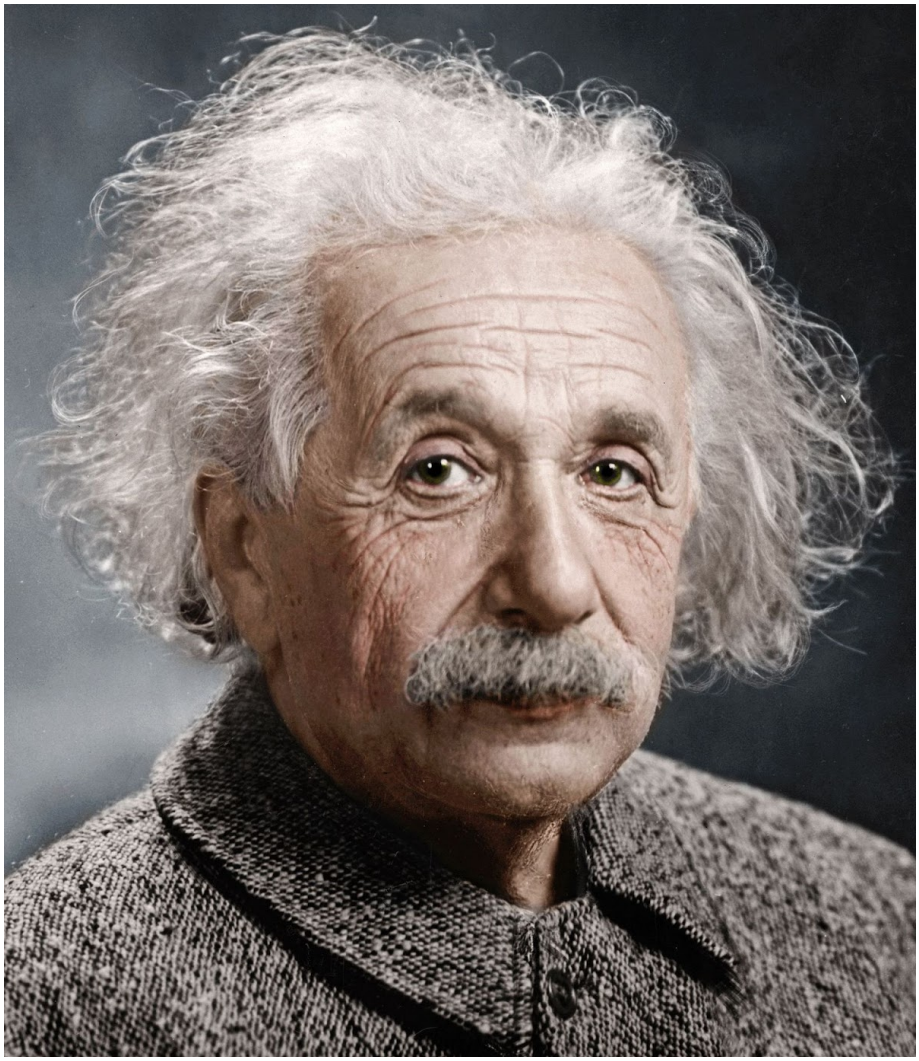
COMPUTER VISION REPORT

Assignment - 1 Report on IMAGE FILTERING



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DSE 312 - Computer Vision

INTRODUCTION

The aim of this assignment is to understand the application and implementation of different types of filters on the Image.

PROBLEM STATEMENT

1. We were given an image, and we had to apply different types of filters on them individually and present the output with the inference related to it.
2. To explain the working of filters on the same image.
3. To implement the image filtering using a programming language (without using any in-built functions).

QUESTIONS

Q1. Apply different filters mentioned below on the image attached (or Einstein image if not found attached) and analyze the impact of them. Describe what you found after applying each filter and why certain phenomena are happening.

a	b	c
d	e	f
g	h	i

The 5 filters can be derived after putting 1 at 5 different locations (one at a time). The locations are -> e, f, d, g, and c. For example, one filter where e = 1

0	0	0
0	1	0
0	0	0

Q2. Apply the following filters on the same image.

