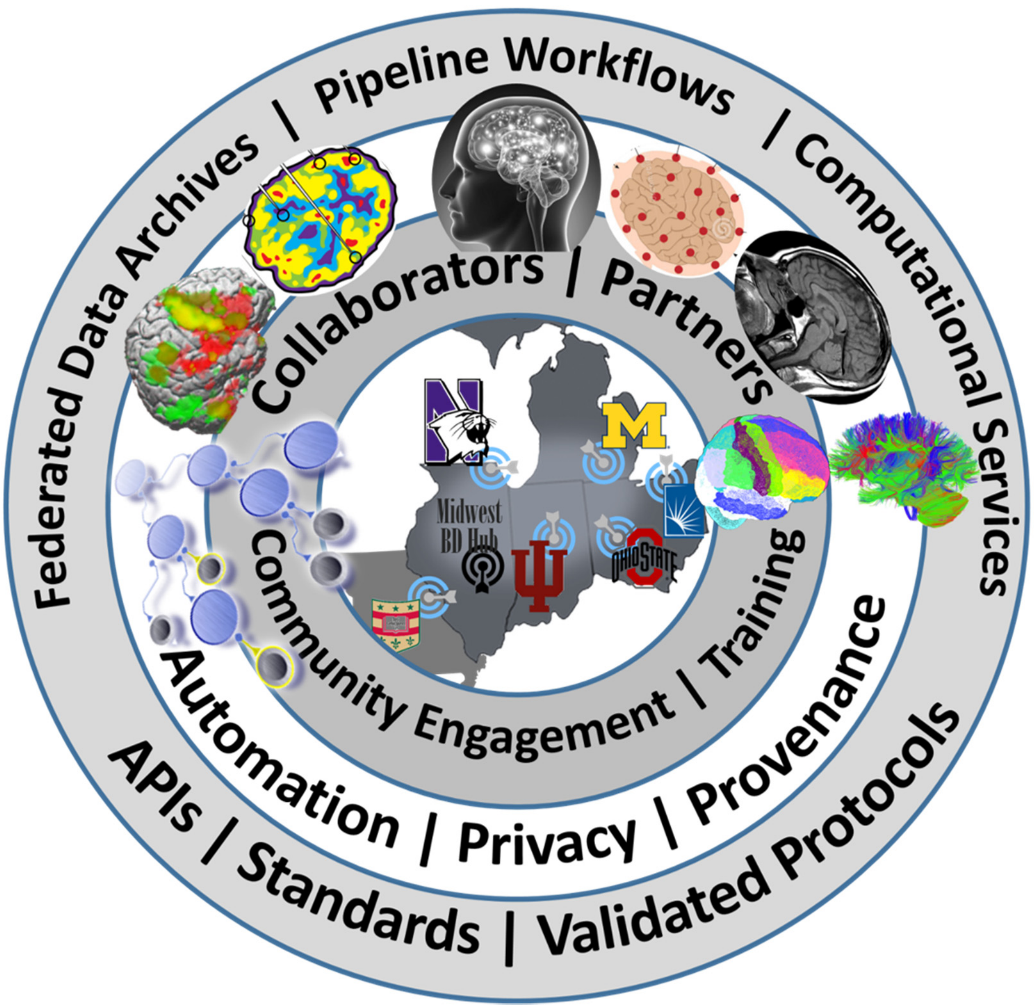
Advanced Computational Neuroscience Network (ACNN)

Midwest Workshop on Big Neuroscience Data, Tools, Protocols & Services

REPORT

Sept 27, 2016



http://www.NeuroscienceNetwork.org/ACNN_Workshop_2016.html

This report summarizes the goals, activities, results and outcomes of the 2016 Advanced Computational Neuroscience Network (ACNN) Workshop on *Big Neuroscience Data, Tools, Protocols and Services*.

Contents

The Advanced Computational Neuroscience Network (ACNN) is partially supported by NSF grants 1636840, 1636846, 1636893, 1636850, and 1550320.

Background

In fall 2015, investigators from the University of Michigan, Indiana University, Ohio State University, Case Western Reserve University, Washington University, and Northwestern University teamed up with other 45 researchers in academic institutions (University of Missouri-Columbia, Purdue University, Iowa University, Kansas University, Cincinnati Children's Hospital, Michigan State University, University of Minnesota, University of Nebraska, Medical College of Wisconsin, University of South Dakota, University of Illinois at Urbana-Champaign, Stanford University, New York University, Columbia University, University of Colorado, University of Southern California, University of Calgary) and industry partners (General Electric, Flywheel, Siemens) to form the Midwest Advanced Computational Neuroscience Network (ACNN).

- In Summer 2016, the Midwest Big Data Hub (http://MidwestBigDataHub.org) announced a funding award to support the inaugural ACNN Workshop under the Computing Community Consortium (CCC).
- In September 2016, the National Science Foundation announced the funding the ACNN as a MBDHub Spoke (http://www.nsf.gov/awardsearch/showAward?AWD_ID=1636840).
- The ACNN Workshop took place September 19-20, 2016 at the Michigan League, University of Michigan, Ann Arbor, MI.

The mission of the Network is to build broad consensus on the core requirements, infrastructure, and components needed to develop a new generation of sustainable interdisciplinary Neuroscience Big Data research.

Workshop Logistics

Venue	**Michigan League,** University of Michigan, 911 N University Ave, Ann Arbor, MI 48109, Phone: (734) 764-0446, Web: **https://uunions.umich.edu/league**
Dates	September 20-21, 2016
Accommodation	○ **Michigan League**, University of Michigan, 911 N University Ave, Ann Arbor, MI 48109, Phone: (734) 764-0446, Web: https://uunions.umich.edu/league ○ The **Holiday Inn** Near the University of Michigan, 3600 Plymouth Road, Ann Arbor, MI 48105, 734-796-9800, Web: http://www.hiannarbor.com
Travel Scholarships	43 Travel scholarships were awarded to Students, Postdocs, Fellows, and other Trainees on a first-come-first-serve bases
URL	**www.NeuroscienceNetwork.org/ACNN_Workshop_2016.html**

Organizers

- University of Michigan: Ivo Dinov, Rich Gonzales, George Alter
- Indiana University: Franco Pestilli, Olaf Sporns, Andrew Saykin
- OSU: Dhabaleswar Panda, Khaled Hamidouche, Xiaoyi Lu, Hari Subramoni

- CWRU: Satya Sahoo
- Washington University: Daniel Marcus, and Northwestern University: Lei Wang

Goals

Students, trainees, fellows, junior investigators, and outside researchers in Midwest academic institutions and industry partners attended and actively participated in this workshop. The workshop goals included

(1) building an active Midwest Neuroscience Network Community,
(2) open-sharing of data-intense challenges, datasets, research projects, expertise, software, services, protocols, resources, learning modules, and
(3) productive discussions of joint (multi-institutional) grants, training opportunities, publications, research projects.

