

Lecture 2

Example: Using DCT

dct

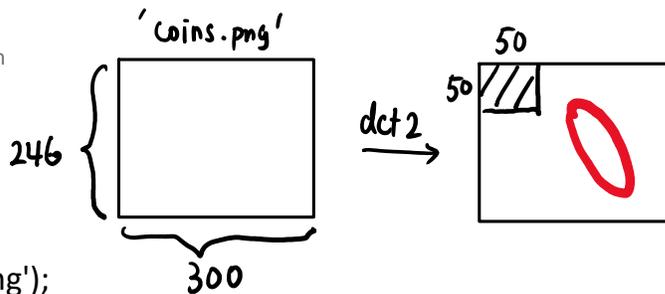
Discrete cosine transform

```
>> x
x =
    1    2    3    4

>> y = dct(x);
5.0000 -2.2304    0 (-0.1585)
>> y(4) = 0;
y =
    5.0000 -2.2304    0    0
>> idct(y)
ans =
    1.0429    1.8964    3.1036    3.9571
```

dct2

2-D discrete cosine transform



```
I = imread('coins.png');
```

```
>> whos I
```

Name	Size	Bytes	Class	Attributes
I	246x300	73800	uint8	

bytes

```
>> Y = dct2(I);
```

```
>> whos Y
```

Name	Size	Bytes	Class	Attributes
Y	246x300	590400	double	

```
>> Y2 = zeros(246, 300);
```

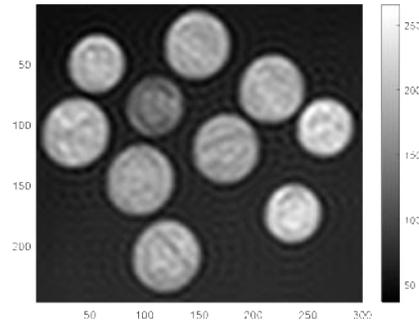
```
>> Y2(1:50, 1:50) = Y(1:50, 1:50);
```

```
>> Xrec = idct2(Y2);
```

```
>> imagesc(Xrec); colormap('gray'); colorbar;
```



```
>> Xrec = idct2(Y2);
```



```
>> 246*300/(50*50)
```

```
ans =
```

```
29.5200 : 1      Compression Ratio
```

```
>> Xdouble = double(I);
```

```
>> mse(Xdouble, Xrec)
```

```
ans =
```

```
183.9365
```

```
>> psnr(Xrec, Xdouble, 255)
```

```
ans =
```

```
25.4841 dB
```

Another metric for distortion measurement:

psnr

Peak signal-to-noise ratio (PSNR)

The psnr function implements this equation to calculate PSNR:

$$PSNR = 10 \log_{10}(\text{peakval}^2 / MSE)$$

`peakval` is either specified by the user or taken from the range of the image data type. For example, for an image of data type `uint8`, the `peakval` is 255. `MSE` is the mean square error between `A` and `ref`.

```
>> 10*log10(255^2/183.9365)
```

```
ans =
```

```
25.4841 dB
```

Next, keep more DCT coefficients:

```
>> Y2(1:100, 1:100) = Y(1:100, 1:100);
```

```
>> Xrec = idct2(Y2);
```

```
>> figure;
```

```
>> imagesc(Xrec); colormap('gray'); colorbar;
```

```
>> psnr(Xrec, Xdouble, 255)
```

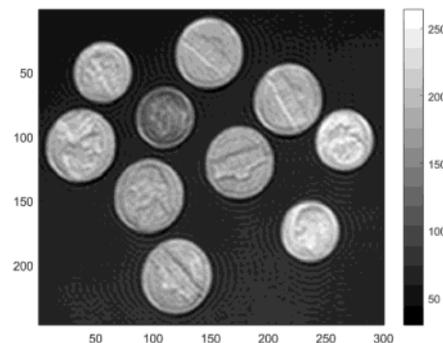
```
ans =
```

```
29.8175 dB
```

```
>> 246*300/(100*100)
```

```
ans =
```

```
7.3800 : 1      Compression Ratio
```



Use JPEG Compressor to compress digital images:

Raw image:

I 246x300 73800 bytes uint8

```
>> imwrite(I, 'bitstream.jpg');
```

8,782 bitstream.jpg

Compression Ratio \doteq 8.4 : 1

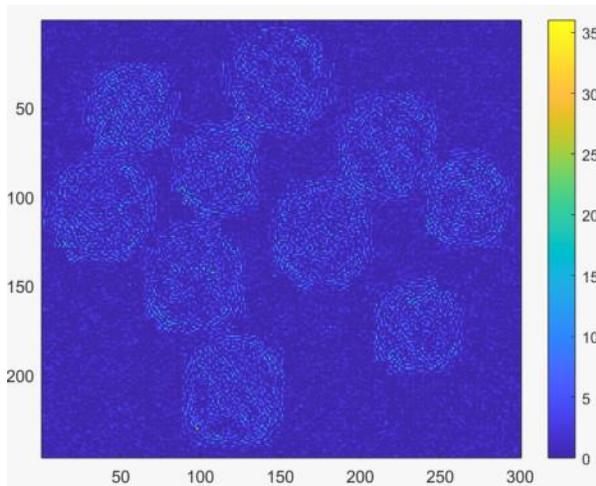
```
>> 73800/8782
```

```
ans =  
8.4036
```

```
>> diff = abs(I - J);
```

```
>> figure;
```

```
>> imagesc(diff); colorbar
```



- Decompression

```
>> J = imread('bitstream.jpg');
```

```
>> whos J
```

Name	Size	Bytes	Class	Attributes
J	246x300	73800	uint8	

```
>> isequal(I, J)
```

```
ans =
```

```
logical  
0
```

I \neq J : Lossy Compression !

```
>> psnr(I, J)
```

```
ans =  
38.0350 dB
```