COSYNE
Computational and Systems Neuroscience
2007
Workshops

26-27 February, 2007
The Canyons
Park City, Utah

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Food included with registration:

Monday 2/26 Hot Breakfast Buffet, Morning Beverage Break, Afternoon Beverage Break
Tuesday 2/27 Hot Breakfast Buffet, Morning Beverage Break, Afternoon Beverage Break, Dinner Buffet (with cash bar)

Lift ticket vouchers:

Vouchers for $50 lift tickets will be available at the Cosyne registration desk each day. Guests may have an unlimited number of vouchers, but they are only good for the dates of the conference (2/26 & 2/27).
The vouchers will then have to be taken to the front desk at The Canyons, where the guest will pay $50 and get a lift ticket for the day, the official ticket price is about $75. (There will be no free lift ticket included in the guestroom price at The Canyons, as there was last year.)

Transportation from The Canyons to Salt Lake City Airport:

The Canyons Front Desk can arrange for a shuttle or taxi.
Or call All Resort Express 24 hours in advance to arrange for a shuttle: 1-800-457-9457

Organization: Fritz Sommer and Jascha Sohl-Dickstein (UC Berkeley)
Organizational support: Christina Laycock and the University of Rochester Conference and Events Office

Active sensation and natural scenes in the vibrissa sensory system

Christopher Moore (MIT), Garrett Stanley (Harvard)

Abstract

The vibrissa sensory system is a key mammalian model for studying sensory encoding. As a high-resolution system that is neither 'visual' nor explicitly 'auditory,' it provides an ideal counterpoint for examining principles of sensory representation, and how they do or do not generalize.

The majority of studies of this system have presented artificial tactile stimuli, passively applied to one or two vibrissae as discrete steps. This context is radically different from what is known of the perceptual engagement of the animal, which requires active sensation (typically 'whisking' against a surface) and contact across multiple vibrissae in distinct spatio-temporal patterns.

This workshop will focus on a variety of new directions in the study of this system. We will focus on understanding the information that is ethologically relevant to the animal, how features are represented and transformed through the system, how tactile information is mechanically transduced at the periphery, and the role of the animal's own behavior in influencing these percepts. Participants will be encouraged to discuss these issues broadly, with an emphasis on comparison with alternative sensory pathways.

Schedule (Monday, Feb 26, White Pine Parlor 1)

8:40 - 8:50		*Opening Remarks*
		Embodiment and Perception
8:50 - 9:30	**Jason Ritt (MIT)**	*Body, brain and choice in sensory computation*
9:45 - 10:15	**Mitra Hartmann (JPL)**	*Quantifying spatiotemporal patterns of input across the vibrissal array*
10:30 - 11:00	**Jason Wolfe**	*Direct measurement of whisker resonance during active whisking in awake, behaving rats*
11:15 - 11:45	**Noah Cowan (Johns Hopkins)**	*A "robotics-inspired" approach to understanding sensorimotor control systems: Cockroach locomotion and navigation*
		Motor Action, Adaptation and Representation
4:00 - 4:20	**Christopher Moore (MIT)**	*The embodied mind: The role of hemodynamics in active sensation*
4:30 - 4:50	**Garrett Stanley (Harvard)**	*Sensory processing in the non-stationary natural world*
5:00 - 5:30	**Dan Hill (UC San Diego)**	*Muscular drive of whisking, and representation and control of whisking by cortex*
5:45 - 6:15	**Dan Barth (CU-Boulder)**	*Coincidence detection in SI barrel neurons*
6:30 - 7:00	**Ehud Ahissar (Weizmann Institute)**	*Summary of the 'state of the field', leading open discussion of future directions*

Asking why - normative models in neuroscience

Alan A. Stocker (NYU), Konrad P. Körding (MIT)

Abstract

We expect that over the course of evolution many properties of the nervous system became close to optimally adapted to the statistical structure of problems the nervous system is usually faced with. Substantial progress has been recently made towards understanding the nervous system on the basis of optimality: asking "why" the nervous system is solving problems the way it does.