The workshop organizers and presenters promoted open-science and deep community involvement (early registration, active workshop participation, post-workshop activities and interactions). A diverse array of participants attended the workshop and the early evidence suggests the formation of new collaborations on development of software tools, services, learning materials, end-to-end pipeline workflows.

Summary Statistics

Statistics	Values	Notes
Number of Attendees	101	registered only
Number of Participating Trainees	63	
Number of Participating Institutions	15	
Number of Academic Institutions	22	
Number of Government and Non-profit Orgs	3	
Number of Participating Industry Partners	5	
Number of scholarships awarded	43	
Number of US States represented	13	
Number of Presentations	32	conference and unconference

Workshop Contacts

- Administrative: Alison Martin (aalison@med.umich.edu)
- Programmatic: Ivo Dinov statistics@umich.edu.
- ACNN Network: info@NeuroscienceNetwork.org

Workshop Handbook

A workshop Handbook was designed and disseminated at the workshop to help attendees with logistics, program, activities and processes.

Program

Day 1 (Tue 9/20/16)

Time	Sessions	Details
8-9 AM	Registration	Onsite registration, nametags, booklets, breakfast, coffee, networking
9:00-9:45	Workshop Overview ACNN Background, Scope Organization/Format	(1) Workshop Overview (Ivo Dinov), 15 min (2) Midwest Big Data Hub Health Sciences (Brian Athey), 15 min (3) Advanced Computational Neuroscience Network (Rich Gonzalez), 15-min
9:45-12:15	Big Neuroscience Data, Gaps/Barriers, Analytical Methods, Available Resources, Distributed Services, and Opportunities	(1) Indiana Computational Neuroimaging Research (Franco Pestilli) 20 min (2) OSU Network Based Computing (Dhabaleswar Panda, Khaled Hamidouche, Xiaoyi Lu, Hari Subramoni) 20 min (3) CWRU Biomedical and Healthcare Informatics (Satya Sahoo) 20 min **BREAK 10 min** (4) HumanConnectome: Neuroimaging Informatics and Analysis Center (Daniel Marcus) 20 min (5) SchizConnect: Flexible, Dynamic Platform for Mediating Multiple Schizophrenia Neuroimaging Databases (Lei Wang) 20 min (6) Michigan Institute for Data Science (Ivo Dinov), 20 min
12:15-1:15	**Lunch Break**	
1:15-3:15	Unconference Breakout Sessions (4 consecutive slots of 30-min each). Participants are encouraged to lead breakouts and mix with others.	Informal self-organized sessions (30-minutes each), round-robin rotations Web-form: https://goo.gl/bKWNvi
3:15-3:30	**Break**	
3:30-4:30	Breakout sessions reports Web-form: https://goo.gl/bKWNvi	Analytics Pipelines Tools/Services Challenges Known Solutions Predictive analytics - methods, tools, protocols, workflows Provenance (data, protocols, results, reproducibility or research findings) Computational Neuroscience Methods Case-studies, data archives, Cloud Services
4:30-5:30	Posters/Demos	Applications (brain mapping, imaging-genetics neurodegeneration) Web-form: https://goo.gl/bKWNvi
6:00-8:00 PM	**Dinner**	Social Networking

Time	Day 2 (Wed 9/21/16) Sessions	Details
8:00-8:30 AM	Registration	Onsite registration, nametags, booklets, breakfast, coffee, networking
8:30-11:00	Core Big Neuroscience Infrastructure	(1) Neuroscience Information Framework: A Cooperative And Collaborative Information, Resource, and Data Discovery Infrastructure (Jeff Grethe) 25 min (2) Indiana Computational Neuroimaging Research (Franco Pestilli) 25 min (3) OSU Network Based Computing (Dhabaleswar Panda, Khaled Hamidouche, Xiaoyi Lu, Hari Subramoni) 25 min **BREAK 10-min** (4) CWRU Biomedical and Healthcare Informatics (Satya Sahoo) 25 min (5) Predictive Big Data Analytics (Ivo Dinov), 25 min
11:00-11:10	**Break**	
11:10-12:10	Lightning Talks	3-5 min Rapid-Fire talks from the Midwest Big Data Community Web-form: https://goo.gl/bKWNvi
12:10-1:10	**Lunch Break**	
1:10-2:40	Unconference Breakout Sessions (3 consecutive slots of 30-min each). Participants are encouraged to lead breakouts and mix with others.	Informal self-organized sessions (30-minutes each), round-robin rotations: Brain structure, Function, Diffusion, Physiology; File Formats; Pipeline workflow Environments; Cloud Services: JIRA, GitHub, Trello, AWS, MapReduce, Hadoop; Driving Biomedical/Healthcare Challenges, etc. Web-form: https://goo.gl/bKWNvi
2:40-2:50	**Break**	
2:50-3:30	Breakout sessions reports	Analytics Pipelines Tools/Services
		Challenges
		Known Solutions
		Predictive analytics - methods, tools, protocols, workflows
		Provenance (data, protocols, results, reproducibility or research findings)
		Computational Neuroscience Methods
		Case-studies, data archives, Cloud Services
3:30-4:00	Live Demos Try-It-Now	Applications (brain mapping, imaging-genetics neurodegeneration)
4:00 PM	**Conclusions**	Workshop Evaluation (http://goo.gl/forms/qSI6PGiN4PfTs6Fg1). Collaborations, joint papers, extramural grant opportunities, Shareable resources, Available Webapps, APIs, workflows
	Post-conference Report	Generate a Report (due 1 month after workshop)

Working Groups

Participants were encouraged to self-organize working groups (e.g., training, TBI, ECoG, connectomics, compressive big data analytics, etc.) that focus on specific Big Neuroscience Data challenges resource, translational education activities, and collaborative opportunities.

