

# Lab 1 - Sampling Quantization and Display

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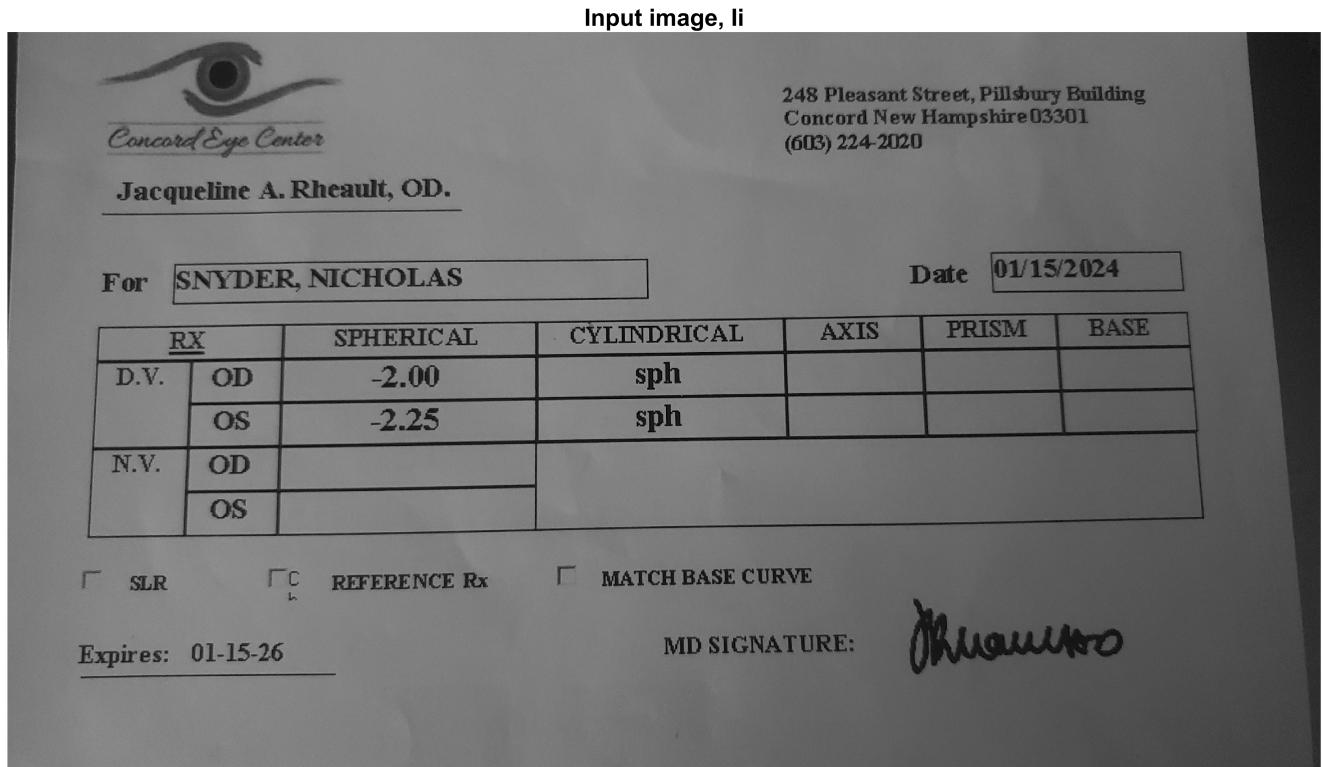
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## Part 1: Spatial Quantization

```
I = imread('prescription.jpg');
Ii = rgb2gray(I);

QF = 2;

imshow(Ii)
title('Input image, Ii')
```



```
Itemp = imresize(Ii,1/QF);
imshow(Itemp)
title('Temporary image, Itemp')
```

Temporary image, Itemp



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For SNYDER, NICHOLAS

Date 01/15/2024

RX		SPHERICAL	CYLINDRICAL	AXIS	PRISM	BASE
D.V.	OD	-2.00	sph			
	OS	-2.25	sph			
N.V.	OD					
	OS					

SLR

<sub>L</sub><sup>C</sup> REFERENCE Rx

MATCH BASE CURVE

Expires: 01-15-26

MD SIGNATURE:

```
Io = imresize(Itemp, QF, 'nearest');
imshow(Io)
title('QF = 2')
```