Normative models typically start with an analytical formulation of which problem the nervous system has to solve, and propose an answer: how the nervous system "should" optimally solve this problem given its limited amount of neural resources. Such a principled framework seems particularly important for understanding complex systems, where pure descriptive models often cannot provide satisfying answers. Normative models have had great success in explaining a wide range of aspects of neural processing, from neural response characteristics to human social behavior. For example, the way sensory neurons encode information is frequently phrased as a problem of most efficiently representing sensory information. As another example, the way people combine cues within the same modality or between modalities is often formulated as optimal inference given the constraint of sensory uncertainty. Such models, by specifying the problem to be solved in a meaningful way, often explain counterintuitive properties of neurons as well as the behavior of humans in perceptual, action and cognitive tasks.

The goal of this workshop is to bring together theoretical and experimental neuroscientists interested in understanding why the brain is behaving the way it does. Experts from different fields, including neurophysiology, perception, cognition and behavior, will present their newest research results. Yet, the focus of the workshop is on discussions among participants and audience.

In particular, the workshop should lead us toward answers of the following questions: What is the state-of-the-art in applying normative models in neuroscience? Where are the limitations of normative models in providing answers in neuroscience? Can we link and unify some of the different approaches (e.g. efficient coding and optimal estimation)?

Schedule (Monday, Feb 26, White Pine Parlor 2)

8:30 - 8:40		*Introduction*
8:40 - 9:15	**Tom Griffiths (UC Berkeley)**	*Normative models of human inductive inference*
9:15 - 9:50	**David Brainard (University of Pennsylvania)**	*Color from a single cone? An ideal observer model to frame questions about early color vision*
9:50 - 10:10		*Break*
10:10 - 10:45	**Pascal Mamassian (CNRS France)**	*Priors and cost functions in visuo-motor psychophysics*
10:45 - 11:20	**David Knill (University of Rochester)**	*Bayesian models for robust cue integration and learning*
11:20 - 11:30		*Wrap-up*

4:00 - 4:35	**Alan Stocker (New York University)**	*The importance of addressing both perceptual bias and variability*
4:35 - 5:10	**Daeyeoul Lee (University of Rochester)**	*What we should do, what we do, and how we do it*
5:10 - 5:30		*Break*
5:30 - 6:05	**Barak Pearlmutter (National University of Ireland Maynooth)**	*A Rant about Names and Theories in Neuroscience*
6:05 - 6:40	**Bruno Olshausen (UC Berkeley)**	*Generative models and visual cortical function*
6:40 - 7:00		*Final discussion*

Conserved functions of the basal ganglia circuit

Jesse H. Goldberg (MIT), Michael A. Farries (UT San Antonio)

Abstract

Recent advances in functional neuroanatomy have revealed that the basic structure of the basal ganglia (BG) is conserved from anamniotic tetrapods to reptiles, birds, and humans. Across species, BG circuits with common neurochemistry, cytoarchitecture and synaptic connectivity form topographically organized loops that interconnect sensory and motor systems and subserve motor learning. What are the essential functions of this circuit and why has it been conserved? The goal of the proposed workshop is to bring together researchers who study the basal ganglia in different systems to discuss common features and functions of the circuit. Specifically, we will focus, first, on the common structure and cellular elements of the BG circuit. We will next consider BG circuit function as it relates to motor learning in songbirds and mammals, and, lastly, its relevance to psychiatric illness in the human patient.

Schedule (Monday, Feb 26, Painted Horse 1)

