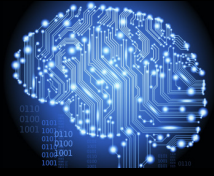


Neuroinformatika



Aušra Saudargienė

ausra.saudargiene@gmail.com

Kurso temos

- Neuroinformatika
- Biologinių neuronų modeliai
- Dirbtinis intelektas ir dirbtiniai neuroniniai tinklai
-

Kurso organizavimas

- Paskaitos
- Laboratoriniai darbai
 - Biologinių neuronų ir jų tinklų modeliai nervų sistemos funkcijoms suprasti
 - Dirbtiniai neuroniniai tinklai duomenų analizei
- Seminarai
 - Literatūros studijavimas

Pradinės žinios

- Programavimo pagrindai
- Fizikos pagrindai
- Matematinės analizės pagrindai
- Neuromokslų pagrindai

Programinė įranga

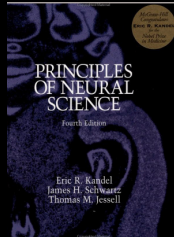
- Matlab
- Octave
- Python
- Neuron
- C++
- Xpp
- AMOS

Įvertinimas

- Laboratoriniai darbai ir seminarai 40%
- Egzaminas 60%

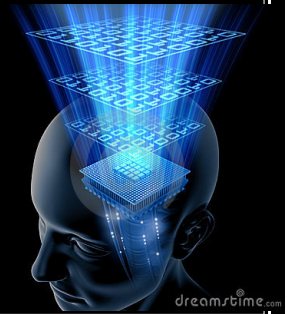
Literatūra

1. Dayan, P. and Abbott, L.F. *Theoretical Neuroscience*. MIT Press, 2001.
2. Izhikevich E.M. *Dynamical Systems in Neuroscience: The Geometry of Excitability and Bursting*. MIT press, 2007
3. Sterrat, D., Graham, B.P., Gillies, A., Willsaw, D. *Principles of Computational modelling in neuroscience*. Psymetrix Limited, Edinburgh, 2011.
4. Koch, C. *Biophysics of Computation: Information Processing in Single Neurons* Oxford University Press: New York, New York, 1999.
5. Trappenberg, T. *Fundamentals of Computational Neuroscience*. Oxford University Press, 2002.
6. Kandel, E.R., Schwartz, J.H., Jessell, T.H. *Principles of Neural Science*. McGraw-Hill Medical, 2000.



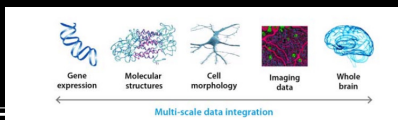
Smegenys

- 1300 g nervinio audinio
ar
- Superkompiuteris?



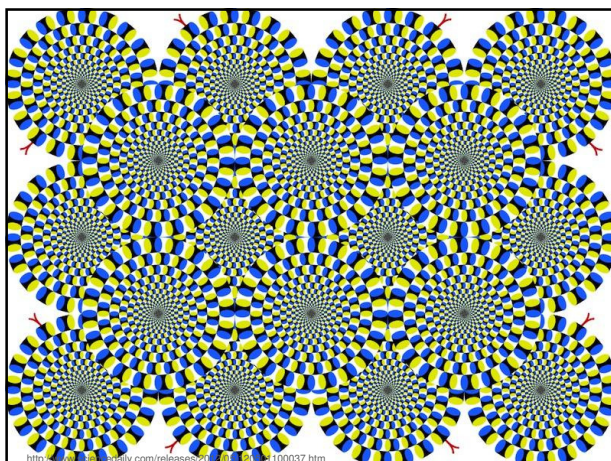
Neuroinformatika

- Neuroinformatika – tai neuromokslų ir informacijos mokslų sankirtoje esanti sritis, skirta nervų sistemų duomenų surinkimui, saugojimui, analizei ir modeliavimui
- Neuroinformatika integruoja visų lygių informaciją – nuo genų ekspresijos iki elgesio.



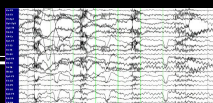
1. Suprasti, kaip mes

- Suprantame
- Mokomės
- Atsimename



2. Gydyti psichines ir neurologines ligas

- Autizmas
- Anoreksija
- Depresija
- Šizofrenija
- Alzheimerio liga
- Parkinsono liga
- Išsėtinė sklerozė
- Epilepsija



Matematinė medicina

- Smegenų ligų ir vaistų/stimuliavimo matematinis ir kompiuterinis modeliavimas
- Neurologinės ir psichikos ligos
 - Parkinsono liga
 - Alzheimerio liga
 - Epilepsija
 - Depresija
 - Spengimas ausyse (*Tinnitus*)
- Gydomo poveikis
 - Farmakologija
 - Išorinis ir giluminis smegenų stimuliavimas (Deep Brain Stimulation)



http://www.captivabrain.com.au/index.php?option=com_content&view=article&id=12&Itemid=1

