Lecture 4: Point Processing Operations

Part 2: Logarithmic and Gamma Transformations

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Notes:

- Sample images are available in the images folder of the current directory. (You may need to add images folder into your path.)
- Related lecture: Lecture4 - Point Processing
- pdf versions of the .mlx files are also available for those using GNU Octave

```
% clear workspace variables and close windows
clc, clearvars, close all;
```

```
I = imread('images/blocks.tif'); %read input image file
if(size(I,3) == 3) % convert to grayscale if not
    I = rgb2gray(I);
end
Id = double(I); %convert to double
```

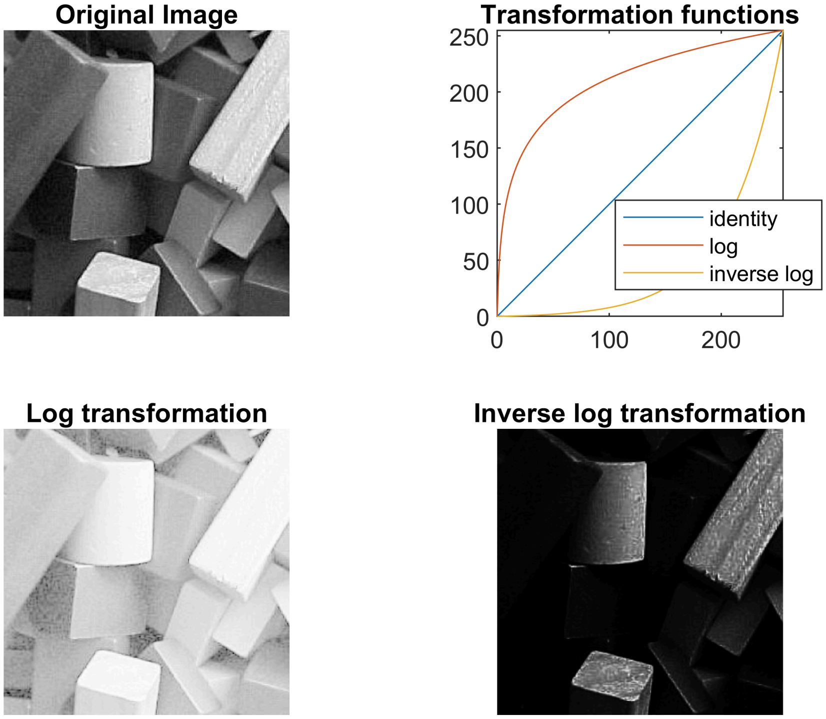
1. Logarithmic and inverse logarithmic transformation

Generate transformation functions

```
x = 0:255;
c = 255/log(256);
y1 = c*log(x+1);
y2 = exp(x/c)-1;
```

Apply log and inverse log transformations on images

```
I1 = uint8(c*log(Id+1)); %log transform
I2 = uint8(exp(Id/c)-1); %inverse log transform

% display
figure, subplot(2,2,1), imshow(I), title('Original Image');
subplot(2,2,2), plot(x,x), hold on, plot(x,y1), hold on, plot(x,y2), axis square
axis([0 255 0 255]), title('Transformation functions'),
legend('identity','log','inverse log','Location','best')
subplot(2,2,3), imshow(I1), title('Log transformation');
subplot(2,2,4), imshow(I2), title('Inverse log transformation');
```



