NeuroMat Reply and Actions to the FAPESP International Committee Evaluation 2015

August 9, 2016

According to the International Committee, NeuroMat strong points are

Reviewer 1:

"Well organized, multidisciplinary, international, productive, excellent training, good tech transfer, excellent dissemination"

"Excellent report from a productive and well managed group who should be congratulated on productivity, international collaboration, training and dissemination"

According to the International Committee, NeuroMat strong points are

Reviewer 1:

"Strong scientific results and production"

"New experimental protocol [...] is a major methodological breakthrough"

"Good output of PDs, PhDs and MS students"

"Training is a strong component"

"LASCON [...] is the major meeting on computational neurosciences in Latin America"

According to the International Committee, NeuroMat strong points are

Reviewer 2:

"Strong points:

1. The scientific qualification of the research team and of the PIs
2. The impressive international web
3. The strong possibilities in terms of knowledge transfer and dissemination"

"Weak points: None, as far as I could detect"

According to the International Committee, NeuroMat strong points are

Reviewer 2:

"The proposal [. . .] presented by NeuroMat is outstanding"

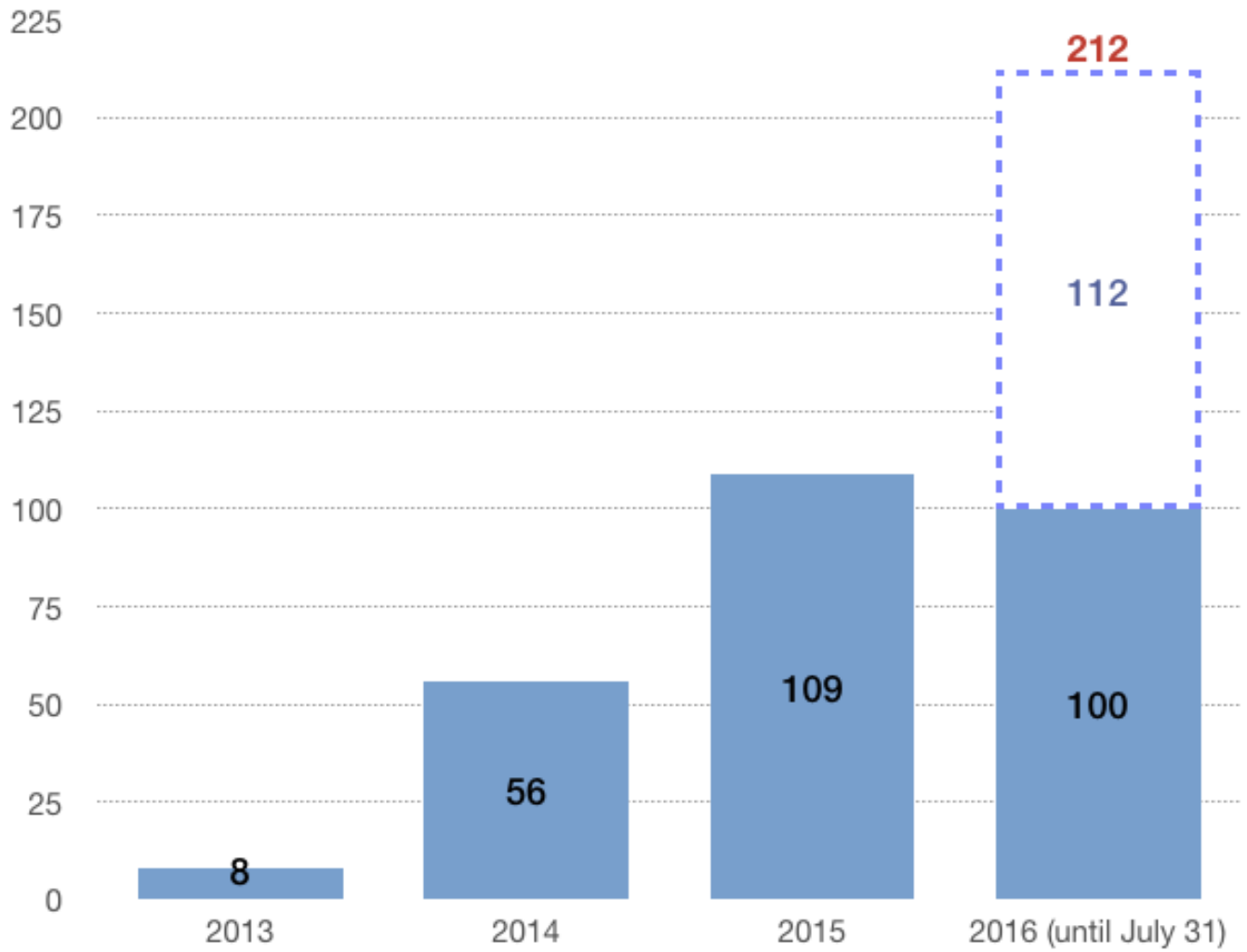
"NeuroMat has developed a quite good and ample set of transfer activities. They seem to me to be innovative and relevant"

"The dissemination activities, in my opinion, are impressive"

This positive evaluation reflects achievements the NeuroMat team has brought about since its inception, in its three areas of activity:

