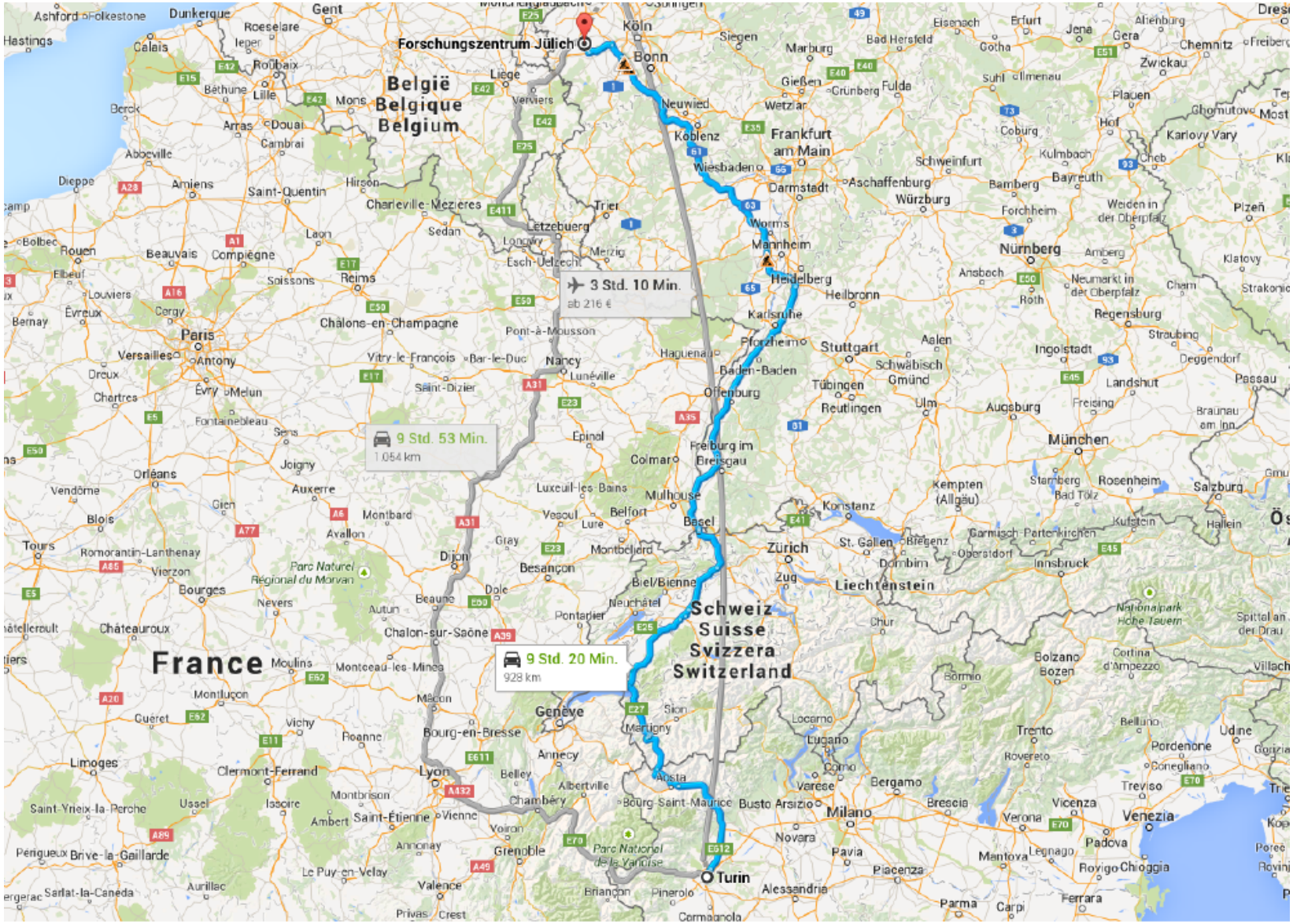
Institute of Neuroscience and Medicine (INM-6) and Institute for Advanced Simulations (IAS-6) of the Research Center Jülich