8:30 - 8:35		*Opening remarks*
8:35 - 9:05	**Sten Grillner (Karolinska Institute)**	*The lamprey basal ganglia - structure and function evolutionary conserved*
9:15 - 9:45	**Michael Farries (U Texas San Antonio)**	*Avian striatal spiny neurons: a mixture of conservation and divergence*
9:55 - 10:10		*Break*
10:10 - 10:40	**Abby Person (U Washington)**	*Thalamic relay of basal ganglia information: insights from songbirds*
10:50 - 11:20	**Michale Fee (MIT)**	*Vocal experimentation in the juvenile songbird requires a basal ganglia circuit*
11:20 - 11:30		*Discussion*
4:00 - 4:30	**Ann Graybiel (MIT)**	*The basal ganglia and action: what's going on in the striatum?*
4:40 - 5:10	**David Redish (U Minnesota)**	*Striatal representations in rats running spatial and non-spatial tasks*
5:20 - 5:40		*Break*
5:40 - 6:10	**Chris Pittenger (Yale)**	*Disrupted basal ganglia information processing in Tourette syndrome*
6:10 - 7:00		*Concluding remarks and discussion*

Emerging information-theoretic measures and methods in neuroscience

Michael Gastpar (UC Berkeley), Jonathan Victor (Cornell)

Abstract

Direct application of information-theoretic tools to laboratory measurements of stimulus-response relationships have resulted in a number of important insights. However, these approaches often require very large amounts of data (especially for multineuronal analyses), and are thus of limited practicality in vertebrate systems, especially the central nervous system. Moreover, there are sound theoretical reasons for using an information-theoretic approach even when the neurons under study do not behave "optimally."

In extension and response to these issues, over the past few years, several research groups have developed a second generation of information-theoretic tools. The goal of the proposed workshop is to provide an in-depth snapshot of the status of these investigations in some of their most exciting aspects, including:
1. Notions of optimality of information representations in neurons
2. Correlation and information measures of redundancy in populations of neurons and/or the implications of limited data
3. Refined methods and approaches to estimate mutual information from measurement data, with a particular focus on populations of neurons
4. Use of information-theoretic tools as a means to characterize the nature of the neural code, rather than the quantity of information carried

Schedule (Monday, Feb 26, Painted Horse 2)

8:30 - 8:35		*Opening remarks*
8:35 - 8:55	**Jonathan Victor (Cornell)**	*Why it is difficult to calculate information, and why there are so many approaches*
9:00 - 9:20	**Michael Berry (Princeton University)**	*Correlated Neural Populations in the Retina*
9:25 - 9:45	**Jonathon Shlens (Salk Institute)**	*Exploring the network structure of primate retina using maximum entropy methods*
9:50 - 10:15		*Break*
10:15 - 10:35	**Toby Berger (Cornell/U Virginia)**	*Energy-efficient recursive estimation by variable-threshold neurons*
10:40 - 11:00	**Naftali Tishby (The Hebrew University)**	*Optimal adaptation and predictive information*
11:05 - 11:25	**William Levy (U Virginia)**	*The interaction between timeliness and information in determining the energetic cost of the action potential of unmyelinated nerves.*

4:00 - 4:20	**David Field (Cornell)**	*Measuring the information content and dimensionality of complex signals: An example of natural scenes and proximity distributions*
4:25 - 4:45	**Dmitri Chklovskii (Cold Spring Harbor)**	*Optimal Information Storage in Noisy Synapses under Resource Constraints*
4:50 - 5:10	**Michael Gastpar (UC Berkeley)**	*Scaling Information Measures for Population Codes*
5:15 - 5:40		*Break*
5:40 - 6:00	**Jonathan Pillow (University College London)**	*Neural characterization using an information-theoretic generalization of spike-triggered average and covariance analysis*
6:05 - 6:25	**Adrienne Fairhall (U Washington)**	*Model evaluation using information*
6:30 - 6:50	**Liam Paninski (Columbia University)**	*Model-based methods for stimulus decoding, information estimation, and information-theoretic optimal stimulus design*

Hippocampal and entorhinal plasticity, coding and computation (2 days)

Hugh Blair (UCLA), Elizabeth Buffalo (Emory), Loren Frank (UCSF)

Abstract

The goal of this two day workshop is to bring together investigators using a variety of experimental and theoretical approaches to understanding processing in the hippocampal entorhinal system. We will have a wide ranging discussion on topics such as

- Grid cells
- Cellular and network level plasticity
- Interactions within and between regions
- Endogenous Rhythms
- Spatial and behavioral coding.
- Hippocampal / Entorhinal function across species

The workshop will emphasize presentations of unpublished or recently published data, and ample time will be allotted for questions and discussion.

