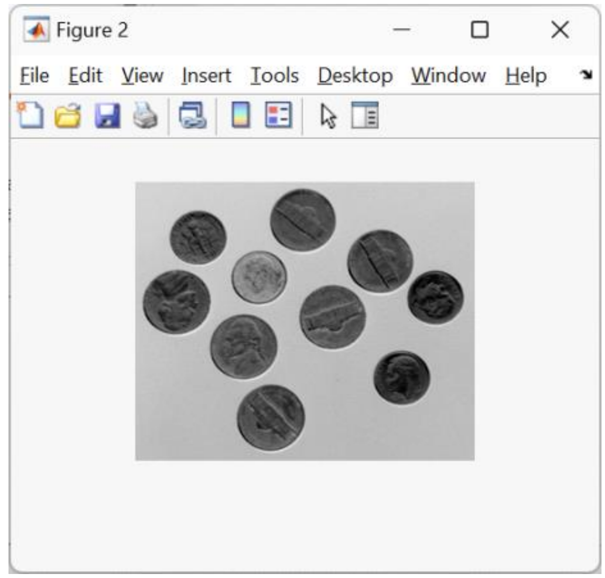
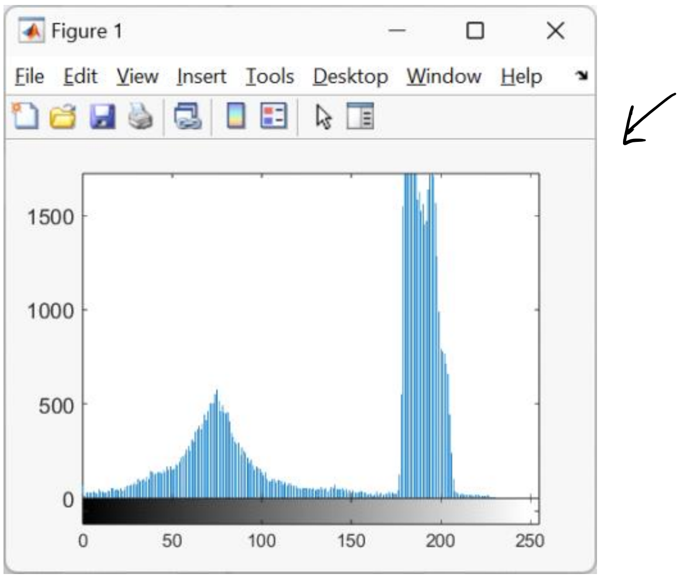
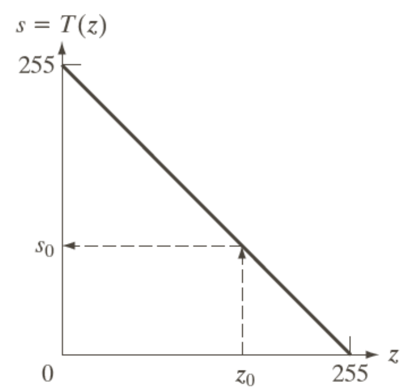
Lecture 8

Negative Images:

```
>> I = imread('coins.png');
>> J = 255 - I;
>> imshow(J)
>> imhist(J)
```





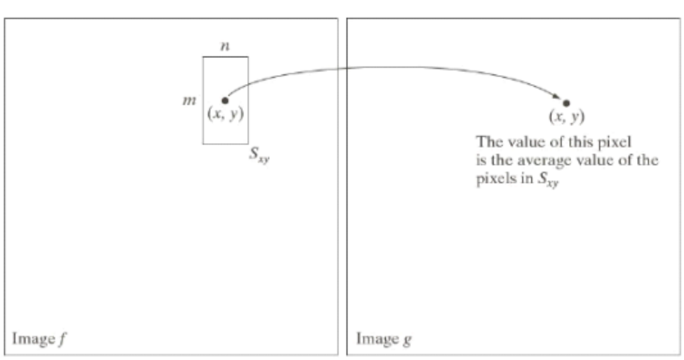


Spatial operations are performed directly on the pixels of a given image. We classify spatial operations into three broad categories:

