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Roll No. : 200163

Assignment-3

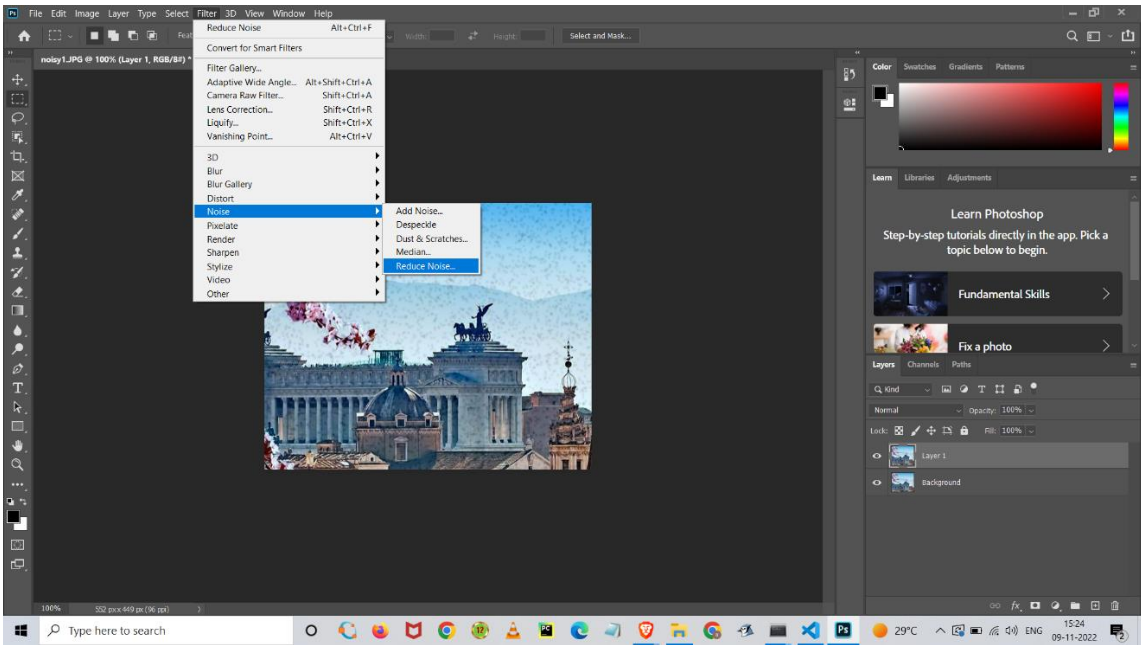
Question 4:

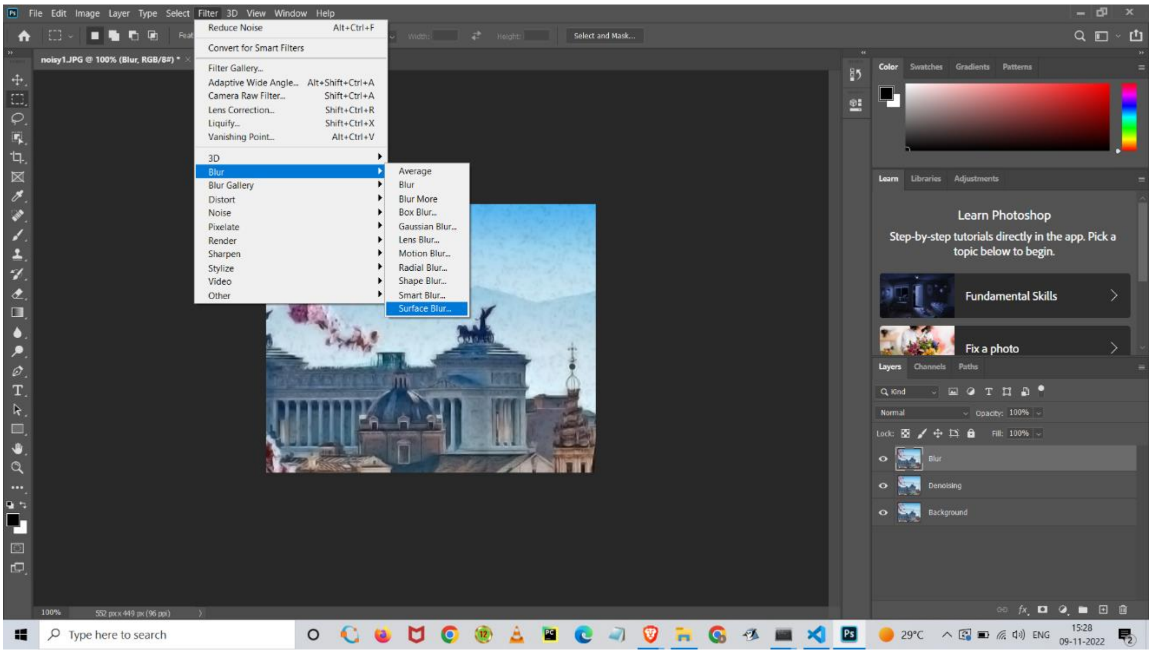
Using IP Software, I implemented blurring and denoising filters on the image as follows:-

