



CNG 466 – FUNDAMENTAL IMAGE PROCESSING TECHNIQUES

Assignment 1

Image Enhancement in Spatial Domain (Lectures 1-3)

Objectives: The purpose of this assignment is to familiarize yourselves with the fundamental spatial domain image enhancement techniques. The assignment is organized into three parts each of which requires different techniques. For each part, you are required to develop your algorithm based on the techniques you learned in the lectures and tune them for specific images.

Description: Three parts of the assignment are as follows;

- 1) Decode the encoded text in the image:** In this part, you are required to decode the hidden text in *Image1.png* shown in Fig.1 which is digitally processed to hide the secret text in the image. Your job is to first investigate the *histogram* of the image and then *enhance* it so that the hidden text becomes visible. However, making it visible is not enough for grading purposes. The resulting image should have a distribution of colors between 0 and 255 which is as close as possible to the uniform distribution. Solutions specific to this image will be penalized severely. Hence, implement a generic algorithm using the knowledge you gained in the lectures.

Implement your solution as a MATLAB script named **Q1_StudentID.m** which;

- (3 pts) Creates one figure to show *Image1.png* and its histogram.
- (10 pts) Enhances the *Image1.png* and forms a reconstructed image *Image1Output.png*.
- (3 pts) Saves *Image1Output.png*.
- (3 pts) Creates one figure to show *Image1Output.png* and its histogram.
- (5 pts) Explanation of code step by step and reasons for used techniques.

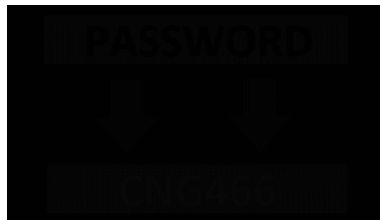


Fig.1: *Image1.png*

- 2) Enhance the quality of the image by removing the noise:** In this part you are required to remove the noise present in the image *Image2.png* shown in Fig.2, preserving informative structures like edges and boundaries as much as possible. You should inspect and identify the properties of the noise present in each image. Then, you should develop a filter and apply it to

denoise the image. You also should inspect the edge maps before and after the process to see the success of preserving the edges.

Implement your solution as a MATLAB script named **Q2_StudentID.m** which;

- (15 pts) Enhances the *Image2.png* by removing the noise and forms a reconstructed image *Image2Output.png*.
- (15 pts) Finds the edges of *Image2.png* and *Image2Output.png*.
- (3 pts) Creates one figure to show *Image2.png*, *Image2Output.png*, and their edges.
- (5 pts) Explanation of code step by step and reasons for used techniques.

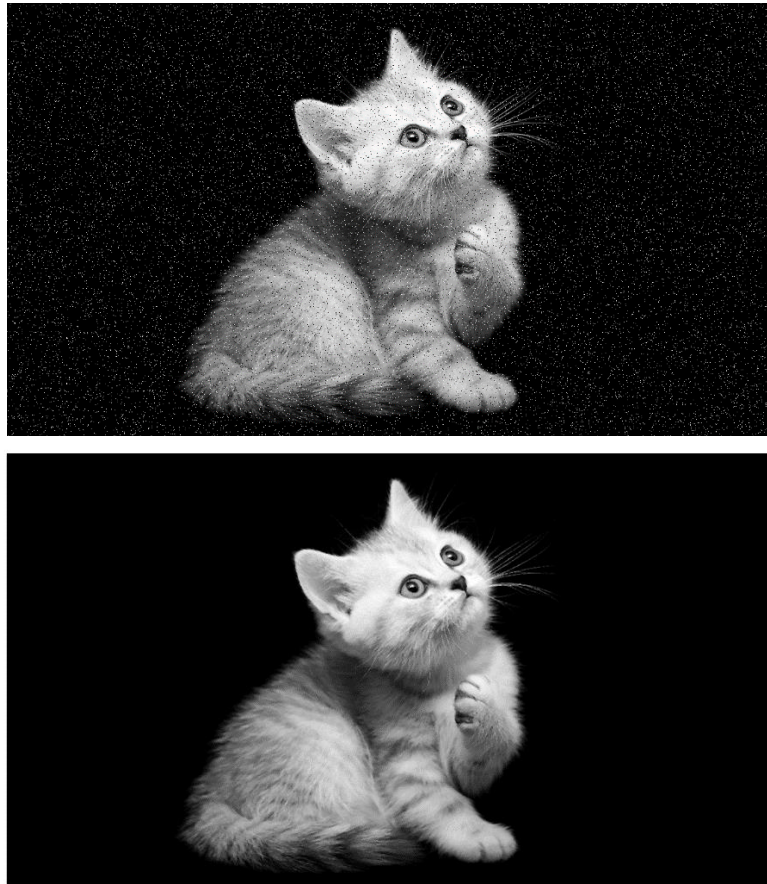


Fig.2: Image2.png and Image2Output.png

- 3) Segment the biggest stars in the image:** In this part, you are required to segment the biggest star in the image *Image3.png* shown in Fig.3. You should develop filter(s) and apply them to segment the bright detail in the image.

Implement your solution as a MATLAB script named **Q3_StudentID.m** which;

- (30 pts) Apply filters to segment the brightest star in the *Image2.png* and forms a reconstructed image *Image2Output.png*.
- (3 pts) Creates one figure to show *Image2.png* and *Image2Output.png*.
- (5 pts) Explanation of code step by step and reasons for used techniques.



Fig.3: Image3.png

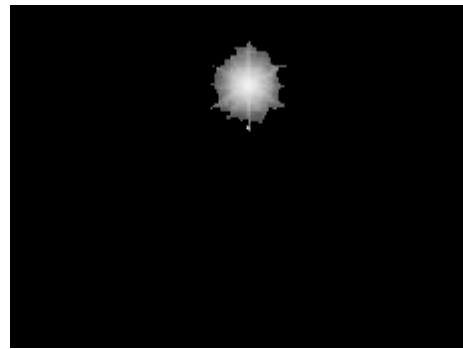


Fig.3: Image3Output.png

Regulations:

- 1) **Programming Language:** You must code your program in MATLAB. You are expected to make sure your code runs successfully. If your code is not implemented in MATLAB and/or doesn't compile, your grade will be zero.
- 2) **Implementation:** In your solutions, you are NOT allowed to use any function from the "Image Processing Toolbox" of MATLAB other than `imread`, `imwrite`, `imshow`, `imhist`, `histeq` and `imtool`.

If you are not sure which functions belong to the image processing toolbox, check from the following link, or please ask me:

https://www.mathworks.com/help/images/referencelist.html?type=function&s_tid=CRUX_topnav

Some other functions that you cannot use are; `conv`, and `conv2` (any function related to convolution).

If your code includes any of the "not allowed functions", your grade from that part will be zero.

You must use the same input and output format which is given to you, including file names. Otherwise, there will be a mark deduction (-2 pts for each part, -6 pts in total).

- 3) **Submission:** Submit three .m files, do not zip them.
- 4) **Deadline:** 03/11/2021 @23:00
- 5) **Late Submission:** Late submission is not allowed; your grade will be zero.
- 6) **Cheating:** Please read carefully the cheating policy from the course syllabus for more details. (Taking a code or a part of a code from any online resource is a cheating case and your grade will be zero.)