These working groups (WG) are initiated organically, coalesce at the breakout sessions, or start informally at social networking periods (e.g., breaks). More information is available online: https://docs.google.com/spreadsheets/d/1Nu8TAAlGL2kvr2bE7TiN9TK2L6oRRCEunI8MiMCHLRE/edit#gid=1581386323

Unconference Breakout Sessions

During the Workshop, Breakout Sessions were proposed by a wide range of investigators from various Midwest academic, government and industry organizations. All participants **reviewed** and many **proposed** discussion topics at the appropriate times. Web-form: https://goo.gl/bKWNvi. Unconference Breakout Sessions included consecutive slots of 30-min each. Workshop participants self-selected to lead breakouts and mix with others. These were Informal self-organized sessions. Participants rotated through breakouts

Day 1 Breakout Sessions

- Deep learning for neurological image analysis (Alexandr Kalinin, akalinin@umich.edu, @alxndrkalinin, SOCR/DCM&B, University of Michigan) -- List of references: http://bit.ly/2cD8ydo
- Deep learning for neurological image analysis (Alexandr Kalinin, SOCR/DCM&B, University of Michigan) -- List of references: http://bit.ly/2cD8ydo --- 3D SparseConvNet: https://github.com/btgraham/SparseConvNet --- ICML Workshop on deep learning for small data: http://bit.ly/2cO2ob0
- Emerging Issues in Optical Imaging Data Analysis (Mark Reimers, Neuroscience, Michigan State)
- NSF Programs 2:15-2:30PM Fen Tsao NSF Big Data Projects programmatic interests 2:30-2:45PM Ken Whang NSF Computational Neuroscience and Infrastructure programmatic interests
- "Manifests & Metadata
- Defining a standard for container-based processing from data management platforms
- (John Flavin, XNAT, WashU; Gunnar Schaefer, Flywheel, Stanford)"
- Big Data and intracranial EEG (ECoG) (Stephen Gliske, University of Michigan)

Day 2 Breakout Sessions

- High-Performance Big Data Processing Tools for NeuroScience (Xiaoyi Lu, D. K. Panda, The Ohio State University)
- SCA: ONERE & RADY: Scalable Compute Archive system including data publishing, integrated pipeline processing on grid/cloud; Franco Pestilli; Arvind Gopu; Soichi Hayashi; John West Indiana University
- Integrated Cloud Data/Computational Platform/Visualization Engine (Ivo DInov, UMich)
- "DIPY Diffusion and Quantitative MRI analysis codebase; Eleftherios Garyfallidis Indiana University"
- Industry partners projects (10 mins each).
    - Victor Miranda GE, Machine learning applied to TBI.
    - Dingxin Wang Siemens, Data Acquisition Plan for Life-Span Human Connectome Projects.
    - Can Akgun Flywheel, Neuroimaging data and algorithms management. each: 7

Hands-on/Try-It-Now Demos

During the conference, participants also signed to present and showcase hands-on their group's challenges, case-studies, datasets, software tools, services, computational infrastructure, and other materials and resources. Many open-science resources were showcased: https://goo.gl/bKWNvi. Examples of Demos included:

- SOCRAT: A Scalable Web Platform for In-Browser Interactive Data Analysis and Visualization (Alexandr Kalinin, SOCR/DCM&B, University of Michigan)
- DViewer: A web-based toolkit for dynamic visualization and analysis of tractography and MRI data (Syed Husain, SOCR/DCM&B, University of Michigan)
- Scalable Compute Archive system for data archival, metadata/protocol QC, integrated pipeline execution on grid/cloud; Arvind Gopu; Indiana University
- The open neuroscience embedded reproducibility environment (ONERE) web UI prototype ; Soichi Hayashi, Indiana University

Lightning Talks

During the workshop, dozens of 3-5 min Rapid-Fire talks from the Midwest Big Data Community were presented.

Index	Presenter	Affiliation	Title	Abstract
1	Alexandr Kalinin	SOCR/DCM&B, University of Michigan	SOCRAT: A Scalable Web Platform for In-Browser Interactive Data Analysis and Visualization	Common exploratory data analysis (EDA) and visualization workflows include platform dependent installation of software packages paired with case-specific low-level scripting in programming languages such as R or JavaScript, or extensive manual processing in interactive tools such as Microsoft Excel. These steps often assume coding skills as well as visualization expertise. To address these limitations we created the Statistics Online Computational Resource Analytics Framework (SOCRAT) — an interactive analytics toolbox which allows flexible, interactive data exploration and visualization on the web. SOCRAT workflows run completely in a web-browser, which makes them platform-agnostic and avoids any software installation requirements. Typical workflows start with entering, loading or simulating data, followed by data preprocessing and wrangling, and interactive data visualization to interrogate the data. Furthermore, it also supports data exploration via clustering and classification, accompanied by algorithm visualizations. As an HTML5 platform, SOCRAT was designed to easily add new charts and analysis modules into the its ecosystem, enabling seamless interaction with existing data input, storage, and analysis tools. This provides users with scalable platform for online data exploration that implements extensive charting capabilities, powerful analysis tools, user-friendly interactive interface, and easy customization.
2	Brad Sutton	Univ of Illinois at Urbana-Champaign	Local Eucalyptus Cloud for Enabling Exploratory High Throughput Neuroimaging Analysis: Initial Experience	The Biomedical Imaging Center at Beckman Institute at the University of Illinois has constructed a private Eucalyptus cloud for high throughput neuroimaging analysis. The system has 60 cores with 18GB RAM per core. Users can roll up small, medium, and large instances of the NITRC-CE (www.nitrc.org) with appropriate versions of neuroimaging software installed, similar to launching on AWS. Users can maintain specific versioning of different software components over the lifetime of the project in disk images. Users have found that the system provides a low-risk environment for performing large scale analysis and enables them to investigate the dependency of results on parameter choices. Examples of use include a large-scale project with 428 participants in which Freesurfer parcellations, bedpostx, and probtrackx2 were run for structural connectomes.
3	Brad Sutton	Univ of Illinois at Urbana-Champaign	PowerGrid for harnessing high performance computing to reconstruct large	Non-Cartesian acquisitions offer many benefits for neuroimaging with MRI, including: more efficient acquisitions, higher SNR in diffusion scans, shorter echo times, and flexible tradeoffs between spatial resolution and overall acquisition time. However, non-Cartesian acquisitions result in large raw data files that can take many weeks to reconstruct on commonly available workstations. This challenge is exacerbated if the data is to be reconstructed with a 64-channel head coil for parallel imaging, multi-shot acquisitions with phase

