CRCNS 2015 - Main Meeting

September 28 – 29, 2015
Alder Commons, University of Washington

Monday, September 28, 2015

8:00-8:45am	Continental Breakfast and Registration
8:35-8:45am	Welcoming remarks Ken Whang, NSF; Andrew Rossi, NIH; Nazim Agoulmine, ANR
8:45-9:45am	Plenary Lecture: *One structure, many demands: how cortical populations support complex behavior* Anne Churchland, Cold Spring Harbor Laboratory
9:45-10:05am	*From Virtual Reality to Reality: How Neurons Make Maps* Mayank Mehta
10:05-10:25am	*Prefrontal cortex reservoir network learns to reconstruct navigation sequences by concatenating place-cell snippets replayed in hippocampus* Peter Dominey, N.Cazini, J.-M. Fellous, A. Weitzenfeld
10:25-10:45am	Coffee Break
10:45-11:05am	*Is multiplexing a general strategy for encoding multiple items in the brain? Evidence from a visual cortical face area and a subcortical auditory area.* Jennifer Groh, V.C. Caruso, J.T. Mohl, A.F. Ebihara, A. Milewski, S. Tokdar, W.A. Freiwald.
11:05-11:25am	*Early visual representations mediate ultra-rapid face detection: EEG and Computational support* Maximilian Riesenhuber, F. Campana, L. Bokeria, J. Martin, X. Jiang, S. Thorpe
11:25am-12:05pm	*Neural circuit mechanisms of category learning: a tale of two approaches* Xiao-Jing Wang & David Freeman
12:05-1:05pm	Lunch (provided)
1:05-1:25pm	*From sound to meaning: a hierarchy of models predict BOLD responses to natural speech* Frederic Theunissen, Alex Huth, Wendy de Heer, Tom Griffiths, Jack Gallant
1:25-1:45pm	*Computational and neural mechanisms of memory guided decisions* Daphna Shohamy, Nathaniel Daw

1:45-2:05pm	*Long Term Reactivation: Theoretical Approaches and Experimental Evidence* Jean-Marc Fellous, Masami Tatsuno
2:05-2:25pm	*Robust inference for nonstationary spike trains* Matthew Harrison, Asohan Amarasingham, Dahlia Nadkarni
2:25-2:45pm	Coffee Break
2:45-3:45pm	Plenary Lecture: *The functional contribution of synaptic complexity to learning and memory* Surya Ganguli, Stanford University
3:45-4:00pm	Break, poster set-up
4:00-7:00pm	Poster session and reception

Tuesday, September 29, 2015

8:00-8:30am	Continental Breakfast
8:30-9:30am	Plenary Lecture: *Dopaminergic error signals in birdsong* Jesse Goldberg, Cornell University
9:30-9:50am	*CPGs, Phase Oscillators, and cross-species studies* Philip Holmes
9:50-10:10am	*Chemoreception and neuroplasticity in respiratory circuits* Yaroslav Molkov, William H. Barnett, Ana P. Abdala, Julian F.R. Paton, Daniel B. Zoccal
10:10-10:30am	Coffee Break
10:30-10:50am	*Calcium dynamics predicts direction of synaptic plasticity in striatal spiny projection neurons* Kim Blackwell, Joanna Jędrzejewska-Szmek. Sriraman Damoradan, Daniel B. Dorman
10:50-11:10am	*Realistic neuronal modeling, is it realistic?* Alon Korngreen
11:10-11:30am	*Patient-specific models of local field potentials recorded from deep brain stimulation electrodes* Cameron McIntyre, Scott Lempka, Nicholas Maling
11:30-11:50am	*Rational derivation of biological data-driven simple network models from full-scale models: Application to phase-specific firing of hippocampal interneurons during theta rhythm* Ivan Soltesz, Marianne J. Bezaire, Ivan Raikov

