German University in Cairo
Faculty of Media Engineering and Technology
Spring 2024

DMET 1001 – Image Processing

Assignment #2

(Due on 30th of April @11:59 PM)

The main aim of this assignment is to implement and experiment with some of the most commonly used image comparator functions. As discussed, some of these functions are used as tools for quality analysis, while others are comparators which are used as loss functions during the learning phase. Hence, in this assignment, you are asked to implement the **comparator functions** discussed in class (lectures 6 & 7), alongside 2 extra comparator functions of your choice utilized in modern research. Here's an example of a survey paper with a list of some of the commonly used quality metrics for image analysis: http://tiny.cc/QualityAnalysisMetrics.

You are free to have the choice of the extra comparative functions implementation from the above-mentioned paper or other resources of your own. In case of getting your reference, you must add its link.

You are asked to deliver the following:

1. A **notebook (.ipynb)** showing your implementation of the functions, alongside test scenarios results.

   The notebook should include the following:

   a. A cell containing your uploading of two different grayscale images and one binary image, all of your own choice.

   b. Cells representing separately each one of the images (the two grayscale and the binary one) along with a preprocessing technique applied to each image.
   You should apply to each image at least 1 preprocessing technique for example: (increasing or decreasing the brightness of the image).
   For more processing techniques ideas, kindly check the four different versions of the cameraman image in lecture 6. You **can use predefined functions** to implement **only** the preprocessing technique.

   c. Cells including the implementation for each comparative function **(do not use any predefined functions)**. Each function should take as input 2 images to be

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compared and return the result of the comparison as practiced in the tutorial and lecture.

d. Cells including test scenarios that apply all the appropriate comparative functions to **each image with its preprocessed version(s)**.
Take care: some comparative functions only work with binary images.

2. A **report** that includes the following:

   a. An explanation of the mathematical definition of each comparative function. This explanation should include how each function compares images for example: pixel by pixel or not, besides, factors that the function might be sensitive to, for example: (brightness).

   b. Suitable image test scenarios that you did.

   c. Recent references such as a conference or a journal paper, for each of the functions mentioned in the lectures (6 & 7), as well as, the two extra functions you chose. Recent references' dates should be within 2020 (inclusive) till now.

   d. A conclusion elaboration on the most suitable utilization for each function based on what you read and learnt from the class (lectures and tutorials), besides, the references you found.

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Submission Guidelines:

- This assignment should be done **in teams of 4 to 6**. Kindly find the teams' formation link: https://forms.gle/rYDYfkqULWzshfAG7
- The deadline for forming teams is on **Tuesday,23/4/2024 at 11:59 PM**. A submission with less than 4 students is subject to be randomly assigned to a team of any size.
- All work done in this assignment must be done by your hands and your hands only. This means that copying code from other teams or ChatGPT is not allowed. A cheating detector will be used to confirm that.
- You should submit **a .ZIP file** to the course email containing the following items:
    - The .ipynb file containing your assignment's implementation (the notebook should be submitted showing the cells being run before and representing the output).
    - A Word document report.
    - A .txt file with the team members' names, IDs and tutorial group.
    - The .zip file should have the following format: [Assignment_2]_[Team_Number].
    - Please use the following link to submit your **.zip** file: https://forms.gle/KayZCinVW69ifADz8