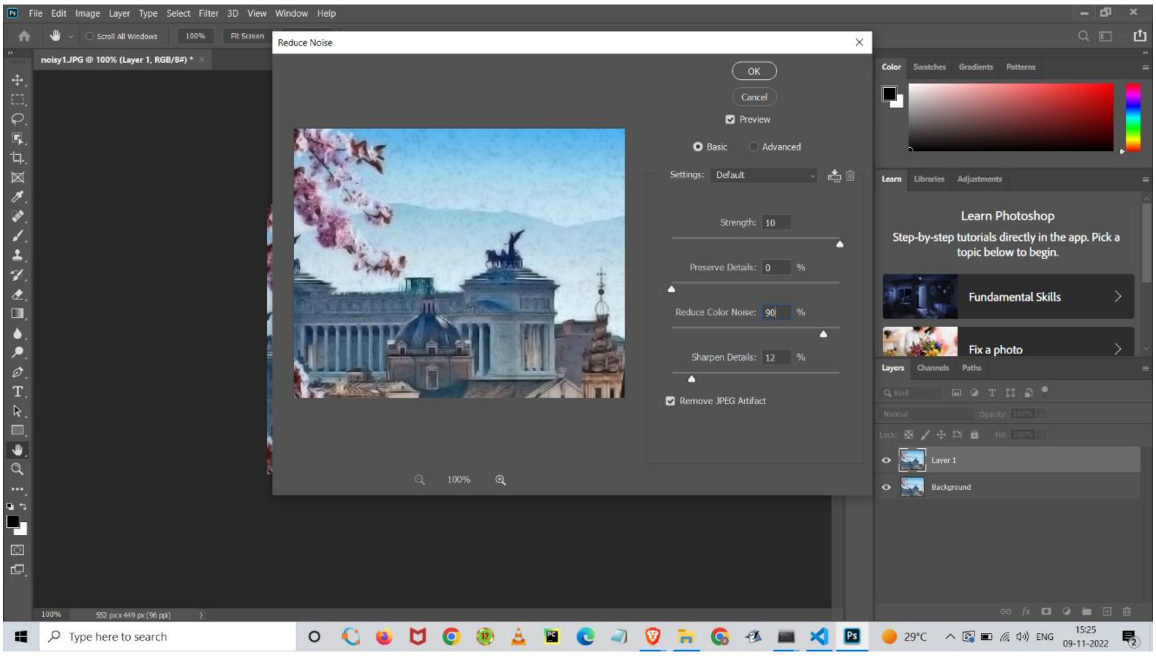
noise reduction

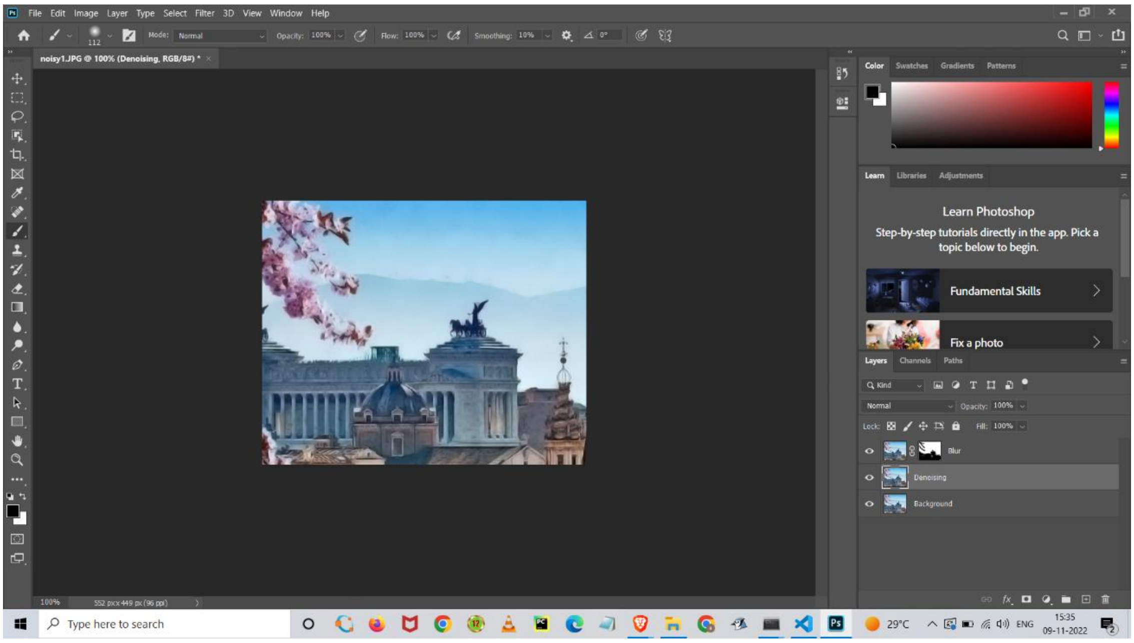
1> noise reduction

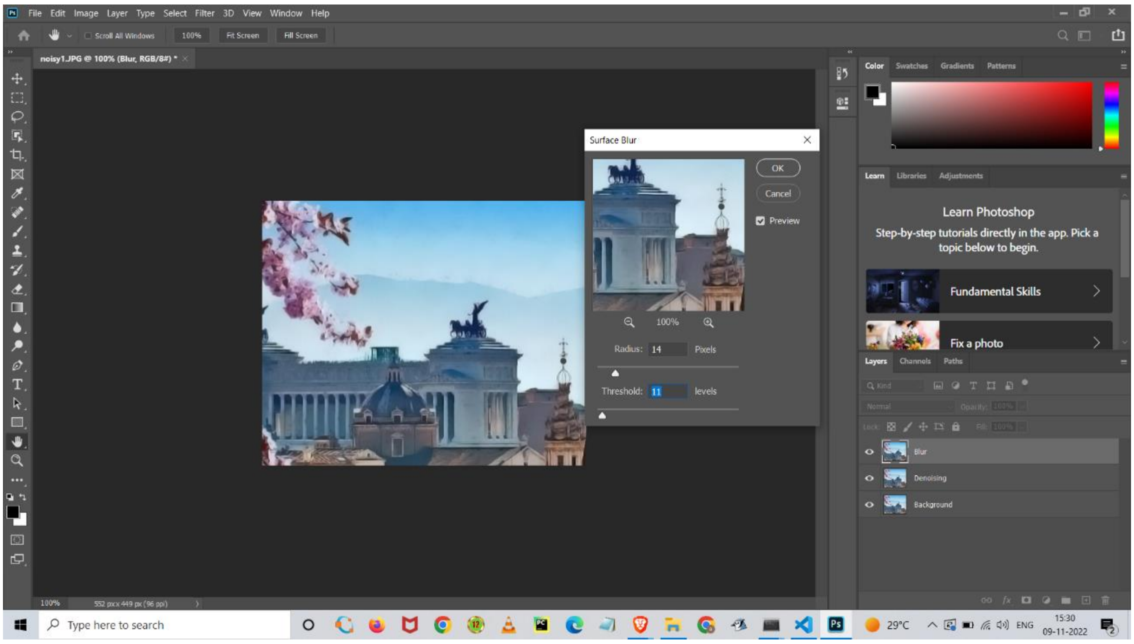
2> blur






File Edit Image Layer Type Select Filter 3D View Window Help
noisy1.JPG @ 100% (Layer 1, RGB/8#) *
Reduce Noise
OK
Cancel
Preview
Basic
Advanced
Settings: Default
Strength: 10
Preserve Details: 0 %
Reduce Color Noise: 90 %
Sharpen Details: 12 %
Remove JPEG Artifact
100%
Learn Photoshop
Step-by-step tutorials directly in the app. Pick a topic below to begin.
Fundamental Skills
Fix a photo
Layer 1
Background
Type here to search
29°C
ENG
15:25
09-11-2022


File Edit Image Layer Type Select Filter 3D View Window Help
noisy1.JPG @ 100% (Denoising, RGB/8#) *
Learn Photoshop
Step-by-step tutorials directly in the app. Pick a topic below to begin.
Fundamental Skills
Fix a photo
Blur
Denoising
Background
Type here to search
29°C
ENG
15:35
09-11-2022


File Edit Image Layer Type Select Filter 3D View Window Help
noisy1.JPG @ 100% (Blur, RGB/8#) *
Surface Blur
OK
Cancel
Preview
100%
Radius: 14 Pixels
Threshold: 11 levels
Learn Photoshop
Step-by-step tutorials directly in the app. Pick a topic below to begin.
Fundamental Skills
Fix a photo
Blur
Denoising
Background
Type here to search
29°C
ENG
15:30
09-11-2022