11:50am-12:50pm	Lunch (provided)
12:50-1:30pm	*Dynamical mechanisms of oscillation transitions in the olfactory system* Thomas Cleland & Leslie Kay
1:30-1:50pm	*Epilepsy: Quantitation of the Inhibitory Restraint - The First Year* Andrew Sornborger, James D. Lauderdale, Peter Kner, Scott Baraban
1:50-2:10pm	Coffee Break
2:10-2:30pm	*Understanding the interaction between form and contrast in mid-level vision* Anitha Pasupathy, Majid Moshtagh, Dina Popovkina, Wyeth Bair
2:30-2:50pm	*Spatiotemporal characterization of attentional remapping in extrastriate area V4* James Mazer, Alexandria Marino
2:50-3:10pm	*Contingent Adaptation* Michael Landy, Zachary M. Westrick, David J. Heeger
3:10-3:30pm	Coffee Break
3:30-4:10pm	*Cellular and circuit mechanisms underlying persistent activity in a neural integrator* Mark Goldman & Emre Aksay
4:10-4:20pm	BigNeuron Hanchuan Peng, Allen Institute for Brain Science
4:20-4:50pm	Program information and updates Andrew Rossi & Ned Talley, NIH; Mathieu Girerd, ANR; Floh Thiels & Ken Whang, NSF
4:50-5:00pm	Closing remarks
5:00-6:00pm	Break, walk to banquet (~15 minute walk)
6:00-10:00pm	Banquet at the Lake Union Cafe, 3119 Eastlake Ave E, Seattle, WA 98102

CRCNS 2015 – Workshop

Topic: The intersection between neuroscience and machine learning

September 30, 2015

Alder Commons, University of Washington

Wednesday, September 30, 2015

8:30-9:10am	Continental Breakfast
9:10-9:15am	Welcoming remarks
9:15-9:45am	*Of Mice and Machines: What can the mouse brain tell us about neural computation* Michael Buice, Allen Institute for Brain Science
9:45-10:15am	*Bayesian and Bayesian Nonparametric Dynamic Modeling of Neuroimaging Data* Emily Fox, University of Washington
10:15-10:35am	Coffee Break
10:35-11:05am	*Flexible gating of contextual influences in natural vision* Odelia Schwartz, University of Miami
11:05-11:35am	*Engineering neural-ish systems* Blaise Agüera y Arcas, Google
11:35am-12:35pm	Lunch (provided)
12:35-1:05pm	*Comparing the brain's representation of shape to that of a deep convolutional network* Wyeth Bair, University of Washington
1:05-1:35pm	*Practical Neural Networks* Greg Corrado, Google
1:35-1:55pm	Coffee Break
1:55-2:40pm	Panel discussion
2:40-2:45pm	Closing remarks

Poster session: Monday, September 28, 4-7pm

1. Auditory representations of vocal gestures in zebra finches
   Hedi Soula, J.E Elie , F.E Theunissen

2. Random graph model of the cortical neuropil with power law long edge distribution - Interpretation of experiments with strategy change during reinforcement learning
   Robert Kozma, Walter J. Freeman, Sanquing Hu, Mark Myers, Miklos Ruszinko, Yury Sokolov , Frank Ohl, Schulz, Tim Wanger

3. "Coaching" Facilitates Brain-Computer Interface Learning
   Aaron Batista, Emily Oby, Alan Degenhart, Elizabeth Tyler-Kabara, Byron Yu

4. Exploring connectivity patterns in storytelling data using Hierarchical Topographic Factor Analysis (HTFA)
   Jeremy Manning, Xia Zhu, Jeremy Cohen, Rajesh Ranganath, Kim Stachenfeld, Erez Simony, Mor Regev, Janice Chen, Uri Hasson, Ted Willke, David Blei, Kenneth Norman

5. Using IVIM and diffusion weighted MRI to measure vascular properties in the aging brain
   Bradley Sutton, Alex Cerjanic, Gabrielle Fournet, Jing Rebecca Li, Denis Le Bihan, Luisa Ciobanu