Schedule, Day 1 (Monday, Feb 26, Kokopelli Parlor 3)

8:30 - 8:55	**Tad Blair (UCLA)**	*Scale-invariant memory representations emerge from moire interference between hexagonal grid fields encoded by theta oscillations: A computational model*
9:05 - 9:30	**Neil Burgess (UCL)**	*Environmental influence on grid cells - interaction with place cells?*
9:40 - 9:55	**Ken Harris (Rutgers)**	*Theta-mediated dynamics of spatial information in hippocampus*
10:05 - 10:20		*Break*
10:20 - 10:45	**Lisa Giocomo (Boston University)**	*Differences in subthreshold oscillations of stellate cells map to differences in periodicity of grid cells*
10:55 - 11:20	**Bruce McNaughton (University of Arizona)**	*Self-organization during early development of toroidal synaptic matrices that may underlie the grid cell phenomenon : theory and (very) preliminary data*
4:00 - 4:25	**Ila Fiete (Caltech)**	*Dynamics of path integration and principles of position encoding in rodent grid cells*
4:35 - 5:00	**Francesco Savelli (UT Houston Medical Center)**	*A minimal model of Hebbian plasticity for the formation of place fields from grid-cell inputs*
5:10 - 5:30		*Break*
5:30 - 5:55	**Gergely Papp (SISSA)**	*Dentate granule cells' contribution to place field formation*
6:05 - 6:30	**Nachum Ulanovsky (University of Maryland)**	*Hippocampal cellular and network activity in freely-moving echolocating bats*
6:40 - 7:00		*General discussion*

Schedule, Day 2 (Tuesday, Feb 27, Kokopelli Parlor 3)

8:30 - 8:55	**Per Sederberg (University of Pennsylvania)**	*Oscillatory activity distinguishes true from false memories*
9:05 - 9:30	**Elizabeth Buffalo (Emory)**	*Hippocampal synchronization and memory Formation*
9:40 - 10:05	**George Dragoi (MIT)**	*Oscillatory binding of place sequences by hippocampal cell assemblies*
10:15 - 10:30		*Break*
10:30 - 10:55	**Surya Ganguli (UCSF)**	*Oscillations, plasticity and memory formation in a solvable recurrent spiking network*
11:05 - 11:20	**Adam Johnson (University of Minnesota)**	*Dynamic representations in the hippocampus: implications for navigation and memory*
4:00 - 4:25	**Nelson Spruston (Northwestern)**	*Dendritic spikes and plasticity of entorhinal-CA1 and CA3-CA1 synapses*
4:35 - 5:00	**Sen Cheng (UCSF)**	*Experience-dependent dynamics of spatio-temporal precision and synchrony in place cells*
5:10 - 5:30		*Break*
5:30 - 5:55	**Wendy Suzuki (NYU)**	*Making New Memories: Associative Learning Signals in the Monkey Medial Temporal Lobe*
6:05 - 6:30	**Joe Manns (Boston University)**	*The role of context in memory for the order of items*
6:40 - 7:00		*General discussion*

How can we understand shape coding in higher level visual areas?

Charles E Connor (Johns Hopkins University), Anitha Pasupathy (University of Washington), Jack Gallant (UC Berkeley)

Abstract

Shape coding is extremely difficult to address experimentally and theoretically, because shape information in visual images is so high-dimensional, variable, and implicit. We want to speculate about what novel experimental and analytical methods might finally make this question tractable. The emphasis will be on actually discovering the neural code for shape (as opposed to important but distinct issues like maximum information, invariance, effects of learning or attention). The major experimental challenge is adequately sampling neural responses across the virtually infinite domain of object shape. The major theoretical challenge is quantifying shape information conveyed by neurons and neural populations. Speakers are encouraged to critique the limitations of current approaches and consider radically new directions, possibly based on analogies to other problems or fields.