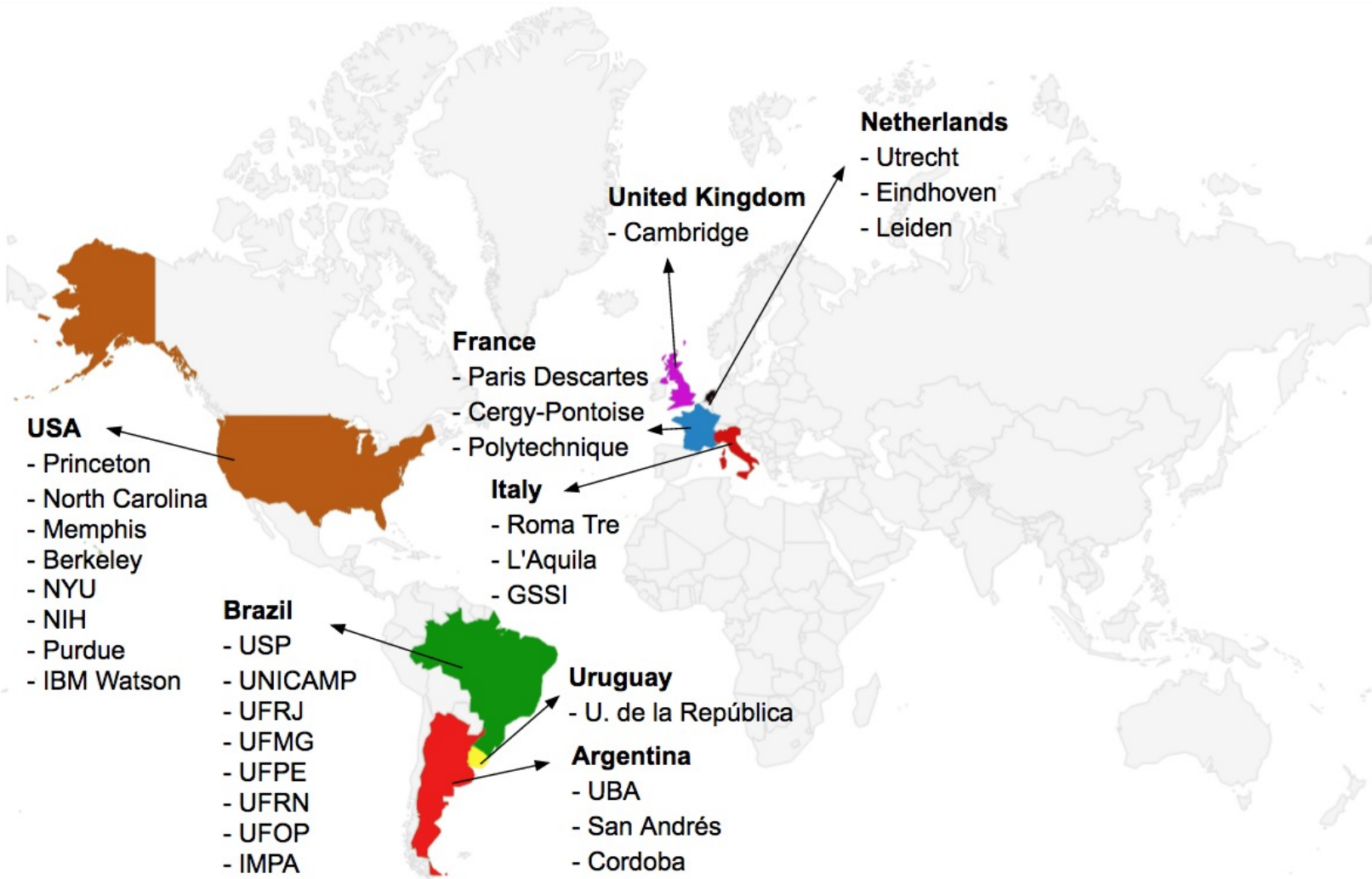
- Scientific Research
- Technology Transfer
- Dissemination