QF = 2



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D.V.	OD	-2.00	sph			
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N.V.	OD					
	OS					

SLR

<sub>L</sub><sup>C</sup> REFERENCE Rx

MATCH BASE CURVE

Expires: 01-15-26

MD SIGNATURE:

```
QF = 8;
Itemp = imresize(Ii,1/QF);
Io = imresize( Itemp, QF, 'nearest');
imshow(Io)
title('QF = 8')
```

QF = 8



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D.V.	OD	-2.00	sph			
	OS	-2.25	sph			
N.V.	OD					
	OS					

SLR

<sub>C</sub> REFERENCE Rx

MATCH BASE CURVE

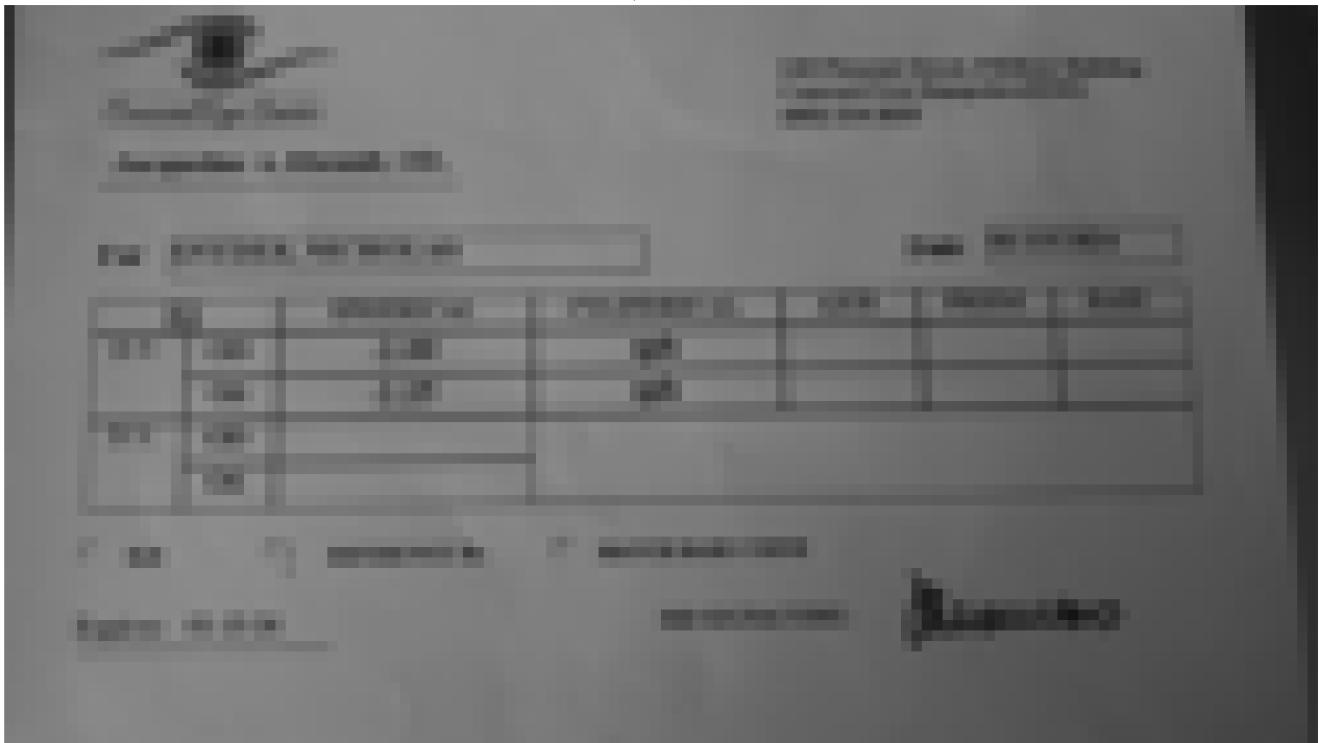
Expires: 01-15-26

MD SIGNATURE:

Image degradation is clearly visible at a Q-factor of 8.

```
QF = 32;  
Itemp = imresize(Ii,1/QF);  
Io = imresize(Itemp, QF, 'nearest');  
imshow(Io)  
title('QF = 32')
```

**QF = 32**



Original image is unrecognizable from 2 feet away at a Q-factor of 32.

