



Figure 1: Original image

### 1. Inversion

In this operation, the colors of an image is inverted. (Figure 2)

This is done by applying the following formula to the matrix representation of the image

$$\text{Inverted\_value} = 255 - \text{original\_value}$$

E.g

If the matrix representation of an image A of size 2x3 pixels is

$$\text{imA} = \begin{bmatrix} 43 & 45 & 123 \\ 164 & 234 & 12 \end{bmatrix}$$

then the inverted image's matrix representation will be

$$\text{imA\_inv} = 255 - \begin{bmatrix} 43 & 45 & 123 \\ 164 & 234 & 12 \end{bmatrix} = \begin{bmatrix} 212 & 210 & 132 \\ 91 & 21 & 243 \end{bmatrix}$$



Figure 2: Inverted image

## 2. Rotation180

In this operation, the image is rotated by 180 degrees (Figure 3)  
For this the matrix itself must be rotated.

E.g

If the matrix representation of an image A of size 3x4 pixels is

$$\text{imA} = \begin{bmatrix} 43 & 45 & 123 & 132 \\ 164 & 234 & 12 & 211 \\ 32 & 121 & 1 & 200 \end{bmatrix}$$

then the rotated image's matrix representation will be

$$\text{rot\_imA} = \begin{bmatrix} 200 & 1 & 121 & 32 \\ 211 & 12 & 234 & 164 \\ 132 & 123 & 45 & 43 \end{bmatrix}$$


Figure 3: Rotated image

### 3. Flip

In this operation, the image is flipped along the vertical axis (Figure 4)  
For this the right side of the matrix must be switched with the left side.

E.g

If the matrix representation of an image A of size 3x4 pixels is

$$\text{imA} = \begin{bmatrix} 43 & 45 & 123 & 132 \\ 164 & 234 & 12 & 211 \\ 32 & 121 & 1 & 200 \end{bmatrix}$$

then the flipped image's matrix representation will be

$$\text{flp\_imA} = \begin{bmatrix} 132 & 123 & 45 & 43 \\ 211 & 12 & 234 & 164 \\ 200 & 1 & 121 & 32 \end{bmatrix}$$


Figure 4: Flipped image

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e.g. Input matrix:

$$\text{imA} = \begin{bmatrix} 43 & 45 & 123 & 132 \\ 164 & 234 & 12 & 211 \\ 32 & 121 & 1 & 200 \end{bmatrix}$$

Provide the inputs as below

3 4 1 43 45 123 132 164 234 12 211 32 121 1 200

The first 2 values denote the number of rows and columns, the 3rd value denotes the operation and the following values are the elements of the matrix

Hence the output should be as follows:

Inversion

212 210 132 123

91 21 243 44

223 134 254 55