Emiliano Torre

2nd Jülich-Torino Workshop on Computational Neurosciences

17 April 2015, University of Torino - Department of Mathematics, Italy


Forschungszentrum Jülich
3 Std. 10 Min.
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9 Std. 20 Min.
928 km
Köln
Bonn
Frankfurt am Main
Mannheim
Heidelberg
Karlsruhe
Stuttgart
München
Nürnberg
Zürich
Basel
Genève
Lyon
Turin
Milano
Venezia
Paris
Nancy
Metz
Dijon
Besançon
Strasbourg
Freiburg im Breisgau
Konstanz
Innsbruck
Liechtenstein
België
Belgique
Belgium
France
Schweiz
Suisse
Svizzera
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Our building...

JÜLICH
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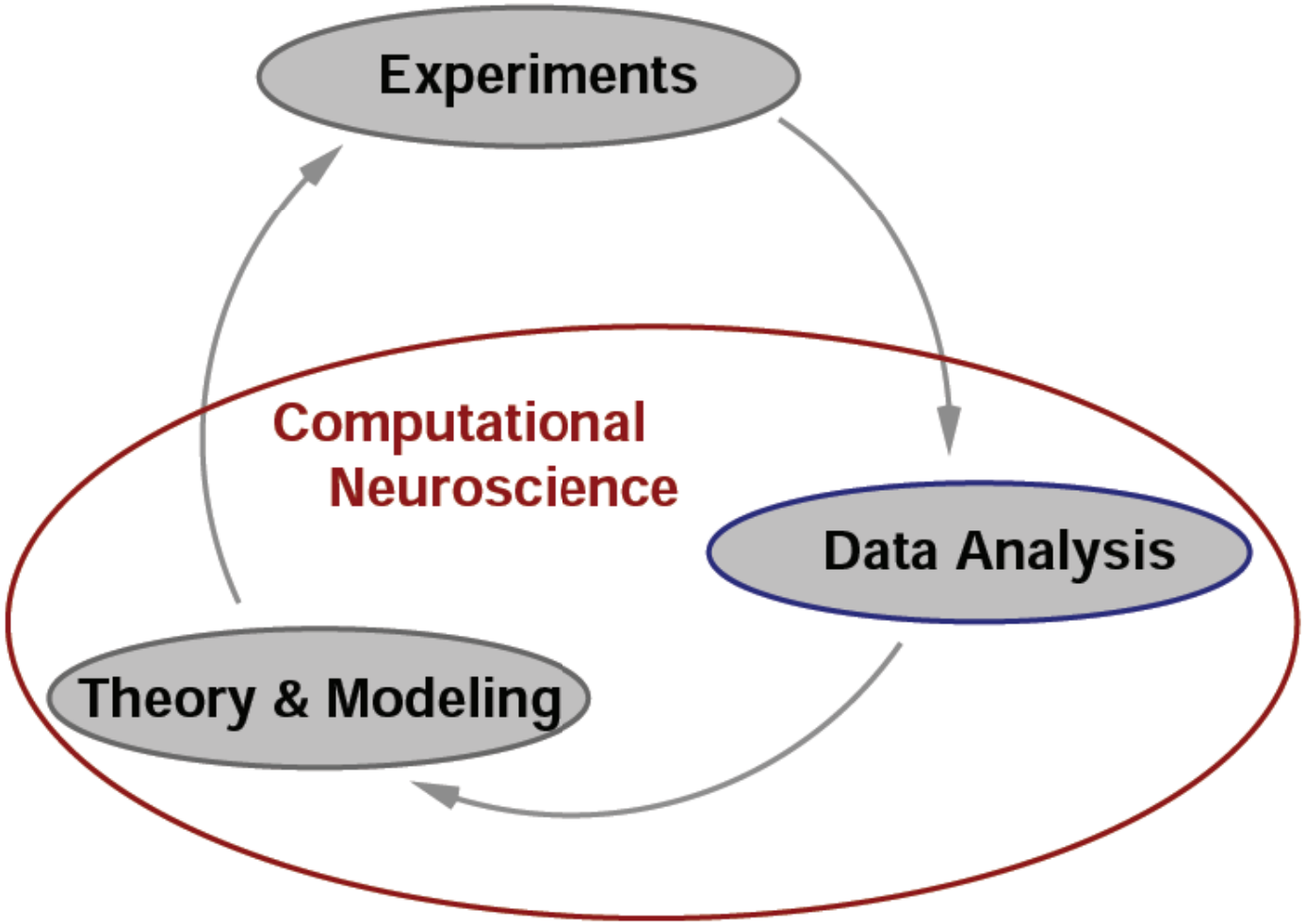
Our building...