The image is still unrecognizable at 10 feet.

Figure 2 is a lossy image compression and resize. In figure 3, the small image is made bigger. The larger image shows a more blocky image.

## Part 2: Decimation

```
I = imread('prescription.jpg');
Ii = rgb2gray(I);
[Height, Width] = size(Ii) % Display the image height and width
```

```
Height = 2268
Width = 4032
```

```
imshow(Ii)
title('Input image, Ii')
```

Input image, li



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For **SNYDER, NICHOLAS** Date **01/15/2024**

<u>RX</u>	SPHERICAL	CYLINDRICAL	AXIS	PRISM	BASE
D.V. OD	-2.00	sph			
OS	-2.25	sph			
N.V. OD					
OS					

SLR       <sub>L</sub><sup>C</sup> REFERENCE Rx       MATCH BASE CURVE

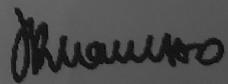
Expires: 01-15-26      MD SIGNATURE: 

Image degradation is clearly visible at a D-factor of 4.

```
DF = 8;
IoD = Ii(1:DF:Height, 1:DF:Width); % True Decimation
IoNN = imresize(IoD, [Height, Width], 'nearest'); % Horizontal expanding
imshow(IoNN)
title('DF = 8')
```

**DF = 8**



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For **SNYDER, NICHOLAS**

Date **01/15/2024**

RX		SPHERICAL	CYLINDRICAL	AXIS	PRISM	BASE
D.V.	OD	-2.00	sph			
	OS	-2.25	sph			
N.Y.	OD					
	OS					

SLR

REFERENCE Rx

MATCH BASE CURVE

Expires: 01-15-26

MD SIGNATURE:

With a factor of 8 the decimated image looks worse than the spatial quantized image at the same factor.

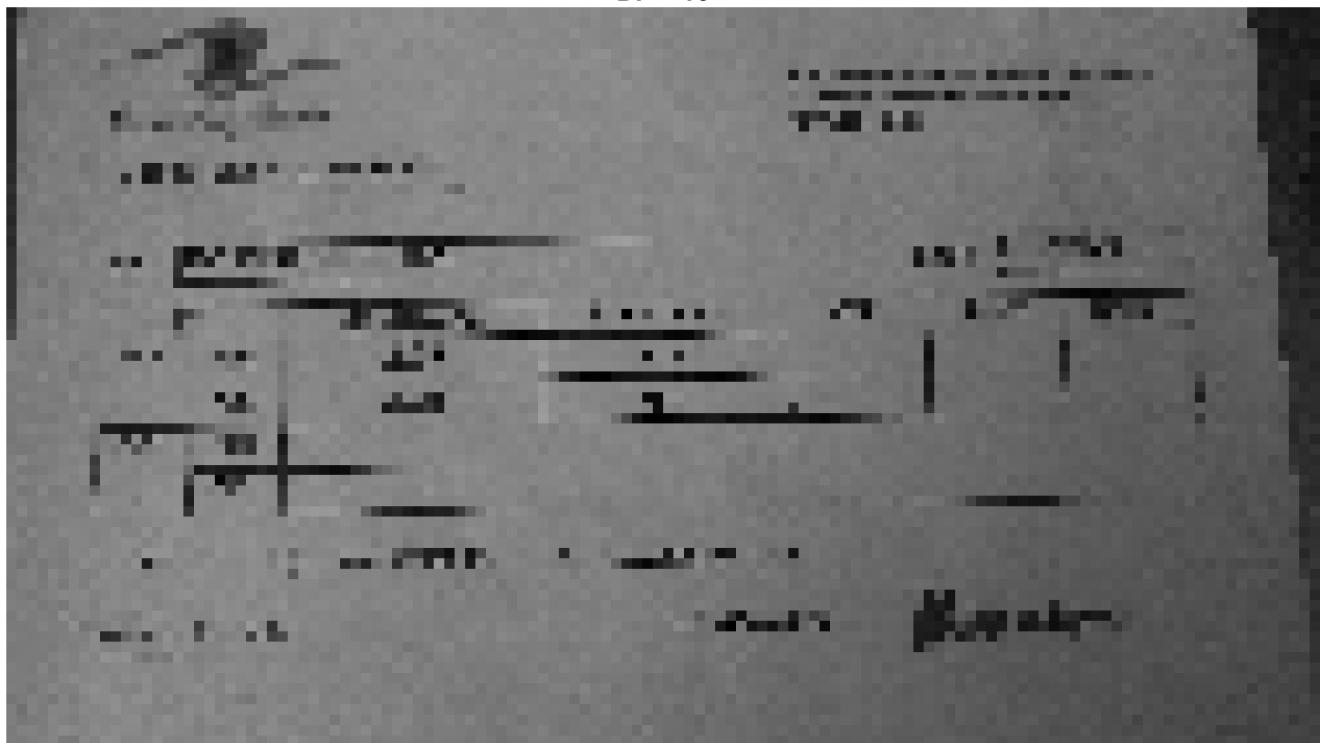
For the image I chose, the slightly askew straight lines probably amplified the effect of the decimation. Another image could look different. I only noticed the degradation of the spatial quantization after the letters seemed blurry. I noticed the lines in the decimated image much easier.

```

DF = 32;
IoD = Ii(1:DF:Height, 1:DF:Width); % True Decimation
IoNN = imresize(IoD, [Height, Width], 'nearest'); % Horizontal expanding
imshow(IoNN)
title('DF = 32')

