

# MATLAB Programming Lesson 6: Image Processing

[The MATLAB files for this section can be found at this link.](#)

The link above contains the live scripts for both coding sections, as well as a PDF of the PowerPoint if you wish to follow along.

## Objectives

- **Understanding Image Representation:** Learn how digital images are represented in MATLAB, including grayscale and color images, and the concept of pixels.
- **Basic Image Operations:** Introduce fundamental operations such as reading, displaying, and saving images, as well as basic arithmetic operations on images.
- **Image Enhancement Techniques:** Explore techniques to improve the visual quality of images, including histogram equalization, contrast stretching, and spatial filtering.
- **Image Filtering:** Understand the concept of convolution and its application in image filtering for tasks such as blurring, sharpening, and edge detection.
- **Segmentation:** Learn techniques to partition an image into meaningful regions, including thresholding, edge-based segmentation, and region growing.
- **Image Restoration:** Explore techniques to restore degraded images, including restoration from motion blur, noise reduction, and super-resolution.
- **Image Analysis and Classification:** Apply image processing techniques for tasks such as object detection, recognition, and classification using machine learning algorithms.

## Main Learning Goal

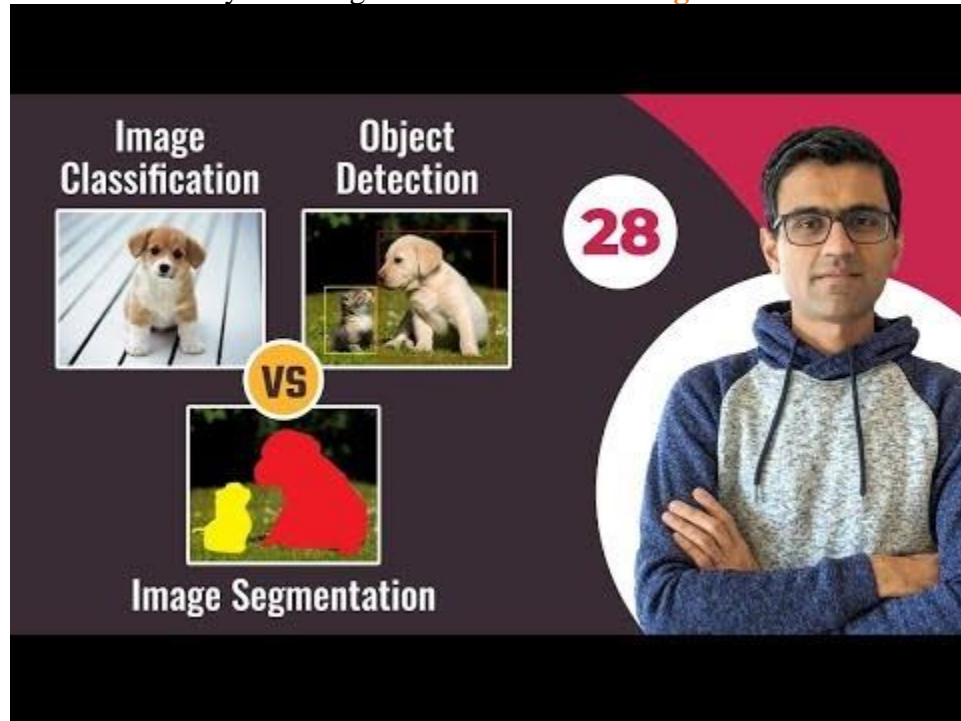
In this introductory MATLAB course on image processing, students will learn the foundational principles of digital image representation and manipulation. They will gain hands-on experience in reading, displaying, and enhancing images using techniques such as histogram equalization and spatial filtering. By the end of the course, students will be equipped with the skills to perform basic image operations and enhance the visual quality of images effectively using MATLAB.

## Focus Question

What are the ethical considerations when applying image enhancement techniques to alter the appearance of individuals or objects in photographs?

# Image Classification

Let's start by watching this short video on **Image Classification**!



