

Some suggested materials in computational neuroscience

This list is not intended to be exhaustive...

In no particular order...

Some interesting books

- (1) Abbott and Dayan. Theoretical neuroscience. MIT Press. 2001.
- (2) Gabbiani and Cox. Mathematics for neuroscientists. Academic Press. 2010.
- (3) Koch. Biophysics of computation. Oxford University Press. 1999.
- (4) Kreiman. Biological and computer vision. Cambridge University Press. 2021.

A short list of must-read computational neuroscience papers

- (1) McCulloch, W., & Pitts, W. (1943). A logical calculus of the ideas immanent in nervous activity. *Bulletin of Mathematical Biophysics*, 5, 115-133.
- (2) Hodgkin, A. L., & Huxley, A. F. (1952). A quantitative description of membrane current and its application to conduction and excitation in nerve. *Journal of Physiology*, 117, 500-544.
- (3) Barlow, H. (1972). Single units and sensation: a neuron doctrine for perception. *Perception*, 1, 371-394. doi:10.1068/p010371
- (4) Koch, C., Poggio, T., & Torre, V. (1982). Retinal ganglion cells: a functional interpretation of dendritic morphology. *Philos Trans R Soc Lond B Biol Sci*, 298(1090), 227-263.
- (5) Hopfield, J. J. (1982). Neural networks and physical systems with emergent collective computational abilities. *PNAS*, 79, 2554-2558. doi:10.1073/pnas.79.8.2554
- (6) Koch, C., & Ullman, S. (1985). Shifts in selective visual attention: towards the underlying neural circuitry. *Hum Neurobiol*, 4(4), 219-227.
- (7) Rumelhart, D. E., Hinton, G., & Williams, R. J. (1986). Learning representations by back-propagating errors. *Nature*, 323, 533-536.
- (8) Bialek, W., Steveninck, R., & Warland, D. (1991). Reading a neural code. *Science*, 252, 1854-1857.
- (9) Steriade, M., McCormick, D. A., & Sejnowski, T. J. (1993). Thalamocortical oscillations in the sleeping and aroused brain. *Science*, 262, 679-685.
- (10) van Vreeswijk, C., & Sompolinsky, H. (1996). Chaos in neuronal networks with balanced excitatory and inhibitory activity. *Science*, 274(5293), 1724-1726. doi:10.1126/science.274.5293.1724
- (11) Olshausen, B. A., & Field, D. J. (1996). Emergence of simple-cell receptive field properties by learning a sparse code for natural images. *Nature*, 381(6583), 607-609. doi:10.1038/381607a0
- (12) Lee, D. D., & Seung, H. S. (1999). Learning the parts of objects by non-negative matrix factorization. *Nature*, 401(6755), 788-791. doi:10.1038/44565

- (13) Riesenhuber, M., & Poggio, T. (1999). Hierarchical models of object recognition in cortex. *Nature Neuroscience*, 2(11), 1019-1025. doi:10.1038/14819
- (14) Rao, R. P., & Ballard, D. H. (1999). Predictive coding in the visual cortex: a functional interpretation of some extra-classical receptive-field effects. *Nat Neurosci*, 2(1), 79-87. doi:10.1038/4580
- (15) Song, S., Miller, KD, Abbott, LF. (2000). Competitive Hebbian learning through spike-timing-dependent synaptic plasticity. *Nature*, 3(9), 919-926.
- (16) Koch, C., & Segev, I. (2000). The role of single neurons in information processing. *Nature Neuroscience*, 3 (supplement), 1171-1177.
- (17) Simoncelli, E., & Olshausen, B. (2001). Natural Image Statistics and Neural Representation. *Annual Review of Neuroscience*, 24, 193-216.
- (18) Fairhall, A. L., Lewen, G. D., Bialek, W., & de Ruyter Van Steveninck, R. R. (2001). Efficiency and ambiguity in an adaptive neural code. *Nature*, 412(6849), 787-792.
- (19) Fusi, S., Drew, PJ, Abbott, LF. (2005). Cascade models of synaptically stored memories. *Neuron*, 45(4), 599-611.
- (20) Mongillo, G., Barak, O., & Tsodyks, M. (2008). Synaptic theory of working memory. *Science*, 319(5869), 1543-1546.
- (21) Fiete, I. R., Senn, W., Wang, C. Z., & Hahnloser, R. H. (2010). Spike-time-dependent plasticity and heterosynaptic competition organize networks to produce long scale-free sequences of neural activity. *Neuron*, 65(4), 563-576.
- (22) Krizhevsky, A., Sutskever, I., & Hinton, G. (2012). *ImageNet Classification with Deep Convolutional Neural Networks*. Paper presented at the NIPS, Montreal.
- (23) Ganguli, S., & Sompolinsky, H. (2012). Compressed sensing, sparsity, and dimensionality in neuronal information processing and data analysis. *Annu Rev Neurosci*, 35, 485-508. doi:10.1146/annurev-neuro-062111-150410
- (24) Serre, T. (2019). Deep learning: the good, the bad and the ugly. *Annual Review of Vision*, 5, 399-426.
- (25) Lillicrap, T. P., Santoro, A., Marris, L., Akerman, C. J., & Hinton, G. (2020). Backpropagation and the brain. *Nat Rev Neurosci*. doi:10.1038/s41583-020-0277-3