6. Development of Functional Neuro-Visco and Poro-Elastography: Initial Results
   Keith Paulsen, Ingolf Sack, Jürgen Braun, Andreas Fehlner, Florian Dittmann, John B. Weaver, Matthew D. McGarry, Likin Tan

7. DataLad: progress toward data distribution
   Yaroslav Halchenko, Michael Hanke

8. Brief sensory stimulation evokes prolonged frequency changes in the mouse locomotor central pattern generator
   Ronald Harris-Warrick, Shelby Dietz, Natalia Shevstova, Ilya Rybak

9. GABA inputs enhance dopamine neuron bursting in vivo: effects of ethanol
   Alexey Kuznetsov, Christopher Lapish, Boris Gutkin

10. Protein Fusion Machinery: Molecular Dynamics, Membrane Mechanics, and Mutational Analysis
    Maria Bykhovskaia, Anand Jagota, Nicole Fortoul, Pankaj Singh, Chung Yuen.Hui, J. Troy Littleton

11. Structure Function Relationships at the Mammalian Neuromuscular Junction (NMJ) and Application to Disease Modeling
    Stephen Meriney, Tyler B. Tarr, Jun Ma, Thomas A. Blanpied, Markus Dittrich, Stephen D. Meriney

12. Somatic sodium channels and spike precision
    Yang Yang, Bina Ramamurthy, Andreas Neef, Matthew Xu-Friedman

13. Combinatorial transcriptional regulation modulates cytoskeletal-mediated dendritic arbor development
    Daniel Cox, Ravi Das, A. Patel, Shatabdi Bhattacharjee, Surajit Bhattacharya, Sumit

Nanda, Giorgio A. Ascoli

14. Numerical methods for modeling and simulation of the electrical properties of spines at an ultra-structural level
    Gillian Queisser, Markus Breit, Dinu Patirniche, Mark Ellisman, Andreas Herz

15. The effect of dendritic spines on short-term ionic plasticity of GABAergic inhibition
    Fidel Santamaria, Namrata Mohapatra, Jan Tønnesen, Andreas Vlachos, Thomas Kuner, Thomas Deller, U. Valentin Nägerl, Peter Jedlicka

16. Controllability Metrics and Algorithms for Structural Brain Networks
    Fabio Pasqualetti

17. Multiple noise sources shape optimal encoding strategies in fundamentally different ways
    Fred Rieke, Braden Brinkman, Alison Weber, Eric Shea-Brown

18. Module structure quality in spatially highly resolved functional brain networks
    Christoph Schmidt, B. Pester, H. Witte, A. Wismueller, L. Leistritz

19. Grid cells, place cells, and the sense of place: fitting the pieces of the puzzle together
    John Lisman, Honi Sanders, César Rennó-Costa, Marco Idiart

20. Development of a neural modeling, estimation, and navigation framework using spiking activity in human subthalamic nucleus
    Uri Eden

21. Striatal cholinergic dependent generation of propagation of beta oscillations
    Xue Han, Krishnakanth Kondabolu, Michelle McCarthy, Nancy Kopell

22. A potential mechanistic link between elevated beta oscillations and bursting in the basal ganglia
    Michelle McCarthy, Benjamin R. Pittman-Polletta, Allison Quach, Krishnakanth Kondabolu, Nancy Kopell, Xue Han

23. Modulating cortical dynamics with a sleep regulatory network
    Michael Schellenberger Costa, Jan Born, Lisa Marshall, Jens Christian Claussen, Thomas Martinetz

24. Closed-loop and phase-independent auditory stimulation during NREM sleep in a thalamocortical neural mass model
    Arne Weigenand, Michael Schellenberger Costa, Hong-Viet V. Ngo, Lisa Marshall, Jan Born, Jens Christian Claussen, Martinetz