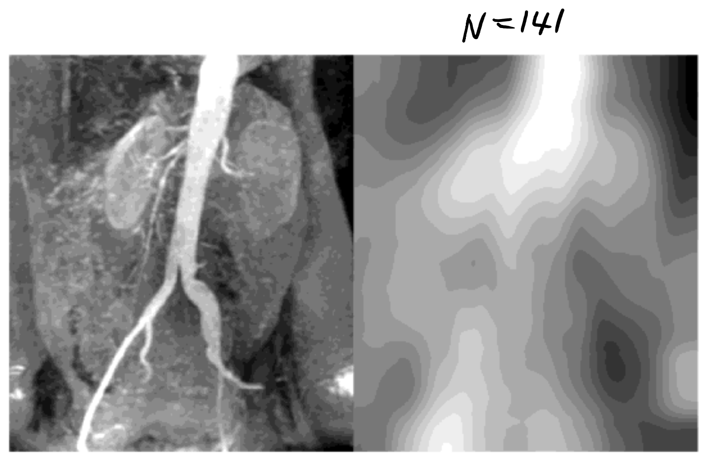
Neighborhood operations

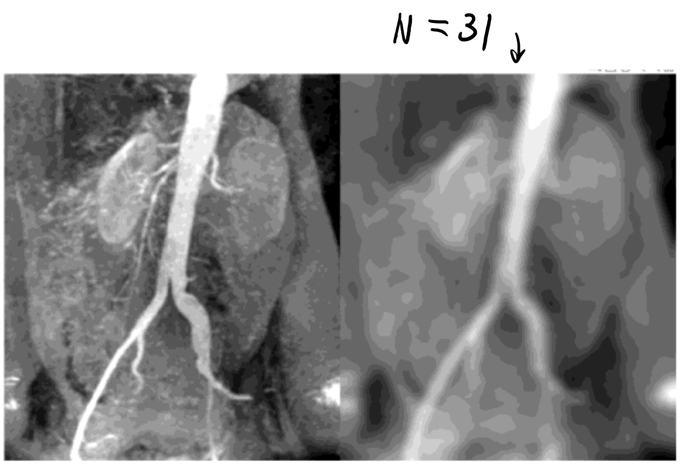
•Generate a corresponding pixel at the same coordinates in an output (processed) image, such that the value of that pixel is determined by a specified operation involving the pixels in a neighborhood of the input image

$$g(x,y) = \frac{1}{mn}\Sigma_{(r,c)\in S_{xy}} f(r,c)$$

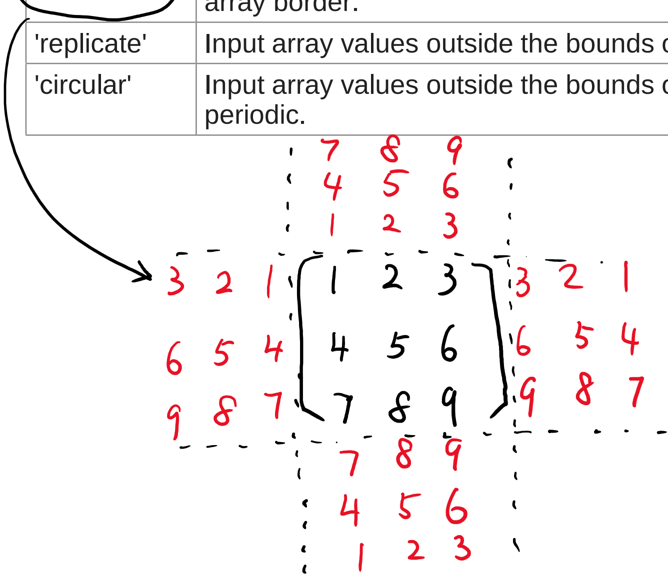


```
>> I = imread('Fig0235(c)(kidney_original).tif');
>> imshow(I)
>> N = 141;
>> h = ones(N, N)/(N*N);
>> doc imfilter
>> J = imfilter(I, h, 'symmetric');
>> figure; imshowpair(I, J, 'montage');
```





