Lecture 11: Image Compression

Huffman Coding Examples

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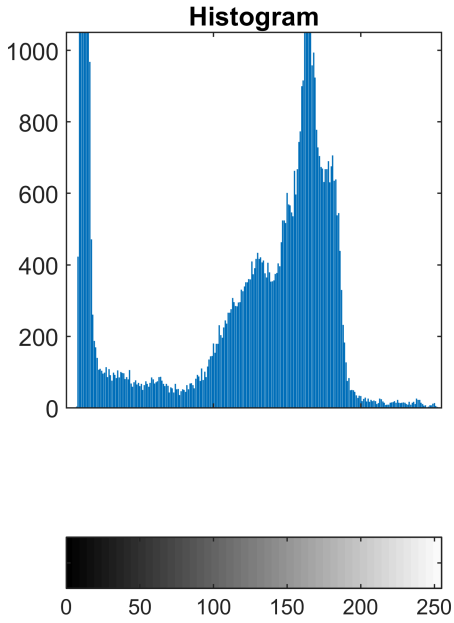
Notes:

- Sample images are available in the images folder of the current directory. (You may need to add images folder into your path.)
- Related lecture: Lecture11 - Image Compression
- pdf versions of the .mlx files are also available for those using GNU Octave
- huffmandict, huffmanenco, huffmandeco functions are part of Communications System Toolbox

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

```
% read image
I = imread('images/cameraman.tif');

% display the image and its histogram
figure, subplot(1,2,1), imshow(I), title('Original Image')
subplot(1,2,2), imhist(I), axis('square'), title('Histogram') % observe the uniformity level of
```



1. Generate Huffman dictionary

```
% calculate normalized image histogram as probability values
h = imhist(I);
h = h/numel(I); % normalize the histogram by dividing its elements to total num of pixels
sum(h) % the sum of the values of a normalized histogram must always be 1
```

```
ans = 1
```

```
intensities = (0:255); % intensity values to be coded
[dict, Lavg] = huffmandict(intensities, h); % generate Huffman dictionary
```

2. Encoding and decoding the image according to the dictionary

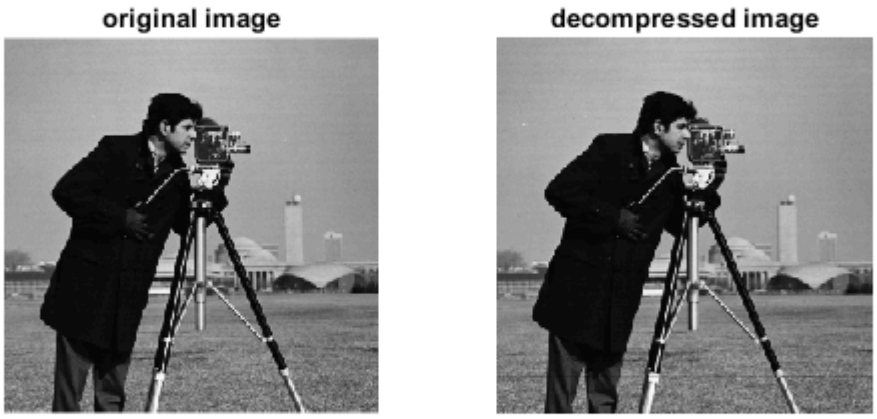
```
% encode image
comp = huffmanenco(I(:),dict);

% decode image
decomp = huffmandeco(comp, dict);

% reshape decompressed vector to original size
Idec = reshape(decomp, size(I));
Idec = uint8(Idec);

% display the original and decompressed images
```

```
figure, subplot(1,2,1), imshow(I), title('original image');
subplot(1,2,2), imshow(Idec), title('decompressed image');
```



Performance measures

```
% check the difference between the original and decompressed images
dif = I-Idec;
sum(dif(:))
```

```
ans = 0
```

Image entropy:

```
Ientropy = entropy(I)
```

```
Ientropy = 7.0097
```

Compare entropy and Lavg. Is it lossless or lossy compression?

```
Lavg
```

```
Lavg = 7.0448
```

Compression ratio:

```
C = 8/Lavg
```

```
C = 1.1356
```

Relative data redundancy:

```
R = 1 - 1/C
```

```
R = 0.1194
```