25. Distribution, amplitude, incidence, co-occurrence, and propagation of human K-Complexes in focal transcortical recordings
    Eric Halgren, Rachel A. Mak-McCully, Burke Q. Rosen, Matthieu Rolland, Jean Régis, Fabrice Bartolomei, Marc Rey, Patrick Chauvel, Sydney S. Cash

26. Computation-Enabled Ventilatory Control System (CENAVEX)
    Ranu Jung, Sylvie Renaud, James Abbas, Yannick Bornat, Brian Hillen, Adeline Zbrzeski, Ricardo Siu, Jonathan Castelli, Brett Davis,Florian Kolbl

27. Adaptive control of lung volume for respiratory pacing in the rodent model

Ricardo Siu, Brian K. Hillen, Anil Thota, James J. Abbas, Sylvie Renaud, Ranu Jung

28. Selecting neuromorphic controller parameters for diaphragmatic pacing following spinal cord injury
    Brian Hillen, James Abbas, Adeline Zbrzeski, Sylvie Renaud, Ranu Jung

29. Approaching optimality in the owl's biased behavior with a population-vector decoder
    Fanny Cazettes, Brian J Fischer, José L Peña

30. CRCNS: Adaptive perceptual-motor feedback for the analysis of complex scenes
    Cynthia Moss, Melville Wohlgemuth, Ninad Kothari, Timothy K. Horiuchi

31. Subtracting negative images of self-generated sensory input improves neural and behavioral detection of external stimuli
    Nathaniel Sawtell, Armen Enikolopov

32. Information coding through adaptive control of thalamic activity
    Garrett Stanley, Clarissa J. Whitmire, Christian Waiblinger, Cornelius Schwarz, Garrett B. Stanley

33. Visualizing Whisker-Air Interactions
    Venkatesh Gopal, Kathleen Suvada, Tyler White, Micheal Meaden

34. Testing probabilistic models of state estimation in spiking sensory neurons using late-stage Xenopus laevis larvae
    Larry Hoffman, Kathrin Gensberger, Sara Hanzi, Hans Straka, Mike Paulin

35. Differential effects of adaptation on odor discrimination
    Maxim Bazhenov, Seth Haney, Debajit Saha, Baranidharan Raman

36. Neurons that detect interocular conflict help initiate binocular rivalry
    Stephen Engel, Sucharit Katyal, Abhrajeet Roy, Sheng He, Bin He

37. Simultaneous recording of neural activity across the primate dorsal stream
    Alex Huk, Jonathan Pillow

38. Can early visual processing be speeded-up by training?
    Jacob Martin, Max Riesenhuber, Simon J Thorpe

39. Adaptive tuning of mutual information in visual cortex
    Woodrow Shew, Wesley P. Clawson, Nathaniel C. Wright, Ralf Wessel

40. Concentration invariant odor identity coding
    Dmitry Rinberg, Alex Koulakov, Chris Wilson

41. Compensation for PKMζ function in LTP and long-term spatial memory in mutant mice
    Todd Sacktor, Panayiotis Tsokas, Changchi Hsieh, André Antonio Fenton, Harel Z. Shouval

42. Energy Landscapes of Human Brain Function Predicted by Structural Connectivity
    Shi Gu, Fabio Pasqualetti , Danielle S Bassett

Main meeting plenary lecture abstracts

One structure, many demands: how cortical populations support complex behavior

Anne Churchland, Cold Spring Harbor Laboratory

The posterior parietal cortex (PPC) receives diverse inputs and is involved in a dizzying array of behaviors. These many behaviors could rely on distinct categories of neurons specialized to represent particular variables or could rely on a single population of PPC neurons that is leveraged in different ways. To distinguish these possibilities, we evaluated rat PPC neurons recorded during multisensory decisions. Newly designed tests revealed that task parameters and temporal response features were distributed randomly across neurons, without evidence of categories. This suggests that PPC neurons constitute a dynamic network that is decoded according to the animal's present needs. To test for an additional signature of a dynamic network, we compared moments when behavioral demands differed: decision and movement. Our new state-space analysis revealed that the network explored different dimensions during decision and movement. These observations suggest that a single network of neurons can support the evolving behavioral demands of decision-making.