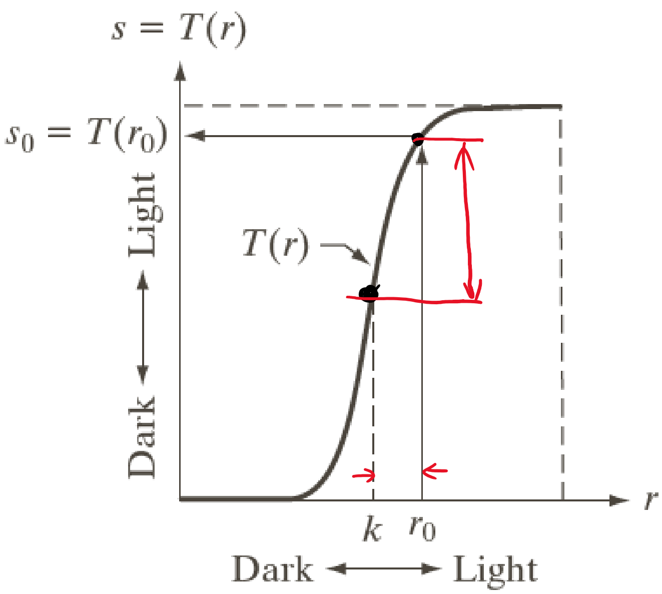
Padding Options	
numeric scalar, X	Input array values outside the bounds of the array are assigned the value X. When no padding option is specified, the **default is 0**.
'symmetric'	Input array values outside the bounds of the array are computed by **mirror-reflecting** the array across the array border.
'replicate'	Input array values outside the bounds of the array are assumed to equal the nearest array border value.
'circular'	Input array values outside the bounds of the array are computed by implicitly assuming the input array is periodic.



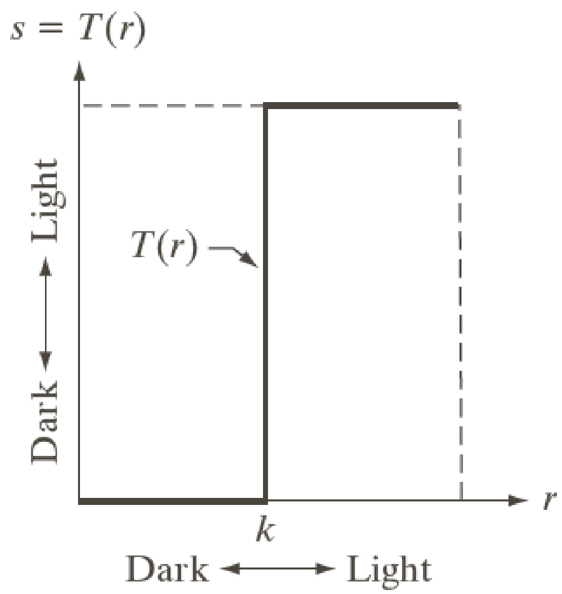
–Single-pixel operations

•$s = T(z)$, where z is the intensity of a pixel in the original image and s is the (mapped) intensity of the corresponding pixel in the processed image.

Contrast Stretching and Thresholding



Contrast Stretching



Thresholding

Gamma Transformation (Correction)