1	0	-1
2	0	-2
1	0	-1

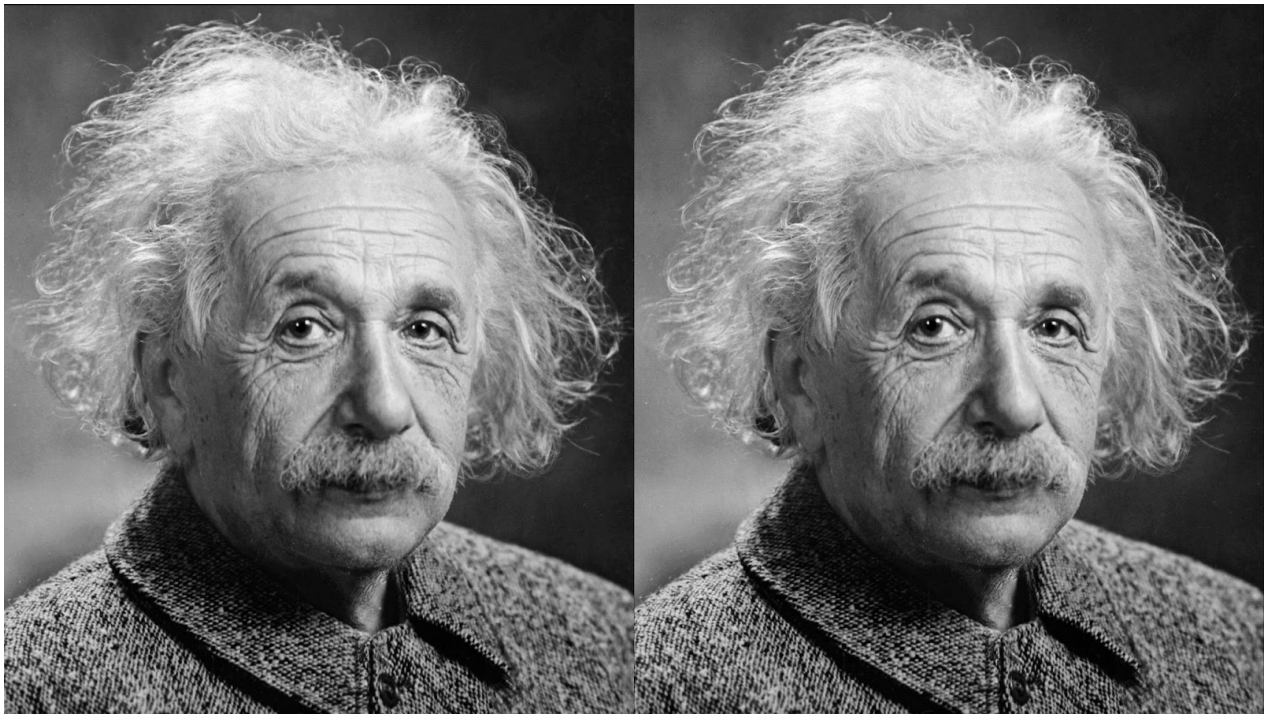
1	2	1
0	0	0
-1	-2	-1

Q3. Apply the average filter and Gaussian filter of size 3*3 on the same. One example of a filter is

