

National University of Science and Technology
School of Electrical Engineering and Computer Science

Department of Software Engineering

EE433: Digital Image Processing

Class: BESE-5

Lab 6: Noise reduction using spatial-domain Techniques

Date: 17th October, 2017

Time: 2pm-5pm

Instructor: Dr. Muhammad Moazam Fraz

Lab Engineer: Ms Iram Tariq Bhatti

Course Learning Outcomes (CLOs)			
Upon completion of the course, students should demonstrate the ability to:		PLO Mapping	BT Level*
CLO 1	Understanding the fundamentals and basic concepts of image processing	PLO 1	C2
CLO 2	Analyze images using mathematical transformations and operations	PLO 2	C4
CLO 3	Develop solutions by using modern tools to solve practical problems.	PLO 5	C5
	* BT= Bloom's Taxonomy, C=Cognitive domain, P=Psychomotor domain, A= Affective domain		

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Learning Outcome

CLO 2: Analyze images using mathematical transformations and operations.

Goal

The goal of this lab is to learn how to perform noise reduction using spatial domain techniques.

Objectives

- Learn how to implement the arithmetic mean filter, as well as some of its variations, such as the contra-harmonic mean, the harmonic mean, and the geometric mean filters.
- Learn how to perform order statistic filtering, including median, min, max, midpoint, and alpha-trimmed mean filters.

Tools/Software Requirement

Python 3.5

MATLAB 2016

Notes:

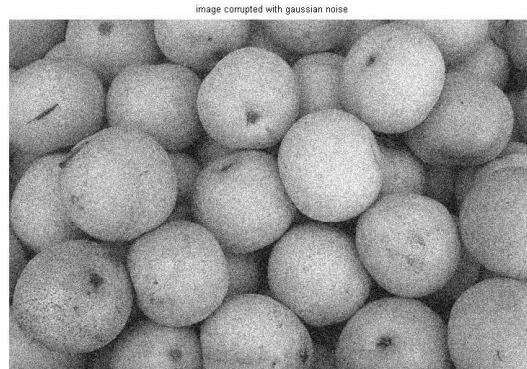
- Use any default Matlab images for this Lab except **pears.png**.
- Use grayscale images to demonstrate your results.
- For python look at the link below:
<http://scikit-image.org/docs/stable/api/skimage.util.html#random-noise>
- Read documentation of following Matlab function. The documentation can be opened by writing doc <function name> in Matlab command window.
Imnoise, t, imfilter, nlfilter function, ordfilt2, medfilt2.

Task#1 Corrupt the input images with different types of noise models.

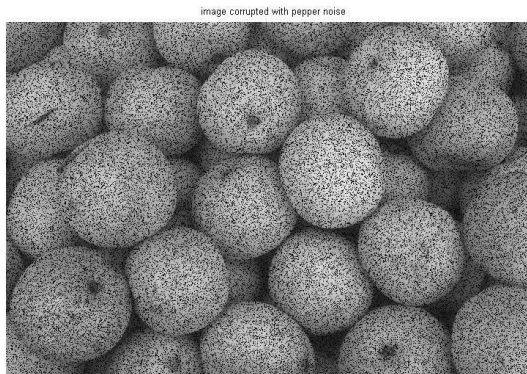
1. 'Gaussian'
2. 'poisson'
3. 'salt & pepper'
4. 'speckle'
5. Salt only noise (implementation provided with Lab6)
6. Pepper only noise (implementation provided with Lab6)

Below is the demonstration for Task 1.

- **Image Corrupted with Gaussian Noise:**



- **Image Corrupted with Pepper Noise:**



- **Image Corrupted with Poisson Noise:**

image corrupted with poisson noise



- **Image Corrupted with Salt & Pepper Noise:**

image corrupted with salt & pepper noise

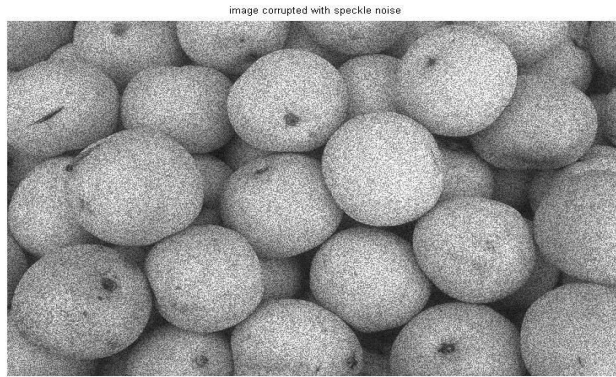


- **Image Corrupted with Salt Noise:**

image corrupted with salt noise



- **Image Corrupted with Speckle Noise:**



Task#2 Apply different kinds of noise removal filters as given below;

1. **Arithmetic mean**
2. **Geometric mean**
3. **Harmonic mean with different parameters**
4. **Contra harmonic mean (implementation provided with Lab6)**
The *contra harmonic mean filter* is used for filtering an image with either salt or pepper noise (but not both).
5. **Min point filters**
6. **Max filters**
7. **Min filters**
8. **Median filters**

Question 1: What is the effect of using the wrong sign when filtering with the contra harmonic mean filter?

Question 2: Why do you think the median filter works on salt and pepper noise but not Gaussian noise?

Below is the demonstration for Task # 2 Images with Noise Removed:

- **Arithmetic mean filter:**



Impact on Gaussian Noise



Impact on Pepper Noise



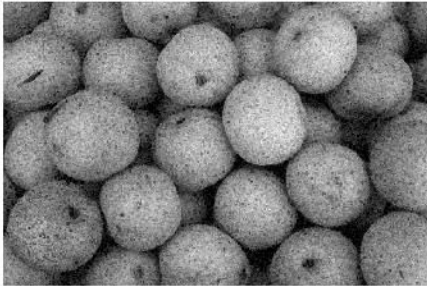
Impact on Poisson Noise



Impact on Salt Noise

● Min Filter:

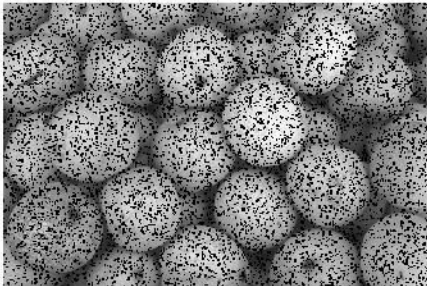
impact on gaussian noise



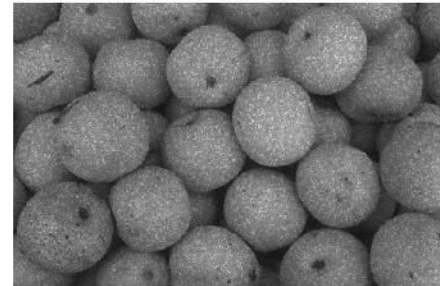
impact on poisson noise



impact on salt & pepper noise



impact on speckle noise



Submission

Perform above mentioned practice tasks in Matlab or Python.

Just make a new folder named as DIP-Lab6 in existing private repository and then add the teacher as a collaborator. All the code must be in runnable format in order to get the credit.

1. A file with commented source code representing the work accomplished for this lab.
2. All files should contain author in the comments at the top of the file.
3. Copy the output image of each filter to the MS WORD file and give explanation of the effect of filter application as visible in respective output images.