TICV MASTER

SPI – Image and segmentation

Semester: Fall, **Academic Year:** 2020/21

Instructor information

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Course Description

- This course is an introduction to image processing, analysis techniques and concepts. It introduces theoretical material and mathematics behind images and imaging. Topics include image formation, specificities of digital images (image contrast, luminosity, noise, geometric deformation etc...), image transformations (histogram equalization, thresholding etc...) and segmentation.
- The students should become familiar with issues such as image enhancement, segmentation and morphological image processing. They could quickly be able to build computer vision applications in their respective disciplines.
- Teaching hours: 12 hours of course, 3 hours of tutorials
- Test and demonstration tools: Matlab + image processing toolbox

Objectives and Learning Outcomes

Upon successful completion of the course, students will have an understanding of image processing challenges and associated topics. Specific learning objectives are:

- Explain how digital images are represented and manipulated in a computer, including reading and writing from storage, and displaying.
- Write a program which implements fundamental image processing algorithms such as contrast enhancement by histogram equalization and thresholding.
- Know when and how to use a specific segmentation technique, according to the image specificities and complexity.
- Be conversant with the mathematical morphology tools such as dilation, erosion, closing and opening

Prerequisites

- Linear Algebra and Differential Equations
- Probability and Statistics
- Algorithmic and Programming skills

Learning Resources

- No specific resources are required. The tutorials are collaborative and conducted with the instructor.

Assessments

The final course grade will be calculated using the following categories:

Assessment	Percentage of Final Grade
Final exam	100%

Course Schedule

Lecture #	Theme/Topic	Learning Outcomes Addressed
#1 (3H)	Introduction to digital image acquisition and processing	Know how the images are formed with analogy to human vision system, Discover image acquisition systems exploiting various light wavelengths, Understand how we moved from analogical to digital images through sampling and quantification, Know some of image properties: luminance, contrast, noise, deformation., Open up to fields of applications.
#2 (3H)	Spatial and intensity resolution of images	Understand the effect of spatial and intensity variation on image. Get familiar with image interpolation (mapping function) when performing spatial transformation. Use histogram and perform equalization using probability density and other adaptive algorithms Know how to perform these changes using Matlab commands
#3 (3H)	Segmentation techniques	Know why we need segmentation Pixel intensity distribution and threshold techniques: from simple global to local adaptive approaches Region based segmentation Contour based segmentation
#4 (3H)	Mathematical morphology tools	Understand the basic definitions of pixel connexity, duality between 4-8 connexity on background/foreground, structuring element and connected components. Learn to apply dilation, erosion, opening and closing operations to restore information after binarization process.
#5 (3H)	Tutorials	Apply the acquired knowledge on different examples: from histogram equalization, thresholding, contour detection to morphological operations to improve obtained segmentation results.