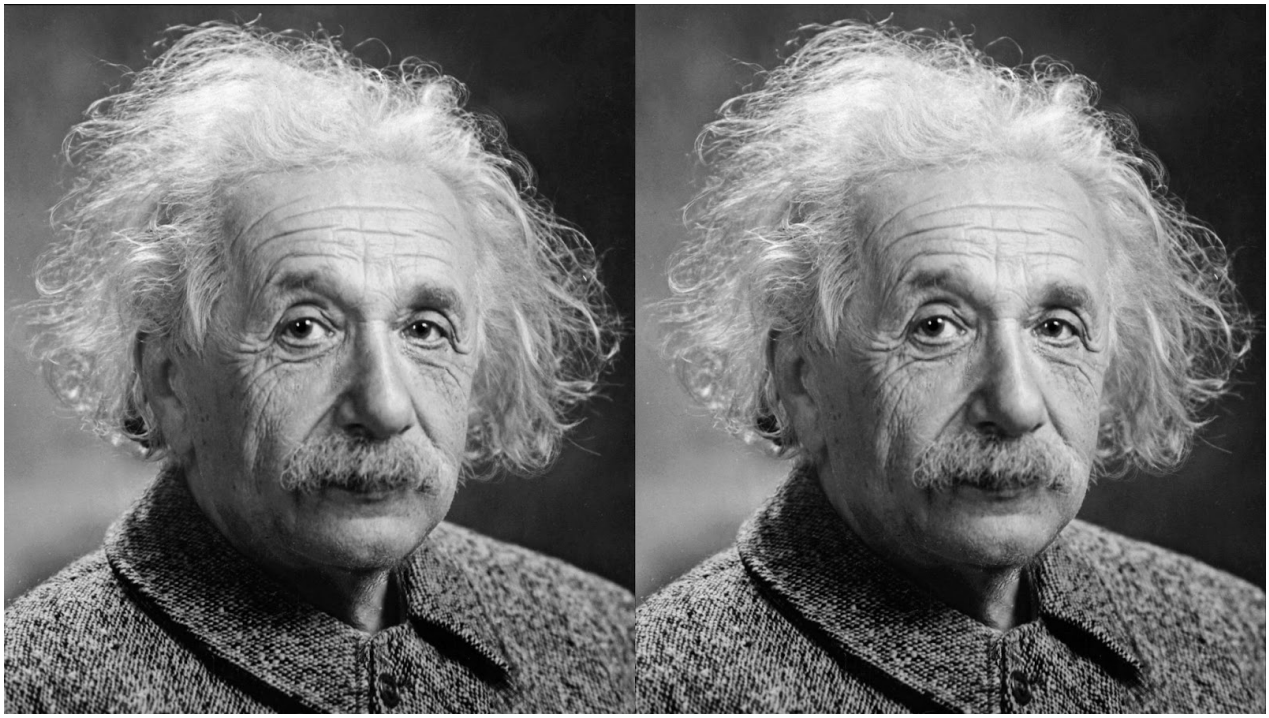
$$\frac{1}{9}\begin{bmatrix} 1 & 1 & 1 \\ 1 & 1 & 1 \\ 1 & 1 & 1 \end{bmatrix}$$