			sets of high-resolution non-Cartesian MRI data	navigation, magnetic field inhomogeneity correction for long readouts, and incorporating prior information. Here we demonstrate the development of open source image reconstruction code for non-Cartesian MRI leveraging GPUs and high performance computing resources via OpenACC and MPI to achieve computationally intensive reconstructions in reasonable time frames. The code is written to be similar to a popular open-source MATLAB reconstruction code through the use of the Armadillo linear algebra library. The code enables high performance MR image reconstruction on world-class systems, such as the Blue Waters supercomputer, while still being accessible and modifiable to researchers that are not HPC experts.
4	Xiaoyi Lu	The Ohio State University	High-Performance Big Data Processing Tools for NeuroScience	
5	Md. Wasi-ur-Rahman	The Ohio State University	High-Performance Hadoop and Spark MapReduce on Modern HPC Systems	Big Data processing and High Performance Computing (HPC) are converging fast to meet the challenges exposed by large-scale data analysis. MapReduce is being used extensively through different execution frameworks (e.g. Hadoop, Spark) on modern HPC systems. Most of these HPC systems follow the Beowulf architecture with separate parallel storage system and very limited local storage. Also, high performance interconnects (e.g. InfiniBand) used in these systems can provide extremely low latency and high bandwidth. Efficient utilization of these resources through enhanced designs for MapReduce is crucial. In this work, we present an enhanced MapReduce design for both Hadoop and Spark frameworks. It introduces RDMA (Remote Direct Memory Access) based shuffle engine to leverage the benefits of high performance interconnects. We also propose different deployment architectures while utilizing Lustre and provide fast shuffle strategies with dynamic adjustments. These works are publicly available under the High-Performance Big Data (HiBD) project.
5	Ming Tang	University of Michigan, Ann Arbor		A unique archive of Big Data on Parkinson's Disease is collected, managed and disseminated by the Parkinson's Progression Markers Initiative (PPMI). The integration of such complex and heterogeneous Big Data from multiple sources offers unparalleled opportunities to study the early stages of prevalent neurodegenerative processes, track their progression and quickly identify the efficacies of alternative treatments. Many previous human and animal studies have examined the relationship of Parkinson's disease (PD) risk to trauma, genetics, environment, co-morbidities, or life style. The defining characteristics of Big Data–large size, incongruency, incompleteness, complexity, multiplicity of scales, and heterogeneity of information-generating sources–all pose challenges to the classical techniques for data management, processing, visualization and interpretation. We propose, implement, test and validate complementary model-based and model-free approaches for PD classification and prediction. To explore PD risk using Big Data methodology, we jointly processed complex PPMI imaging, genetics, clinical and demographic data.Model-free Big Data machine learning-based classification methods (e.g., adaptive boosting, support vector machines) can outperform model-based techniques in terms of predictive precision and reliability (e.g., forecasting patient diagnosis). We observed that statistical rebalancing of cohort sizes yields better discrimination of group differences, specifically for predictive analytics based on heterogeneous and incomplete PPMI data. UPDRS scores play a critical role in predicting diagnosis, which is expected based on the clinical definition of Parkinson's disease.
6	Chao Gao	University of Michigan, Ann Arbor	Applications of Model-based and Model-free Techniques for Diagnostic Prediction and Classification of Amyotrophic Lateral Sclerosis(ALS)	
8	Alexander Gates	Indiana University	Comparing the Multi-scale	It has recently been argued that the human brain functions across many temporal and spatial scales. This multi-scale structure can be

			Structure of Human Connectomes	captured by complex networks which reveal how the pattern of connectivity between brain regions varies from local properties of the individual regions to the global organization of the entire system. The community structure of functional brain networks, in particular, has been related to cognitive behavior with reported alterations in structure for brains in disease. Here, we introduce a framework for the comparison of network communities with multi-scale structure that intuitively captures how individual scales contribute to the overall similarity. The framework is used to differentiate the functional connectome in schizophrenia.
9	Stephen Gliske	University of Michigan, Ann Arbor	Identification of the seizure onset zone using big data analysis of High Frequency Oscillations	
10	Vincent Koppelmans	University of Michigan, Ann Arbor	Regional cerebellar volumetric correlates of manual motor and cognitive function	Cerebellar volume declines with advancing age. However, only a few studies have investigated age differences in regional cerebellar volume (RCV) and their association with sensorimotor and cognitive function. In a sample of 213 healthy older adults we investigated the association of RCV with age, motor skills, and cognition. Volume of two cerebral regions was obtained for comparison of effect sizes. RCVs were derived from T1-weighted MRI scans using an automated segmentation method called SUIT and clustered using principal component analysis. We derived RCV and brain volumes using SUIT software combined with advanced normalization tools (ANts) and FreeSurfer respectively. Both ANTs and FreeSurfer are computationlly heavy programs that can take many hours to run per dataset. For this, we used the University of Michigan Flux high performance computing cluster. Motor and cognitive outcome measures were clustered into 2 motor compound scores (left and right hand manual motor skill) and 2 cognitive compound scores (“Verbal memory and mental flexibility”, and “Mental rotation and inhibitory control”). We found some evidence that some clusters of the cerebellum are more involved in motor performance (e.g., Curs I and lobule I-IV) whereas others seem to be more involved in cognitive functioning (Lobule VIIIb + IX). Small to moderate effect sizes of the here reported brain-behavior associations suggest that RCV is important in sensorimotor and cognitive performance, and that these associations are not mainly mediated by volume of cortical regions, considering similar effect sizes. These results provide new insights into cerebellar contributions to behavior in healthy older adults.
11	Syed Husain	SOCR/DCM&B, University of Michigan	DViewer: A web-based toolkit for dynamic visualization and analysis of neuroimaging datasets	
12	Arthur Gerhson	Case Western Reserve University	Cloudwave Signal Format: An Open Semantic Data Format for Electrophysiological Signal Data	
13	Eunjee Lee	University of Michigan	Bayesian Hierarchical Group Spectral Clustering for Brain Functional Connectivity	We propose a Bayesian group hierarchical spectral clustering model to examine if the functional connectivity is disrupted in subjects with brain disorders. Our method decomposes the functional connectivity matrices into an underlying relational structure among brain areas and subject-specific network in a low-dimensional space. An additional layer is added in our model to incorporate effects of other covariates, which enables to test the group difference of functional connectivity. We take a Bayesian approach to estimate parameters in our model. Our real data analysis revealed that bilateral precuneus had weaker connection between right posterior cingulate gyrus and left angular gyrus for Alzheimer’s disease patients than mild cognitive impairment (MCI) patients. There was connectivity difference of paracentral gyrus with other brain regions including superior, middle, inferior frontal gyri.

