BINUS University

Academic Career: ***Undergraduate / ~~Master~~ / ~~Doctoral~~ *)***			**Class Program:** ***~~International~~/Regular/~~Smart Program~~/~~Global Class~~*)***
☑ **Mid Exam** ☐ **Final Exam** ☐ **Short Term Exam** ☐ **Others Exam : _____**			**Term : Odd/~~Even~~/~~Short~~ *)**
☑ **Kemanggisan** ☑ **Alam Sutera** ☐ **Bekasi** ☐ **Senayan** ☐ **Bandung** ☐ **Malang**			**Academic Year :** **2021 / 202**
Faculty / Dept. : School of Computer Science		Deadline	Day / Date : Friday / Nov 26th, 2021 Time : 17:00
Code - Course : COMP7116001- Computer Vision		Class	: All Classes
Lecturer : Team		Exam Type	: Online
*) *Strikethrough the unnecessary items*			
The penalty for CHEATING is DROP OUT!!!			

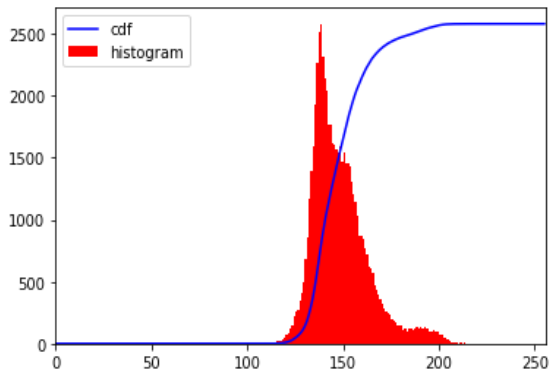
Learning Outcomes

LO 1: Describe various computational principles and standard image processing operators in computer vision

LO2: Explain the local features with their detectors and descriptors in computer vision

ESSAY (100 %)

1. A **[LO 1 & LO 2, 10 points]** Given a histogram of an image as it is shown in the below figure, how do you tell whether the associated image is having a good or bad contrast from its histogram. Describe detail steps of a histogram transformation process that will likely improve the image contrast.



1. B **[LO 1 & LO 2, 10 points] Using python notebook (.ipynb extension),** demonstrate a contrast enhancement process on a low contrast image (an image of your choice) based on detail steps depicted in the problem 1. A. Your code must also be able to show side by side the image and its associated histogram of both the original and the transformed images. You may use

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relevant python libraries such as numpy, skimage and/or OpenCV to quickly implement your program. Please use markdown cells to put your comments on each code segment.

2.

0	**0.2**	**1**
0.2	**0.4**	**0.2**
0	**0.2**	**0**

(A)

0.1	**0.1**	**0.1**
0.1	**0.1**	**0.1**
0.1	**0.1**	**0.1**

(B)

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

(C)

0	**-1**	**0**
0	**3**	**0**
0	**-1**	**0**

(D)

[LO 1 & LO 2, 10 points] Describe precisely the effect of each linear filter shown in the above figures if it is applied to an image (an image of your choice). Which filters result in (a) stronger blurring image; (b) stronger brighten and (c) stronger darken the image. Demonstrate your computational codes **in python notebook (.ipynb extension).** Some relevant python libraries are welcome to employ and please use markdown cells to write your explanation/comments.

3. **[LO 1 & LO 2, 20 points]** Explain thoroughly what you know about (1) non-maximum suppression and (2) hysteresis thresholding in the Canny edge detector algorithm. Use diagram if neccessary to show how both techniques are carried out. Implement the aforementioned approaches **in python notebook (.ipynb extension)**and demonstrate the results. Again, you may use relevant python libraries and a sample image of your choice.

4. **[LO 1 & LO 2, 25 points]** Demonstrate Harris corner algorithm based on the following steps **using python notebook (.ipynb extension)** (please use an image and a Gaussian filter of your own):
    1. Compute Gaussian derivatives at each pixel
    2. Compute second moment matrix M in a Gaussian window around each pixel
    3. Compute corner response function R
    4. Threshold R
    5. Find local maxima of response function (non-maximum suppression)

5. **[LO 1 & LO 2, 25 points]** Given some key-points in the image and their corresponding key-points in the other image as they are all shown in the below figures, write detail steps on how they are created and how an image matching process based on the key-points is carried out. Credit will be given to someone who is able to demonstrate the matching process in **python notebook (.ipynb extension)**. You may use your own images.

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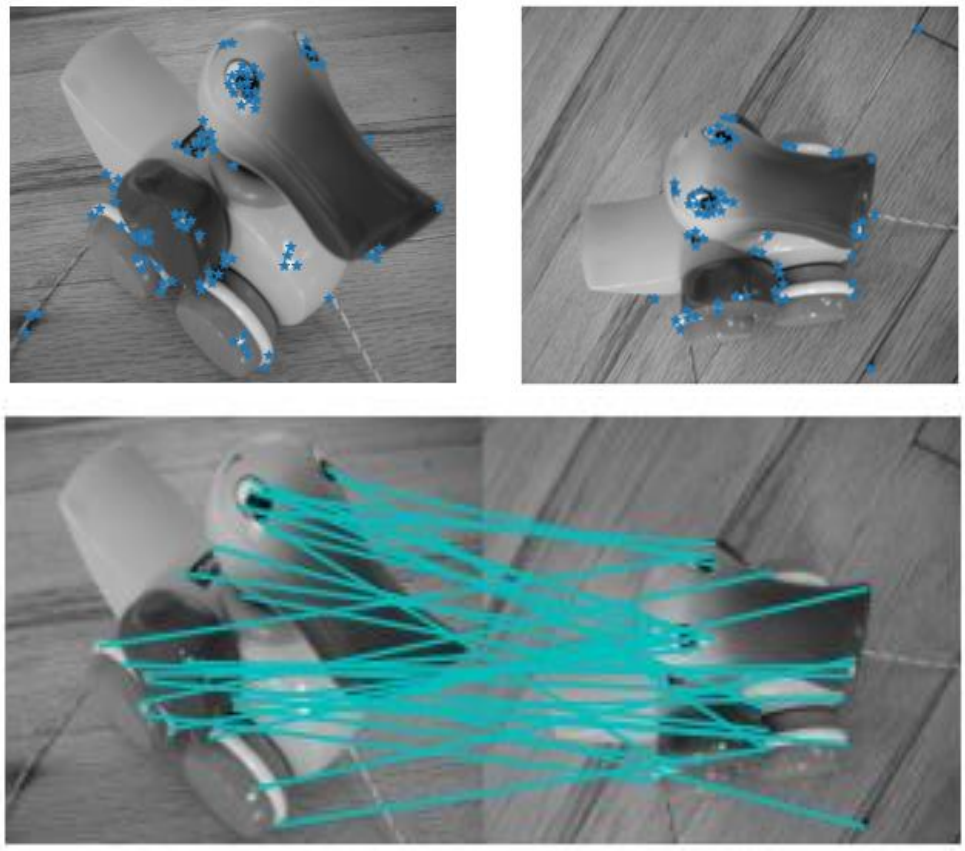

-- Good Luck --

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