MATLAB Programming Section 06: Teacher Guide

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Storyline

The lesson begins with a brief video that compares image classification to object detection and image segmentation. This opens the floor for a conversation about image processing, specifically the different ways of representing and manipulating an image. The lesson proceeds with a deeper dive into four different aspects of image processing: importing and reading images, image segmentation, preprocessing and postprocessing techniques, and some examples of each. The students are then encouraged to practice thresholding, a processing technique, on a series of puck images. Once familiar with the idea of image processing, the students will consider real-world applications for the processing techniques and the implications of the techniques in those domains.

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?

Elicit

How will I engage students and elicit their ideas?

Activity Name and Description	Teacher Moves	Student Moves	Resources
• **Image Classification** • *10 minutes* • A short video will be played and followed up with some discussion-	• Teacher will play the video about image classification. • Teacher will ask the students to consider the	• Students will watch the short video.	

Activity Name and Description	Teacher Moves	Student Moves	Resources
based questions. • The video can be accessed at this link: Image Classification.	following questions: 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	• Students will discuss the questions with their peers.	

Activity Name and Description	Teacher Moves	Student Moves	Resources
	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? • Teacher will encourage the students to share their answers with the class.		

Develop

How will I get students to explore, explain, and develop ideas?

Activity Name and Description	Teacher Moves	Student Moves	Resources
• **Image Processing** • *30 minutes* • This lecture is broken into four parts: • Introduction • Image Segmentation • Processing Techniques • Image Processing Examples • The livescript is available here: MATLAB_Section06_Livescript. • The data files are available here: MATLAB_Section06_DataFiles.	• Teacher will provide students with the livescript and the corresponding data files so they can follow along. • The teacher will lecture on the four big parts of image processing. • Teacher should encourage questions and answer them as needed.	• Students will download the livescript and data files to follow along. • Students should actively engage and ask questions as needed.	• Images Documentation - MathWorks • Image Segmentation in MATLAB – Mathworks • Image Segmentation in MATLAB • Image Preprocessing

Deploy

How will I get students to use and apply their ideas to what they've learned?

Activity Name and Description	Teacher Moves	Student Moves	Resources
• **Image Thresholding Practice** • *30 minutes* • Students will practice thresholding	• Teacher will ensure the students have the necessary files and	• The students will open the assignment and download	• Images Documentation - MathWorks

Activity Name and Description	Teacher Moves	Student Moves	Resources
images in this activity. • The student version of the livescript is accessible here: MATLAB_Section06_ProcesssingPractice • The necessary images are linked here: – Puck_1 – Puck_2 – Puck_3 • The assignment can be found here: Pucks Finder and Flag Creation	livescript for the assignment. • The teacher will encourage independent work and provide assistance as needed.	all necessary files. • The students will work independently on their livescript. • Students should ask questions as necessary. • Once completed, the students will submit their work as a livescript to the assignment.	

Refine

How will I get students to extend, elaborate, and change their ideas based on what we now understand?

Activity Name and Description	Teacher Moves	Student Moves	Resources
• **Real-World Image Processing** • *15 minutes* • Students will form groups of four to discuss real-world applications for the techniques	• Teacher will assist students in forming groups four. • Teacher will direct students to the discussion board for	• Students will form groups of four and pull up the discussion board. • Students will think about the techniques	

Activity Name and Description	Teacher Moves	Student Moves	Resources
they have learned. • They will follow the discussion board assignment linked here: Section 06 Discussion	assignment directions. • Teacher should provide assistance as needed.	they've learned, and they will choose a real-world application where these techniques can be used. • Students will also consider the ethical implications, limitations and impacts of the techniques for use in their chosen domain • Students, within their group, should post a response to the discussion board. • Students should also respond to one (at the least) other post.	