Original Image

Denoised Image

Using IP Software, I tried removing shadows (gutter) from the image as follows:-

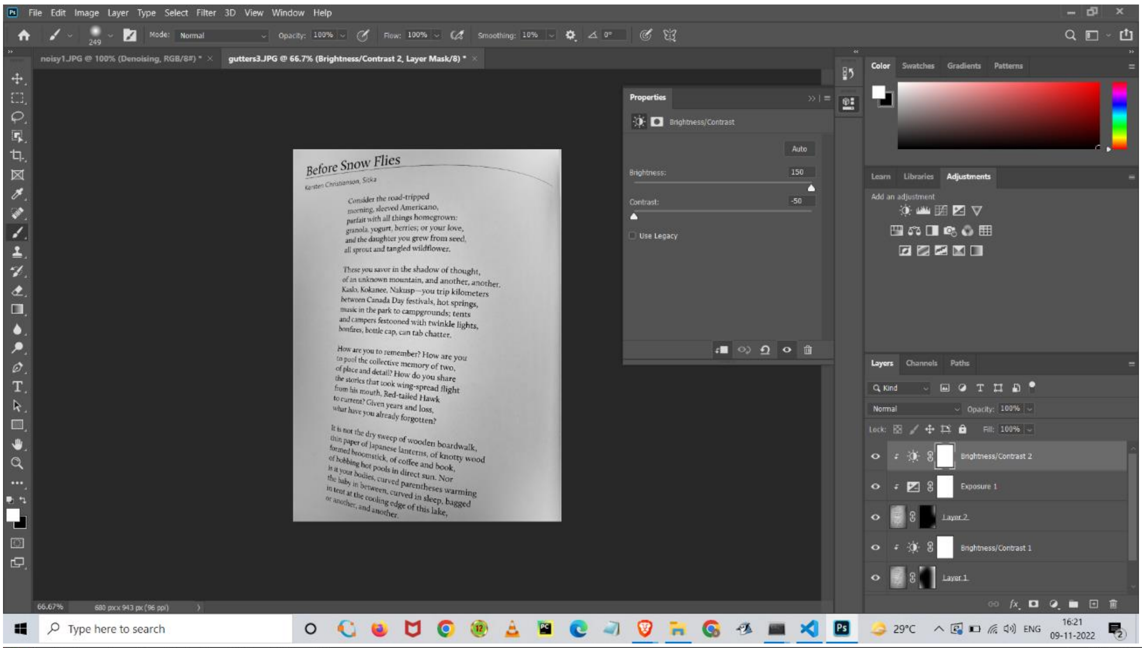
de-shadow

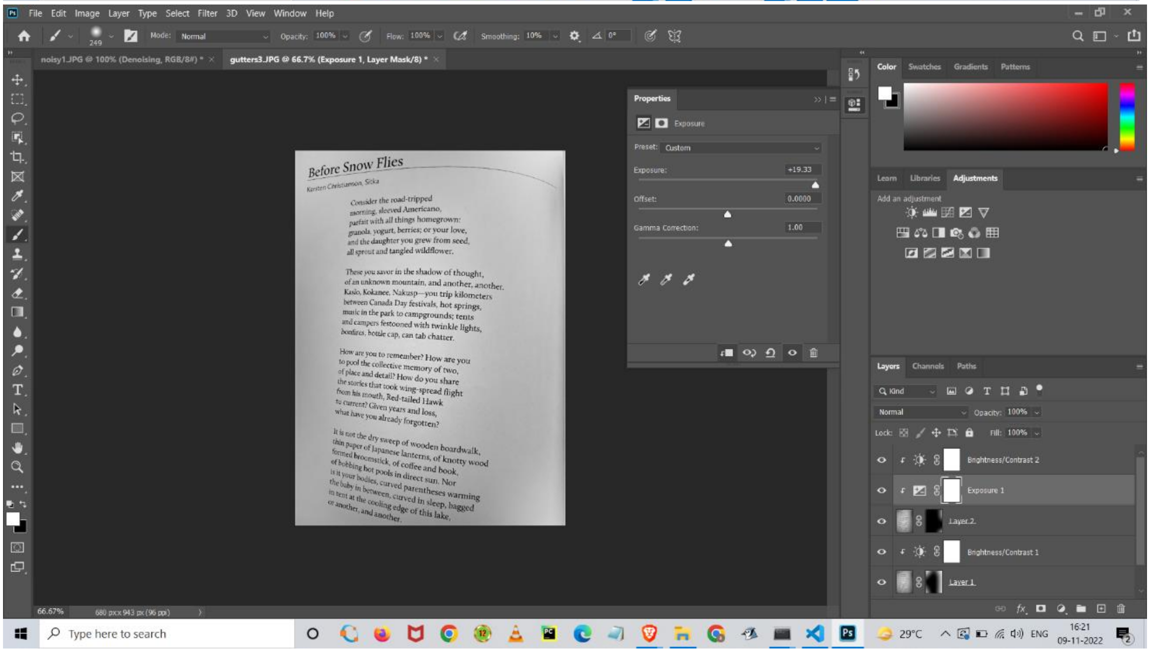
1> select dark parts

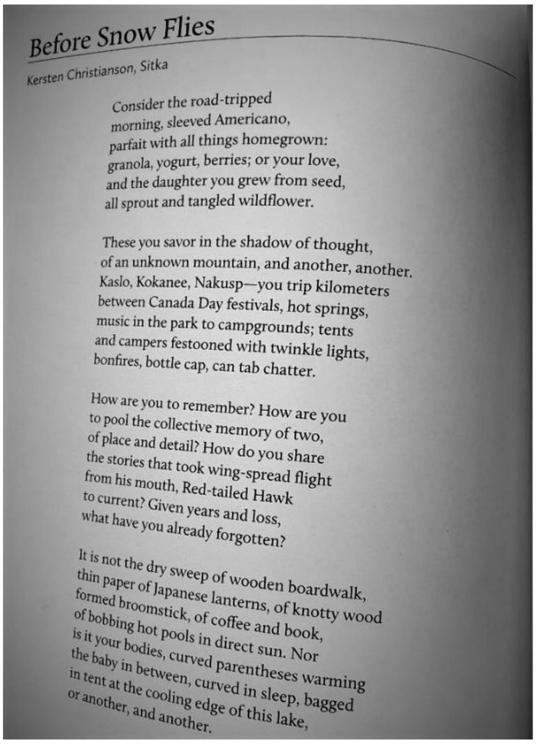
2> increase brightness of dark parts

3> select other remaining dark parts

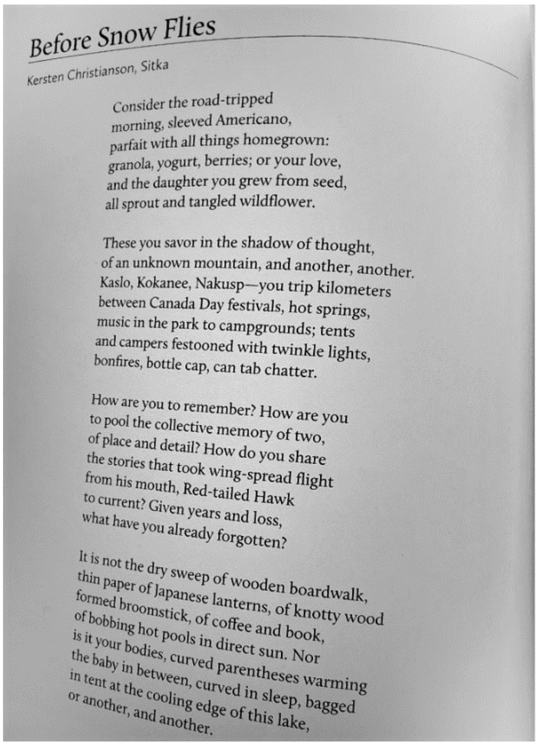
4> increase exposure



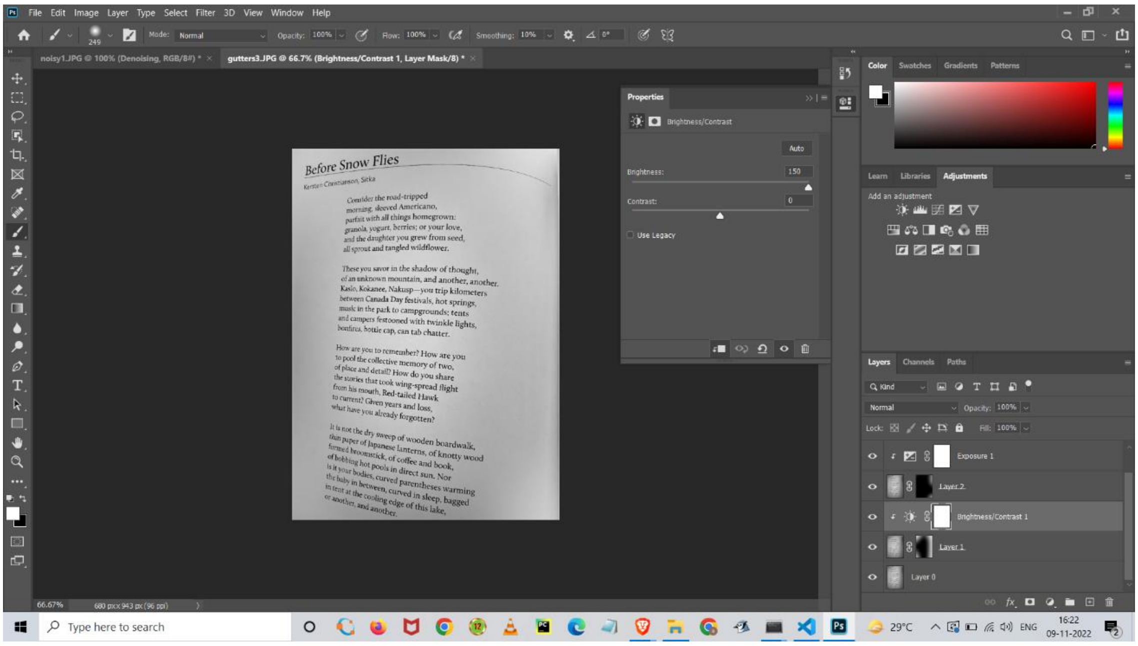




Original Image


Before Snow Flies
Kersten Christianson, Sitka
Consider the road-tripped
morning, sleeved Americano,