Shareable Resources

A web-form (https://goo.gl/okbqF1) was used to gather and aggregate items for inclusion in the ACNN sharable resources. Examples (not an exclusive list) of appropriate resources that may be suggested include:

- Highly scalable APIs
- Relevant publications
- Cloud-services
- Computational Resources
- Algorithms, methods, techniques
- Education and Training Opportunities

The real-time summary of the results and a tabular representation of previously submitted resource meta-data.

Trainee/Fellow Scholarship Application

43 travel/accommodation scholarships were awarded to Students, Postdocs, Fellows, and other Trainees to sponsor their travel and local accommodation. Awards were made base on merit, first-come-first-serve.

Trainee Scholar	Affiliation	Type (undergrad, grad, postdoc, fellow, young investigator)
Seungyoung Hwang	Johns Hopkins University	Grad
Jingyang Zhou	New York University	Grad
Malika Datta	Columbia University	Grad
Uttara Tipnis	Purdue University	Grad
Alexander Gates	Indiana University	Grad
Asish Banik	Michigan State University	Grad
Vineet Raghu	University of Pittsburgh	Grad
Kathryn Alpert	Northwestern University	Grad
Wasiur Rahman	The Ohio State University	Grad
Shashank Gugnani	The Ohio State University	Grad
Chunyu Song	Washington University in St. Louis	Grad
Elizabeth Fox	Wright State University	Grad
Vibha Viswanathan	Purdue University	Grad
Scott Lewis	University of Missouri - St. Louis, Hughes Lab	Grad
Charlie Vollmer	Colorado State University	Grad
Rejaul Karim	Michigan State University	Grad
Yiying Liu	Case Western Reserve University	Grad
Bradley Caron	Indiana University	Grad
Brent McPherson	Indiana University	Grad
Daniel Bullock	Indiana University	Grad

Dipti Shankar	The Ohio State University	Grad
Elise Jing	Indiana University	Grad
Josh Faskowitz	Indiana University	Grad
Joshua Valdez	Case Western Reserve University	Grad
Kamalaldin Kamalaldin	Kalamazoo College	Grad
Kefei Liu	Indiana University School of Medicine	Grad
Nusrat Islam	The Ohio State University	Grad
Arthur Gershon	Case Western Reserve University	Post-Doc
Michael Moore	Michigan State University	Post-Doc
Sandra Smieszek	Case Western Reserve University	Post-Doc
Shuai Chen	Washington University in St. Louis	Post-Doc
Mahdi Moqri	University of Florida	Young Investigator
John Flavin	Washington University, NRG (Dan Marcus)	Young Investigator
David Johnson	Manchester University	Young Investigator
John West	Indiana University Center for Neuroimaging	Young Investigator
Li Shen	Indiana University	Young Investigator
Brad Sutton	University of Illinois at Urbana-Champaign	Young Investigator
Eleftherios Garyfallidis	Indiana University	Young Investigator
Xiaowei Song	Northwestern University	Young Investigator
Xiaoran Yan	Indiana University	Young Investigator
Jonathan Dudley	Cincinnati Children's Hospital Medical Center	Young Investigator
Jonathan Winstone	Washington University in St. Louis	Young Investigator
Arvind Gopu	Indiana University - Pervasive Technology Institute	Young Investigator

Partner Participation

A number of non-academic partners contributed to the blend of multi-institutional participants enriching the event and providing a balanced view of the challenges, gaps, resources, and opportunities in the field of computational neuroscience. Examples of these include

Affiliation	**Partners**
Department of Defense/VA Interagency Program Office Health IT	John Burke, Julie White, Mike Ross, Gaurav Seth Stephen Konya, Andrew Drew, Russell Davis
National Science Foundation	Kenneth Whang, Fan Zhao
Arbor Research Collaborative for Health	Lisa Henn
China Data Center	Juanle Wang
Flywheel	Gunnar Schaefer
Level X Talent	Michael Conlin
Spark	Chris Roszell

Academic Participants	Number of Participants
Case Western Reserve University	5 attended
Cincinnati Children’s Hospital Medical Center	1 attended
Colorado State University	1 attended
Columbia University	1 attended
Eastern Michigan University	1 registered, 0 attended
Indiana University	16 attended
Johns Hopkins University	1 attended
Kalamazoo College	1 attended
Manchester University	1 attended
Michigan State University	9 registered, 8 attended
New York University	1 attended
Northwestern University	4 attended
Oakland University	3 registered, 2 attended
Purdue University	3 registered, 2 attended
The Ohio State University	8 attended
University of California	1 attended
University of Florida	3 registered, 1 attended
University of Illinois	1 attended
University of Michigan	48 registered, 26 attended
University of Missouri	1 attended
University of Pittsburgh	1 attended
Washington University	5 attended
Weill Cornell Medical College	1 registered, 0 attended
Wright State University	2 attended