Schedule (Monday, Feb 26, Arrowhead Parlor 1)

8:30 - 8:50	**Connor, Pasupathy, Gallant**	*Introduction*
8:50 - 9:30	**Jack Gallant (UC Berkeley)**	*Statistical issues in studies of higher vision: inherent problems and (some) solutions*
9:30 - 10:10	**Ed Connor (Johns Hopkins University)**	*Adaptive stimulus mutation to explore neural tuning in the 3D shape domain*
10:10 - 10:50	**Roozbeh Kiani (U Washington)**	*Representation of Object Category Structure by Response Patterns of Neuronal Population in Monkey Inferior Temporal Cortex*
10:50 - 11:30	**David Leopold (NIH)**	*Norm based coding of faces in the monkey inferotermporal cortex*
4:00 - 4:40	**Mike Lewicki (CMU)**	*A theoretical approach to shape representation based on natural scene statistics*
4:40 - 5:20	**Tony Movshon (NYU)**	*Can understanding the analysis of motion illuminate the analysis of form?*
5:20 - 6:00	**Fei-Fei Li (Princeton)**	*Modeling real-world objects: a statistical approach*
6:00 - 7:00		*General discussion*

Neurally plausible statistical inference

Chris Eliasmith (Universty of Waterloo), Charles H. Anderson (Washington University, St. Louis), Brian Fischer (Caltech)

Abstract

The workshop will present recent advances in the modeling of statistical representations and transformations in neural systems. We think this topic will be of interest at Cosyne because the neural plausiblity of many of the statistical methods adopted from machine learning is questionable. Given the effectiveness of biological inference, it seems worthwhile to incorporate biological constraints to discover the algorithms employed by real systems. In addition, there has recently been a dramatic increase in interest in understanding neural systems as centrally involved in statistical inference. The workshop will provide an opportunity to present a variety of perspectives on this idea, as well as address the issues of appropriate approximations to machine learning methods.

Schedule (Monday, Feb 26, Arrowhead Parlor 2)

8:30-8:55	**Charles Anderson (Washington University)**	*Principles of Computing with Redundant Population Codes*
9:10-9:35	**Jeff Beck (University of Rochester)**	*Bayesian inference with probabilistic population codes*
9:50-10:05		*Break*
10:05-10:30	**Sophie Deneve (Institut des Sciences Cognitives, CNRS)**	*Bayesian inference and learning with networks of integrate and fire neurons*
10:45-11:10	**Maneesh Sahani (University College London)**	*Title TBD*
4:00-4:25	**Chris Eliasmith (Universty of Waterloo)**	*Biologically plausible hierarchical statistical inference*
4:40-5:05	**Erick Chastain and Rajesh Rao (University of Washington)**	*Embodied Population Codes: Bayes-optimal combination of Inference and Action Selection in a neural population*
5:20-5:35		*Break*
5:35-6:00	**Brian Fischer (Caltech)**	*A model of sound localization in the barn owl using populations of spiking neurons*
6:15-6:40	**Mehrdad Jazayeri (New York University)**	*On the readout of sensory neural signals in perceptual tasks*

All talks will be followed by 15 minutes of discussion.

Decision making

Julia Trommershäuser (Giessen University), Alfonso Renart Fernandez (Rutgers)

Abstract

Recent methodological and computational advances have started to shed light into the process of how the brain encodes and uses noisy sensory information for guiding behavior. Decision-making research seeks to understand how perception is transformed into action, taking into account the fundamentally ambiguous representations that the brain constructs of the sensory environment, as well as the consequences of actions for the attainment of the current behavioral goals.

The wide scope of the enterprise has attracted attention from a broad range of disciplines. Workshop participants will address the role of reinforcement and implicit learning, the encoding of associative cues, the role of optimization principles for the shaping of behavior, and possible neuro-physiological implementations of these computations.

