

Teaching image processing with MATLAB to physics students

Image processing is an engaging activity appropriately taught to beginning students in STEM fields. I introduce my physics undergraduates to image processing with MATLAB in the first week of the class. They are supplied a brief introduction and a self explanatory Live Script which explores how to import an image from a URL, examine its provenance, and then manipulate the color space, histogram the data in different color channels, transform the color space, create a montage, select pixels by value, and segment using circle finding and edge detection methods available a function calls in MATLAB.

This introduction is followed by a lab in camera calibration and coin location finding in which they come to appreciate quantitatively quality of the image acquisition system in their mobile phones. By doing this themselves, students come to appreciate how a 3dRuler mobile phone app works, increasing their appreciation for the technology in their pockets further. The techniques can also be applied to implement video tracking in MATLAB for experiments in mechanics. Familiarity with image processing delights especially the students with an interest in astronomy. The camera calibration and its use is essentially the basis for photogrammetry which may interest engineers.

Outcomes of the introduction to image processing supplied in this course have included students sudden deep interest and appreciation for the deep learning capabilities of MATLAB. Students have launched into 2nd semester projects in which classical image processing techniques and deep learning have been applied successfully to develop products which perform species identification of disease carrying vectors (mosquitos and ticks) as well as in analysis of pesticide spray dispersion samples. Other students have applied classical and deep learning image processing techniques to images of cosmic ray interactions in mobile phone camera sensors. Can you think of an application?