Sponsors

The National Science Foundation, http://www.nsf.gov/news/news_summ.jsp?cntn_id=136784

Midwest Big Data Hub, http://MidwestBigDataHub.org

The Michigan Institute for Data Science (MIDAS), http://midas.umich.edu

The Indiana Imaging Research Facility (IRF), https://www.indiana.edu/~irf/home

OSU Network Based Computing, http://nowlab.cse.ohio-state.edu

CWRU Biomedical and Healthcare Informatics, https://goo.gl/l19s07

Michigan Nutrition Obesity Research Center (MNORC) http://mmoc.med.umich.edu

Post-conference Evaluation

At the conclusion of the workshop, all attendees were asked to anonymously complete a workshop evaluation survey which was submitted electronically as a web-form (http://goo.gl/forms/qSI6PGiN4PfTs6Fg1). The aggregate results of this evaluation will be used to improve, enhance and expand future ACNN training events, activities and bootcamps.

As of September 22, 2016, the results of the survey (https://docs.google.com/a/umich.edu/forms/d/e/1FAIpQLSflpWyA5uzs1DoUWiNw6rUzC1MpEZzGr2uz-UCUi4hmoyhoyQ/viewanalytics?usp=form_confirm) are summarized below:

Demographics

Describe your background, expertise and interests in Big Neuroscience Data and Predictive Analytics
ComputationalComputational neuroscientist Medical image computing, bioinformatics Computer Scientist with master'smaster's degrees in Computer Science and Bioinformatics, interested in multidisciplinary science, web portals, usability, big data management and processing. We are collaborating with Dr. Franco Pestilli in prototyping a web portal based system that allows archival of datasets and application environments (VMs, Docker containers, etc.) including code tied to publications. Predictive P analytics and computational neuroimaging

What is your job role?

Undergraduate student	1
Graduate/professional student	0
Post doctoral researcher	0
Scholar/Fellow	0
Faculty	3
Developer	0
Researcher/Scientist	0
Administrator	0
Government official	0
Industry partner	0
Other	1

Undergraduate student	1	20%
Graduate/professional student	0	0%
Post doctoral researcher	0	0%
Scholar/Fellow	0	0%
Faculty	3	60%
Developer	0	0%
Researcher/Scientist	0	0%
Administrator	0	0%
Government official	0	0%
Industry partner	0	0%
Other	1	20%

How did you hear about this event?

Question	Count	
Internet search	1	
Friend / Colleague	4	
Emailed invitation	1	
Another website	0	
Our website	0	
Other	0	
Internet search	1	20 %
Friend / Colleague	4	80 %
Emailed invitation	1	20 %
Another website	0	0%
Our website	0	0%
Other	0	0%

What attracted you to participate in the ACNN Workshop?
I am co-PI on the ACNN grant
Workshop theme aligns with my research interests very well.
Our collaborator Dr. Franco Pestilli suggested we attend the workshop.
Transdisciplinary open-science opportunities in computational neuroscience research and application.
Feedback
Overall, how would you rate the event? [Overall]

Question	Count	
1	0	0%
2	0	0%
3	0	0%
4	1	20%
5	4	80%

How helpful was the content presented at the event? [Overall]

Question	Count	
1	0	0%
2	0	0%
3	0	0%
4	1	20%
5	4	80%

How engaging were the speakers at the event? [Overall]

Question	Count	
1	0	0%
2	0	0%
3	0	0%
4	1	20%
5	4	80%

How likely is it that you would recommend the event to a colleague? [General]

Question	Count	
1	0	0%
2	0	0%
3	0	0%
4	1	20%
5	4	80%

How likely are you to attend a similar event again in the future? [General]

Question	Count	
1	0	0%
2	0	0%
3	0	0%
4	1	20%
5	4	80%

Accommodation [Logistics]

Question	Count	
1	0	0%
2	0	0%
3	0	0%
4	1	20%
5	4	80%

Welcome kit [Logistics]

Question	Count	
1	0	0%
2	0	0%
3	0	0%
4	1	20%
5	4	80%

Communication emails [Logistics]

Question	Count	
1	0	0%
2	0	0%
3	0	0%
4	1	20%
5	4	80%

Transportation [Logistics]

Question	Count	
1	0	0%
2	1	20%
3	0	0%
4	0	0%
5	4	80%

Welcome activity [Logistics]

Question	Count	
1	0	0%
2	0	0%
3	1	20%
4	0	0%
5	4	80%

Venue [Logistics]

Question	Count	
1	0	0%
2	0	0%
3	0	0%
4	0	0%
5	5	100 %

Activities [Logistics]

Question	Count	
1	0	0%
2	0	0%
3	0	0%
4	1	20%
5	4	80%

Closing ceremony [Logistics]

Question	Count	
1	0	0%
2	0	0%
3	2	40%
4	0	0%
5	3	60%

Workshop facilities were satisfactory [Workshop Arrangements]

Question	Count	
1	0	0%
2	0	0%
3	0	0%
4	1	20%
5	4	80%

Workshop facilitators were effective in communicating ideas and issues [Workshop Arrangements]

Question	Count	
1	0	0%
2	0	0%
3	0	0%
4	1	20%
5	4	80%

Workshop facilitators were effective in organizing sessions so that I was actively involved [Workshop Arrangements]

Question Count
1 0 0%
2 0 0%
3 0 0%
4 1 20%
5 4 80%

A collaborative and helpful tone was established during the session [Workshop Arrangements]

Question Count
1 0 0%
2 0 0%
3 0 0%
4 1 20%
5 4 80%

Overall workshop logistics were well-planned and organized [Workshop Arrangements]

Question Count
1 0 0%
2 0 0%
3 0 0%
4 1 20%
5 4 80%

Learn Big Data Advances, Challenges and Opportunities [Workshop Outcomes]

Question Count
1 0 0%
2 0 0%
3 0 0%
4 1 20%
5 4 80%

Learn strategies for efficient Big Data management [Workshop Outcomes]