Schedule (Tuesday, Feb 27, White Pine Parlor 1)

8:30 - 9:15	**Yonatan Loewenstein (The Hebrew University of Jerusalem)**	*Synaptic plasticity that is driven by the covariance of reward and neural activity may underlie the dynamics of learning behavior*
9:15 - 10:00	**Paul E. M. Phillips (University of Washington)**	*Encoding the "value" of future rewards by mesolimbic dopamine reflects benefits but not costs.*
10:00 - 10:45	**Leo Sugrue (Stanford University)**	*Choosing the greater of two goods: Neural currencies for valuation and choice*
10:45 - 11:30	**Alex Huk (University of Texas at Austin)**	*Neural time-integration for perceptual decision making*
4:00 - 4:45	**Xiao-Jing Wang (Yale University School of Medicine)**	*Stochastic decision making: Langevin versus Fokker-Planck*
4:45 - 5:30	**Wei-Ji Ma (University of Rochester)**	*Optimal decision-making with probabilistic population codes*
5:30 - 6:15	**Konrad P. Körding (Northwestern University)**	*Causal inference in the sensorimotor system*
6:15 - 7:00	**Denis Schluppeck (Nottingham University)**	*Deciding where to look Topographic areas of human posterior parietal cortex*

Functional requirements of a visual theory

David Arathorn (GIC), Bruno Olshausen (UC Berkeley), Jim DiCarlo (MIT)

Abstract

The objective of this workshop is to gather a group of investigators who are interested in building theories of the visual system and want to identify hard but important questions in vision are not being commonly asked, or widely discussed, and even less pursued experimentally or theoretically.

If one attempts to apply the existing body of neuronal hypotheses on the mechanics of vision to real world vision problems one immediately discovers there are substantial areas essentially unaddresssed. For example, if a student asks how does the visual system supply its owner with a navigable three dimensional model of a rock outcropping viewed monocularly, one would be hard pressed to find either a computational model or any compelling evidence of which visual area or areas host such a computation. More curiously, there is not much attention paid in the literature to the fact that this is an important unanswered question. Instead, texts in which facts and theories about the visual system are compiled tend to be data-driven: even important questions for which there are no experimental results are usually absent. One of the consequences of being data-driven is that the efforts in the field tend to get blown into overpopulated corners by the prevailing methodological winds.

The inspiration here is taken from common engineering practice: if you are going to build something, you first compile a functional requirements document which should be a reasonably complete description of what the something is required to do. This is an antidote to the natural tendency to solve the easy problems first, only to find that the solutions one has adopted at the beginning preclude solutions for the hard problems later on.

This will be a 'working' workshop. There will be a limited number of opening presentations on important, underaddressed capabilities of the visual system, current theoretical cul-de-sacs, and other issues which should be under consideration in the construction of any working theory of vision. The majority of the time attendees will be expected to participate in compiling an outline of visual functions, the importance, the level of current understanding, who is doing experimental or theoretical work relevant to that area. When this document is later cleaned up it can serve as a map for students or others interested in informing themselves or working in particular areas. It should also hopefully serve to guide funding agencies to direct means to un-addressed, or under-addressed, areas of research. If the effort comes to be judged as useful, this document can be kept up to date by regular re-occurrences of this workshop.

Panelists

David Arathorn (GIC)
Bruno Olshausen (UC Berkeley)
Jim DiCarlo (MIT)
Charles Anderson (Washington University)
David Field (Cornell)
Yann LeCun (NYU)
Michael Lewicki (CMU)
Fei-Fei Li (Princeton)
Andrew Ng (Stanford)
Aude Oliva (MIT)
Thomas Serre (MIT)
Antonio Torralba (MIT)
Alan Yuille (UCLA) - tentative

Because this is a discussion-oriented workshop there are no formal presentations as such. Each panelist will give a 10 minute platform statement, and the rest of the time will be devoted to discussion.

Tentative schedule (Tuesday, Feb 27, White Pine Palor 2)

8:30 - 8:45	*Overview and goals - the organizers*
8:45 - 9:45	*Panel presentations*
9:45 - 10:00	*General discussion*
10:00-10:15	*Break*
10:15-11:15	*Panel presentations*
11:15-11:30	*General discussion*

4:00 - 5:00	*Panel presentations*
5:00 - 5:30	*General discussion*
5:30 - 5:45	*Break*
5:45 - 6:45	*Panel presenations*
6:45 - 7:00	*General discussion*

How active is the cortex?