```

**DF = 16**

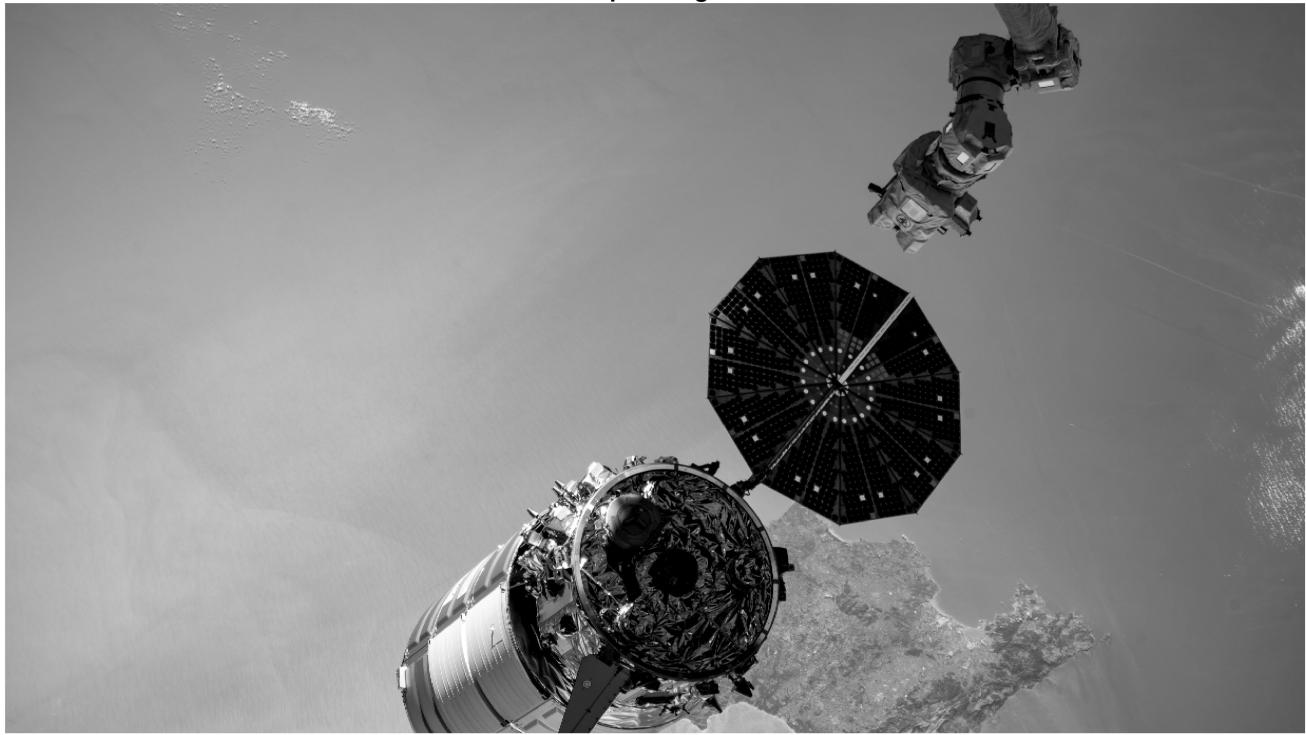


The image with a factor of 32 is completely unreadable.

