Resource Summary Report

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Rutgers University Quantitative Neuroscience Laboratory

RRID:SCR_008541
Type: Tool

Proper Citation

Rutgers University Quantitative Neuroscience Laboratory (RRID:SCR_008541)

Resource Information

URL: http://qneuro.rutgers.edu

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Description: THIS RESOURCE IS NO LONGER IN SERVICE, documented August 23, 2016. The brain is made of billions of neurons, which together form the world''s most powerful information-processing machine. Despite decades of research, the fundamental principle by which these cells work together is still unknown. Many theories for brain function have been proposed over the last century. But only in the last few years has it become possible to record simultaneously from large enough numbers of neurons to put these theories to the test experimentally. This is an unprecedented opportunity, but it opens up a new question: how do we go from the gigabytes of experimental data that we now have, to concise conclusions about the function of the brain? The data processing methods traditionally used in neuroscience are not sophisticated enough to exploit this new flood of information. Fortunately, modern statistics and machine learning theory is making great strides in precisely the type of techniques needed to process these large multivariate databases. By applying these methods to neuronal data, we can now test long-standing hypotheses about brain function. The Cell Assembly The main focus of our research is an experimental search for cell assemblies. Before describing what a cell assembly is, it will be useful to describe what it is not. The brain is often thought of as a feed-forward system. In this scheme, sensory information is processed by successive levels of cortical analyzers, each of which transforms the results of previous levels, until sensory information is in a suitable form to guide the animals behavior. In support of this idea, the pattern of connections in the cortex does appear to respect a hierarchical organization, with the output of low-level areas corresponding to a single sensory modality being integrated into high-level multi-modal areas. Responses in higher-level sensory areas appear to have more complex responses to sensory stimuli, in agreement with increased abstraction as the hierarchy is traversed. However, there are several levels at which this feed-forward picture is incomplete. At the circuit diagram level, there more connections projecting across and down the hierarchy, than there are feed-forward projections. What''s more, if information were processed in a strictly feed-forward manner, one would expect a neuron to respond identically to repeated presentations of the same sensory stimulus. Although this is a fairly good approximation in primary sensory areas of cortex, in high-level structures responses are often more variable than expected from strict sensory control. Finally, although feed-forward processing can describe how an animal could perform simple stimulus-response behaviors, it cannot explain more complex top-down behaviors such as memory or thought. An alternative point of view, put forward over 50 years ago by Canadian psychologist Donald Hebb, holds that recurrent and feedback connections play an essential role in brain function. The principal actor in this view is the cell assembly, an anatomically distributed subset of neurons, amongst which mutually excitatory connections have been strengthened by repeated co-activation, allowing the assembly to later maintain its activity through reverberation without direct sensory stimulation. This theory allows for sensory-response behavior, and also behavior resulting purely from internally generated cognitive activity, by the sequential activation of a series of assemblies, leading in turn to the production of motion. In our research, we search for signatures of assembly activity in simultaneous recordings from multiple neurons, and aim to characterize the properties of assembly activity in ways not possible from theory alone. Software for Automatic Clustering KlustaKwik is a program developed in the lab for automatic cluster analysis, specifically designed to run fast on large data sets. In order facilitate open-source development, it is now located at klustakwik.sourceforge.net. This study was supported by NIH grants MH073245 and DC009947; NSF grant SBE-0542013 to the Temporal Dynamics of Learning Center, an NSF Science of Learning Center; a National Institute on Deafness and Other Communication Disorders, NIH, grant DC-005787-01A1; and a Spanish grant FIS 2006-09294. K.D.H. is an Alfred P. Sloan fellow. We would like to dedicate this work to the memory of D. J. Amit.

Synonyms: Rutgers, Quantitative Neuroscience Laboratory

Resource Type: data or information resource, database, laboratory portal, organization portal, portal

Availability: THIS RESOURCE IS NO LONGER IN SERVICE

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Ratings and Alerts

No rating or validation information has been found for Rutgers University Quantitative Neuroscience Laboratory.

No alerts have been found for Rutgers University Quantitative Neuroscience Laboratory.

Data and Source Information

Source: SciCrunch Registry

Usage and Citation Metrics

We found 8 mentions in open access literature.

Listed below are recent publications. The full list is available at PRECISE-TBI .

Guimarães Marques MJ, et al. (2018) Long-term Potentiation Decay and Poor Long-lasting Memory Process in the Wild Rodents Proechimys from Brazil's Amazon Rainforest. Frontiers in behavioral neuroscience, 12, 2.

Leefmann J, et al. (2016) Neuroethics 1995-2012. A Bibliometric Analysis of the Guiding Themes of an Emerging Research Field. Frontiers in human neuroscience, 10, 336.

Pilutti LA, et al. (2012) Weight status in persons with multiple sclerosis: implications for mobility outcomes. Journal of obesity, 2012, 868256.

Ibáñez A, et al. (2011) Facial and semantic emotional interference: a pilot study on the behavioral and cortical responses to the Dual Valence Association Task. Behavioral and brain functions : BBF, 7, 8.

Cluff T, et al. (2009) Motor learning characterized by changing Lévy distributions. PloS one, 4(6), e5998.

Keen-Rhinehart E, et al. (2009) Interactive Methods for Teaching Action Potentials, an Example of Teaching Innovation from Neuroscience Postdoctoral Fellows in the Fellowships in Research and Science Teaching (FIRST) Program. Journal of undergraduate neuroscience education : JUNE : a publication of FUN, Faculty for Undergraduate Neuroscience, 7(2), A74.

Henshall DC, et al. (2009) Electroencephalographic and behavioral convulsant effects of hydrobromide and hydrochloride salts of bupropion in conscious rodents. Neuropsychiatric disease and treatment, 5, 189.

Maravall M, et al. (2007) Shifts in coding properties and maintenance of information transmission during adaptation in barrel cortex. PLoS biology, 5(2), e19.