Tim Blanche, Mike Deweese (UC Berkeley)

Abstract

How active is the cortex?

This simple but fundamental question awaits a definitive answer. Yet it's one that has far-reaching implications ranging from the nature of neural coding to the design of effective cortical prostheses. One school of thought says that information processing in the cortex is subserved by a network of highly redundant, broadly tuned, and inherently noisy neurons. Consequently large populations of cortical neurons are active during any given task. The alternate view is that most cortical neurons are silent most of the time, and neural computation involves only a small subset of sparsely active, highly reliable neurons. Physiological evidence and theoretical arguments exist in support of both models.

In recent years large scale neuronal recordings with multielectrode arrays and 2-photon microscopy are beginning to shed light on this important question. The goal of this workshop is to bring together new experimental measures of neural activity from a diversity of cortical areas and species.

This workshop will be of interest to people seeking answers to the following questions: How significant are experimental sampling biases? What is the relative importance of the recording technology, the depth and type of anesthesia in acute recordings, the level of arousal in chronic recordings, and the type of stimulus or behavioral paradigm? Have electrophysiologists been studying the minority of highly active neurons? If so, what is the other largely ignored population doing? Can we reconcile the small number of active neurons typically encountered along a single unit electrode track with recent data from 2-photon imaging that suggest the majority of neurons are active? Do the experimental data support a population coding scheme? Are overall activity levels consistent with the predictions of metabolic and sparse coding models? Or does the answer depend on the cortical area in question? Is there a progression of neural sparsity as one moves from primary sensory cortices to higher cortical areas?

Most importantly can we reach a consensus on how active or inactive the cortex is?

Schedule (Tuesday, Feb 27, Painted Horse 1)

8:30 - 8:50	**Tim Blanche (UC Berkeley)**	*Opening remarks, population sparsity in primary visual cortex*
8:55 - 9:20	**Ben Willmore (UC Berkeley)**	*Definition and measurement of sparseness in extrastriate visual cortex*
9:30 - 9:55	**Charles Gray (Montana State University)**	*Striate neuronal responses to time varying natural scenes are sparse and heterogeneous*
10:05 - 10:20		*Break*
10:20 - 10:45	**Tony Zador (Cold Spring Harbor)**	*Sparse coding in auditory cortex*
10:55 - 11:20	**Xiaoqin Wang (Johns Hopkins University)**	*Stimulus selectivity and responsiveness of auditory cortex*
4:00 - 4:25	**Bruce McNaughton (University of Arizona)**	*Sparse vs. distributed coding: economy vs. efficiency, and a lession from the subicular-neocortical projection*
4:35 - 5:00	**Jason Kerr (Max Planck Institute)**	*Population imaging of spontaneous and sensory-evoked activity in vivo: what's the difference?*
5:10 - 5:35	**Kenneth Harris (Rutgers)**	*Fine structure of spontaneous and evoked activity in neocortex*
5:45 - 6:00		*Break*
6:00 - 6:25	**Stephen Waydo (Caltech)**	*Sparse representation in the human medial temporal lobe*
6:35 - 7:00	**Michael Brecht (Erasmus MC)**	*Barrel cortex spikes: quantification and psychophysics*

Reducing the complexity of sensorimotor control

Emo Todorov (UC San Diego)

Abstract

Acting in a complex and uncertain environment is a hard problem which the sensorimotor system solves with apparent ease. Can we understand how it does that, to the point of being able to build synthetic systems with comparable performance? Many hypothetical strategies have been inferred from analyses of simple movements. However some of them are too simplistic to solve complex control problems while others call for computations that are generally intractable. Is there a middle ground, which can enable brains and robots to achieve high performance without a prohibitive amount of computation? To address this question, the workshop will bring together a diverse group of researchers focusing on motor behavior, neurophysiology, computational modeling, and robotics. The talks will cover a range of topics including neural representations that facilitate computation, construction of complex skills from motor primitives, combining reward-based and imitation-based learning, adaptation on multiple spatial and temporal scales.

