## Disclosure

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American Epilepsy Society | 2013 Annual Meeting
Learning Objectives

• Understand the importance of “Big Data” in epilepsy research
• Get familiar with http://ieeg.org
• Basic concepts of Cloud Computing
Is the 'Avatar' concept really possible?

By Elizabeth Landau, CNN
February 3, 2010 9:07 a.m. EST

100 billion neurons

50 trillion glia

Sample at 1kHz

150 Petabytes/sec (neurons)

750 Exabytes/sec total

750,000 Fios cables
Basic Science
Translational

- Populations/ metadata/ outcomes/ Rx
- Imaging
- Continuous ECoG/ high bandwidth
- Pharma, devices, biomarkers
Opportunity and Challenge

Opportunity
- Map circuits at the cellular level
- Data mining
- Crowd sourced science
- Personalized “informatics”

Challenge
- Storage
- Organizing
- Navigating
- Analyzing
- Sharing (*must align incentives*)
Big Epilepsy Data

Databases: EPGP, Baylor, Epilepsiae
P20s: Biomarkers, SUDEP
Clinical Trials
Pharma: PADS, etc.
Registries: Pregnancy, SUDEP…

IEEG.org
Human BRAIN Projects (US/ EU)
Central Sharing: data, code, Jnls, NIH
DARPA et al.
The International Epilepsy Electrophysiology Portal is a collaborative initiative funded by the National Institutes of Neurological Disease and Stroke. This initiative seeks to advance research towards the understanding of epilepsy by providing a platform for sharing data, tools, and expertise between researchers. The portal includes a large database of scientific data and tools to analyze these datasets. (United States National Institutes of Health Grant #1 U24 NS063930-01)

New Release!
Tue, 06/27/2013 - 16:33 — Joost Wagenaar

Dear IEEG-Portal user:

We have just released a major update to the IEEG-Portal. The goal for this release was to significantly improve the flexibility of the web-console and to improve the usability of the Matlab Toolbox. Please make sure that you download the latest Matlab toolbox (ieeg-matlab-0.8.1.zip) from:
https://code.google.com/p/braintrust/downloads/list

Major updates:
Architecture

Web Browser-based search, communication, control

Toolbox

Web services

Application Server (Cloud hosted)

Search + integration

Remote analysis tools (MATLAB, Java, C) and/or MATLAB console

Tool exchange

Metadata & annotations DB (Cloud DBMS)

EEG, Image data (Cloud storage)

Compiled tools (Cloud virtual machines)
Recent Activity
You opened snapshot 004_A0001_D001 @ 2013 Nov 7 12:17:53
You opened snapshot Study O22 @ 2013 Nov 7 12:25:26
You opened snapshot Study O06 @ 2013 Nov 7 12:23:13
You opened snapshot Study O05 @ 2013 Nov 7 12:09:33
You opened snapshot 2013-10-08 06:19 - lttb-annotated @ 2013 Nov 2 06:54:49
You opened snapshot Study O17 @ 2013 Nov 2 06:32:29
You opened snapshot Study O16 @ 2013 Nov 2 06:30:49
You opened snapshot Study O14 @ 2013 Nov 2 06:29:58
You opened snapshot Study O13 @ 2013 Nov 2 06:29:11
You opened snapshot Study O13 @ 2013 Nov 2 06:28:54
You opened snapshot Study O16 @ 2013 Nov 2 06:28:31
You opened snapshot 2013-10-08 06:19 - lttb-annotated @ 2013 Nov 2 06:47:01
You opened snapshot Study O10 @ 2013 Nov 1 19:21:03
You opened snapshot Study O10 @ 2013 Nov 1 19:19:53
You opened snapshot 004_A0001_D001 @ 2013 Nov 1 18:12:57
You opened snapshot 004_A0001_D001 @ 2013 Nov 1 17:56:51
You opened snapshot 004_A0002_D002 @ 2013 Nov 1 16:52:21
You opened snapshot 2013-10-09 06:19 - lttb-annotated @ 2013 Nov 1 16:12:55
You opened snapshot 004_A0001_D001 @ 2013 Oct 30 08:45:12
You opened snapshot Study O10 @ 2013 Oct 30 06:49:16
You opened snapshot 004_A0001_D001 @ 2013 Oct 27 06:31:00
You opened snapshot 2013-10-09 06:19 - lttb-annotated @ 2013 Oct 27 06:30:08
You opened snapshot Study O16 @ 2013 Oct 27 06:26:32

Recommendations

Invite your collaborators and colleagues!

Portal Status

There are 150 total public datasets available, with 127930 annotations
Number of human recordings: 86 (86 public)
Number of animal recordings: 109 (98 public)
80GB of data have been downloaded by 194 users.