OUTPUT

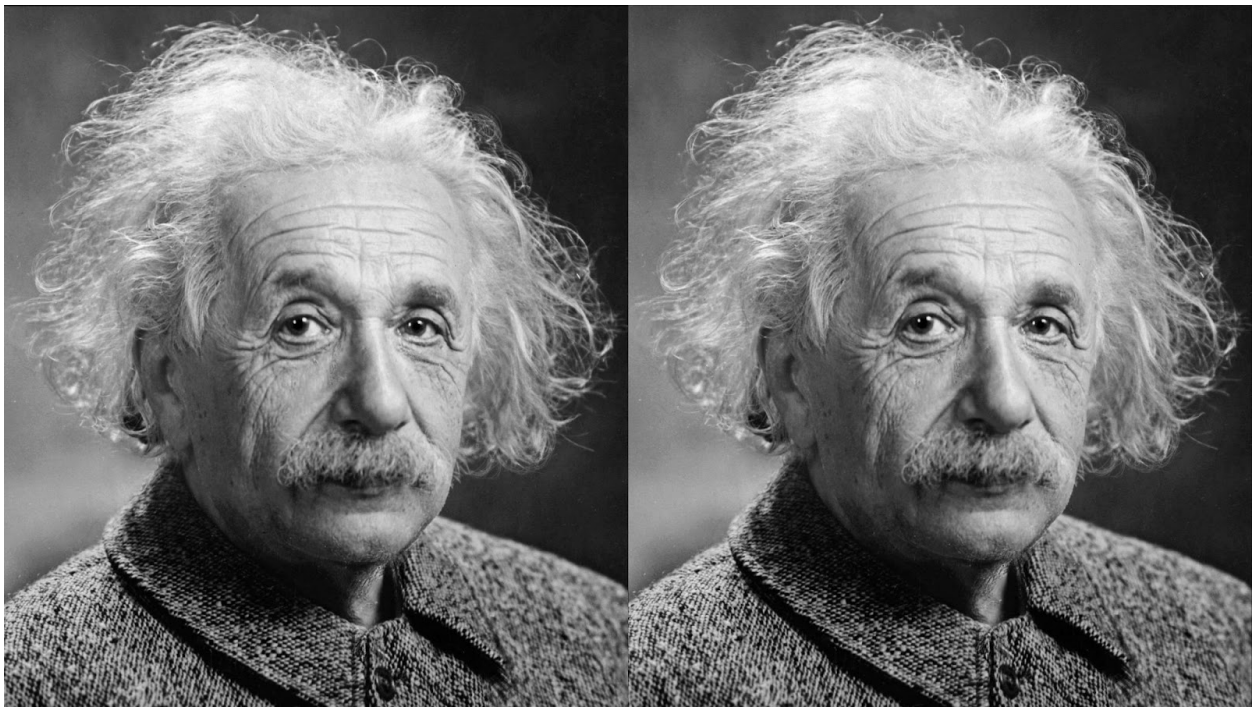
1. For Identity Kernel: e = 1



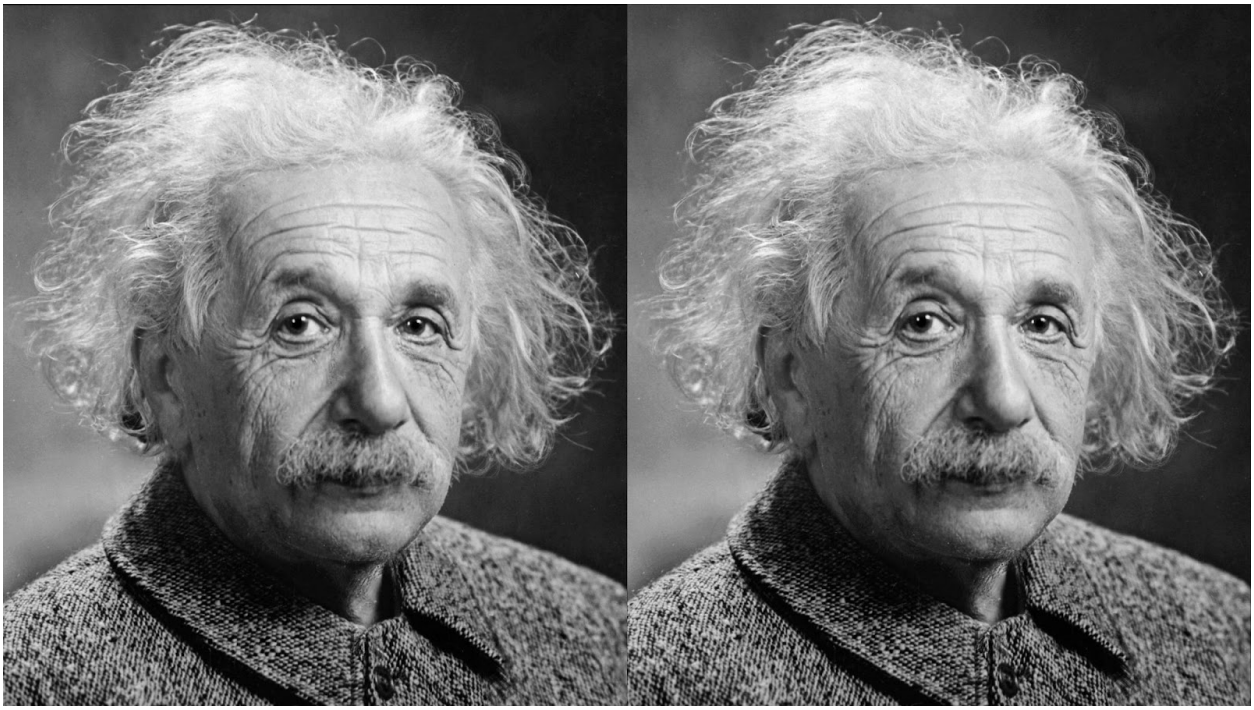