Schedule (Tuesday, Feb 27, Painted Horse 2)

8:30 - 8:40		*Opening remarks*
8:40 - 9:10	**Mitsuo Kawato (ATR Computational Neuroscience Laboratories)**	*Heterarchical learning: combination of supervised and reinforcement learning*
9:10 - 9:40	**Stefan Schaal (USC)**	*TBD*
9:40 - 10:00		*Break*
10:00 - 10:30	**Emo Todorov (UC**	*Compositionality in optimal control*
10:30 - 11:00	**Andrew Ng (Stanford)**	*Reinforcement learning and apprenticeship learning for robotic control*
11:00 - 11:30	**Dinesh Pai (Rutgers)**	*Biomechanisms for sensorimotor control*
4:00 - 4:30	**Konrad Köerding (Northwestern)**	*Costs drive learning: how the motor system learns to get things cheaply*
4:30 - 5:00	**Mark Churchland (Stanford)**	*Neural dynamics during movement planning and execution*
5:00 - 5:30	**Maurice Smith (Harvard)**	*A multi-timescale model of learning, retention and generalization*
5:30 - 5:50		*Break*
5:50 - 6:20	**Andrea D'Avella (Santa Lucia Foundation)**	*Muscle synergies as building blocks for sensorimotor control*
6:20 - 6:50	**Philip Sabes (UC San Francisco**	*The eyes don't have it (all): Optimal integration of reach planning across "coordinate frames"*
6:50 - 7:00		*General discussion*

What role does spike synchrony or correlation play in sensory processing?

Jason Samonds, Matt Smith (Center for the Neural Basis of Cognition, Carnegie Mellon University)

Abstract

More laboratories are now routinely recording from larger numbers of neurons trying to answer questions about cortical circuitry and population coding. We have long known there is weak, but significant correlation or synchrony between pairs of neurons at every level of sensory processing. The correlation occurs at various temporal scales (milliseconds to 100's of msec) and for neuron pairs with distances approaching several millimeters. The objective of this workshop is to discuss what we have learned about these correlations and how they might effect sensory processing. Specifically, how can we interpret or extract how these results influence sensory processing at the network level.

This workshop will be of interest to neurophysiologists recording from multiple electrodes simultaneously, computational neuroscientists working on network models, and information theorists interested in population coding. The interaction among these specialists should lead to a synergistic relation to improve experiment design and data interpretation and modify current models with the most recent empirical data.

Schedule (Tuesday, Feb 27, Arrowhead Parlor 1)

8:30 - 8:35		*Opening Remarks*
8:35 - 9:05	**AB Bonds (Vanderbilt University)**	*Now that you have that multicell data you always wanted, what do you do with it?*
9:15 - 9:45	**Don Johnson (Rice University)**	*Correlations in Populations: Information-Theoretic Limits*
9:55 - 10:10		*Break*
10:10 - 10:40	**Matt Smith (Carnegie Mellon University)**	*Stimulus and distance dependence of neuronal correlation in macaque primary visual cortex*
10:50 - 11:20	**Simon Schultz (Imperial College London)**	*Synchrony and sensory coding in the cortex and cerebellum*
4:00 - 4:30	**Elad Schneidman (Weizmann Institute of Science)**	*Weak pairwise correlations imply strongly correlated networks states in neural population codes*
4:40 - 5:10	**Ifije Ohiorhenuan (Cornell University)**	*Maximum entropy modeling of multi-neuron firing patterns in V1*
5:20 - 5:35		*Break*
5:35 - 6:05	**Peter Latham (University College London)**	*Unsupervised learning, correlations, and error correcting codes: how are they related, and what can neural data tell us about them?*
6:15 - 6:45	**Jason Samonds (Carnegie Mellon University)**	*Evidence of cooperative and competitive mechanisms for stereo computation in macaque V1*
6:45 - 7:00		*Discussion and Concluding Remarks*