NeuroMat Scientific Publications: Citations

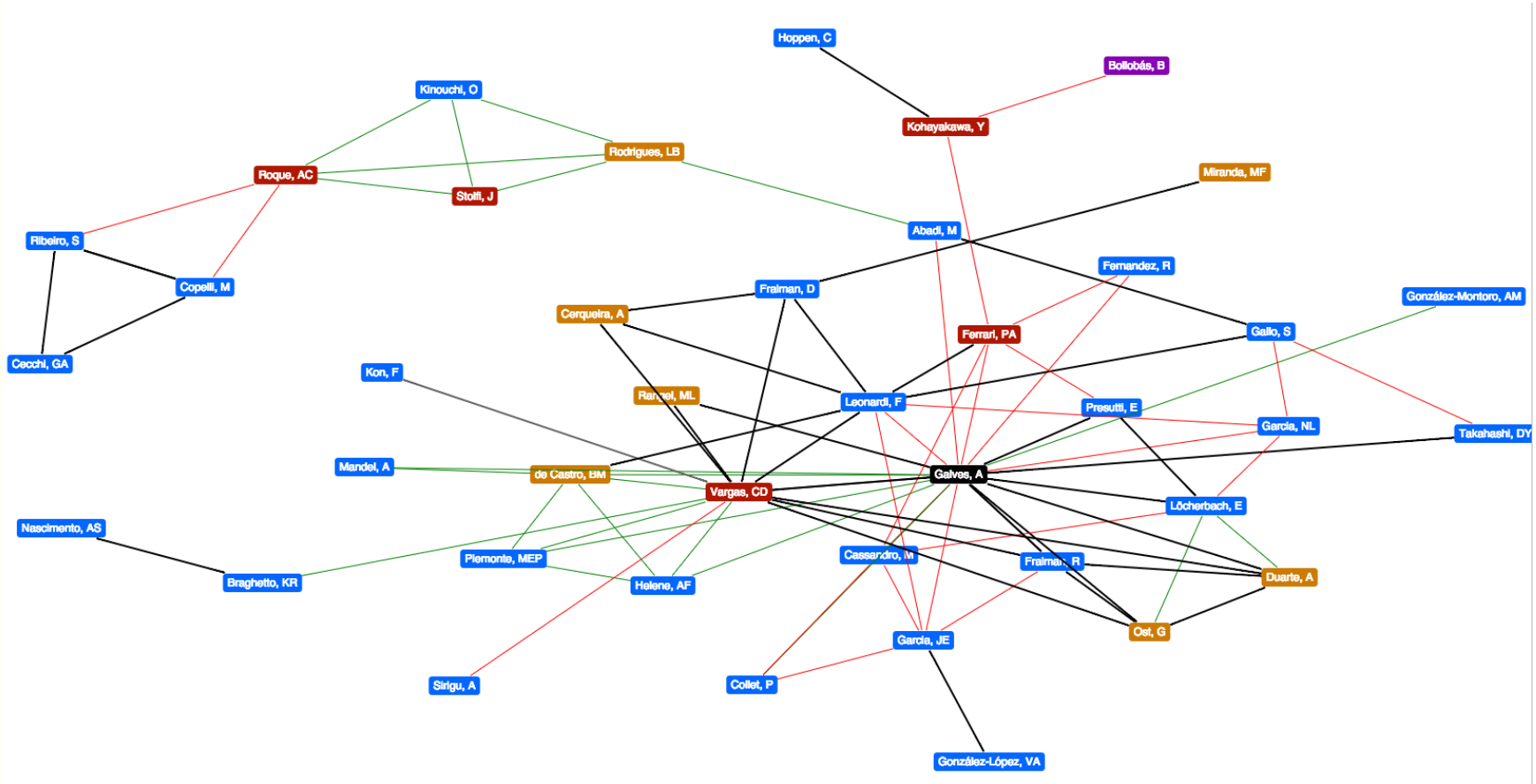


https://scholar.google.com.br/citations?user=OaY57UIAAAAJhl=pt-BR

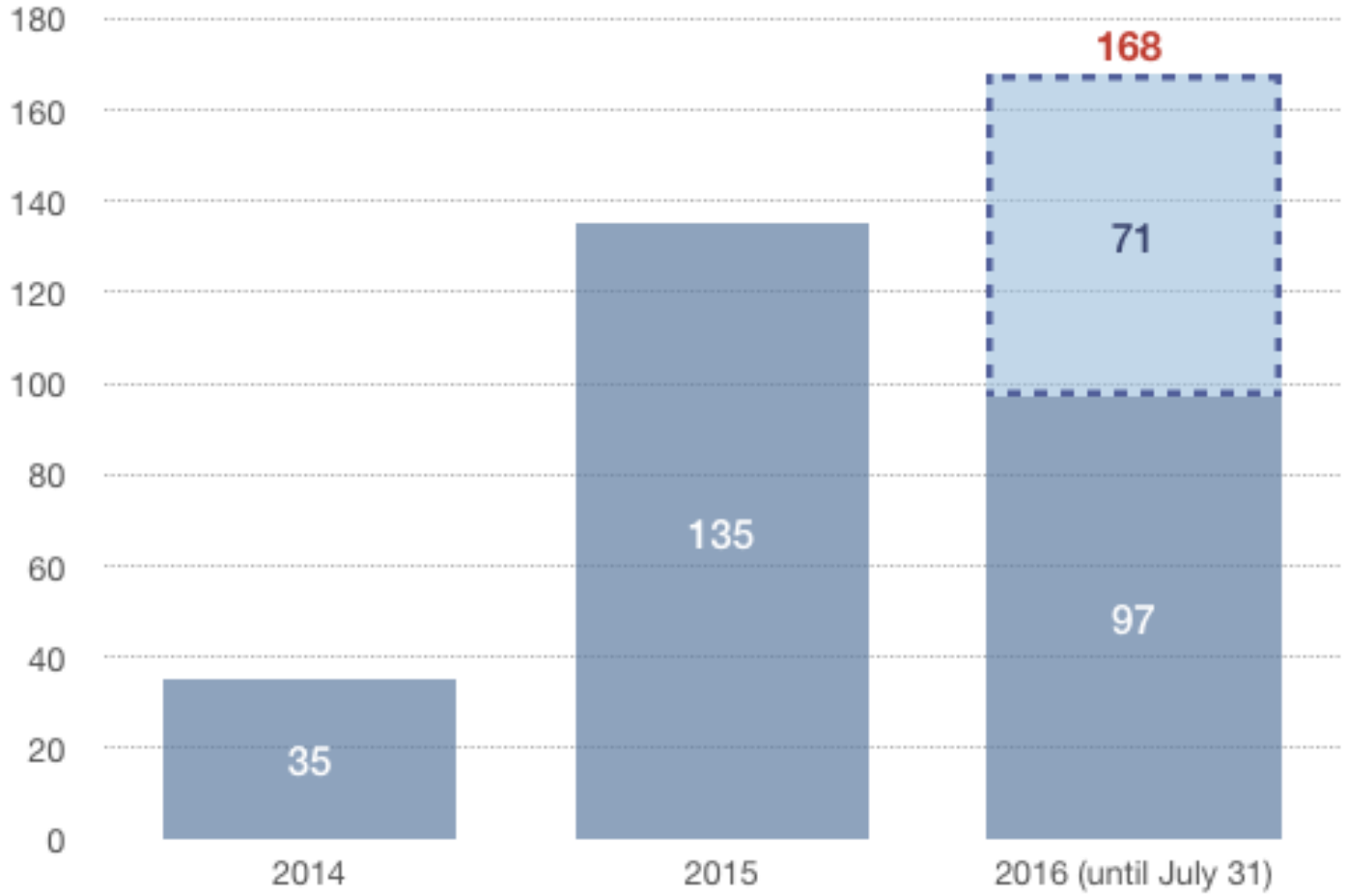
NeuroMat International Research Team



Graph of Interactions of the NeuroMat Research Team



Scientific Missions

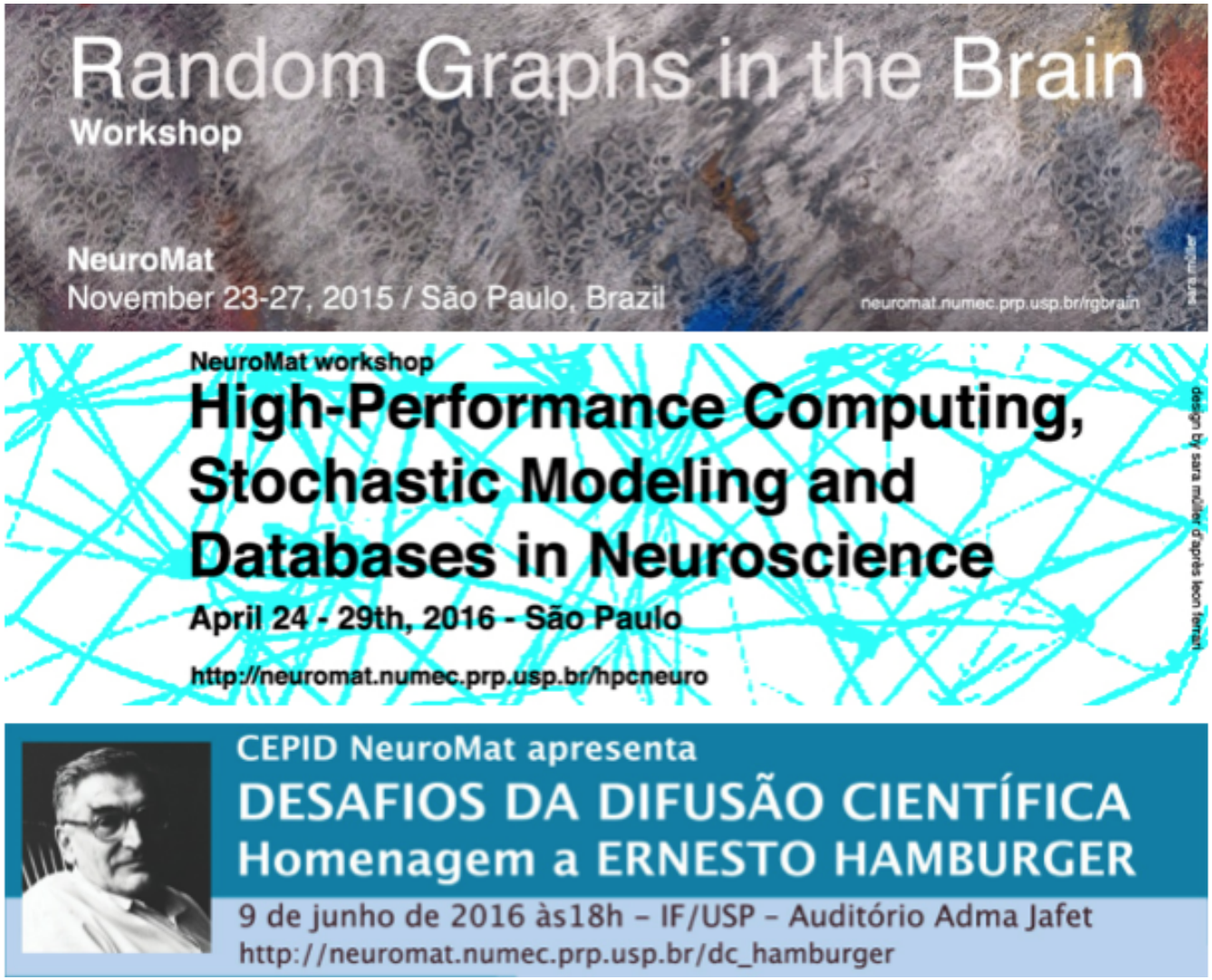


NeuroMat Scientific Meetings and Schools

2o. Dia Temático - NeuroMat: Métodos estatísticos, probabilísticos e computacionais em Neurobiologia	June 2016
Desafios da Difusão Científica - Homenagem a Ernesto Hamburger	June 2016
Workshop: High-Performance Computing, Stochastic Modeling and Databases in Neuroscience	April 2016
VI Latin American School on Computational Neuroscience - LASCON	January 2016
I Science Fair: connecting science and public schools	November 2015
Workshop: Random Graphs in the Brain	November 2015
Workshop: Stochastic Modelling of Neural Nets and Spike Sorting	May 2015
1st NeuroMat Young Researchers Workshop	May 2015
1st Latin American Brain Mapping Network Meeting	March 2015
Training "Spike sorting: What is it? Why do we need it? Where does it come from? How is it done? How to interpret it?"	November 2014
Roundtable "New Forms of Scientific Journalism and the CEPID NeuroMat Work"	September 2014
18th EEGLAB Workshop	September 2014
NeuroMat's First Workshop	January 2014

http://neuromat.numec.prp.usp.br/events

NeuroMat Scientific Meetings and Schools



NeuroMat Theoretical Milestones

A new stochastic model for biological neural networks: systems with interacting stochastic chains with memory of variable length

Stochastic process driven by context tree models retrieved from EEG data

A new stochastic model for biological neural networks: systems with interacting stochastic chains with memory of variable length

Galves and Löcherbach (2013): development of a new class of stochastic processes to model networks of interacting neurons. This was the starting point for:

- 11 new scientific articles
- 83 citations
- 8 postdoctoral projects
- 5 PhD dissertations
- INCF Special Interest Group on Stochastic Modeling of Neural Systems (http://bit.ly/nmincfsig)

Stochastic process driven by context tree models retrieved from EEG data

Duarte, Fraiman, Galves, Ost and Vargas (2016):

- a new statistical approach to address the conjecture that the brain operates as statistician, assigning models to external stimuli.
- a new experimental protocol to test this conjecture.
- a new mathematical object: stochastic processes driven by context tree models.
- a new statistical model selection procedure for functional data.

