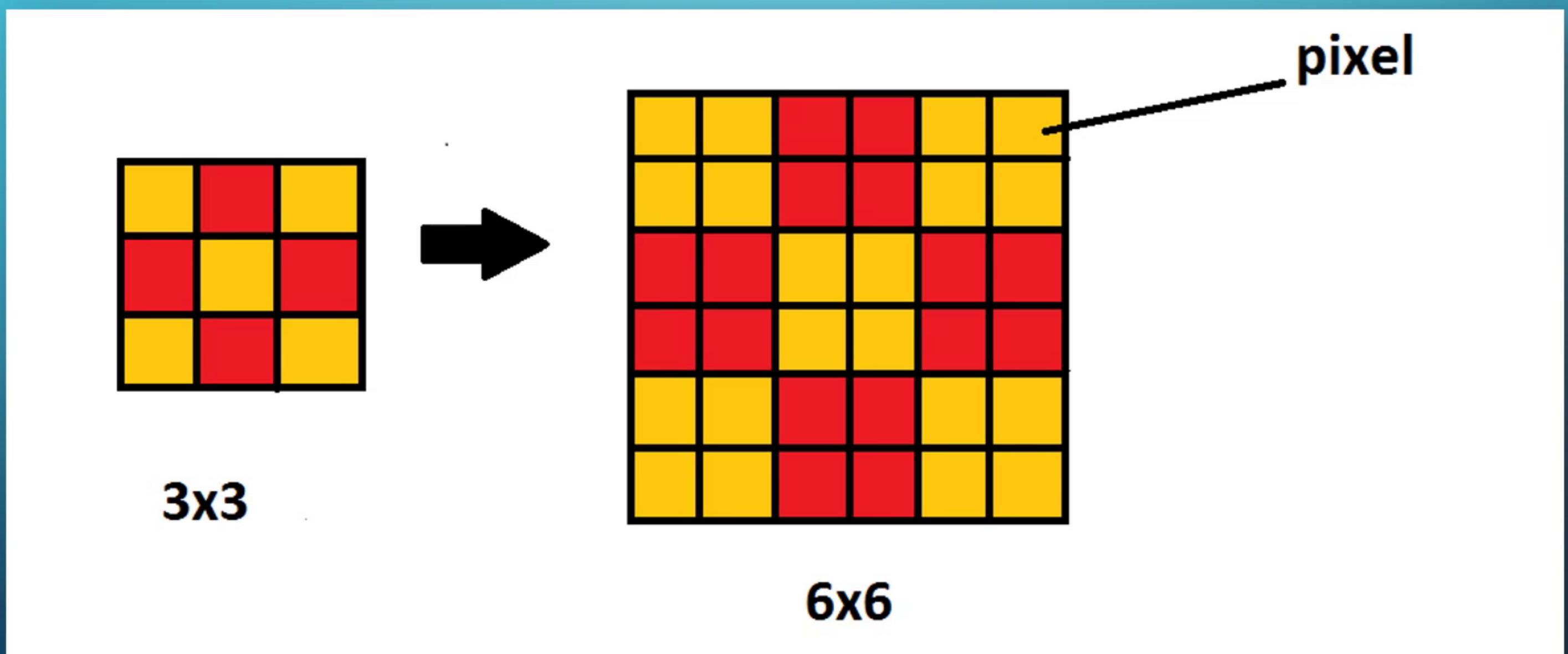


# Introduction

- ❖ In this project we will learn how to manipulate images in order to obtain different colour effects.
- ❖ We will use matrix multiplication in order to manipulate image colour and achieve different effects.
- ❖ We will look at several different ways to manipulate the image colours to obtain effects similar to those of *Instagram* and other **Graphic Softwares**.

# What is an Image?

- An image can be represented by a matrix with the dimensions corresponding to the dimensions of the image.



# Relevant Topic from ME501

- ❖ Linear Algebra
  - Transformation Matrix (Kernel)

