Form 3-3-2

Japan-U.S. Brain Research Cooperation Program

Information Exchange Seminar Program FY2016: Report

Research Field: _ Behavioral Systems/ Cognitive_

1. Seminar title: Modeling Neural Activity: Statistics, Dynamics, and Networks (MONA2) 2016

2. Dates, from/to (06/22/2016)/(06/24/2016)

3. Location:
Waikoloa Beach Marriott Resort & Spa, Hawaii Island, Hawaii, US

4. Coordinators

Japanese Coordinator
Name Shigeru Shinomoto
Title Associate Professor
Affiliation Kyoto University

U.S. Coordinator
Name Robert E Kass
Title Professor
Affiliation Carnegie Melon University

5. Participants:

Japan: Invited participants 11 people Others 7 people

(Please give names, titles and affiliations of invited participants)

Naoshige Uchida Professor Harvard University (travel expenses supported by the US)
Tetsuo Yamamori PI RIKEN Brain Science Insitute
Shigeru Shinomoto Associate Professor Kyoto University
Tomoki Fukai PI RIKEN Brain Science Insitute
Shun-ichi Amari PI RIKEN Brain Science Insitute
Hideaki Shimazaki Postdoctral Fellow RIKEN Brain Science Insitute
Takuya Sasaki Assistant Professor The University of Tokyo
Hiroyuki Nakahara PI RIKEN Brain Science Insitute
EunJung Hwang Assistant Project Scientist UCSD (travel expenses supported by the US)
Ken Takiyama Associate Professor Tokyo University of Agriculture and Technology
Yasuhiro Tanaka Assistant Professor University of Tokyo

U.S.: Invited participants 15 people Others 28 people

(Please give names, titles and affiliations of invited participants)

Robert Kass Professor Carnegie Mellon University
Sonja Gruen Professor Research Centre Juelich
Markus Diesmann Professor Research Centre Juelich
Spencer Smith Assistant Professor UNC-Chapel Hill

Byron Yu Associate Professor Carnegie Mellon University
Carina Curto Associate Professor Penn State University
Tatyana Sharpee Associate Professor Salk Institute
Jonathan Victor Professor Weill Cornell Medical College
Andrea Hasenstaub Assistant Professor UCSF OHNS (CIN)
Susanne Ahmari Assistant Professor University of Pittsburgh
Bijan Pesaran Assistant Professor New York University
Tobias Teichert Assistant Professor University of Pittsburgh
Uri Eden Professor Boston University
Demba Ba Assistant Professor Harvard University
Vladimir Itskov Associate Professor Pennsylvania State University

6. Seminar Outline and Significance:

The second international workshop "Modeling Neural Activity: Statistics, Dynamics, and Networks" was held in Waikoloa, Hawaii, June 22-24, 2016. The primary purposes of the workshop were (1) to bring together U.S. and Japanese researchers in this area and (2) to explore fruitful interactions of modeling ideas that come from mathematics, statistics, and biophysics, especially in the era of Big Data. We chose Hawaii because it is much easier for each U.S. participant to travel to Hawaii than to travel to Japan and, similarly, it is easier for each Japanese participant to travel to Hawaii than the U.S. The airfare is also much less costly. This way the travel burden is shared across all participants. The organizers include Drs. Shun-Ichi Amari (RIKEN), Emery Brown (MIT, Harvard Medical School), Carina Curto (Pennsylvania State University), Tomoki Fukai (RIKEN), Robert Kass (Carnegie Mellon), Shigeru Shinomoto (Kyoto University), and Yasuhiro Tsubo (Ritsumeikan University). The specific objectives of the workshop are to
1. Define important problems involving statistical modeling and dynamical systems modeling, including network analysis, and useful strategies for attacking them, with special attention to the new challenges posed by Big Data;
2. Foster communication between U.S. and Japanese researchers who work on modeling neural activity;
3. Foster communication between experimental neuroscientists and those trained in statistical and computational methods;
4. Encourage young researchers, including graduate students, to present their work;
5. Expose young researchers to important challenges and opportunities in this interdisciplinary domain, while providing a small meeting atmosphere to facilitate the interaction of young researchers with senior colleagues;
6. Include as participants women, under-represented minorities and persons with disabilities who might benefit from the small workshop environment;
7. Encourage further dissemination of the findings presented at the workshop via a set of peer-reviewed articles.

(Significance)

We had two major motivations for holding this workshop. First, computational neuroscience is represented strongly in both the U.S. and Japan yet, despite great overlap in publication outlets, there has been too little concrete communication and interaction between research groups across our two countries. Second, computational neuroscience has grown, in distinct directions, from the success of biophysical models neural activity, the attractiveness of the brain-as-computer metaphor, and the increasing prominence of statistical and machine learning methods throughout science. This has helped create a rich set of ideas and tools associated with "computation" to studying the nervous system, but it has also led to a kind of balkanization of expertise. The workshop brought together statistical, biophysical, and network modeling methods in the service of experimental neuroscience. Major advances in recording and imaging technologies have put into the hands of investigators wonderful tools for conducting previously unimagined experiments, yielding rich data sources that can shed new light on basic neuroscience and its clinical implications. The data sets are, however, often large and complex, so that novel methods of analysis are needed if the wealth of new information is to be turned into useful knowledge. Furthermore, biophysical modelers are also pushing their approaches so that they can handle much larger networks and more realistically complex systems. Computational neuroscience comprises what is known as ″theoretical neuroscience,″ namely mathematical modeling, together with advanced methods for the analysis of neural data, yet these two aspects of the field, mathematical and statistical, have evolved separately. While some fundamental connections have been identified (see the chapter by Paninski, Brown, Iyengar, and Kass, in the 2010 book Stochastic Methods in Neuroscience, Oxford), there are great opportunities to push much further.

7. Seminar Results and Future Implications:

Several of the participants are working on a major review article, for the Annual Reviews series, that will discuss essential ideas of statistical modeling and mathematical modeling in neuroscience, and sketch possible ways the two fields can interact. This involves both U.S. and Japanese authors, and is thus an ongoing U.S.-Japan collaboration. In addition, many investigators established new connections with each other-especially modelers and experimentalists, including across international boundaries--and most of these individuals on the U.S. side have NIH funding. We expect to see new collaborative research forming as a result. Third, because of the tremendous enthusiasm for the high quality of the meeting, several of the U.S.-Japan organizers have begun discussing options for next steps to carry ideas forward productively, and lay the groundwork for another such gathering. We solicited ideas and suggestions from participants during the closing discussion, and received many additional comments by email afterward. The current plan is for Rob Kass and Hiro Nakahara to have several online planning meetings and a face-to-face meeting during which time we would create a draft plan for another meeting.

8. Other (implementation issues, feedback, etc.)