Advanced Computational Neuroscience
Tuesday and Thursday, 2:00 - 3:30, Kolb 7th Floor Seminar Room
Teaching Assistants: Ann Kennedy, Lyudmila Kushnir, Jeff Seely, Merav Stern

January
23 Larry - experimental results from electric fish, flies and cerebellum
28 Larry - perceptron, Fisher linear discriminant, pseudo-inverse and maximum margin classifiers, likelihood ratio, capacity of the perceptron (full and sparse)
30 Larry - linear readout of continuous variables, maximum likelihood and MAP, application to Poisson spiking

February
4 Stefano - SVMs
6 Stefano - Relation between response properties of individual neurons and geometry to neural representations
11 Stefano - Random representations, measures of dimensionality, effect of different nonlinearities, retention of correlations, non-linear SVMs, kernel PCA
13 Stefano - Shattering dimensionality, application to pre-frontal cortex
18 Stefano - A theoretical framework for generalization. VC dimension, generalization in the case of sparse representations
20 Mattia - bagging, boosting, scaling of capacity with neuron number of synapse number per neuron, biologically realistic readouts
25 Larry - Generative models, introduction to Boltzmann machines
27 COSYNE – no meeting

March
4 COSYNE – no meeting
6 Marcus - benefits of deep architectures, learning complex functions, computational power of deep vs. shallow networks, supervised learning in deep networks: (stochastic) gradient descent, backpropagation
11 Marcus - example architectures, deep belief networks and deep Boltzmann machines, recurrent neural networks (backpropagation in time), (Hessian-free optimization?)
13 Marcus - speeding up learning, momentum; learning rates, improving generalization through regularization, weight constraints, injecting noise, dropout, mixture of experts, building invariances, convolutional nets
18 Vacation – no meeting
20 Vacation – no meeting
25 Marcus/Ken - unsupervised learning as generative pre-training, representing the input distribution and extracting useful features, energy based models and contrastive divergence, example architectures, restricted Boltzmann machines, auto-encoders
27 Guest lecture - Rob Fergus?

April
1 Guest lecture - Yoshua Bengio?
3 Ken – balanced and inhibitory-stabilized networks
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