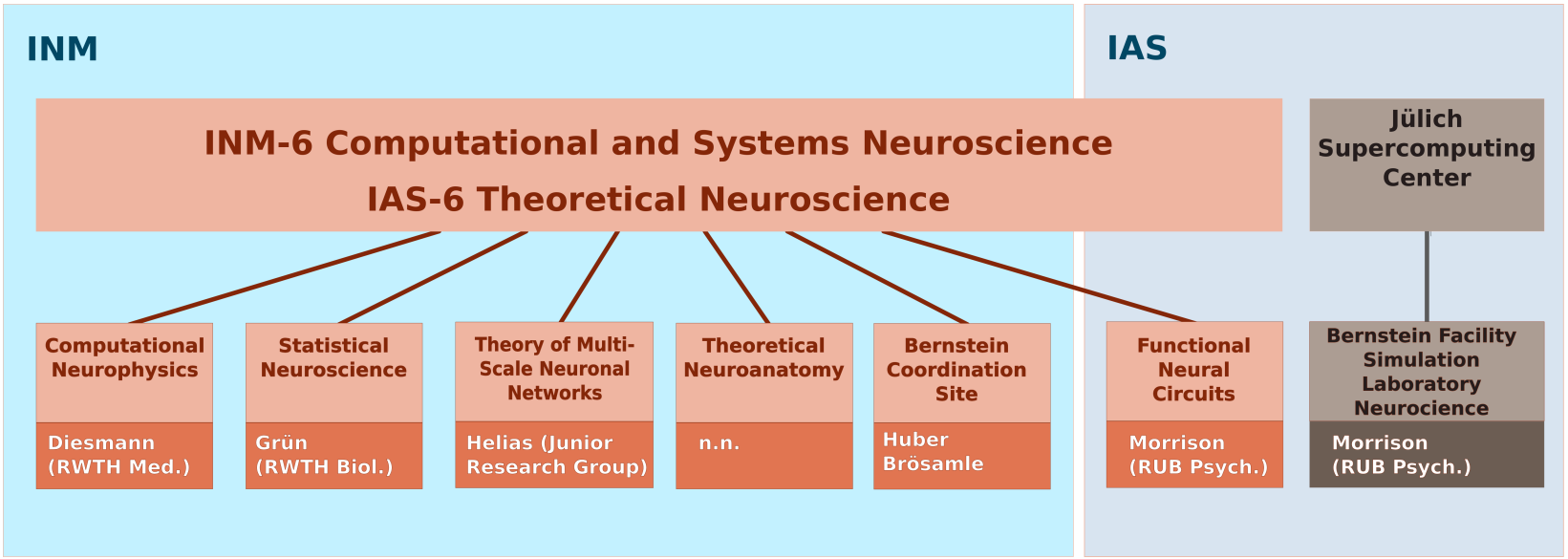
...and us

http://www.fz-juelich.de/inm/inm-6/EN/

Computational neuroscience: an integrative loop



INM-6 / IAS-6: four integrated groups








Folie 6

Computational Neurophysics Lab

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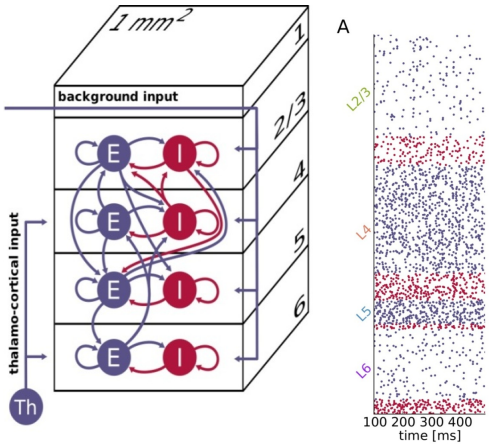
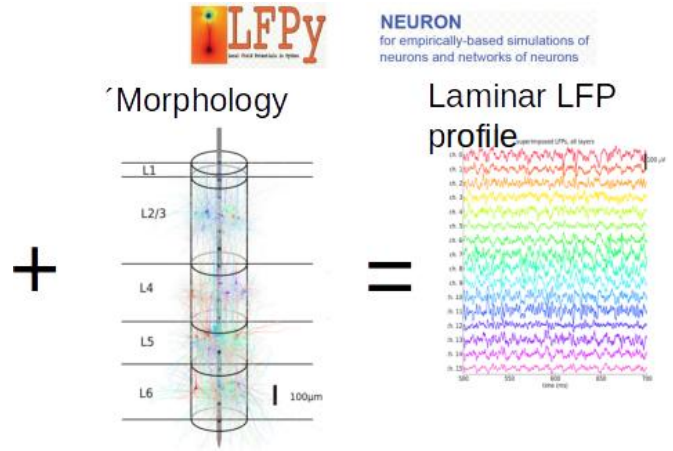
nest:: simulated()