### Part 3: Intensity Quantization

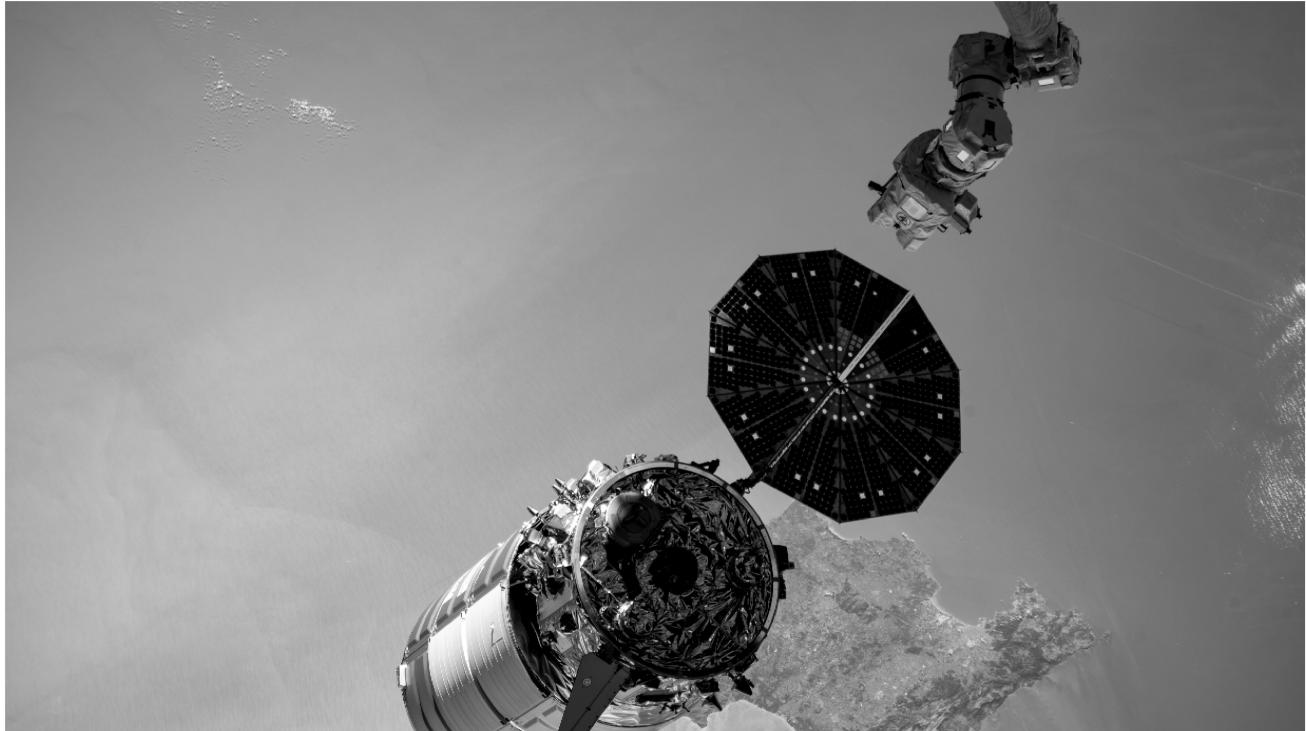
```
I = imread('capsule.jpg');
Ii = rgb2gray(I);
imshow(Ii)
title('Input image')
```

