Chapter 4 – The Image Processing Toolbox at a glance
What will we learn?

- How do I read an image from a file using MATLAB?
- What are the main data classes used for image representation and how can I convert from one to another?
- Why is it important to understand the data class and range of pixel values of images stored in memory?
- How do I display an image using MATLAB?
- How can I explore the pixel contents of an image?
- How do I save an image to a file using MATLAB?
The Image Processing Toolbox (IPT): essential functions and features

- Displaying information about an image file
- Reading an image file
- Data classes and data conversions
- Displaying the contents of an image
- Exploring the contents of an image
- Writing the resulting image onto a file
The Image Processing Toolbox (IPT): essential functions and features

- Displaying information about an image file
  - `imfinfo`

- Example 4.1 (page 62)

```plaintext
Filename: '/.../peppers.png'
FileModDate: '16-Dec-2002 06:10:58'
FileSize: 287677
Format: 'png'
Width: 512
Height: 384
BitDepth: 24
ColorType: 'truecolor'
FormatSignature: [137 80 78 71 13 10 26 10]
InterlaceType: 'none'
Transparency: 'none'
Description: 'Zesty peppers'
Copyright: 'Copyright The MathWorks, Inc.'
```
The Image Processing Toolbox (IPT): essential functions and features

- Reading an image file
  - `imread`
  - `dicomread`
  - `nitfread`
  - `hdrread`
The Image Processing Toolbox (IPT): essential functions and features

- Data classes and data conversions
  - Most common classes for images:
    - `uint8`
    - `double`
    - `logical`

- Image data class conversions

<table>
<thead>
<tr>
<th>Name</th>
<th>Converts an image to data class...</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>im2single</code></td>
<td>single</td>
</tr>
<tr>
<td><code>im2double</code></td>
<td>double</td>
</tr>
<tr>
<td><code>im2uint8</code></td>
<td><code>uint8</code></td>
</tr>
<tr>
<td><code>im2uint16</code></td>
<td><code>uint16</code></td>
</tr>
<tr>
<td><code>im2int16</code></td>
<td><code>int16</code></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Name</th>
<th>Description: converts... into...</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>ind2gray</code></td>
<td>an indexed image</td>
</tr>
<tr>
<td><code>gray2ind</code></td>
<td>a grayscale image</td>
</tr>
<tr>
<td><code>rgb2gray</code></td>
<td>an RGB (truecolor) image</td>
</tr>
<tr>
<td><code>rgb2ind</code></td>
<td>an RGB (truecolor) image</td>
</tr>
<tr>
<td><code>ind2rgb</code></td>
<td>an indexed color image</td>
</tr>
</tbody>
</table>

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The Image Processing Toolbox (IPT): essential functions and features

- Displaying the contents of an image
  - `image`: displays an image using the current colormap.
  - `imagesc`: scales image data to the full range of the current colormap and displays the image.
  - `imshow`: displays an image and contains a number of optimizations and optional parameters for property settings associated with image display.
  - `imtool`: displays an image and contains a number of associated tools that can be used to explore the image contents.
The Image Processing Toolbox (IPT): essential functions and features

- Exploring the contents of an image
  - `imtool`
    - Provides all the image display capabilities of `imshow` as well as access to other tools for navigating and exploring images, such as the `Pixel Region` tool, `Image Information` tool, and the `Adjust Contrast` tool.
The Image Processing Toolbox (IPT): essential functions and features

- Writing the resulting image onto a file

  - `imwrite`

Example 4.4 (page 71)

```matlab
I = imread('peppers.png');
imwrite(I, 'pep75.jpg');
imwrite(I, 'pep05.jpg', 'quality', 5);
imwrite(I, 'pep95.jpg', 'quality', 95);
```

(a) ![Original Image](image1.png)  
(b) ![Image with quality 75](image2.png)  
(c) ![Image with quality 5](image3.png)  
(d) ![Image with quality 95](image4.png)
Hands-on

- Tutorial 4.1: MATLAB Image Processing Toolbox - a guided tour (page 72)

- Tutorial 4.2: Basic image manipulation (page 74)