2. For Identity Kernel: d = 1



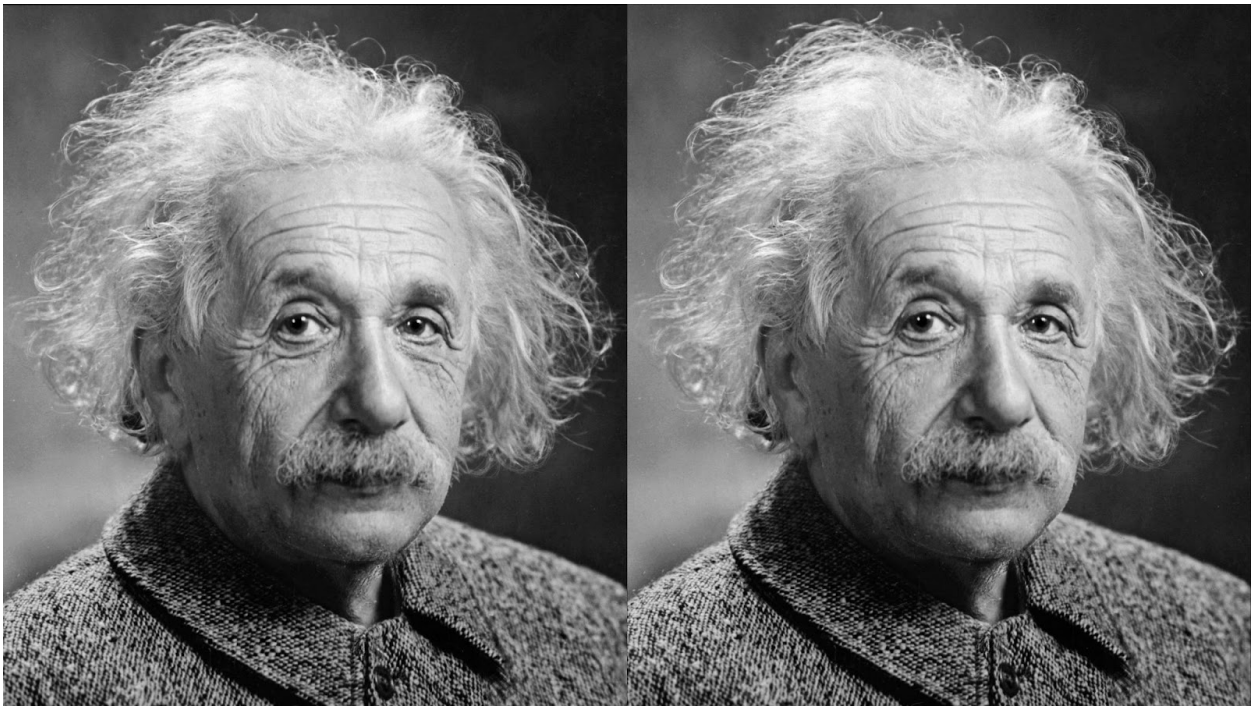
3. For Identity Kernel: c = 1