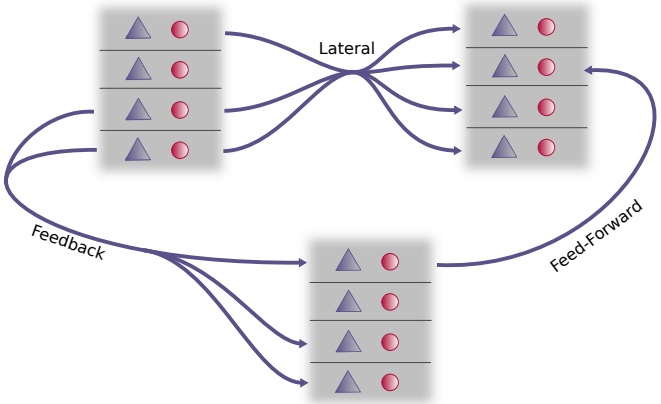
cortical column model



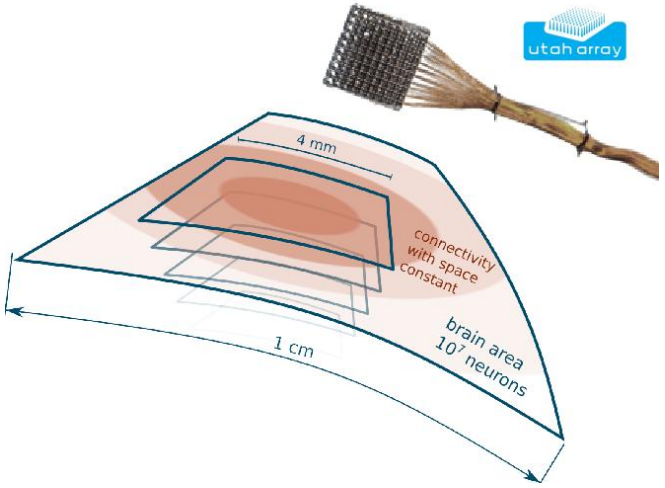
field potential model



multi-area model



topological 4x4 mm model



Computational Neurophysics Lab

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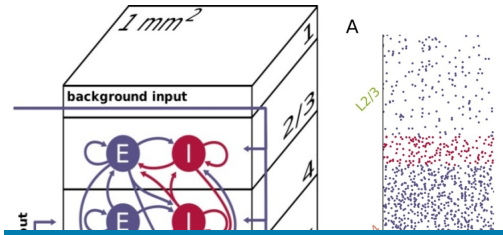