NeuroMat new research facility: the High-Performance Computational Center

- to test and construct large-scale computational implementations of these models (over 100,000 neurons).
- launched in April 2016.
- Workshop "HPC, Stochastic Modeling and Databases in Neuroscience" (April 25-29, 2016), with representatives from the BRAIN Initiative (USA), the Allen Institute (USA), the Human Brain Project (UE), the Virtual Brain (UE), RIKEN Brain Institute (Japan) and the International Neuroinformatics Coordinating Facility.

NeuroMat new research facility: the High-Performance Computational Center

Future and underway developments

- learning and training of graduate students and post-docs on graphics processing unit (GPU) and parallel programing (expected to be concluded until 2017).
- organization of the "First NeuroMat HPC Course on Parallel and GPU Programming for Neuroscience" (to occur in the second semester of 2016).
- development of computer simulations of large-scale networks of stochastic spiking neurons, analysis and evaluation of the mathematical models results, publication of articles in the highest level international journals (expected to be developed during 2017 and 2018).

Technology Transfer

From NeuroMat original scientific project:

- "NeuroMat long-term objective is to explain complex neuroscientific phenomena, with focus on plasticity mechanisms underlying learning and memory, neurorehabilitation and adapted rewiring."
- "Post-injury plasticity state of art is still at a phenomenological stage."

One of NeuroMat's central scientific goals is to build a conceptual framework for this phenomenology.
This goal is NeuroMat technology-transfer compass point.

Original NeuroMat Technology Transfer Fronts

- Neuro-rehabilitation and diagnosis
  - Plasticity in brachial plexus avulsion
  - Psychosis and psychiatric illnesses
  - Plasticity in cerebrovascular accident
- Computational tools
  - Neuroscience Experiments System (NES)
  - Open Database

FAPESP's evaluation only criticism

The research team lacks expertise in therapeutic applications

Organizational restructuring is our response to FAPESP's criticism

- New coordinator:
  - NeuroMat PI Antonio Roque (USP Ribeirão Preto)
- New partner:
  - physiotherapist and new NeuroMat researcher Maria Elisa Pimentel Piemonte (FMUSP) and collaborators
  - with synergistic interaction with NeuroMat
- New front:
  - plasticity in Parkinson's disease

Current NeuroMat Technology Transfer Fronts

- Neuro-rehabilitation and diagnosis
  - Plasticity in brachial plexus avulsion
  - Psychosis and psychiatric illnesses
  - **Plasticity in Parkinson's Disease**
- Computational tools
  - Neuroscience Experiments System (NES)
  - Open Database

Technology Transfer

- This organizational restructuring strengthens the interaction between NeuroMat's scientific and technology-transfer activities
- Towards NeuroMat's main goal:
  - to explain complex neuroscientific phenomena, with focus on plasticity mechanisms.

NeuroMat Initiative towards Parkinson's Disease

Since its inception in November 2015:

1. Scientific results already obtained:
   - "Is the defective gait automaticity associated to deficiencies in implicit learning in patients with Parkinson Disease?" (MDS 20th International Congress of Parkinson's Disease and Movement Disorders, Berlin)
   - "Association between deficiencies in implicit learning and balance control in patients with Parkinson Disease" (4th World Parkinson Congress, in September 20-23, 2016, Portland).
   - "Automaticidade da marcha e aprendizagem implícita: uma relação defeituosa na doença de Parkinson?" (4th COBRAFIN Congresso Brasileiro de Fisioterapia Neurofuncional, de 7 a 9 de setembro de 2016, Recife)

NeuroMat Initiative towards Parkinson‘s Disease

Since its inception in November 2015:

2. New experimental protocol to address the diagnosis and evaluation of the Parkinson's disease stage and progression.

- pilot study with Parkinson‘s disease patients at Associação Brasil-Parkinson and USP Faculdade de Medicina, with the acquisition of a large sample of data from these patients.

NeuroMat Initiative towards Parkinson's Disease (PD)

Since its inception in November 2015:

3. NeuroMat National Network for PD health care and treatment

- monthly health care trainings for PD patients, relatives and caretakers.
- monthly best practices lectures for PD health professionals.
- establishment of a Brazilian network of PD associations, health professionals and patients, to be extended to a Latin-American network in the medium term.
- development of a public health care line for PD
  - there is no health care line for PD at SUS.
  - NeuroMat intends to develop a new public health care line for PD.

Technology-Transfer

Besides this new partnership, NeuroMat continues its very successful partnerships with:

- Instituto de Neurologia Deolindo Couto, led by NeuroMat PI Claudia Vargas.
- Instituto do Cérebro, led by NeuroMat researcher Sidarta Ribeiro.

Brachial Plexus Avulsion

- strategic and successful partnership with Instituto de Neurologia Deolindo Couto.
- new tools for diagnosis of brachial plexus avulsion.
- new therapeutic protocols associated to the rehabilitation of brachial plexus avulsion patients.
- pilot studies with brachial plexus avulsion patients at Instituto de Neurologia Deolindo Couto, with acquisition of a large sample of data from these patients.

