Academic Reflective Journal

1. **Introduction:**

This Journal is about my experience in the lab, Image Processing Fundamentals. The purpose of this document is to explain how the images can be modified through simple operations and how these basic operations are the base that evolves to artificial intelligence.

2. **Description of Experience or Topic:**

The teacher provided this laboratory, then I went to Google Colab to modify it following the steps and instructions there. This lab is written in Python and focuses on image processing. I learned several things, like that the images are matrices of numbers, and that is how the computers see them. Also, I learned that colors are divided into channels. I used basic image operations that adjust brightness and contrast. Also, I used neighbor operations that use kernels for blurs and edges. Then, I worked with advanced techniques such as contrast improvement, equalized histograms, and geometric transformations. After that, I acquired some knowledge to apply these techniques to create artistic filters. Finally, I simulate how artificial intelligence transfers the style of an image to a new one.

3. **Personal Reflection:**

My thoughts and feelings were eager to know how the image processing works. I believe that to develop this laboratory, it is necessary to spend more than 45 minutes and have a deep understanding or explanation in class. Step by step, I can understand different concepts and try to join these with the code in the file. It was interesting to know how I can modify the images to change values in the matrix, for example. I realized how computer vision is a real mathematical application. I believe that geometric transformations are an interesting topic, and I need to deep into these concepts to reinforce the information. Some of the code had errors that I can fix to follow with the next lines. Additionally, I find it challenging to follow all the lines in the code because I lack knowledge of Python programming.

Section 1: Technical Understanding (40%)

•What was the most surprising discovery about how images are represented? I discovered that images are matrices of numbers and they have different channels (red, green, blue). Also, behind an image, there is data.

•How do the mathematical operations we implemented relate to visual effects? Regarding this, I learned that changing the image is as easy as modifying numbers in the matrix. It affects brightness or contrast, for example.

•Which technique was most challenging to understand and why? CLAHE technique because it works in parts.

Section 2: Connections and Applications (40%)

•How do today's lab activities connect to the Nano Banana demonstration from class? Nano Banana learn by herself, and I need to choose the filter that I want to apply.

•What real-world applications can you envision for the techniques you learned? Autonomous cars use these techniques to identify edges and other things to make decisions.

•How might you combine traditional and AI approaches in a future project? I need to go deep to learn more about traditional and AI techniques, so I can decide which to use and when.

Section 3: Personal Reflection (20%)

•What aspect of image processing interests you most for further exploration? How are they able to add things to an original image?

•How has this lab changed your understanding of digital photography and image editing? I understood that these are based on simple operations to do that.

•What questions do you still have about image processing? How they are able to identify with some part of the edges, what complete object is behind?

4. **Discussion of Improvements and Learning:**

This experience helped me to understand the concepts of image processing, and the application of techniques reinforced the knowledge of the documentation and part of the class explanation. But I realized that I have a lack of knowledge regarding the Python programming language. Also, I learned about other libraries in Python that I did not know before. Now, I can understand how images are processed by filters. Knowledge of this topic is important for application in future projects, and combined with other techniques. The pipeline process is another essential concept that will help me develop projects.

5. **Conclusion:**

In conclusion, this lab has been a good experience to know concepts, relate theory with practical exercise, reinforce my self-learning, and align with some of the explanations in class. Additionally, it shows me how the bases of artificial intelligence are not necessarily complex.

6. **References (if applicable):**

- ITAI 1378 2025 Mod 02 Fundamentals of Image Processing.pptx
- 1506.02640 Yolo.pdf
- image_processing_lab.ipynb