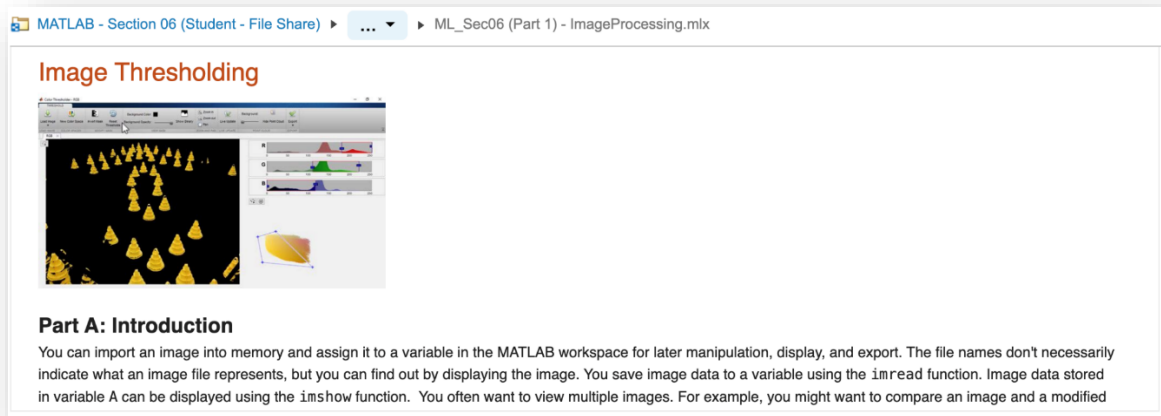
[LINK: https://youtu.be/taC5pMCm70U](https://youtu.be/taC5pMCm70U)

## Let's discuss the following:

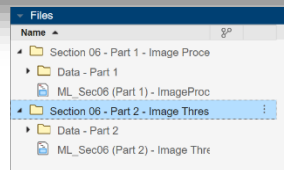
1. How does the concept of image classification in the video relate to everyday tasks or experiences where you classify or categorize objects or items?
2. Can you draw parallels between the process of image classification discussed in the video and how our brains classify and recognize objects or patterns in the world around us?
3. Have you encountered any applications or technologies in your daily life that utilize image classification, such as smartphone camera features, social media tagging, or spam filters? How do they work, and how do they compare to the techniques discussed in the video?
4. Are there any hobbies or interests you have that involve categorizing or organizing visual information, such as sorting photographs, organizing collections, or identifying objects in nature? How does your understanding of image classification relate to these activities?

# Image Processing

Please copy over the files for Section 06 from the MATLAB Drive



[The MATLAB files for this section can be found at this link.](#)

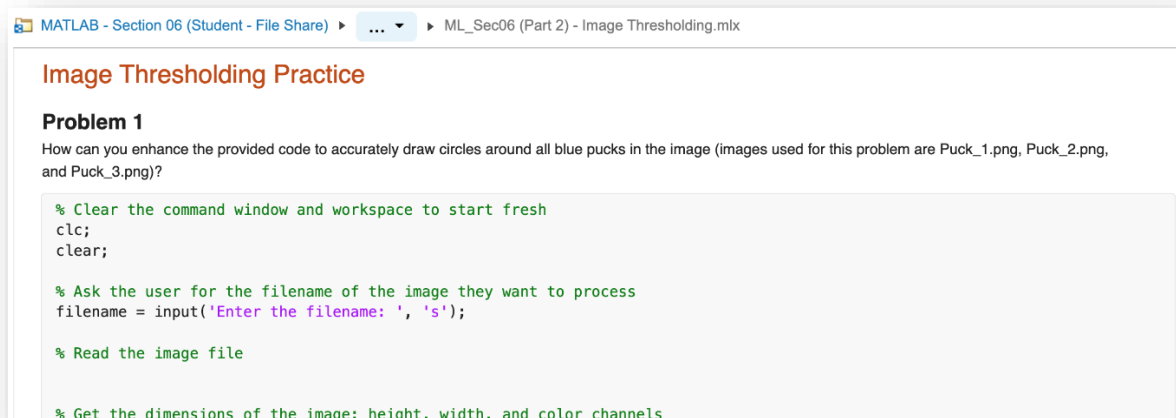


For the first coding activity, please open “MATLAB\_Sec06(Part1)\_ImageProcessing\_v2.mlx”

Please follow the examples along with the instructor or the PowerPoint PDF that can be found in the same folder as this section’s code in the MATLAB Drive. After completing this live script, please continue to Part 2.