Question Count
1 0 0%
2 0 0%
3 1 20%
4 0 0%
5 4 80%

Learn the practice of Big Data Analytics [Workshop Outcomes]

Question Count
1 0 0%
2 0 0%
3 1 20%
4 0 0%
5 4 80%

Learn about computational Neuroscience applications of Big Data [Workshop Outcomes]

Question Count
1 0 0%

Question	Count	
2	0	0%
3	0	0%
4	1	20%
5	4	80%

Professional networking [Workshop Outcomes]

Question	Count	
1	0	0%
2	0	0%
3	0	0%
4	0	0%
5	5	100 %

Sessions allowed for interactive exchanges [Workshop Sessions]

Question	Count	
1	0	0%
2	0	0%
3	0	0%
4	1	20%
5	4	80%

Usefulness of the presented data, resources, tools and services [Workshop Sessions]

Question	Count	
1	0	0%
2	0	0%
3	0	0%
4	1	20%
5	4	80%

Sessions were structured and organized well [Workshop Sessions]

Question	Count	
1	0	0%
2	0	0%
3	0	0%
4	1	20%
5	4	80%

Welcome activity [Which sessions did you find most relevant?]

Question	Count	
Not relevant	0	
Relevant	2	
Very relevant	2	
Did not attend	1	
Not relevant	0	0%
Relevant	2	40 %

Question	Count	
Very relevant	2	40 %
Did not attend	1	20 %

Speaker #1 [Which sessions did you find most relevant?]

Question	Count	
Not relevant	0	
Relevant	2	
Very relevant	2	
Did not attend	1	
Not relevant	0	0%
Relevant	2	40 %
Very relevant	2	40 %
Did not attend	1	20 %

Activity #1 [Which sessions did you find most relevant?]

Question	Count	
Not relevant	0	
Relevant	2	
Very relevant	2	
Did not attend	1	
Not relevant	0	0%
Relevant	2	40 %
Very relevant	2	40 %
Did not attend	1	20 %

Speaker #2 [Which sessions did you find most relevant?]

Question	Count	
Not relevant	0	
Relevant	2	
Very relevant	2	
Did not attend	1	
Not relevant	0	0%
Relevant	2	40 %
Very relevant	2	40 %
Did not attend	1	20 %

Activity #2 [Which sessions did you find most relevant?]

Question	Count	
Not relevant	0	

Question	Count	
Relevant	2	
Very relevant	2	
Did not attend	1	
Not relevant	0	0%
Relevant	2	40 %
Very relevant	2	40 %
Did not attend	1	20 %

Closing activity [Which sessions did you find most relevant?]

Question	Count	
Not relevant	0	
Relevant	0	
Very relevant	2	
Did not attend	3	
Not relevant	0	0%
Relevant	0	0%
Very relevant	2	40 %
Did not attend	3	60 %

List a couple of BIG IDEAS about Big Neuroscience Data that came to you during this workshop?

Collaborate with Flywheel and similar groups if possible.

Form working groups on specific topics (e.g., connectomics, TBI, training, etc.)

Notes

Below are some notes from the workshop that may suggest specific follow up actions and activities:

- Aggregate **meta-data about (open) computational neuroscience resources** of interest to ACNN community
- Develop an **ACNN Resourceome Navigator** allowing the community to search, traverse and explore available resources, identify potential interoperability and integration points, and build meta-resources based on disparate infrastructure, available datasets, open-source software, web-services, etc.
- Design the ACNN website to allow portal search, reviews, collaboration and interaction on CDE, provenance, workflows, projects, etc.
- Presenters to post their demos/presentations/etc. on workshop website
- Promote formation of Working Groups (WGs)
- FAIR principles for advancing open-science (findable, accessible, interoperable, reusable)
- May need better management of unconference presenters (include coaching for junior investigators)
- Plan meetings much more in advance (2017 Indiana/Bloomington, 2018, OSU/Columbus, 2019 TBD)
- Develop training and education materials to provide a springboard for undergrads, grads, transdisciplinary scholars to get involved and advance in the field of computational neuroscience
- Develop/propose pilot collaborative projects among subsets of the key ACNN institutions
- Other …

Participants

List of Workshop presenters and participants.

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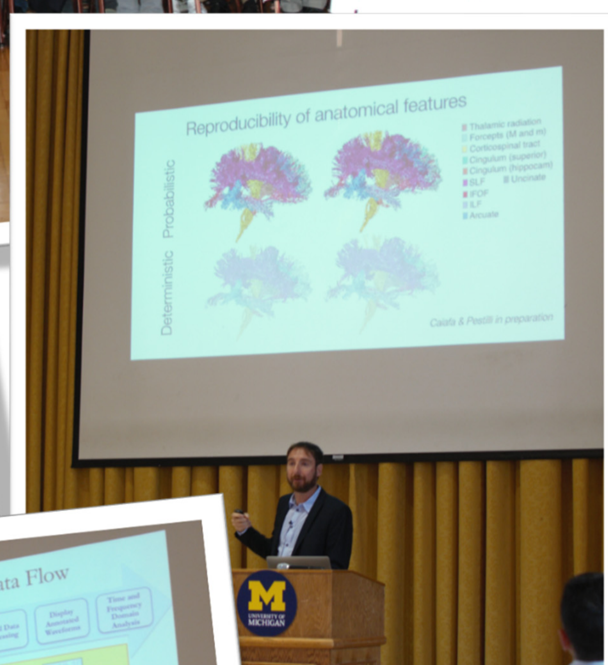
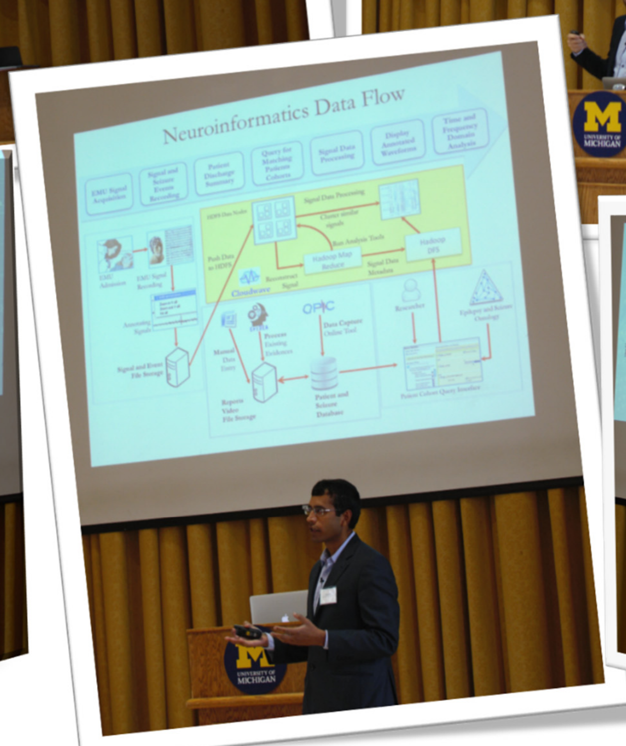
Event Photos