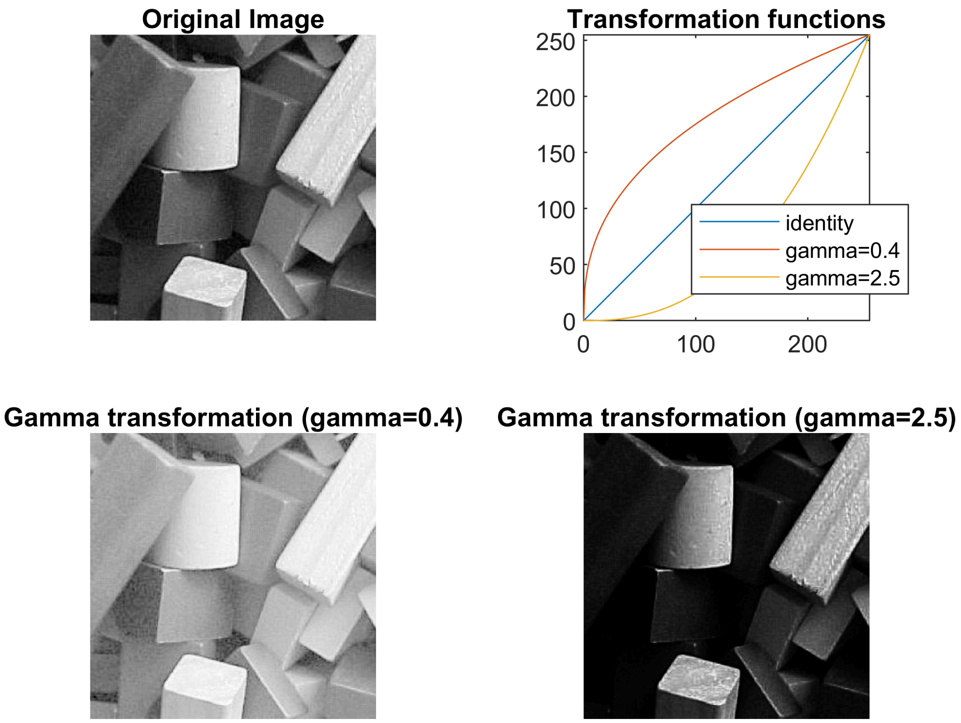
2. Gamma transformation

Apply transformation functions

```
x = 0:255;
gamma1 = 0.4;
gamma2 = 2.5;
y1 = x .^ gamma1;
y2 = x .^ gamma2;
y1 = 255*y1/max(y1);
y2 = 255*y2/max(y2);
```

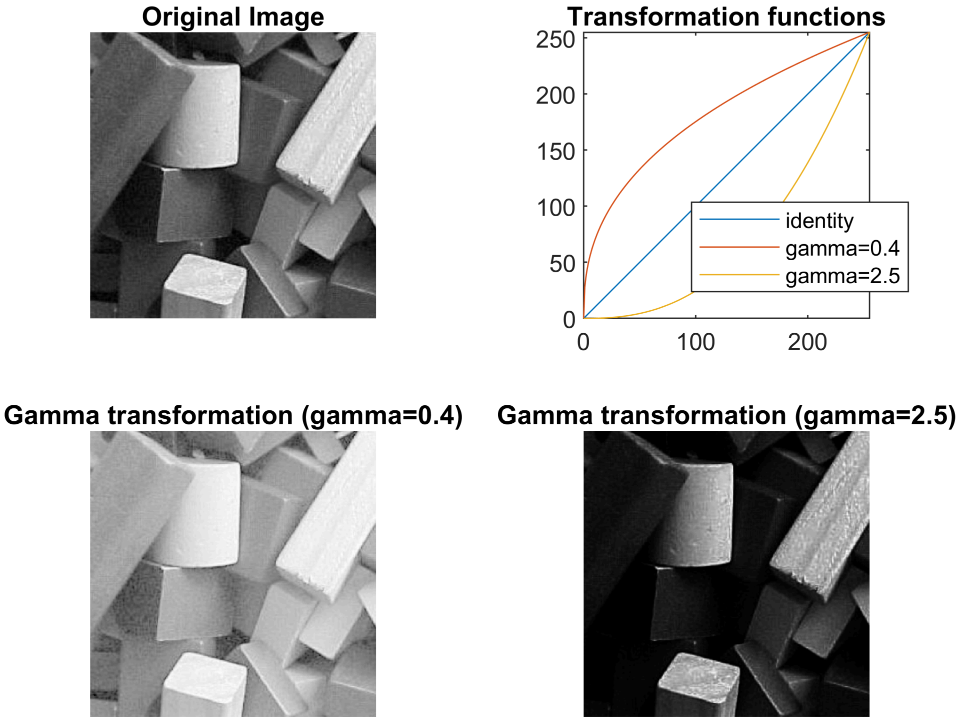
Applying gamma transformation option 1: manual

```
I3 = Id .^ gamma1;
I4 = Id .^ gamma2;

% display
figure,subplot(2,2,1), imshow(I), title('Original Image');
subplot(2,2,2), plot(x,x), hold on, plot(x,y1), hold on, plot(x,y2), axis square
axis([0 255 0 255]), title('Transformation functions'),
legend('identity',strcat('gamma= ', num2str(gamma1)),strcat('gamma=', num2str(gamma2)),'Locatio
subplot(2,2,3), imshow(I3,[]), title(strcat('Gamma transformation (gamma=', num2str(gamma1), '
subplot(2,2,4), imshow(I4,[]), title(strcat('Gamma transformation (gamma=', num2str(gamma2), '
```



Applying gamma transformation option 2: using imadjust function

```
I5 = imadjust(I,[],[],gamma1);
I6 = imadjust(I,[],[],gamma2);

figure, subplot(2,2,1), imshow(I), title('Original Image');
subplot(2,2,2), plot(x,x), hold on, plot(x,y1), hold on, plot(x,y2), axis square
axis([0 255 0 255]), title('Transformation functions'),
legend('identity',strcat('gamma= ', num2str(gamma1)),strcat('gamma=', num2str(gamma2)),'Locatio
subplot(2,2,3), imshow(I5), title(strcat('Gamma transformation (gamma=', num2str(gamma1), ')')
subplot(2,2,4), imshow(I6), title(strcat('Gamma transformation (gamma=', num2str(gamma2), ')')
```



Original Image

Transformation functions

Gamma transformation (gamma=0.4)

Gamma transformation (gamma=2.5)