The functional contribution of synaptic complexity to learning and memory

Surya Ganguli, Stanford University

An incredible gulf separates theoretical models of synapses, often described solely by a single scalar value denoting the size of a postsynaptic potential, from the immense complexity of molecular signaling pathways underlying real synapses. To understand the functional contribution of such molecular complexity to learning and memory, it is essential to expand our theoretical conception of a synapse from a single scalar to an entire dynamical system with many internal molecular functional states. Moreover, theoretical considerations alone demand such an expansion; network models with scalar synapses assuming finite numbers of distinguishable synaptic strengths have strikingly limited memory capacity. This raises the fundamental question, how does synaptic complexity give rise to memory? To address this, we develop new mathematical theorems elucidating the relationship between the structural organization and memory properties of complex synapses that are themselves molecular networks. We also apply our theories to model the time course of learning gain changes in the rodent vestibular oculomotor reflex, both in wild-type mice, and knockout mice in which cerebellar long term depression is enhanced; our results indicate that synaptic complexity is necessary to explain diverse behavioral learning curves arising from interactions of prior experience and enhanced LTD.

Dopaminergic error signals in birdsong

Jesse Goldberg, Cornell University

In reinforcement learning an animal learns through trial and error to select those actions that maximize rewards such as food or juice. Dopamine neurons in the ventral tegmental area (VTA) mediate reinforcement by signaling reward prediction error: they are activated by better-than-predicted reward outcomes and suppressed worse-than-predicted ones. Yet it remains unclear if dopaminergic error signals apply to behaviors such as speech or playing an instrument that are not learned for external reward but are instead learned by matching performance to personal goals. Songbirds use auditory feedback to learn their song, and have a dopaminergic projection from VTA to Area X, a basal ganglia nucleus required for song learning. To test if dopamine encodes error during internally-guided performance evaluation, we recorded zebra finch VTA neurons as we induced perceived auditory error in specific song syllables using distorted auditory feedback. A subset of VTA neurons, including those antidromically identified as projecting to Area X, was suppressed after distorted syllables, consistent with a worse-than-predicted outcome. These neurons were also activated at the precise moment of the song when a predicted distortion did not occur, consistent with a better-than-predicted outcome. Error-encoding VTA neurons were a homogenous group that exhibited slow, tonic, irregular discharge similar to optogenetically tagged mammalian dopamine neurons. Yet they were intermingled with other VTA neurons that exhibited heterogeneous firing patterns, did not encode performance error, and were strongly modulated by movement. Together, these findings identify how auditory error signals reach vocal motor circuits and, more broadly, demonstrate that principles of dopaminergic prediction error can generalize to behaviors that are not learned for external rewards but are instead learned by comparing performance outcomes to internal models.

Workshop talk abstracts

Of Mice and Machines: What can the mouse brain tell us about neural computation
Michael Buice, Allen Institute for Brain Science

Michael Buice is a member of the modeling, analysis, and theory team at the Allen Institute, where he explores the implications of theories of neural processing and contributes to mathematical and data analysis. Before arriving at the Allen Institute, Buice worked in the lab of Ila Fiete at the University of Texas at Austin, where he helped derive a system size expansion for the Fisher Information for sensory and working memory systems, and developed analytic expressions for the fluctuations in attractor network models of neural networks. He held a postdoctoral research position in Carson Chow's group at the Laboratory of Biological Modeling at the National Institutes of Health (NIH). There, Buice applied kinetic theory and density functional theory to oscillator models of neural networks, answering open questions regarding the stability of asynchronous firing states in networks of finite size, a dynamical phenomenon related to the information present in the network. In addition, Buice helped construct a method for deriving equivalent reduced stochastic equations for systems with "incomplete information", such as an interacting network of neurons in which only a few neurons are actually recorded. Buice earned a Ph.D. in physics from the University of Chicago working with Jack Cowan to adapt techniques from the analysis of reaction-diffusion systems in physics to the statistics of simple models of neural networks.