parfait with all things homegrown:
granola, yogurt, berries; or your love,
and the daughter you grew from seed,
all sprout and tangled wildflower.
These you savor in the shadow of thought,
of an unknown mountain, and another, another.
Kaslo, Kokanee, Nakusp—you trip kilometers
between Canada Day festivals, hot springs,
music in the park to campgrounds; tents
and campers festooned with twinkle lights,
bonfires, bottle cap, can tab chatter.
How are you to remember? How are you
to pool the collective memory of two,
of place and detail? How do you share
the stories that took wing-spread flight
from his mouth, Red-tailed Hawk
to current? Given years and loss,
what have you already forgotten?
It is not the dry sweep of wooden boardwalk,
thin paper of Japanese lanterns, of knotty wood
formed broomstick, of coffee and book,
of bobbing hot pools in direct sun. Nor
is it your bodies, curved parentheses warming
the baby in between, curved in sleep, bagged
in tent at the cooling edge of this lake,
or another, and another.

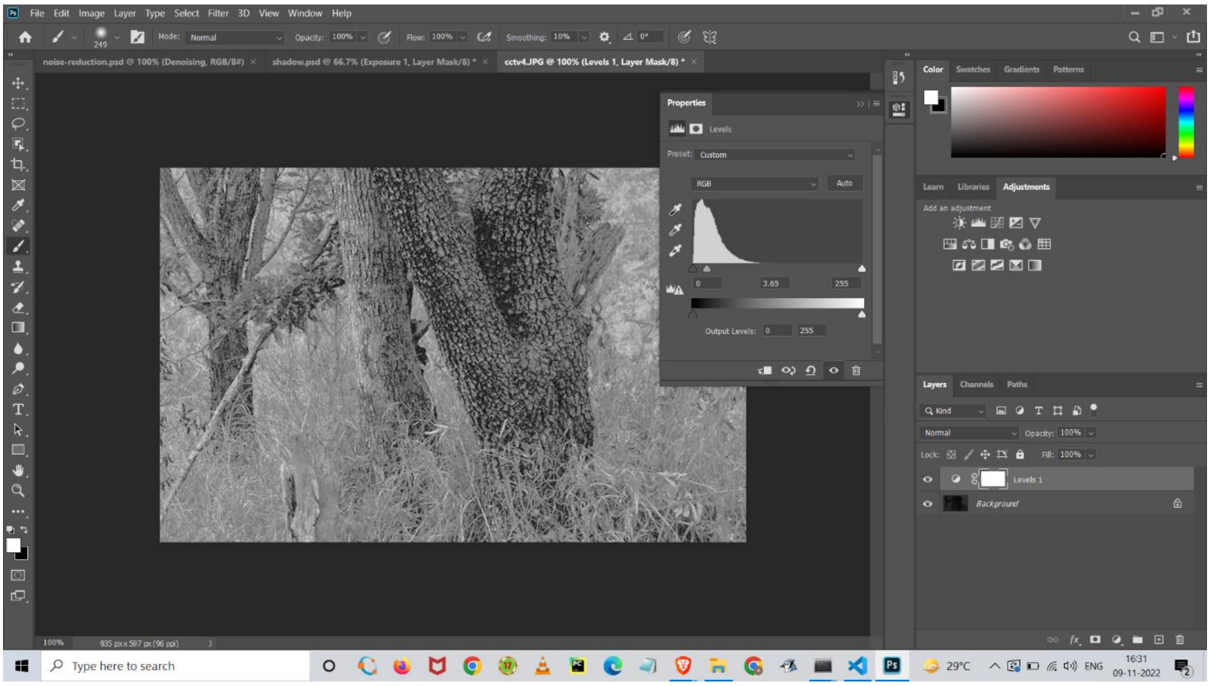
Shadow removed Image



Using IP Software, I tried improving brightness of image by using histogram equalization on the image as follows:-

cctv

1> change light levels



Original Image

Improved Image

Question 1:

Which of the following statements are true regarding Mean shift clustering Algorithm: -

1. It is a non-parametric density estimation algorithm
2. It is a non-parametric density gradient estimation algorithm
3. Mean Shift vector points from center of region of interest towards center of mass of region of interest
4. It is computationally expensive as complexity varies as O(nT)
5. This algorithm is robust to outliers in the dataset