Psychosis and Psychiatric illnesses

- strategic and successful partnership with Instituto do Cérebro.
- NeuroMat senior investigator Sidarta Ribeiro is Instituto do Cérebro‘s Director.
- psychosis and psychiatric disorders prediction and diagnosis through speech analyses with machine learning processes.

Neuroscience Experiments System (NES)

NES is the only open source software for neuroscience data that:

- unifies data from different natures (clinical, electrophysiological, imaging, behavioral, etc.)
- allows for the verification and reproduction of experiments and its results.
- records provenance data from the experiment protocol until the generated experiment data.

NES is listed in the INCF neuroscience computational tools.

https://github.com/neuromat/nes/
https://github.com/INCF/nes

The Goalkeeper Game

- new computer game associated to the experimental protocol developed in the article by Duarte, Fraiman, Galves, Ost and Vargas (2016).
- the beta version is already freely available on the internet.
- the game allows for cheap and large-scale neuroscience data collection.
- alongside its experimental aspects, the game addresses a new mathematical challenge interesting by itself: the learning processes and decision-making models used by the player.
- the game has been presented in dissemination events such as USP's Virada Científica 2015.

The Goalkeeper Game

http://game.numec.prp.usp.br/en/

Towards a NeuroMat Database

NeuroMat's original scientific project: "a new Data Analysis Laboratory will be implemented."

- this is being done with Brachial Plexus Avulsion and Parkinson's Disease data.
- long-term goal: put a "common ground" clinical assessments and electronic storage, handling and sharing of data, building a model for evaluation of patients with similar injuries worldwide.

Dissemination

- NeuroMat dissemination makes its own media.
- NeuroMat dissemination is at the scientific frontier of science communication.
- NeuroMat dissemination works as a collaborative web-2.0 hub, that at the same time improves available scientific content to the general public and fosters a community for science.

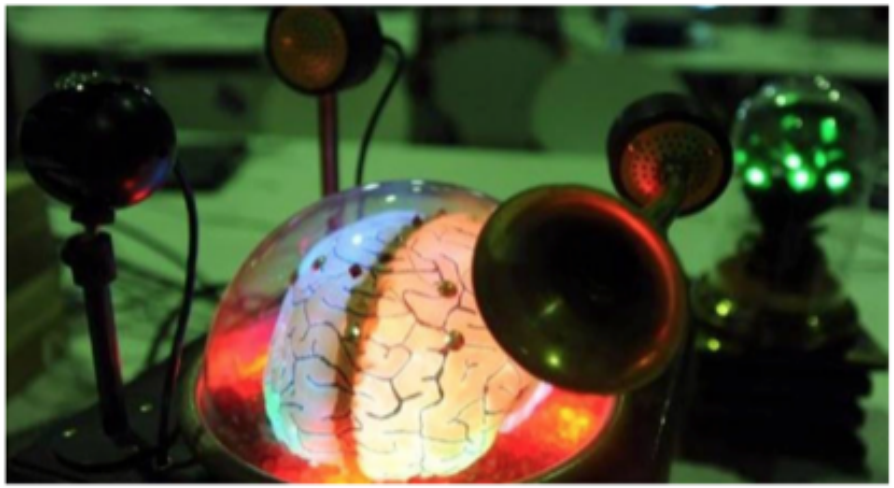
Dissemination

EXAME.COM NEGÓCIOS MERCADOS ECONOMIA BRASIL MUNDO TECNOLOGIA CARREIRA SE

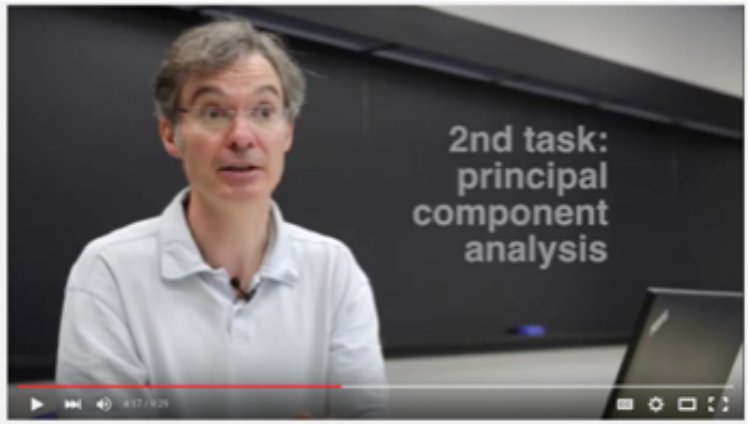
Software ajuda a gerenciar experimentos em Neurociência

Recomende 394 views 0 Salvar notícia

Britta Pedersen/AFP



Cérebro: NeuroMat reúne pesquisadores de áreas como Matemática, Ciência da Computação, Estatística, Neurociência, Biologia, Física e Comunicação



Spike Sorting, Christophe Pouzat, NeuroMat

Communication

Facebook	Daily posts	4,000 views per month
Newsletter	Monthly editions	634 subscribers 30 issues since Feb 2014
Homepage		~7,500 users (47% non-Brazilian) 76,642 page views since Dec 2013
Online lectures		10 lectures
Online interviews and conference recordings		23 recordings
NeuroCineMat		2 completed movies 3 under development
Media Exposure	1.5 piece per month	50 external outlets