## Image Thresholding Practice

Please copy over the files for Section 06 from the MATLAB Drive, the Part 2 live script should be in the same folder.



[The MATLAB files for this section can be found at this link.](#)

For this section you can use the hints given and the PPT to complete the given problems on your own. If you need help, the teacher or teaching assistant will be able to walk through the problem with you. Make sure to refer back to the previous live script if you are stuck on what code to use to solve a problem!



"Facial Recognition" by [mikemacmarketing](#) is licensed under [CC BY 2.0](#)

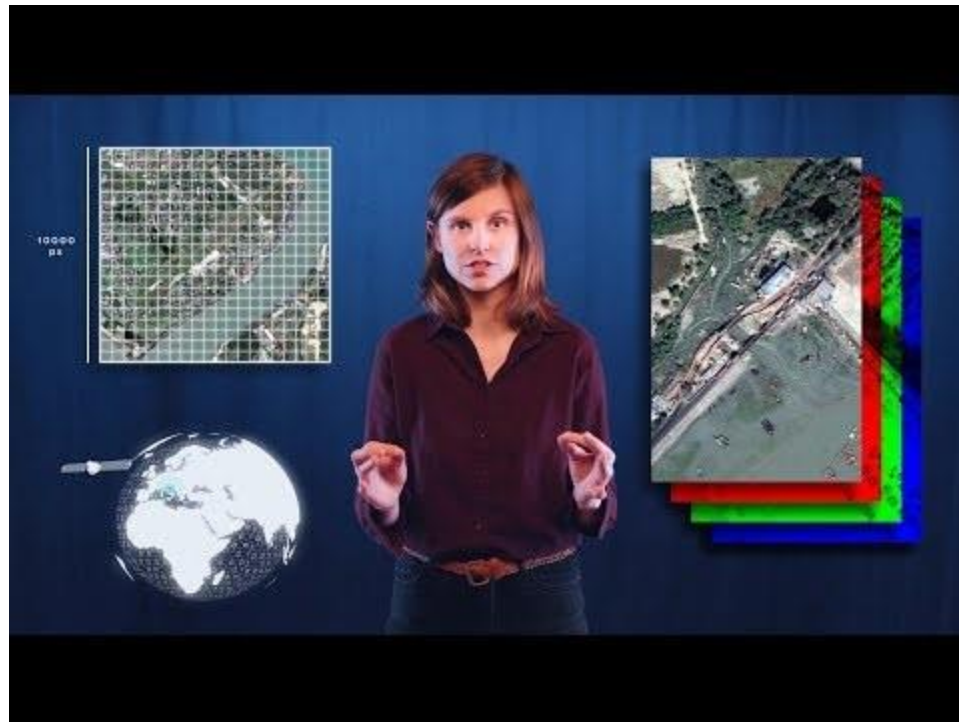
Let's think about the image processing techniques we've learned in this section: Real-world applications of image processing are vast and varied, including medical imaging, satellite imagery analysis, and facial recognition systems. Each application poses unique challenges and opportunities for leveraging the techniques you've learned.

Let's start by watching the following videos:

1. [Video on Facial Recognition](#)



2. [Video on Satellite Deep Learning](#)



3. [Video on Medical Imaging](#)



**Now let's discuss the following questions:**

1. What are the potential ethical issues that arise when applying image processing techniques in these fields?
2. What are the current limitations of image processing techniques in these fields? What do they want to accomplish next, and what is stopping them right now?

3. What are the potential impacts, both positive and negative, of these technologies on society.