Contributions

You contributed 7 snapshots
You contributed 93 annotations
Your snapshots were viewed 50 times
Your snapshots were analyzed 0 times
### Dataset Details for Study 022:

- **Patient Label:** 022
- **Age At Onset:** 19
- **Handedness:** Left
- **Gender:** Female
- **Ethnicity:** White
- **Seizure History:** Partial/Complex Non-epileptic
- **Precipitants:** Nocturnal
- **Developmental Disorders:** None
- **Traumatic Brain Injury:** None
- **Prematurity:** None
- **Fam. History Of Epilepsy:** None
- **Snapshot ID:** 3c55f63c-83e0-11e0-8800-0015c56a07b6
- **Age At Admission:** 21
- **Seizure In Study:**
  - 500

### Image Count:
- **Reference Electrode:** 47
- **Contact Groups:**
  - **TSG:** Left, Temporal, 500
  - **ATS:** Left, Temporal, 500
  - **PTS:** Left, Temporal, 500
  - **TIG:** Left, Temporal, 500

---

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<td>4</td>
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http://ieeg.org
“Big data”
iEEG Patient Report

Study IDs:

Patient information

Resected: Y
Gender: F
Seizure Type: Focal Partial-Secondarily generalized tonic-clonic
Handedness: Left
ILAESurgicalOutcome: Class 5: Less than 50% reduction in number of seizure days from baseline, or an increase in seizure days of up to 100% from baseline

Clinical Reports

ImageReport - 11/05/1999
[ MiRI ] [ post epilepsy surgery ] [ w+woContrast ]

CONCLUSION/IMPRESSION: Postoperative change at left temporal lobe with mild surrounding gliosis. No evidence of abscess. FINDINGS: Since the previous MRIs the area of signal abnormality at the left temporal lobe has been resected with pathology demonstrating severe gliosis consistent with chronic seizure disorder. Subsequently, there was development of a wound infection with removal of bone flap and placement of titanium mesh. The small extra-axial fluid collection present on outside. Previous CT has resolved as has the fluid collection superficial to the left bone plate, which has now been replaced with titanium mesh. There is mild T2 hyperintensity about the resection at the left lateral temporal lobe compatible with postoperative change/gliosis. Minimal surrounding postoperative contrast enhancement. No evidence of focal abscess, with no restricted diffusion evident. Normal variant cavum septum pelucidum and vergae. Otherwise unchanged.
<table>
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<td>Joost Wagenaar</td>
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<td>IEEGDownload</td>
<td>Download sections of data from snapshots and concatenate them into a single Matlab variable.</td>
<td>Joost Wagenaar</td>
<td>96f1:e27-753a-4946-9ad7-4b12a6a5629f</td>
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<td>Joost Wagenaar</td>
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First Experiment: Compare HFOs

Wagenaar, Stacey, et al., *in submission*.
The Patient
HFO Detection
Raw Detections
Ex 2: Surgery
Ex #3: Deploying Devices
Canine Epilepsy: Continuous ECoG

Ann Vanleer, PhD
Continuous ECoG > 1 year = ”Big Data”
An example of the channel and event states produced
Which parts of seizures are most similar to the bursts?

Hoameng Ung
How do their state transitions compare?

Transition to Seizure

Bursts
Seizures change after implant, …and over time

Status epilepticus

Wulsin, Davis et al., pre-publication
Progression to Status Epilepticus:
Seizure Structure in 2-D

- Seizures in SE cluster in time according to their ST patterns

Vanleer et al., pre-publication
Potential Benefits

• Identify periods of seizure likelihood
  – High (red)
  – Medium (white)
  – Low (blue)

• Improvement in quality of life

• Record, analyze, and archive real-time, ambulatory iEEG data

Seizure Timeline: Subject NVC1001_23_004

Seizure Timeline: Subject NVC1001_23_004

# Results: Data Repository

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<th>Valid data (days)</th>
<th>Baseline reported (seizures/month)</th>
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April ’12
Drop Mx

Stop daily Mx
July ’12

Response

Response

Response
Drug discovery: A jump-start for electroceuticals

Kristoffer Famm, Brian Litt, Kevin J. Tracey, Edward S. Boyden & Moncef Slaoui

Affiliations | Corresponding author

Nature 496, 159–161 (11 April 2013) | doi:10.1038/496159a
Published online 10 April 2013
Correction (April, 2013)
We're the global leader in solving business challenges through predictive analytics.

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FOCUS INDUSTRY The Energy industry uses our expertise in machine learning and big data to drive high stakes decisions. Find out more

Featured Competitions view all »

GE Flight Quest 2
Optimize flight routes based on current weather and traffic.
Crowd-Sourced Science

- AES, NIPS
- Seizure detection/ prediction
- $10,000 Prizes
- Train & Test sets
- Winner AES 2014
Big Data: Brain Networks, *in detail*
Share, collaborate, accelerate
Crowd source, “modern” research
New model for patient care
Impact on Clinical Care and Practice

• A method for aggregating data, experience
• Place for continuing education/training
• A new method for patient-specific therapy
Support

NINDS (R01-NS041811-04, U24NS063930-01A1)
CURE
Brain Research Foundation
Brain and Behavior Research Foundation
The Dr. Michel and Mrs. Anna Mirowski Discovery Fund