Visualisierung medizinischer Daten I
Topics

Part 1 (L. Dimitrov)

1. What are signals?
2. Why is signal sampling necessary?
3. How to explain the sampling process from a signal-theoretical point of view?
4. How does the real-world sampling process differ frm the theoretical one?
5. What is the spectrum of a signal?
6. What is convolution?
7. What is the Fourier transform?
8. What does the convolution theorem state?
9. Why is the convolution theorem of such an importance?
10. Why is reconstruction necessary?
11. What is the ideal reconstruction filter?
12. Which popular reconstruction filters are there?
13. What are the causes and effects of pre-aliasing?
14. Can pre-aliasing be avoided and how?
15. What are causes and effects of post-aliasing?
16. Can post-aliasing be avoided and how?
17. How is reconstruction done from a signal-theoretical point of view?
18. What is filtering?
19. How can filters be classified?
20. What is image segmentation?
21. Why is segmentation necessary?
22. Which classification criteria and methods for segmentation do you know?
23. What is special about segmentation of tomographic data?
24. Which geometric features in images can be used for segmentation?
25. How can geometric features be extracted?
26. What are local segmentation methods?
27. What are global segmentation methods?
28. What is mathematical morphology and how does it relate to segmentation?
29. Which classification criteria and methods for registration do you know?
30. What is surface extraction?
31. What is surface extraction necessary for?
32. Which two main problems poses surface extraction?
33. What is fundamental to all surface extraction methods?
34. Which popular methods for surface extraction are there?
35. How does the marching cubes method work?
36. What are surface extraction advantages?
37. What are surface extraction disadvantages?
38. How are normal vector to the extracted surfaces found?
39. What is a gradient vector?
40. What is gradient extraction?
41. What is gradient extraction necessary for?
42. Which popular methods for gradient extraction are there?
43. How can gradients be estimated in a discrete samples data set?
44. Which two classes of gradient estimators exist?
45. What is image registration?
46. Which are the three constituent parts of every registration method?
47. What are popular choices for each of the three parts of registration?
48. How can registration methods be classified?
49. What kinds of transformations can be used in registration?

50. What kinds of cost functions for registration are there?
51. Which optimization methods are used in registration?
52. How do registration and segmentation relate to each other?
53. What are Graphical Processing Units?
54. What are optical models for volume renering?
55. Which classes of optical models are there?
56. What is the Volume Rendering Integral?
57. How does ray casting relate to the VRE?
58. Why are GPUs particularly well-suited for volume ray casting?
59. How is ray casting principally done on GPUs?
60. Which popular ray casting applications exist?

Part 2 (M. Sramek)

1. Classification of 3D grids
2. Cartesian Grid and its Elements
3. Classification of acquisition techniques
4. CT tomography, basic description and CT data characteristics
5. CT tomography, projection measurement and reconstruction
6. MRI, basic description, physical background and MRI data characteristics
7. MRI, spatial localization, gradient fields and measurement in arbitrary planes
8. MRI, scanning protocols, T1, T2 and proton density images
9. PET – positron emission tomography
10. SPECT – single photon emission tomography
11. Surface and volume graphics, voxelization
12. The DICOM Standard, characteristics, role of DICOM in a hospital
13. Volume visualization - viewing techniques
14. Volume visualization by mapping
15. Classification of rendering techniques
16. Direct volume rendering, basics, techniques
17. Direct volume rendering by compositing
18. Direct volume rendering, splatting, texture mapping
19. Direct volume rendering, ray casting
20. The role of the transfer functions in volume visualization
21. Specification of density-based transfer functions
22. Transfer functions with LH Histogram
23. Multidimensional transfer functions
24. Sampling in volume rendering, problems and solutions