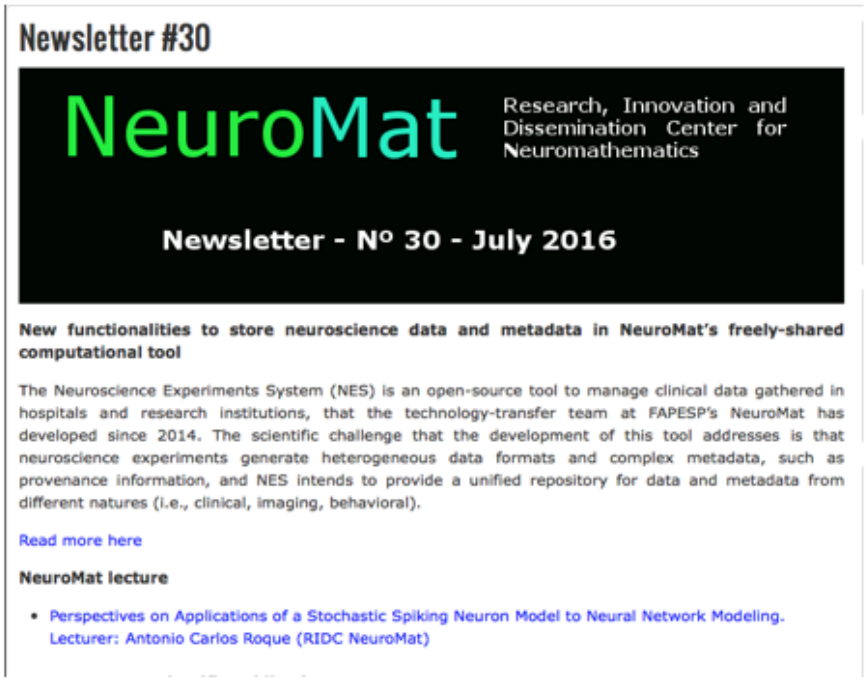
https://www.facebook.com/neuromathematics/?fref=ts

Communication

Future and underway developments

- New scientific dissemination blog - TRAÇO DE CIÊNCIA
  - two posts per week
  - 120 views per day since its inception in April 2016
- New NeuroMat Homepage: new functionalities for technology transfer
  - Open neuroscience database
  - NeuroMat Initiative towards Parkinson's Disease
  - The Goalkeeper Game
  - Neuroscience Experiments System
  - Medical decision support algorithms

Communication



Newsletter #30

NeuroMat

Research, Innovation and Dissemination Center for Neuromathematics

Newsletter - Nº 30 - July 2016

New functionalities to store neuroscience data and metadata in NeuroMat's freely-shared computational tool

The Neuroscience Experiments System (NES) is an open-source tool to manage clinical data gathered in hospitals and research institutions, that the technology-transfer team at FAPESP's NeuroMat has developed since 2014. The scientific challenge that the development of this tool addresses is that neuroscience experiments generate heterogeneous data formats and complex metadata, such as provenance information, and NES intends to provide a unified repository for data and metadata from different natures (i.e., clinical, imaging, behavioral).

Read more here

NeuroMat lecture

- Perspectives on Applications of a Stochastic Spiking Neuron Model to Neural Network Modeling. Lecturer: Antonio Carlos Roque (RIDC NeuroMat)

TRAÇO DE CIÊNCIA

blog de difusão científica NeuroMat

Wiki-difusão: uma nova forma de divulgar ciência

Por David Alves

Uma parte fundamental na ciência está no ato de torná-la pública, seja para a comunidade científica ou para a população geral, e esse é um processo de comunicação. A divulgação da ciência é um trabalho preciso e delicado,

http://neuromat.numec.prp.usp.br/newsletter/neuromat

https://difusaoneuromat.wordpress.com/

Communication

Future and underway developments

- Wikipedia Initiative
  - NeuroMat is Wikipedia's largest institutional contributor in the sciences field in the world.
  - Half a million characters added on Neuromathematics concepts.
  - 29,137 people reached.
  - 330 Media archives added for open use.
  - 1 FAPESP Scientific Journalism Scholarship.
  - 4 USP Scholarships for undergraduate students.
  - 1 Wikipedia edit-a-thon (1 planned to August 2016).
  - 2 Scientific publications.
  - 2 Works accepted for scientific congresses.

Communication

Artigo Discussão Ler Editar Editar código-fonte Ver histórico Pesquisa

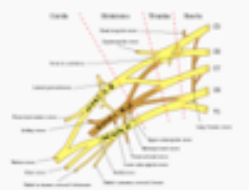
Lesão do plexo braquial

Origem: Wikipédia, a enciclopédia livre.

Lesão ou **lesões do plexo braquial** são danos causados aos nervos do plexo braquial, um conjunto de nervos que conduz sinais da medula espinhal, que está alojada no canal espinhal da coluna vertebral, para os membros superiores. Essas lesões podem ocorrer como resultado de traumas, tumores ou inflamações no ombro.[1][2][3] Em geral, lesões do plexo braquial podem ser classificadas como obstétricas ou traumáticas. As lesões obstétricas podem acometer recém-nascidos, como uma distócia de ombro durante um parto difícil.[4][5] A lesão traumática pode surgir de várias causas, como acidentes de trânsito, principalmente envolvendo motocicletas, e esportes de contato.[6][7] A síndrome de Parsonage-Turner causa inflamação do plexo braquial sem lesão óbvia, mas com sintomas incapacitantes.[1][8]

Índice [mostrar]

Lesão do plexo braquial



Esquema mostrando o plexo braquial (clique para ampliar)

Classificação e recursos externos

CID-10	G54.0, P14.3, S14.3
CID-9	353.0, 767.6, 953.4
DiseasesDB	31267
MeSH	D020516

História [editar | editar código-fonte]

O primeiro relato foi feito pelo obstetra Smellie em 1764.[9] Em 1874 Duchenne e Erb comentam sobre a paralisia das raízes superiores. Onze anos depois, Klumpke descreve a paralisia das raízes inferiores. A reconstrução cirúrgica é realizada por Kennedy, em 1903.[10]

Anatomia [editar | editar código-fonte]