Bayesian and Bayesian Nonparametric Dynamic Modeling of Neuroimaging Data
Emily Fox, University of Washington

Modern time series, such as arising from high-resolution neuroimaging devices, present new modeling and computational challenges due to the sheer dimensionality of the series. One challenge is how to model the complex evolution of the time series with intricate and possibly evolving relationships between the multitude of dimensions. For scalability, it is crucial to discover and exploit a sparse dependency structure. In this talk, we present a series of case studies in dynamical modeling of complex neuroimaging data. Two of our case studies focus on scalable structures for capturing sparse dependencies between data streams. In particular, we consider graphical models and low-dimensional embeddings of time series. We apply these models to: (1) performing single-trial MEG classification of words and (2) inferring functional connectivity graphs in an auditory processing task. In a third case study, we turn to modeling the complex dynamics of intracranial EEG using a Bayesian nonparametric dynamical model, automatically parsing these recordings.

Flexible gating of contextual influences in natural vision
Odelia Schwartz, University of Miami

An appealing hypothesis suggests that neurons represent inputs in a coordinate system that is matched to the statistical structure of images in the natural environment. I discuss theoretical work on unsupervised learning of statistical regularities in natural images. In the model, Bayesian inference amounts to a generalized form of divisive normalization, a canonical computation that has been implicated in many neural areas. In our framework, divisive normalization is flexible: it is recruited only when the image is inferred to contain dependencies, and muted otherwise. I particularly focus on recent work in which we have applied this approach to understanding spatial context effects in visual cortical processing of natural inputs.

Engineering neural-ish systems
Blaise Agüera y Arcas, Google

Neural nets are finally coming of age. Modern convolutional and recurrent neural networks are sweeping the field as practical solutions to hard machine perception problems. They are also increasingly addressing other tasks that brains can do but have been historically hard for computers: description, translation, chat and natural language, robotics, and even synthesis (hallucination and neural net art). While these artificial systems are not usually designed to be biologically plausible in their implementation details, they are decidedly more "neural" than previous approaches to AI or feature-engineered machine learning. There are, for example, meaningful direct comparisons to be made between electrophysiological recordings from brains and activity from artificial deep neural nets under the same stimuli. These comparisons have begun to allow us to gain greater intuition about both the natural and the artificial systems.

Comparing the brain's representation of shape to that of a deep convolutional network
Wyeth Bair, University of Washington

We aim to uncover the circuits and computations underlying mid-level visual processing in the cerebral cortex. Electrophysiological studies of cortical neurons provide hints to the visual representation, but recording sessions are too brief to explore the vast space of possible functional circuits. To gain traction, we have started to probe the function of artificial hierarchical neural networks, a class of models that now represent the highest performing general purpose computerized image recognition systems. These networks provide important insights because they are complicated and difficult to understand but, unlike cortical neurons in vivo, can be studied at great length. This allows experimental neuroscientists to hone their methods and understand the limitations to traditional approaches in the face of visual units that have highly complex functionality. In addition, studying these networks can reveal whether response properties obtained via artificial training end up being similar to those found in the cortex. The existence of analogous properties in artificial nets could suggest that similar constraints have guided the development of circuits in the brain, and it would provide the only known model to explain the complex visual representation of shape. If artificial and cortical units do not match, then the brain may still hold important insights for artificial vision. I will focus on an examination of the encoding of boundary curvature of simple shapes in V4 to make direct comparisons between electrophysiological data and deep convolutional networks.