$s = c \cdot r^{\gamma}$ If $\gamma = 5$, then $s = c \cdot r^5$

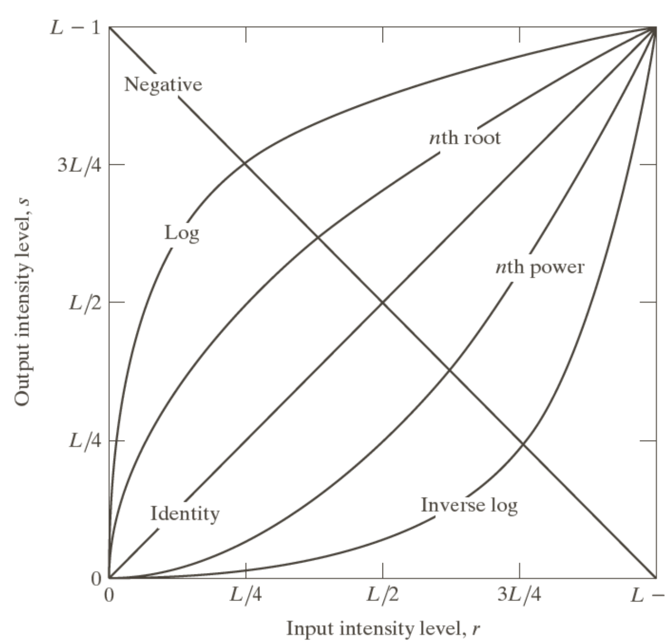
↓ constant

If $r = 0$, then $s = 0$

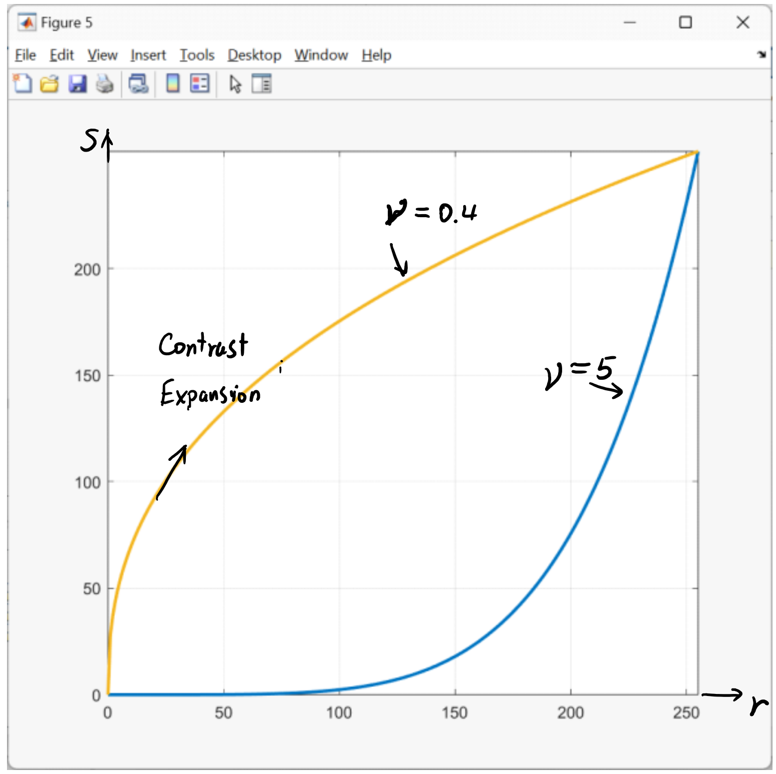
$r = 255$, then $s = 255$

$255 = c \cdot r^5$

Then $c = \frac{255}{255^5} = 255^{-4}$



```
>> clear all
>> r = 0: 255;
>> c = 1/(255^4);
>> s = c*(r.^5);
>> plot(r, s); grid
```



How about $\nu = 0.4$

$$s = c_2 \cdot r^{0.4}$$

$$c_2 = \frac{255}{255^{0.4}} = 255^{0.6}$$

```
>> c = 255^0.6;
>> s = c*(r.^0.4);
>> hold on; plot(r, s);
```

% Fig. 3.8

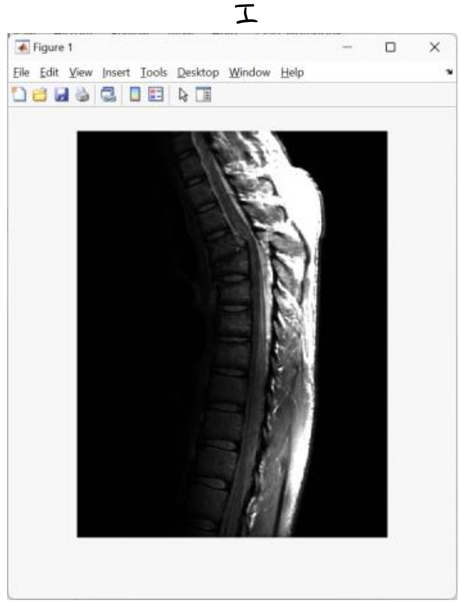
```
>> I = imread('Fig0308(a)(fractured_spine).tif');
imshow(I);

L = 256;
gamma = 0.4;
>> % Output image
J = double(I).^gamma * (L-1)/((L-1)^gamma);
figure;
imshow(J, []);
```

(L-1) = 255, (L-1) = 255

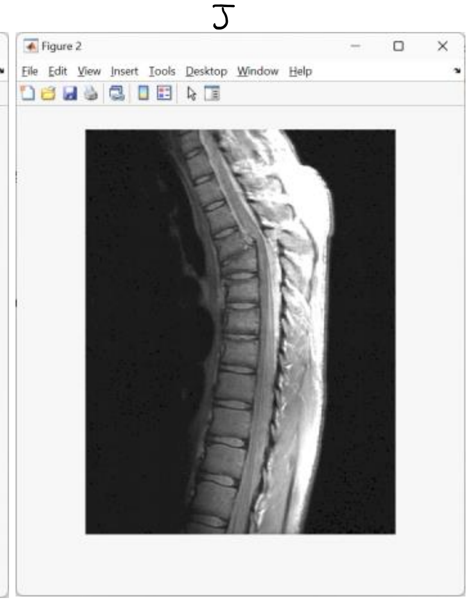
$$s = r^{0.4} \cdot \frac{255}{255^{0.4}}$$

C_2

I



J



imshow(I,[]) displays the grayscale image I, scaling the display based on the range of pixel values in I. imshow uses [min(I(:)) max(I(:))] as the display range. imshow displays the minimum value in I as black and the maximum value as white. For more information, see the DisplayRange argument

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