O plexo braquial é composto de nervos espinhais, que fazem parte do sistema nervoso periférico. Ele inclui os nervos sensoriais e motores que inervam os membros superiores. O plexo braquial inclui os 4 últimos nervos cervicais (C5-C8) e o 1º nervo torácico (T1). Cada um desses nervos se divide em troncos menores, divisões e cordões. O cordão lateral inclui o nervo musculocutâneo e o ramo lateral do nervo mediano. O cordão medial inclui o ramo medial do nervo mediano e o nervo ulnar. O cordão posterior inclui o nervo axilar e o nervo radial.[11]

A sensibilidade e motricidade do membro superior é responsabilidade das

https://pt.wikipedia.org/wiki/User:MGromov

https://commons.wikimedia.org/wiki/NeuroMat

Education

- Training courses for public schools

School	District	Area of the action	Grade	Students involved	Undergraduate monitors
Emef Deputado César Arruda Castanho	Jardim Cambara	Neuroscience and biology	7th	70	7
Emef Prof.a Ileusa Caetano Silva	Jardim Educandário	Neuroscience and biology	6th	70	7
EE Canuto Do Val	Barra Funda	Neuroscience and biology	8th	140	7
Emef Desembargador Amorim Lima	Vila Gomes	Neuroscience and biology	8th	70	7
Emef Desembargador Amorim Lima	Vila Gomes	Statistics	8th	90	1

- School Fair Science (November 2015)

Education

Future and underway developments

New course for public school teachers: "The Statistician Brain"

- New partnership with Escola de Aplicação USP
- New partnership with USP Escola
- New partnership with Secretaria da Educação do Estado de São Paulo

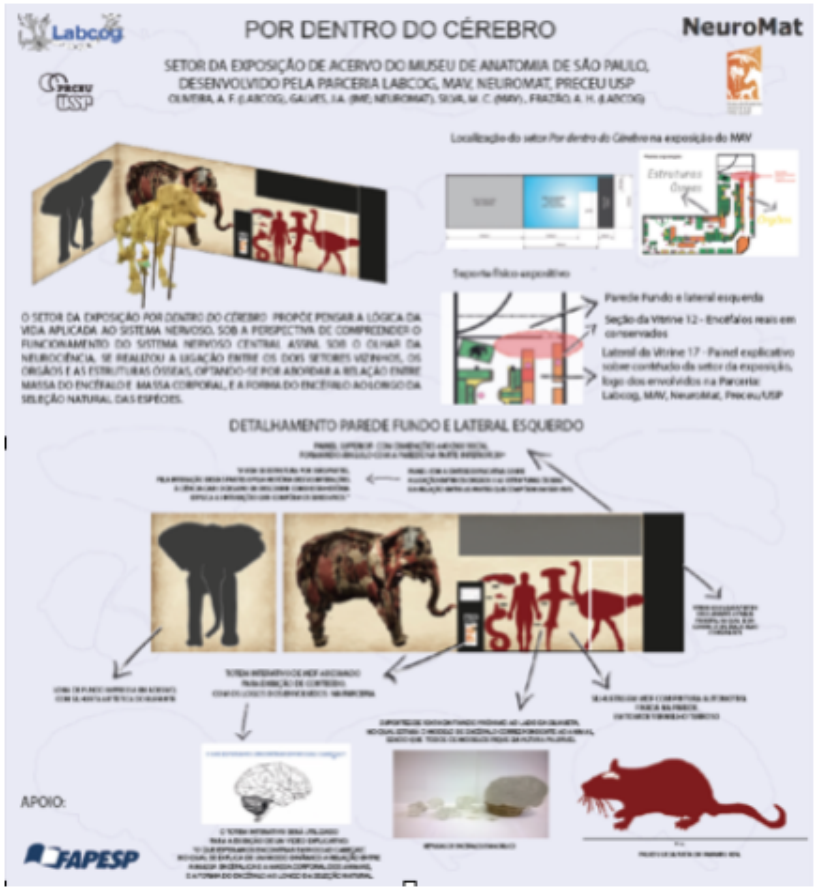
Exhibition

Participation in the photo exhibition "Esporte e Cérebro - A Expansão do Corpo pela Tecnologia", at the Museu do Amanhã (August 2 - October 2, 2016).

Exhibition to be launched this year: "Inside the Brain"

- NeuroMat partnership with:
  - USP's Museum of Veterinary Anatomy
  - the Laboratory of Cognitive Science (Labcog)
- support of USP Pró-Reitoria de Cultura e Extensão Universitária
- 600 images from the Museum of Veterinary Anatomy to be added to Wikipedia by the NeuroMat team

Exhibition


Labcog
POR DENTRO DO CÉREBRO
NeuroMat
SETOR DA EXPOSIÇÃO DE ACERVO DO MUSEU DE ANATOMIA DE SÃO PAULO,
DESENVOLVIDO PELA PARCERIA LABCOG, MAV, NEUROMAT, PRECEU USP
Localização do setor Por dentro do Cérebro na exposição do MAV
Suporte Físico expositivo
Parede fundo e lateral esquerda
Seção da Vitrine 12 - Encéfalos reais em conservados
Lateral da Vitrine 17 - Painel explicativo sobre conteúdo do setor da exposição, logo dos envolvidos na Parceria: Labcog, MAV, NeuroMat, Preceu/USP
DETALHAMENTO PAREDE FUNDO E LATERAL ESQUERDO
APOIO:
FAPESP


ESPORTE E
CÉREBRO
A EXPANSÃO DO
CORPO PELA
TECNOLOGIA
2 DE AGOSTO A
2 DE OUTUBRO

http://neuromat.numec.prp.usp.br