

CSE 5408: MEDICAL IMAGE ANALYSIS [4 0 0 4]

The Analysis of Medical Images, Digital Image Acquisition: X-Ray, MRI, US, Nuclear Imaging, Image Storage and Transfer, Image Enhancement: Measures of Image Quality, Image Enhancement Techniques, Noise Reduction, Feature Detection, Segmentation: Principles and Basic Techniques: Segmentation in Feature Space: Segmentation by Classification in Feature Space, Clustering in Feature Space, Active Contours and Active Surfaces: Explicit Active Contours and Surfaces, Level Sets, Geodesic Active Contours, Shape, Appearance and Spatial Relationships: Shape Models, Simple Models, Implicit Models, The Medial Axis Representation, Active Shape and Active Appearance Models, Validation: Measures of Quality, The Ground Truth., Representativeness of Data, Significance of Results, 3D volume creation and volume rendering techniques, Clinical applications of imaging case studies discussion. Medical image analysis software (ImageJ, MevisLab, 3Dslicer, pyRdiomics, ITKSnap, MITK).

SDL: Sampling, Quantization, Noise models, Color models [6]

References

1. Klaus D. Toennies. (2017). Guide to Medical Image Analysis Methods and Algorithms. Second Edition. Springer Germany.
2. Birkfellner and W, T. (2014). Applied Medical Image Processing: A Basic Course. 2nd Edition, Taylor and Francis
3. Nick Pears, Yonghuai Liu, Peter Bunting. (2012). 3D Imaging, Analysis and Applications, Springer Heidelberg, Springer London.
4. Bernhard Kainz, Kanwal Bhatia, Ghislain Vaillant, Maria A. Zuluaga. (2017). Reconstruction, Segmentation, and Analysis of Medical Images, Lecture Notes in Computer Science 10129, Springer
5. Marleen de Bruijne, Philippe C. Cattin, Stéphane Cotin, Nicolas Padoy, Stefanie Speidel, Yefeng Zheng, Caroline Essert (2021). Medical Image Computing and Computer Assisted Intervention – MICCAI 2021. LNCS 12901, Springer Germany
6. Rafael C. Gonzalez, Richard E. Woods (2017), Digital Image Processing, (4e), Pearson, 2017.

Course Outcomes:

Student should be able to,

1. Summarize the Imaging techniques, DICOM format and select the imaging technique for a clinical task
2. Apply and evaluate the image enhancement and segmentation methods to obtain objects of interest
3. Validate the segmented objects, analyze and measure the features.
4. Create the 3D volume and render the anatomical structures
5. Design and construct the methods to perform image processing using various tools