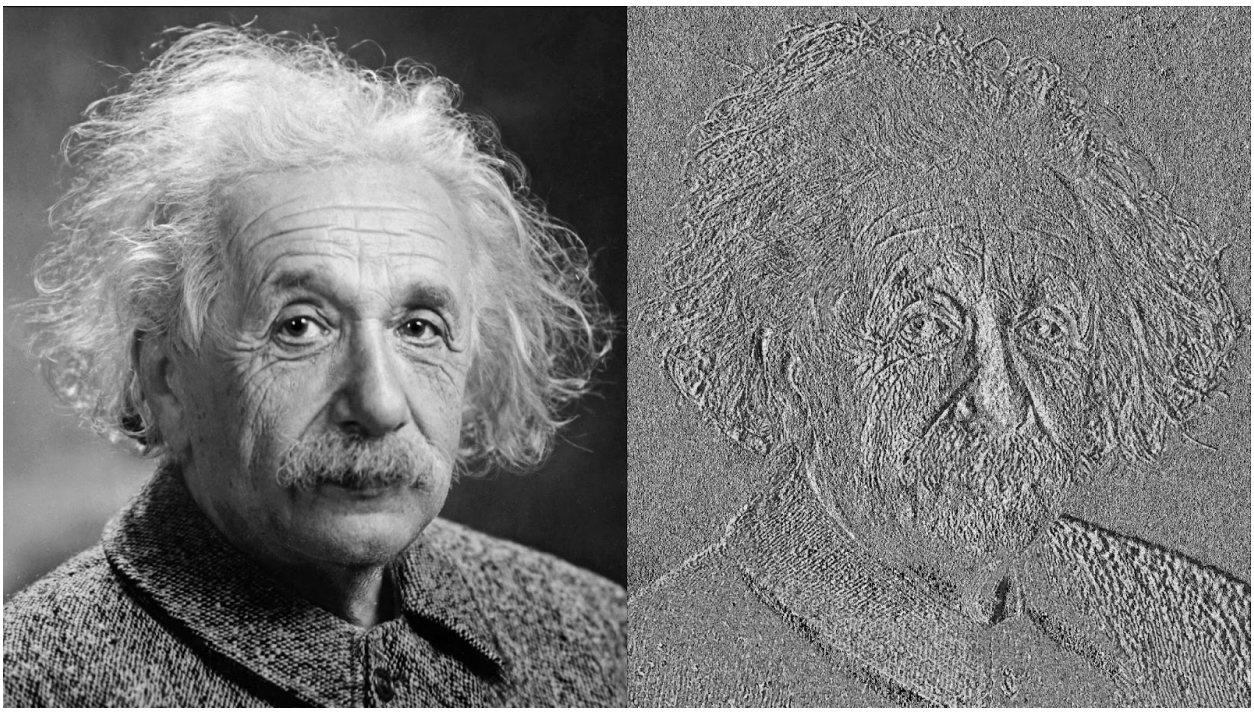
4. For Identity Kernel: f = 1



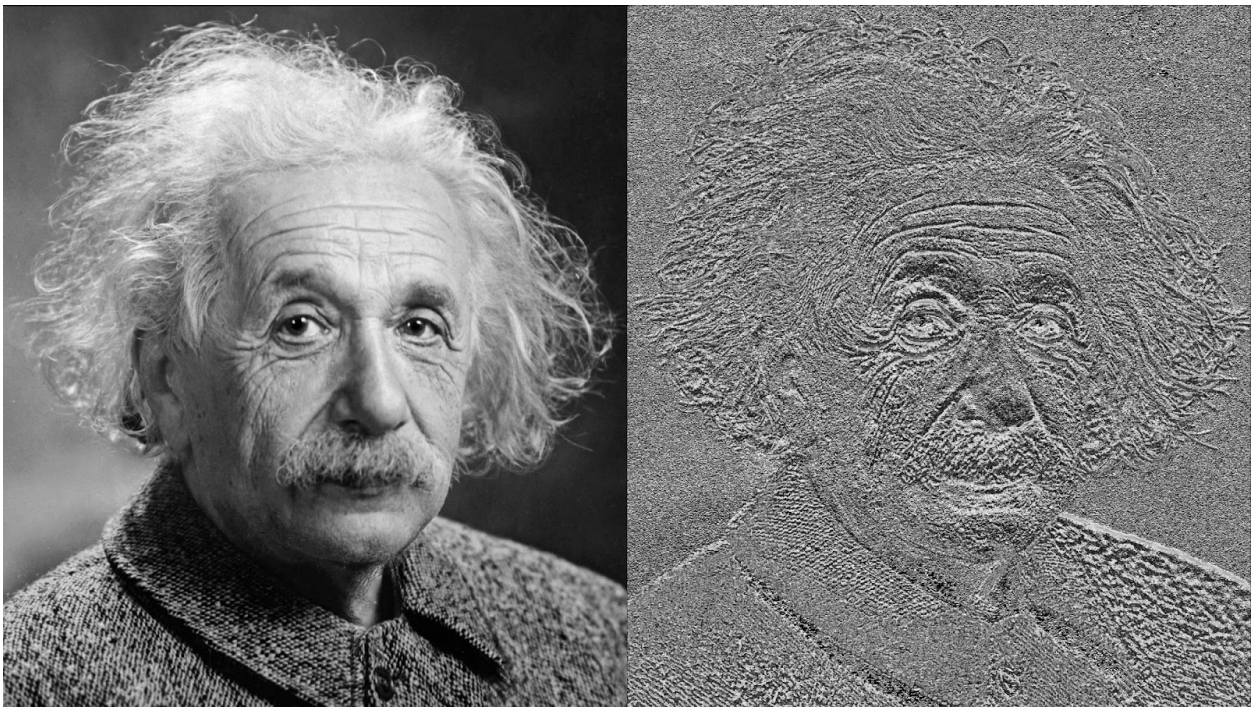
5. For Identity Kernel: g = 1