A collage of photos from the 2016 ACNN Big Neuroscience Data Workshop


Midwest Workshop on
Big Neuroscience Data,
Tools, Protocols & Services
Computational Neuroscience Network (ACNN)
http://www.NeuroscienceNetwork.org/ACNN_Workshop_2016.html

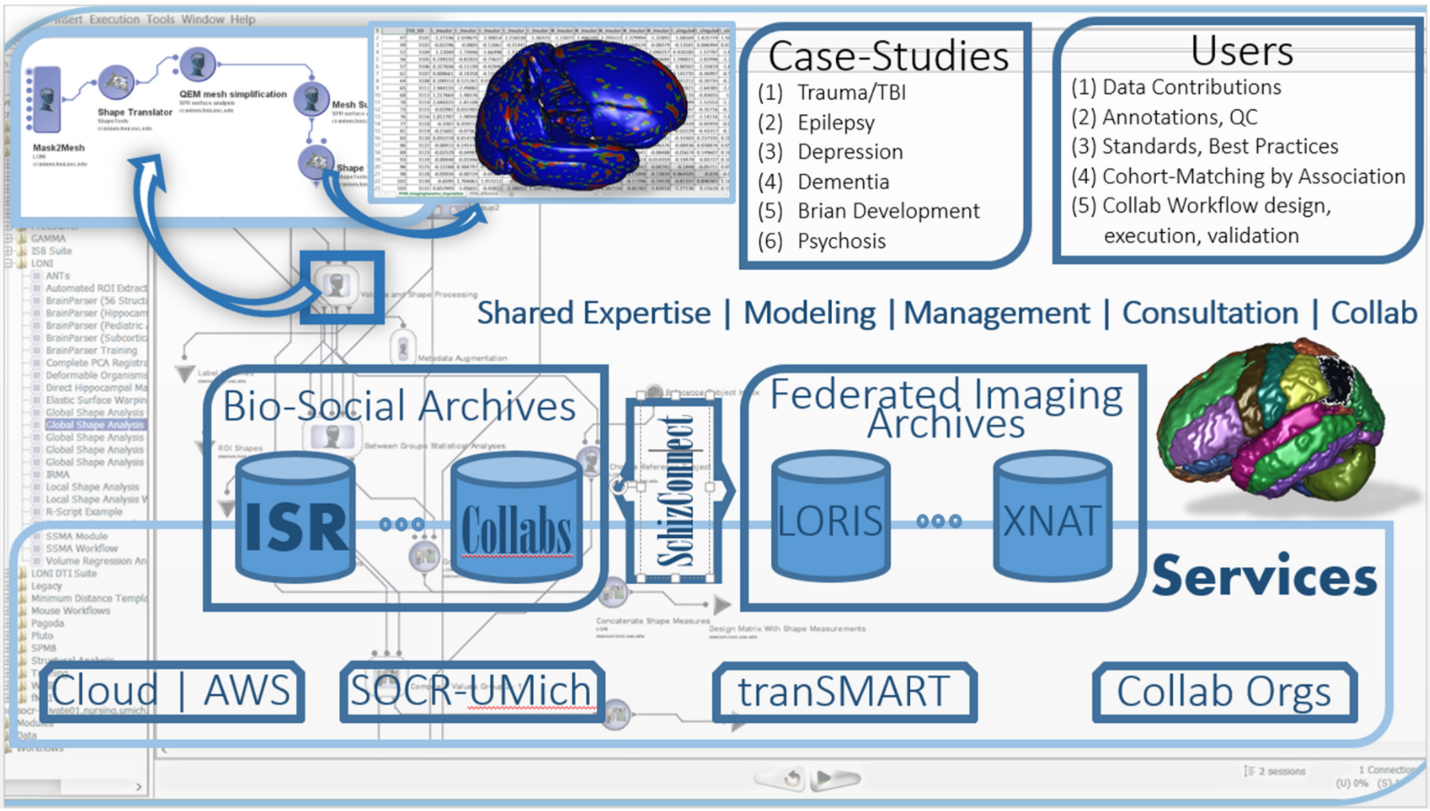

Compressive Big Data Analytics (CBDA)
One can design an algorithm that searches and keeps only the most informative data elements by requiring that the derived estimates represent optimal approximations to y within a specific sampling index subspace $\{(m, l)\} \subseteq \Omega$
We want to investigate if CBDA inference estimates can be shown to obey error bounds similar to the upper bound results of point imbedding's in high-dimensions (e.g., Johnson-Lindenstrauss lemma) or the restricted isometry property


Reproducibility of anatomical features
Probabilistic
Deterministic
Thalamic radiation
Forceps (M and m)
Corticospinal tract
Cingulum (superior)
Cingulum (hippocam)
SLF
Uncinate
IFOF
ILF
Arcuate
Caiafa & Pestilli in preparation


Neuroinformatics Data Flow

[Advanced Computational Neuroscience Network (ACNN)](http://www.NeuroscienceNetwork.org)

Midwest Workshop on Big Neuroscience Data, Tools, Protocols & Services



http://www.NeuroscienceNetwork.org/ACNN_Workshop_2016.html