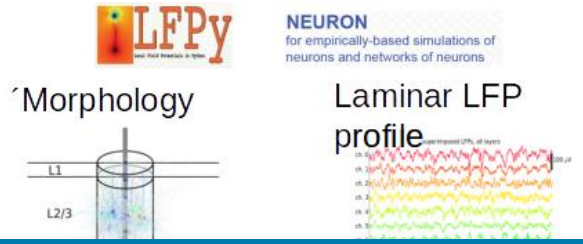
nest:: simulated()

cortical column model

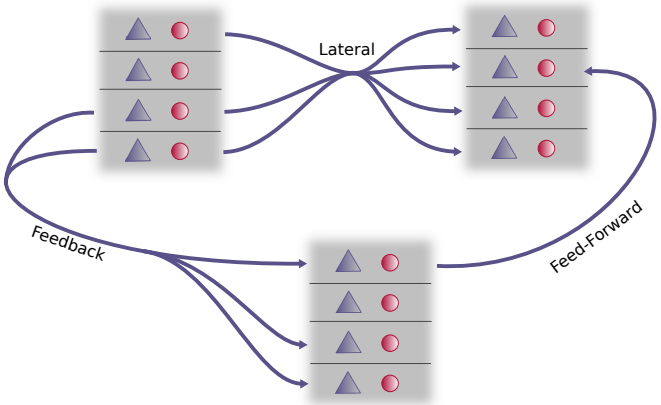


field potential model

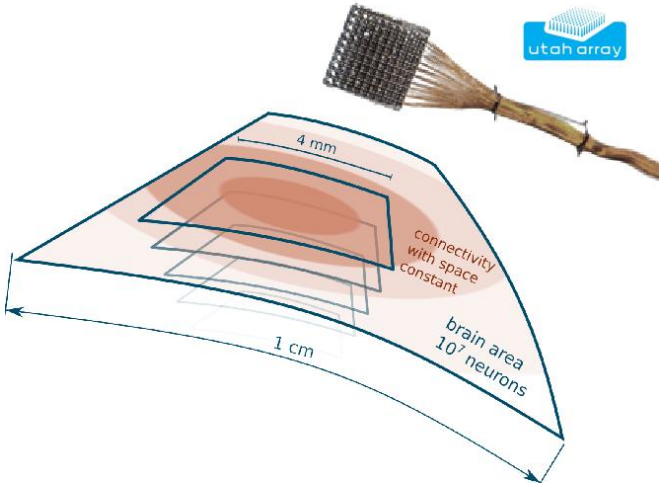


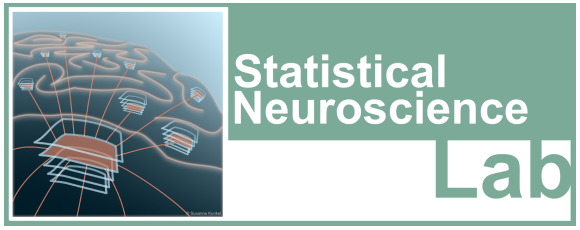
Simulation of brain-scale neuronal networks at cellular and synaptic resolution