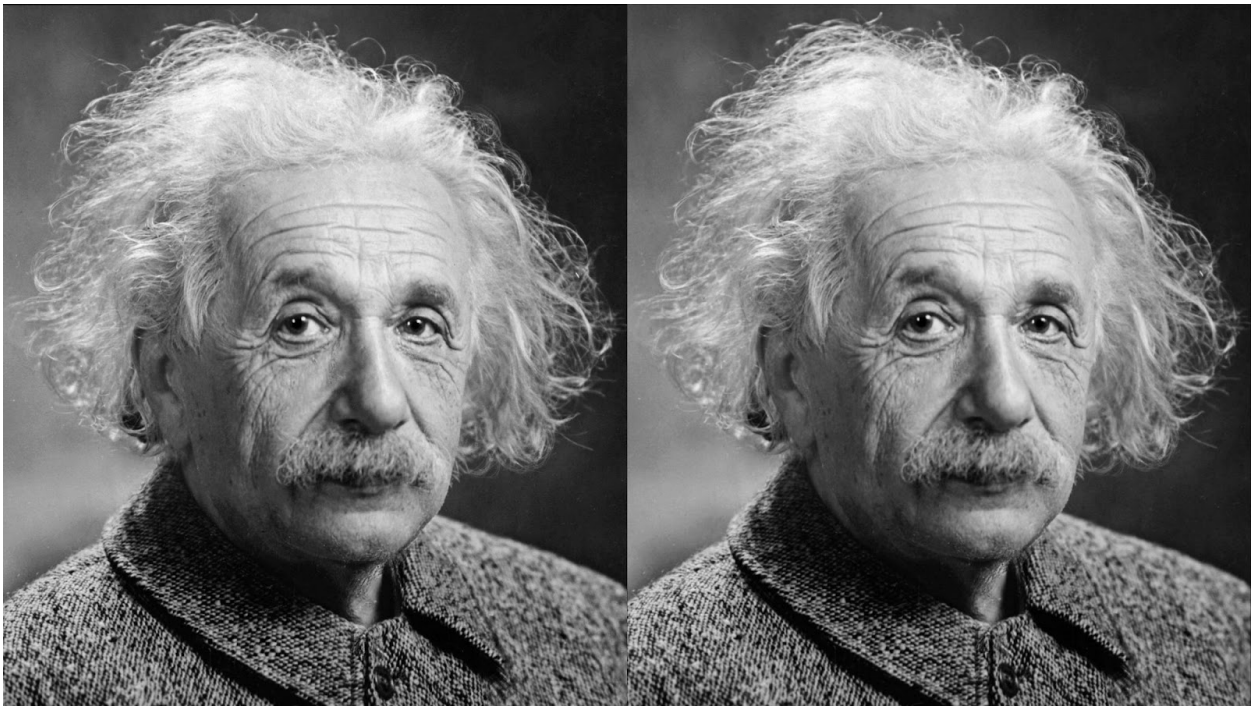
6. For Q2, when the matrix is: ([1, 0, -1], [2, 0, -2], [1, 0, -1])



