Reference guide to techniques and concepts in Computational Neuroscience

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Statistics

1. What is the standard deviation?
2. What is the standard error of the mean?
3. What is a T-test?
4. What is a homogenously distributed random variable?
5. What is a correlation coefficient?
6. What is covariance?
7. What is a confidence interval?
8. What is the coefficient of variation?
9. What is the fano factor?

Image processing and model generation

10. What is convolution?
11. How do you implement edge detection in a brain and in a computer?
12. What is histogram equalization?
13. What is the point-spread function?

14. What is deconvolution? What does it mean physically?
15. How do you add two images and avoid saturation?
16. What is background subtraction?
17. What is the marching cubes algorithm?
18. What is mesh generation?
19. What is a finite element?
20. What is ray tracing?

Signal processing

21. What is the envelope of a function?
22. What is a Fourier transform?
23. What is relative phase?
24. What is binning? Write a matlab program.
25. What is a PSTH?
26. What is an ISIH?
27. What is frequency?
28. What is wavelength?
29. What is single value decomposition?
30. What is an eigenvalue and eigenvector?
31. What is stochastic resonance?

Microscopy

32. What is focal length?
33. What is numerical aperture?
34. What is confocal microscopy?
35. What is epifluorescence?
36. What is 2-photon microscopy?
37. What is a pulsed laser?
38. What is the energy necessary to photolyze caged compouds?
39. What is FRET?
40. What is FRAP?
41. What is phototoxicity? How do you avoid it?

Electrophysiology

42. What is a pipette? How is it made, what are the electrical properties?
43. What is resistance?
44. What is capacitance?
45. What is series resistance?
46. What is the cell resistance?
47. What is a junction potential?
48. What is voltage clamp?
49. What is current clamp?
50. What is capacitance compensation?

51. What is series resistance compensation?
52. What is the anode break response?

Information

53. What is entropy?
54. What is a bit?
55. What is mutual information?
56. What is the meaning of cross-correlation in information theory?
57. Give an example of a maximum rate information channel
58. What is Bayesian probability?

EEG and fMRI

59. What is an EEG?
60. What is a P and N in an EEG recording?
61. What is the BOLD signal?
62. What is atomic precession?
63. What is transcranial magnetic stimulation?
64. What is a di-pole source?
65. What is tensor diffusion analysis?

Biophysics

66. What is diffusion?
67. What is an electromagnetic field?
68. What is charge?
69. What is mass-action dynamics?
70. What is a Markov-chain?
71. What are rate constants?
72. What is the dissociation constant?
73. What is Michaelis-Menten?
74. What is CICR?
75. What is an open, closed, inactivated state of a channel?
76. How many Calcium channels exist?
77. How many K channel families exist?
78. How many Na channels exist?
79. What is shunting inhibition?

Simulations

80. What is a parameter space?
81. What is a Monte Carlo simulation?
82. What are the Hodgkin and Huxley equations?
83. How do you integrate a graph?
84. How do you calculate the derivative of a graph?

85. What is an integrate-and-fire model?

86. What is a phase-plane?

87. What is an isocline?

88. What is a nullcline?

Concepts

89. What is a receptive field?

90. What is a cortical column?

91. What is coincidence detection?

92. What is rate coding?

93. What is a threshold?

94. What is the reflex-arc?

95. What are the What and Where visual pathways?

96. What is the binding problem?

97. What is Hebbian learning?

98. What is non-Hebbian learning?

Neural networks

99. What is a backpropagating neural network?

100. What is a genetic algorithm?

101. What is a Kohonen network?

102. What is self-organized criticality?

103. What is a cellular automata?

104. What is a perceptron?

105. What is the traveling salesman problem?

106. What is an np-complete problem?