

Introduction to Digital Signal and Image Processing

- Signals and Biomedical Signal Processing
- What is a "Signal"?
- Analog, Discrete, and Digital Signals
- Processing and Transformation of Signals
- Signal Processing for Feature Extraction
- Some Characteristics of Digital Images
- Fourier Transform
- One-Dimensional Continuous Fourier Transform
- Sampling and NYQUIST Rate
- One-Dimensional Discrete Fourier Transform
- Two-Dimensional Discrete Fourier Transform
- Filter Design
- Image Filtering, Enhancement, and Restoration
- Point Processing
- Mask Processing: Linear Filtering in the Space Domain
- Frequency Domain Filtering
- Edge Detection and Segmentation of Images
- Edge Detection
- Image Segmentation
- Wavelet Transform
- From Fourier Transform to Short-Time Fourier Transform
- One-Dimensional Continuous Wavelet Transform
- One-Dimensional Discrete Wavelet Transform
- Two-Dimensional Wavelet Transform
- Main Applications of the DWT
- Discrete Wavelet Transform in MATLAB
- Other Signal and Image Processing Methods
- Complexity Analysis
- Cosine Transform
- Introduction to Stochastic Processes
- Introduction to Information Theory
- Registration of Images
- Clustering and Classification
- Clustering versus Classification
- Feature Extraction
- K-Means: A Simple Clustering Method
- Bayesian Classifier
- Maximum Likelihood Method
- Neural Networks

Processing of Biomedical Signals

- 1) Electrical Activities of Cell
- 2) Ion Transport in Biological Cells
- 3) Electrical Characteristics of Cell Membranes
- 4) Hodgkin-Huxley Model
- 5) Electrical Data Acquisition
- 6) Some Practical Considerations for Biomedical Electrodes
- 7) Electrocardiogram
- 8) Function and Structure of the Heart
- 9) Electrocardiogram: Signal of the Cardiovascular System
- 10) Cardiovascular Diseases and the ECG
- 11) Processing and Feature Extraction of ECGs
- 12) Electroencephalogram
- 13) The Brain and Its Functions
- 14) Electroencephalogram: Signal of the Brain
- 15) Evoked Potentials
- 16) Diseases of the Central Nervous System and the EEG
- 17) EEG for Assessment of Anesthesia
- 18) Processing and Feature Extraction of EEGs
- 19) Electromyogram
- 20) Muscle
- 21) EMG: Signal Muscles
- 22) Neuromuscular Diseases and the EMG
- 23) Other Applications of the EMG
- 24) Processing and Feature Extraction of the EMG
- 25) Other Biomedical Signals
- 26) Blood Pressure and Blood Flow
- 27) Electrooculogram
- 28) Magnetoencephalogram
- 29) Respiratory Signals
- 30) More Biomedical Signals

Processing of Biomedical Images

1. Principles of Computed Tomography
2. Formulation of Attenuation Computed Tomography
3. The Fourier Slice Theorem
4. X-Ray Imaging and Computed Tomography
5. Introduction and Overview
6. Physics of X-Rays
7. Attenuation-Based X-Ray Imaging
8. Image Quality
9. Computed Tomography
10. Biomedical CT Scanners
11. Diagnostic Applications of X-Ray Imaging
12. CT Images for Stereotactic Surgeries

13. CT Registration for Other Image-Guided Interventions
14. Complications of X-Ray Imaging
15. Magnetic Resonance Imaging
16. Physical and Physiological Principles of MRI
17. MRI
18. Formulation of MRI Reconstruction
19. Functional MRI (fMRI)
20. Applications of MRI and fMRI
21. Processing and Feature Extraction of MRI
22. Comparison of MRI with Other Imaging Modalities
23. Registration with MR Images
24. Ultrasound Imaging
25. Why Ultrasound Imaging?
26. Generation and Detection of Ultrasound Waves
27. Physical and Physiological Principles of Ultrasound
28. Resolution of Ultrasound Imaging Systems
29. Ultrasound Imaging Modalities
30. Modes of Ultrasound Image Representation
31. Ultrasound Image Artifacts
32. Three-Dimensional Ultrasound Image Reconstruction
33. Applications of Ultrasound Imaging
34. Processing and Feature Extraction of Ultrasonic Images
35. Image Registration
36. Comparison of CT, MRI, and Ultrasonic Images
37. Bio-Effects of Ultrasound
38. Positron Emission Tomography
39. Physical and Physiological Principles of PET
40. PET Signal Acquisition
41. PET Image Formation
42. Significance of PET
43. Applications of PET
44. Processing and Feature Extraction of PET Images
45. Comparison of CT, MRI, Ultrasonic, and PET Images
46. Other Biomedical Imaging Techniques
47. Optical Microscopy
48. Fluorescent Microscopy
49. Confocal Microscopy
50. Near-Field Scanning Optical Microscopy
51. Electrical Impedance Imaging
52. Electron Microscopy
53. Biometrics