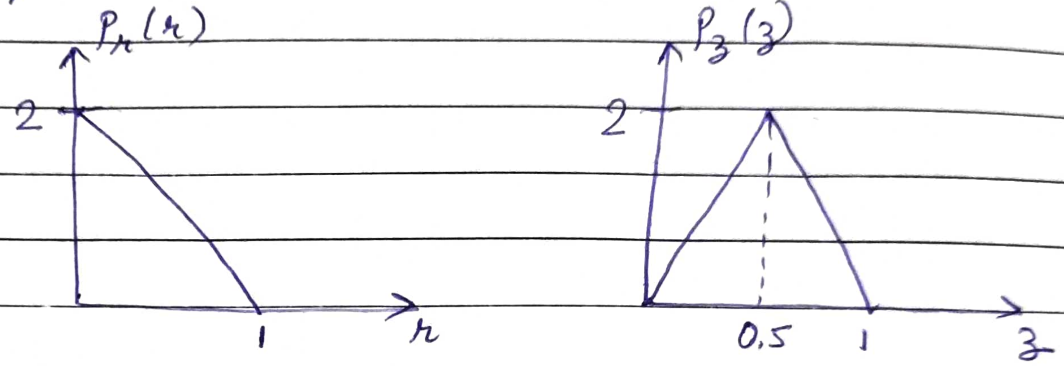
Answer 1: 2,3,5

Question 2: Which of the following statements are true in Image Processing: -

1. A continuous image is digitized at sampling points.
2. Blurring an image with the help of a smoothing filter may lead to noise reduction.
3. Laplacian is the first-order derivative operator.
4. Convolution measures similarity between the two signals
5. Gaussian filter is circularly symmetric and response is dependent of orientation
6. Fringes of color appear at image boundaries in chromatic aberration

Answer 2: 1,2,6

Ques : An image with intensities in the range [0, 1] has the PDF $p_r(r)$ shown in the following diagram. It is desired to transform the intensity levels of this image so that they will have the specified $p_z(z)$ shown. Assume continuous quantities and find the transformation (in terms of r and z) that will accomplish this :-



Ans : Value of the histogram component corresponding to the kth intensity level in a neighbourhood is

$$p_r(r_k) = \frac{n_k}{n}$$

for $k = 1, 2, \ldots, K-1$, where n_k is the number of pixels having gray level value r_k, n is the total number of pixels in the neighbourhood, and K is the total number of possible gray levels. Suppose that the neighbourhood is moved one-pixel to the right. This deletes the leftmost column and introduces a new column to the right. The updated histogram then becomes :-

$$p'_r(r_k) = \frac{1}{n}[n_k - n_{L_k} + n_{R_k}]$$

for $k = 0, 1, \ldots K-1$, where n_{L_k} is the number of occurrences of level r_k on the left column and n_{R_k} is the similar quantity on the right column. The preceding equation can be written also as

$$p'_r(r_k) = p_r(r_k) + \frac{1}{n}[n_{R_k} - n_{L_k}]$$

for $k = 0, 1, \ldots, K-1$. The same concept applies to other modes of neighbourhood motion:

$$p'_r(r_k) = p_r(r_k) + \frac{1}{n}[b_k - a_k]$$

for $k = 0, 1, \ldots, K-1$, where a_k is the number of pixels with value r_k in the neighbourhood area deleted by the move and the b_k is the corresponding number introduced by the move.

$$\sigma_{\bar{g}}^2 = \sigma_f^2 + \frac{1}{K^2}[\sigma_{\eta_1}^2 + \sigma_{\eta_2}^2 + \ldots + \sigma_{\eta_K}^2]$$

The first term on the right side is 0 because the elements of f are constants. The various $\sigma_{\eta_i}^2$ are simply samples of the noise, which is has variance σ_η^2. Thus $\sigma_{\eta_i}^2 = \sigma_\eta^2$ and we have

$$\sigma_{\bar{g}}^2 = \frac{K}{K^2}\sigma_\eta^2 = \frac{1}{K}\sigma_\eta^2$$

Reference : Digital Image Processing
3rd edition - R. Gonzalez,
R. Woods book
Chapter 3 - Intensity Transformations and Spatial Filtering
Problem 3.11