7. For Q2, when the matrix is: ([1, 2, 1], [0, 0, 0], [-1, -2, -1])

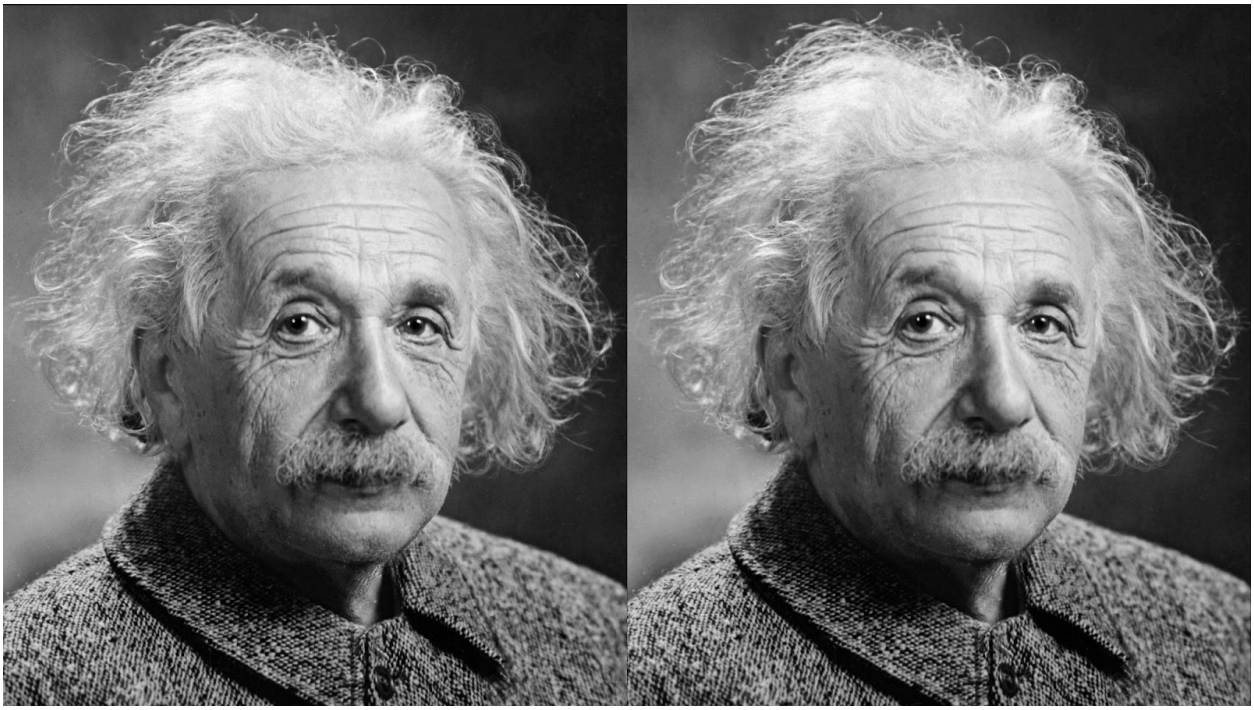


8. For Q3, When the matrix is (Average Filter): ([[1, 1, 1], [1, 1, 1],[1, 1, 1]]) / 9



Due to the size of the image, we had to zoom the image to find some noticeable changes.

9. For Q3, When the matrix is (Gaussian Filter): ([[1, 2, 1], [2, 4, 2], [1, 2, 1]])/16



Due to the size of the image, we had to zoom the image to find some noticeable changes.

INFERENCE

1. **Filter: 1e**

   Effect: No change to the image.

   Inference: This filter doesn't modify the image; it remains the same.

2. **Filter: 1f**

   Effect: Shifts the image slightly to the left.

   Inference: Objects in the image will appear to be shifted to the left.

3. **Filter: 1d**

   Effect: Shifts the image slightly to the right.

   Inference: Objects in the image will appear to be shifted to the right.

4. **Filter: 1g**

   Effect: Shifts the image downward.

   Inference: The application of weighted values in the diagonally left and downward direction causes the filtered image to **shift diagonally to the right and upward direction.**

5. **Filter: 1c**

   Effect: Shifts the image to the left.

   Inference: The application of this filter will cause the resulting filtered image to **shift diagonally to the left and downward direction.** This outcome arises from the presence of a weighted value in the filter that corresponds to the pixel situated diagonally in the right and upward direction relative to the current pixel.

6. **Filter: 2a**

   Effect: Detects horizontal edges.

   Inference: This filter is the Sobel horizontal edge detection filter. It detects horizontal edges in the image, emphasising changes in intensity from left to right.

7. **Filter: 2b**

   Effect: Detects vertical edges.

   Inference: This filter is the Sobel vertical edge detection filter. It detects vertical edges in the image, emphasising changes in intensity from top to bottom.

8. **Filter: 3a (Average Filter)**

   Effect: Applies Average filter.

   Inference: This filter applies blurring to the image. It replaces each pixel's value with the average of its neighbouring pixels, resulting in a smoother appearance.

9. **Filter: 3b (Gaussian Filter)**

   Effect: Applies Gaussian blurring.

   Inference: This filter applies Gaussian blurring to the image. It smooths the image by giving more weight to the central pixels and less weight to the surrounding pixels, creating a gentle blur effect.

CONCLUSION

We explored image filtering and processing using basic convolution techniques. We gained insights into how these filters impact images by applying various filters, such as edge detectors, shift operators, and blurring kernels. We learned that different filters can emphasise edges, highlight specific change directions, or achieve smoothing effects.

REFERENCES

1. GeeksForGeeks
2. Class notes/slides
3. Alper Yilmaz, Mubarak Shah, UCF