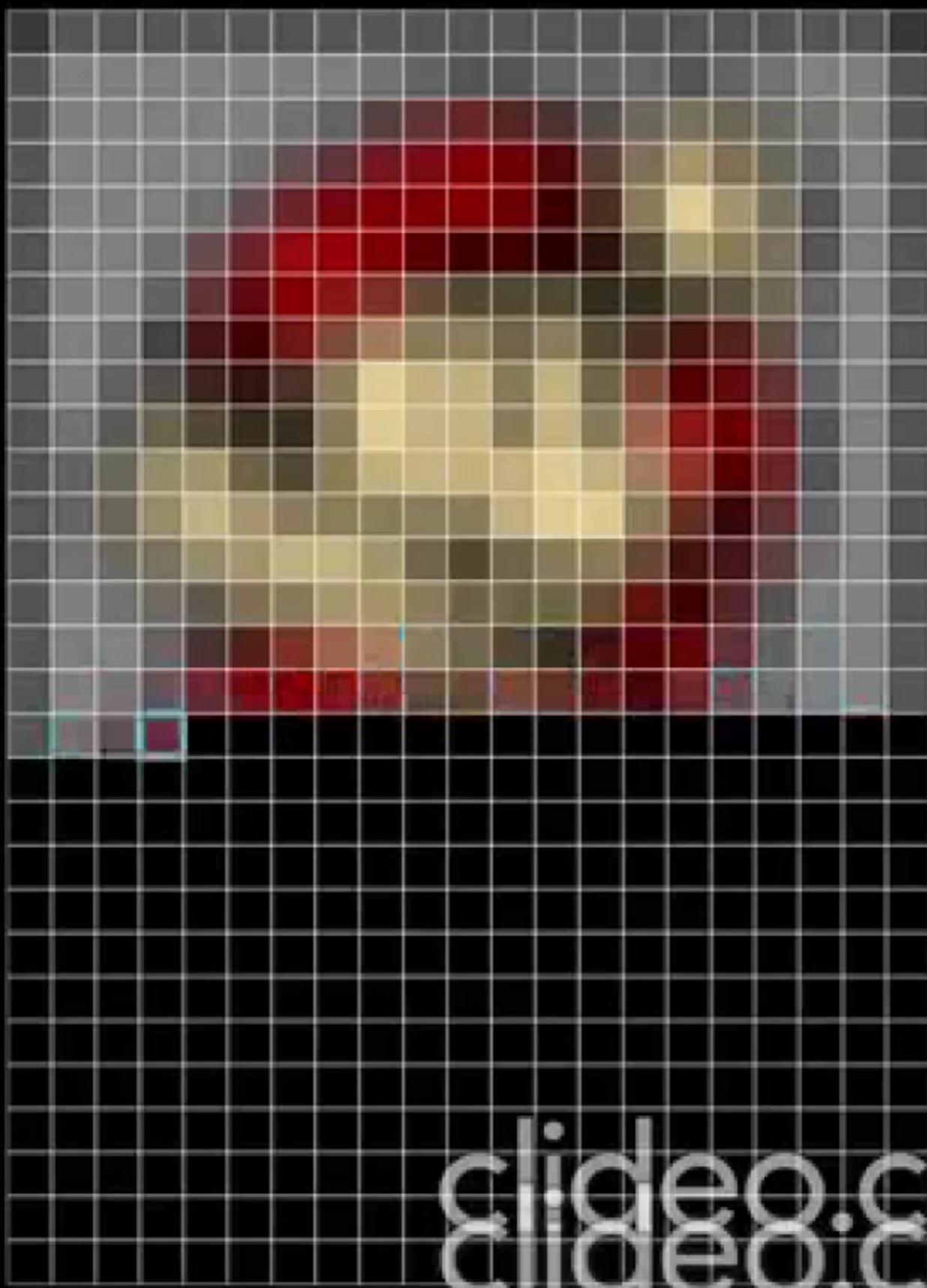
- ❖ Convolution

$$(1, 2, 3) * (4, 5, 6) = (4, \quad \quad \quad )$$

4

$a_0$	$a_1$	$a_2$
1	2	3

6	5	4
$b_2$	$b_1$	$b_0$



clideo.com

# Blurring of an Image

Kernel :

$$\frac{1}{9} \begin{bmatrix} 1 & 1 & 1 \\ 1 & 1 & 1 \\ 1 & 1 & 1 \end{bmatrix}$$

Box Blur (Normalized)

$$\frac{1}{16} \begin{bmatrix} 1 & 2 & 1 \\ 2 & 4 & 2 \\ 1 & 2 & 1 \end{bmatrix}$$

Gaussian Blur (Weighted Averaging)

# Sharpening of an Image

Kernel :

$$\begin{bmatrix} 0 & -1 & 0 \\ -1 & 5 & -1 \\ 0 & -1 & 0 \end{bmatrix}$$

# MATLAB Code

## First Part : Image Input and Initialization of the Transformation Matrices

```
1 clear all
2 clc
3 ImJPG=imread('1.jpg');
4 [m,n,l]=size(ImJPG);
5
6 GrayMatrix=[1/3 1/3 1/3; 1/3 1/3 1/3; 1/3 1/3 1/3];
7 SepiaMatrix=[0.393 0.769 0.189;0.349 0.686 0.168;0.272 0.534 0.131];
8 IdentityMatrix=[1 0 0; 0 1 0; 0 0 1];
9 RedChannel=[1 0 0; 0 0 0; 0 0 0];
10 GreenChannel=[0 0 0; 0 1 0; 0 0 0];
11 BlueChannel=[0 0 0; 0 0 0; 0 0 1];
```