multi-area model



topological 4x4 mm model





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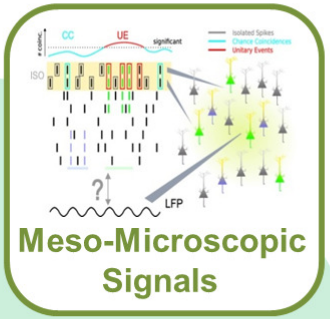
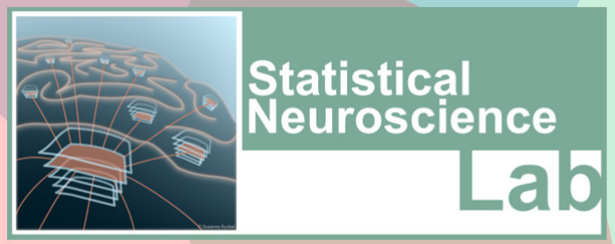
elephant
ELECTROPHYSIOLOGY ANALYSIS TOOLKIT

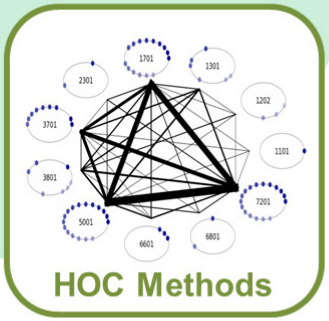
Management of Projects





Development of Analysis Methods

Application to Experimental Data



Statistical Neuroscience Lab

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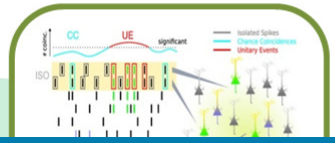
elephant
ELECTROPHYSIOLOGY ANALYSIS TOOLKIT

Management of Projects

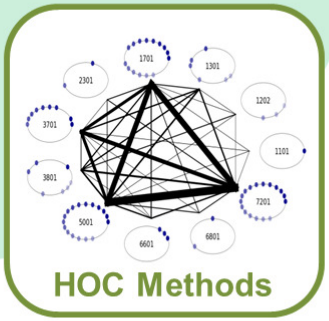


Methods and tools for accessing the spatio-temporal organization of cortical processing during natural behavior

Vision for Action

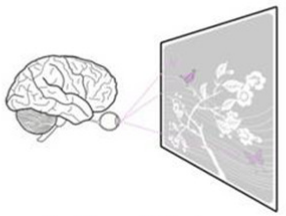
Statistical Neuroscience Lab

Development of Analysis Methods



HOC Methods

Application to Experimental Data



Active Vision

Reach and Grasp

Theory of Multi-scale Neuronal Networks

INM-6 IAS-6 Lab

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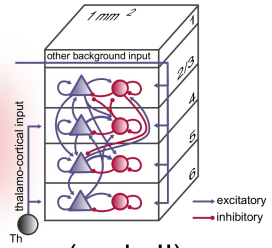
spatial scale in cortex

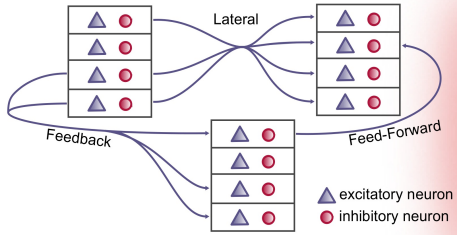
(i) scale-specific connectivity

example: layer-specific connectivity in microcircuit



(scale II)

example: long-range connectivity between areas



(scale III)

neural recording

neural recording

(ii) experimental observation

example: fast, local oscillation

influences

example: slow, global oscillation

(i)+(ii)

(i)+(ii)

