IMAGE RESTORATION

Spatial Filters

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2.5 Image Restoration

- **Image restoration** methods are used to improve the appearance of an image by application of a restoration process that use mathematical model for image degradation.

- **Example of the type of degradation:**
  - *Blurring caused by motion or atmospheric disturbance.*
  - *Geometric distortion caused by imperfect lenses.*
  - *Superimposed interface patterns caused by mechanical systems.*
  - *Noise from electronic source.*

2.5.1 Noise Definition

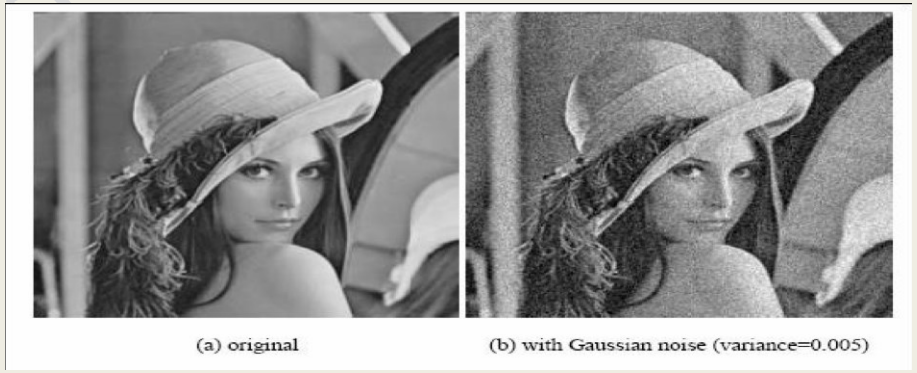
- **Noise** is any undesired information that contaminates an image. Noise appea in image from a variety of source.
- The digital image a acquisition process, which converts an optical image into a continuous electrical signal that is then sampled is the primary process by which noise appears in digital images.

- At every step in the process there are fluctuations (تذبذب) caused by natural phenomena (ظاهره) that add a random value to exact brightness value for a given pixel.
- In typical image the noise can be modeled with one of the following distribution:

➢Gaussian (“normal”) distribution.

➢Uniform distribution.

➢Salt _and _pepper distribution.



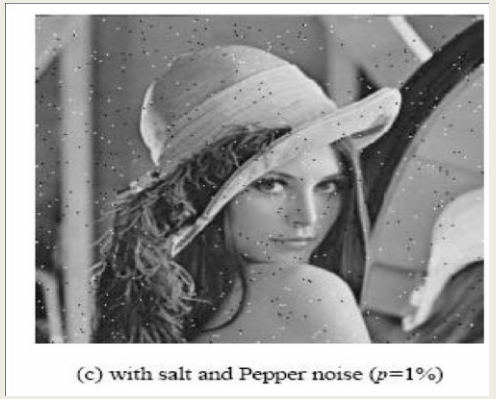


Figure (2.12) : Noisy Image

2.5.2 Noise Removal Using Spatial Filters

- Spatial filtering is typically done for:
  - Remove various types of noise in digital images.
  - Perform some type of image enhancement.
- The three types of spatial filter are:
  - Mean filters
  - Median filters (order filter)
  - Enhancement filters
- Mean and median filters are used primarily to conceal or remove noise, although they may also be used for special applications.
- For instance, a mean filter adds “softer” look to an image.
- The enhancement filter highlights edges and details within the image.

Spatial Filters

- Spatial filters are implemented with convolution masks. Because convolution mask operation provides a result that is weighted sum of the values of a pixel and its neighbors, it is called a linear filter.
- Overall effects the convolution mask can be predicated based on the general pattern. For example:

  - If the coefficients of the mask sum-to one, the average brightness of the image will be retained.
  - If the coefficients of the mask sum to zero, the average brightness will be lost and will return a dark image.
  - If the coefficients of the mask are alternatively positive and negative, the mask is a filter that returns edge information only.
  - If the coefficients of the mask are all positive, it is a filter that will blur the image.