## Second Part : Changes done in the Image at Pixel Level

```
12
13     for i=1:m
14         for j=1:n
15             PixelColor=reshape(double(ImJPG(i,j,:))),3,1);
16             ImJPG_Gray(i,j,:)=uint8(GrayMatrix*PixelColor);
17             ImJPG_Sepia(i,j,:)=uint8(SepiaMatrix*PixelColor);
18             ImJPG_Identity(i,j,:)=uint8(IdentityMatrix*PixelColor);
19             Red(i,j,:)=uint8(RedChannel*PixelColor);
20             Green(i,j,:)=uint8(GreenChannel*PixelColor);
21             Blue(i,j,:)=uint8(BlueChannel*PixelColor);
22         end;
23     end;
```

# RGB Channels of an Image

Kernel :

$$\begin{bmatrix} 1 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{bmatrix}$$

Red Channel

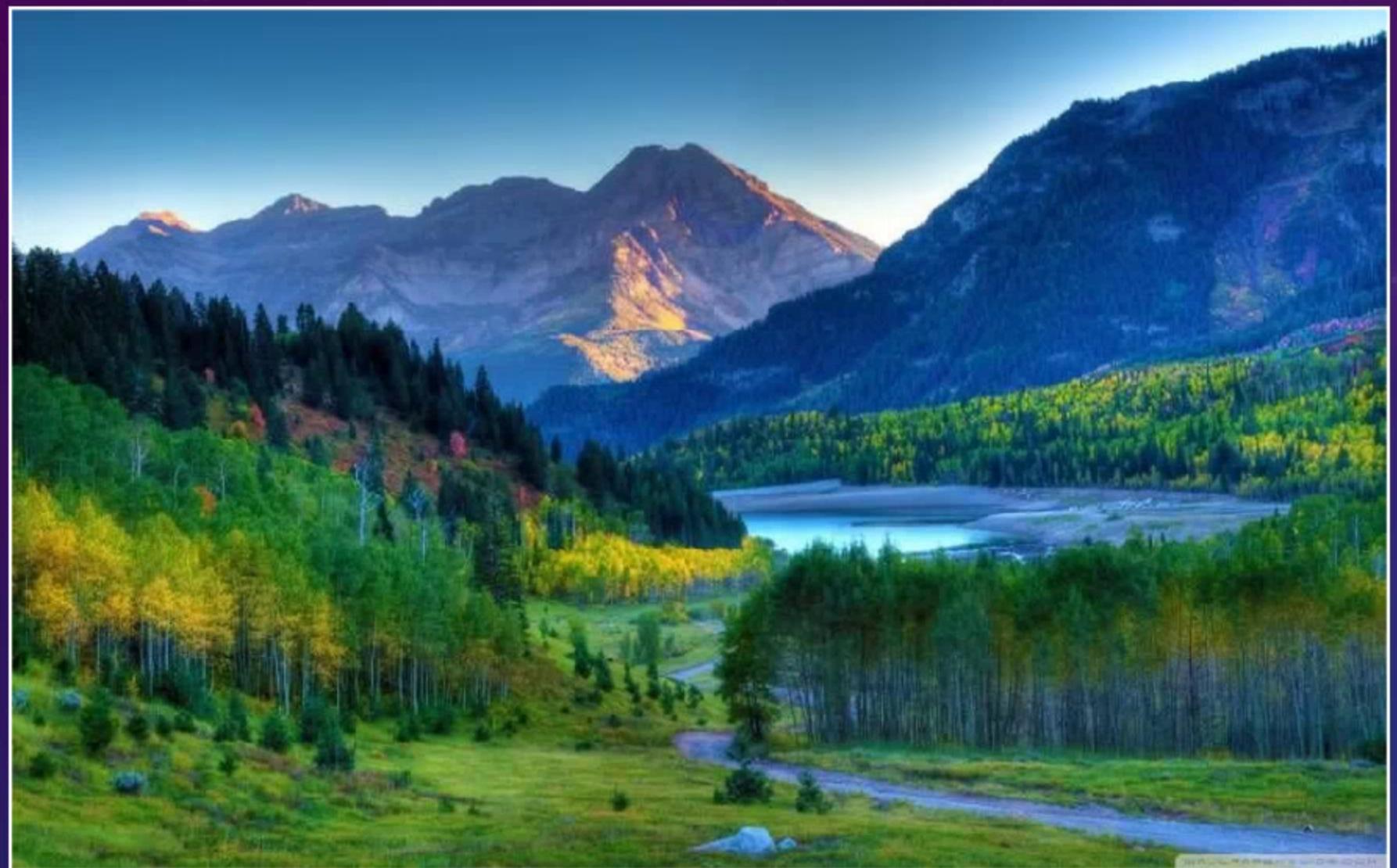
$$\begin{bmatrix} 0 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 0 \end{bmatrix}$$

Green Channel

$$\begin{bmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

Blue Channel

**Original Image**



**Filtered Image**