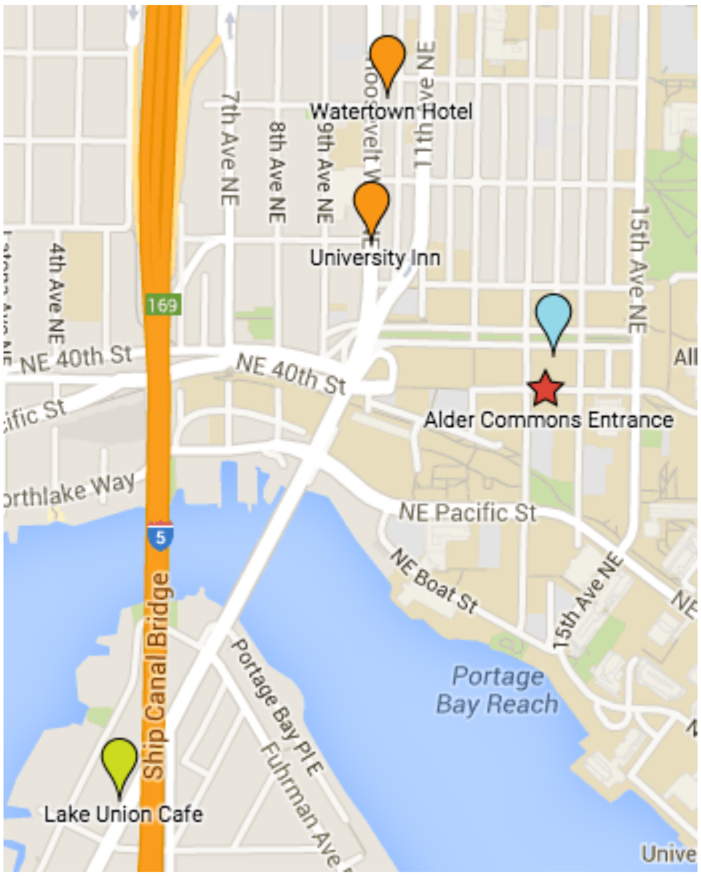
Practical Neural Networks
Greg Corrado, Google

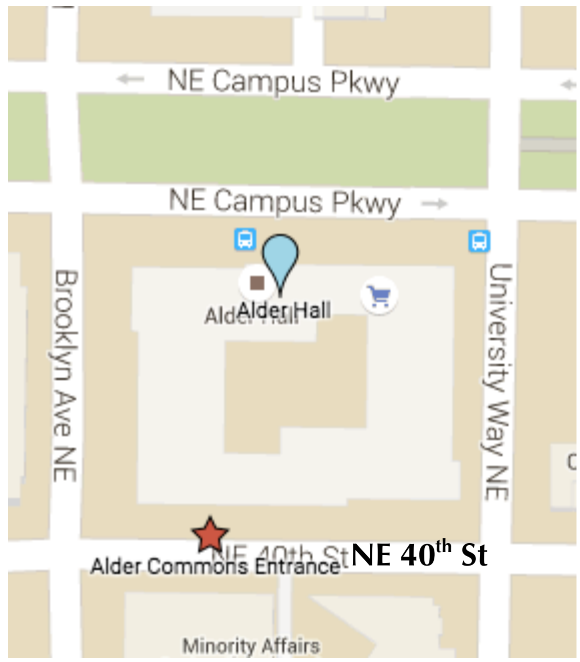
Industrial scale applications of machine learning are surprisingly important in the products and services we enjoy today. Over the last few years classical artificial neural networks have reemerged as one of the most powerful, practical machine learning tools available. More than it was driven by algorithmic advances, this “deep learning” renaissance has been fueled by the availability of ever larger data stores and clever use of vast computational resources. Greg will describe Google's large scale distributed neural network framework and the applications of neural networks to the domains of image recognition, speech recognition, and text understanding.

Location information and map

Conference venue – Alder Commons, University of Washington

The meeting and workshop are being held at Alder Commons on the University of Washington campus. Alder Commons is located in Alder Hall, at 1315 NE Campus Parkway, Seattle, WA 98105. **Importantly**, the entrance to Alder Commons is NOT from NE Campus Parkway; **enter Alder Commons from NE 40th Street**, near the intersection with Brooklyn Ave NE. On the maps below, the star shows the location of the entrance to use.