(iii) scale-specific analytical description

example: activity averaged across neural population

uses as building block

example: activity averaged across brain area

Theory of Multi-scale Neuronal Networks

INM-6 IAS-6 Lab

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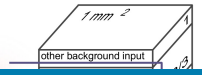
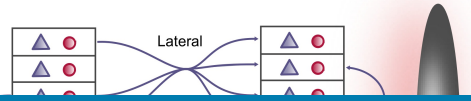
Theory of multi-scale neuronal networks

layer-specific connectivity in microcircuit

long-range connectivity between areas

(i) scale-specific



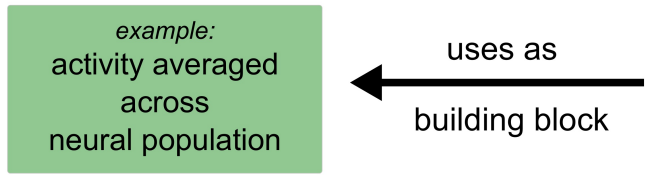


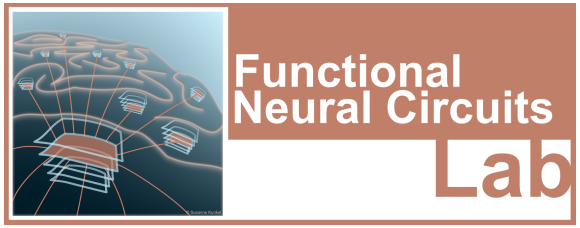
The transfer function of the LIF model: A reduction from colored to white noise

(ii) experimental observation

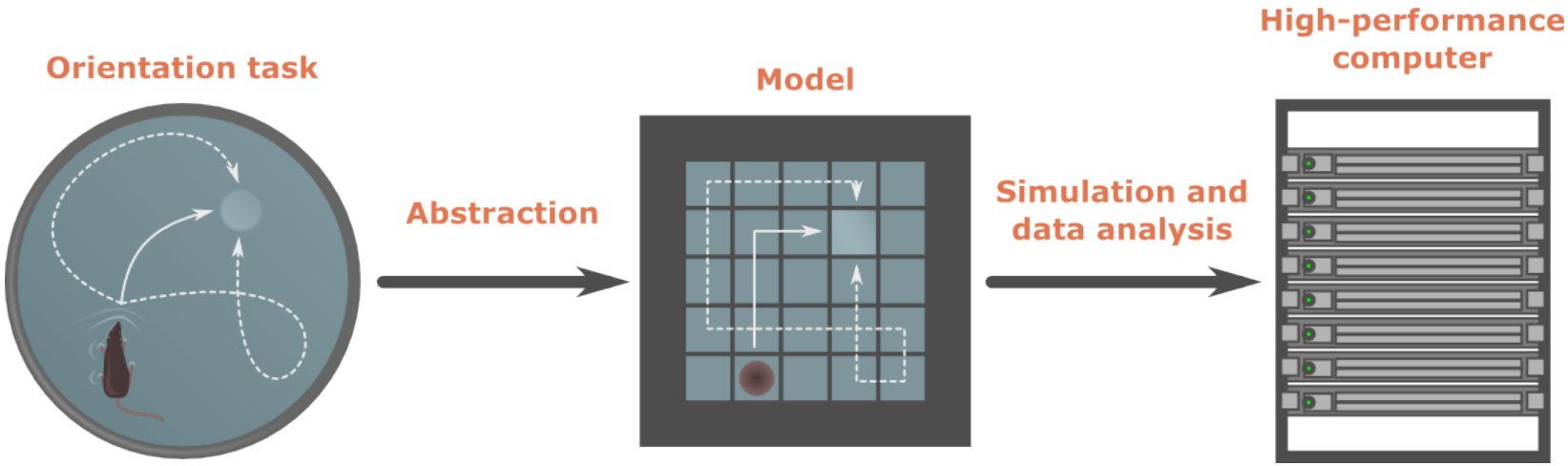
Population rate oscillations in multi-layered spiking networks

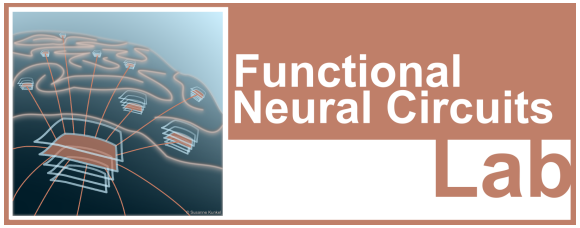
(iii) scale-specific analytical description





