

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

8	Ken - non-normal matrices
10	Ken - non-normal matrices
15	Yashar - random matrices
17	Yashar - random matrices
22	Yashar - random matrices
24	Yashar - random matrices
29	Yashar - random matrices