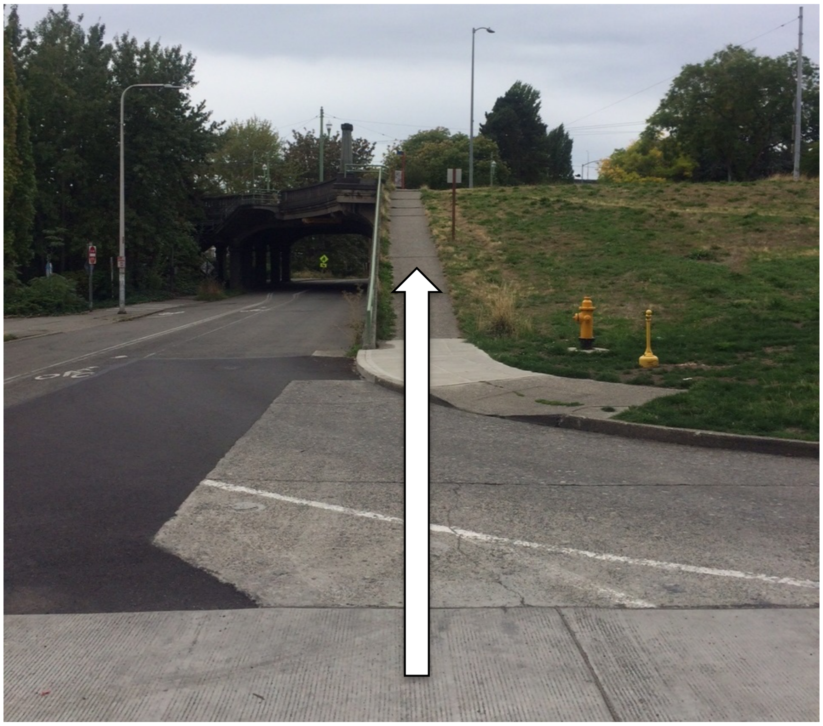


Banquet – Lake Union Cafe, 3119 Eastlake Ave E, Seattle, WA 98102

The banquet on Tuesday, September 29th is being held at the nearby Lake Union Cafe, located at 3119 Eastlake Ave E, Seattle, WA 98102. The Lake Union Cafe is just across the University Bridge from the conference venues and hotel – see the yellow marker on the map above. It is approximately a 15-minute walk. King County Metro bus route 70 also travels from the conference venue to near the Lake Union Cafe. Walking and bus directions are below:

Walking from Alder Commons (0.7 miles, 15 minutes): Turn right out the door from Alder Commons and walk west down NE 40th Street. Continue down NE 40th street (which turns into Lincoln Way) for approximately three blocks, passing Localpoint and Lander Hall. After passing

Lander Hall, cross the street and walk up the ramp (see photo below), which will take you up to the University Bridge and Eastlake Avenue. Walk across the bridge. Once across the bridge, cross the street to the other side of Eastlake Avenue at the first stoplight; the Lake Union Cafe is on the right side of the street. Continue down Eastlake Avenue, arriving at the Lake Union Cafe shortly after you pass underneath the highway bridge.



Walking from the Watertown Hotel or University Inn (0.8 miles, 15 minutes**):** Cross the street to the west side of Roosevelt Way NE. Walk south on Roosevelt Way NE towards the University Bridge. Cross the University Bridge, and continue down Eastlake Avenue. You will arrive at the Lake Union Cafe shortly after you pass underneath the highway bridge.

By bus: Catch King County Metro bus route 70 on the north side of NE Campus Parkway, at the stop for NE Campus Parkway & 12th Avenue NE. The bus will cross the University Bridge. Get off at the stop for Eastlake Ave E & E Allison St, and walk a short distance north on Eastlake Avenue to arrive at the Lake Union Cafe. The bus fare is $2.75, exact change required.