- Investigation of interplay of structure, dynamics and plasticity to realise cognitive functions in spiking neural network models
- Development of technology to simulate large-scale neuronal networks exploiting high-performance computing facilities





- Investigation of interplay of structure, dynamics and plasticity to realise cognitive functions in spiking neural network models
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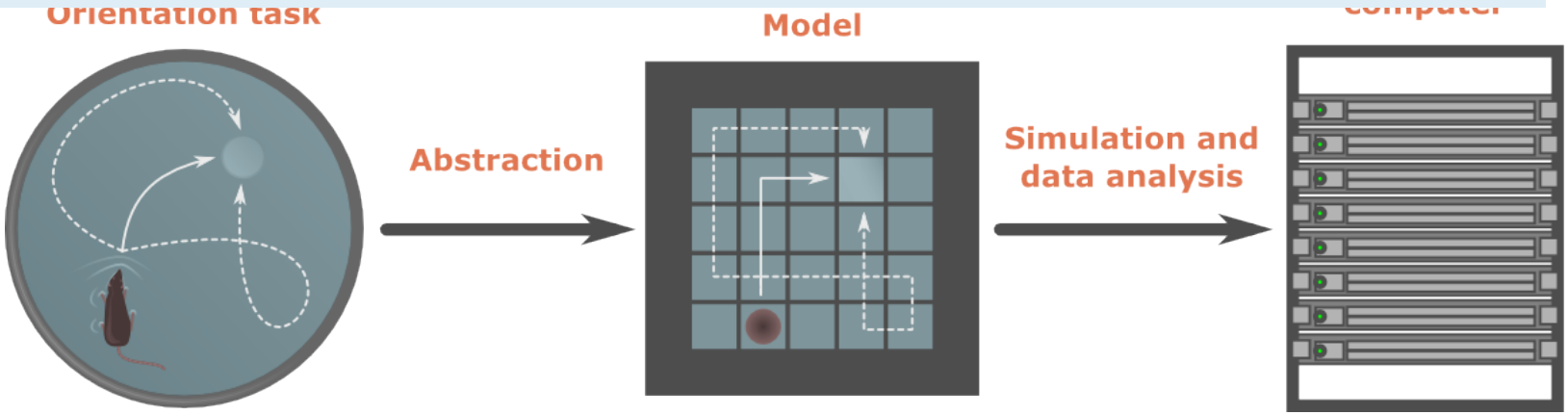
Effect of Alzheimer's disease on the dynamical and computational characteristics of recurrent neural networks



Our “home” cluster: Hambach

Large simulations / data analysis require intensive computation.
Hambach satisfies most of these needs:

- 42 nodes, 24(48) cores/node $\rightarrow$ 1080 cores
- Each core: 2.15 GHz CPU, 64 Gb RAM

The Jülich supercomputer: JuQueen

When *Hambach* can't do it, *JuQueen* can

- 28.672 nodes, 16 cores/node $\rightarrow$ 458.752 cores

Our programme today

9:00-9:30	Welcome and Introduction
9:30-10:15	Sonja Grün (Jülich)
10:15-11:00	Laura Sacerdote (Torino)
11:00-11:30	Coffee Break
11:30-12:15	Moritz Helias & Jannis Schücker (Jülich)
12:15-12:45	Cristina Zucca (Torino)
12:45-14:30	Lunch
14:30-15:15	Markus Diesmann (Jülich)
15:15-15:45	Federico Polito (Torino)
15:45-16:15	Coffee Break
16:15-16:45	Claudia Bachmann (Jülich)
16:45-17:15	Hannah Bos (Jülich)
17:15-17:35	Roberta Sirovich (Torino)
17:35 -	Discussion

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17:35 -	Discussion

Enjoy the workshop!