Input image



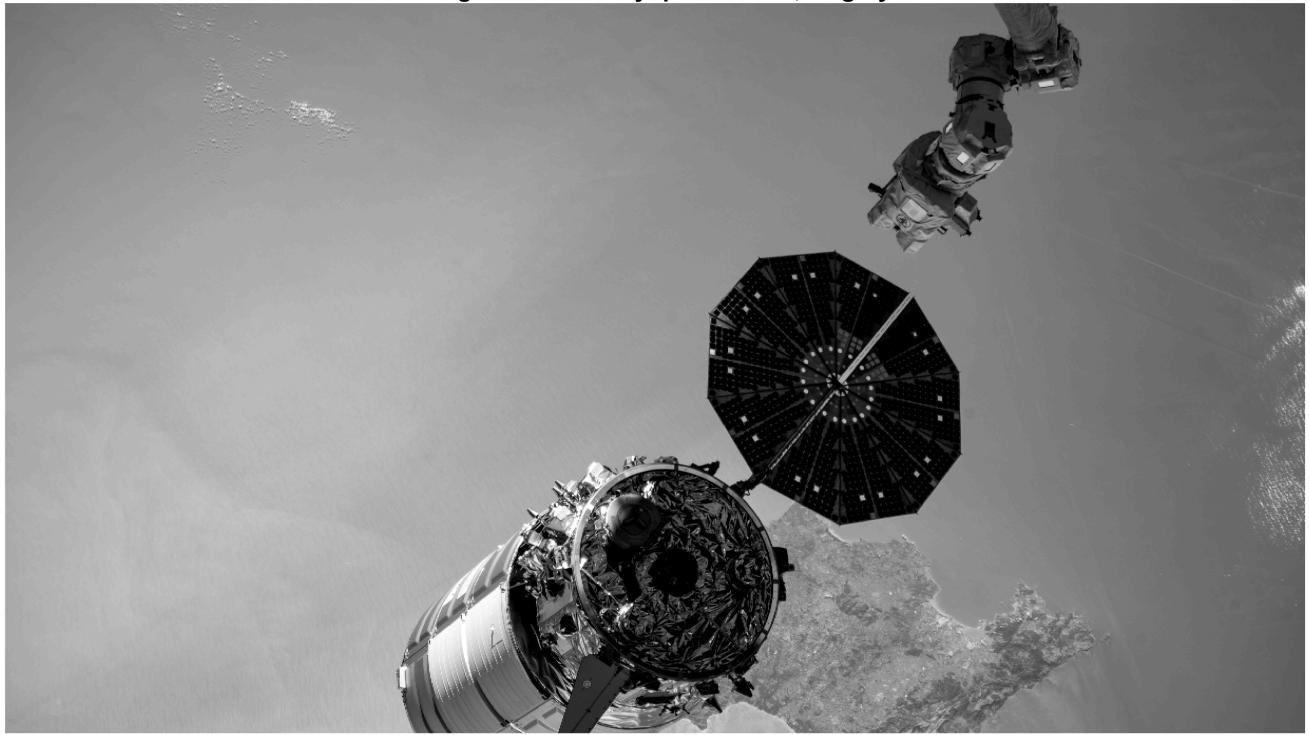
```
N = 8;
NumberOfIntensityLevels = 2^N;
[Io, map] = gray2ind(Ii, NumberOfIntensityLevels);
imshow(Io, map);
title(['Same image after intensity quantization, ', num2str(2^N), ' gray levels'])
```

Same image after intensity quantization, 256 gray levels



```
N = 6;
NumberOfIntensityLevels = 2^N;
[Io, map] = gray2ind(Ii, NumberOfIntensityLevels);
imshow(Io, map);
title(['Same image after intensity quantization, ',num2str(2^N), ' gray levels'])
```

Same image after intensity quantization, 64 gray levels



False contouring can be seen at 64 gray levels.

Viewing the image from further away makes it harder to see the false contours. This could be that my eyes are not good at viewing far away objects. At a point it is just blurry and that includes all contours

```
N = 1;
NumberOfIntensityLevels = 2^N;
[Io, map] = gray2ind(Ii, NumberOfIntensityLevels);
imshow(Io, map);
title(['Same image after intensity quantization, ',num2str(2^N), ' gray levels'])
```

Same image after intensity quantization, 2 gray levels



A compressed image is less data to transmit across the internet. A binary image is many times smaller than an image with 256 gray levels. Faxing lessened in popularity as internet speeds increased across the world.