3. Kurti pažangias technologijas

Dirbtinio intelekto algoritmai

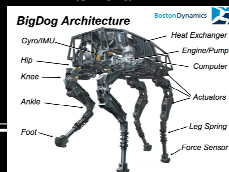
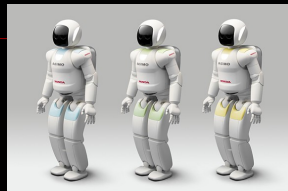
- Žaislai
- Buitinė technika
- Pramoniniai įrenginiai
- Transporto priemonės
- Programinė įranga



3. Kurti pažangias technologijas

Robotai

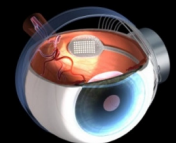
- Autonominiai
 - Valdo motoriką
 - Daro sprendimus
- Adaptyvūs
 - Mokoši
 - Atsimena



3. Kurti pažangias technologijas

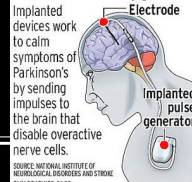
Neuroprotezai

- Dirbtinė tinklainė
- Kochlearinis aparatas
- Smegenų implantai



Wired for therapy

Implanted devices work to calm symptoms of Parkinson's by sending impulses to the brain that disable overactive nerve cells.



SOURCE: NATIONAL INSTITUTE OF NEUROLOGICAL DISORDERS AND STROKE
PHOTOGRAPHIC: SHUTTER

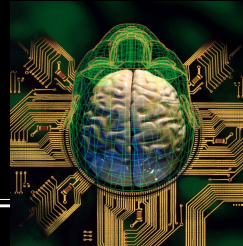
Neuroinformatikos sritys

- Duomenų saugojimas ir analizė.
- Kompiuterinių-matematinių biologinių nervų sistemų modelių sudarymas, analizė, taikymas
- Specializuotos programinės įrangos kūrimas.
- Neuroinžinerija



Human Brain Project 2013-2023

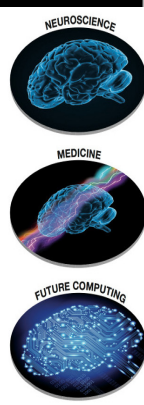
- Tikslas – sukurti žmogaus smegenų kompiuterinį modelį
- 10 metų projektui EU Komisija skiria 1 milijardą eurų



The Human Brain project 2013-2023

■ Mokslinių tyrimų kryptys:

- Future Neuroscience
- Future Medicine
- Future Computing



Grupės Human Brain Project

- SP1 - Strategic Mouse Brain Data
- SP2 - Strategic Human Brain Data
- SP3 - Cognitive Architectures
- SP4 - Theoretical Neuroscience
- SP5 - Neuroinformatics
- SP6 - Brain Simulation
- SP7 - High Performance Computing
- SP8 - Medical Informatics
- SP9 - Neuromorphic Computing
- SP10 - Neurorobotics
- SP11 - Applications
- SP12 - Ethics and Society
- SP13 - Management

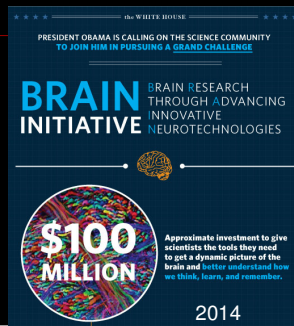
EXPERIMENTAL DATA

MODELS OF NEURAL SYSTEMS

INFORMATION AND COMPUTING PLATFORMS FOR NEUROSCIENCE

- Atvira prieiga 2016m.

'Big data' iniciatyvos



Baltic-Nordic Summer Schools on Neuroinformatics 2013-2016

1st Baltic-Nordic Summer School on Neuroinformatics Computations in the Brain and Translational Neuroscience Vilnius Magnus University, Kaunas, Lithuania 29-31 May 2013

2nd Baltic-Nordic Summer School on Neuroinformatics Integration of Multimodal, Multiscale Data into Models Tampere University of Technology, Tampere, Finland 10-13 June 2014

The course is focused on computational modeling of brain functions both at the cellular, network, and cognitive levels and on emerging multiscale modeling techniques of brain functions. Course lectures also contain brief introduction to key experimental techniques (including electrophysiology, imaging) for modeler introduction to look for multiscale modeling, databases and sources of data. The target audience is doctoral students and researchers from various fields of neuroscience interested on how computers informatics.



3rd Baltic-Nordic Summer School on Neuroinformatics (BNNI 2015) Multiscale computational neuroscience: Neurons, networks and systems

15-18 June 2015
University of Tartu, Tartu, Estonia

The BNNI 2015 is focused on computational multiscale modelling of brain functions at the cellular, network and systems levels. The course will also cover data sources, measurements and analysis of neural activity.

Target audience.
Doctoral students and postdoctoral researchers, both theoreticians and experimentalists, who would like to get an introduction to neuroinformatics and computational neuroscience.

Confirmed speakers
Bruce Graham, University of Stirling
Sean Hill, the École Polytechnique Fédérale de Lausanne
Claudio Mirasso, Universitat de les Illes Balears Palma de Mallorca
Arnd Roth, University College London
Michael Wibral, Brain Imaging Center, Goethe University
Raul Vicente, University of Tartu

More information and registration at neuro.cs.ut.ee/bnni2015/

IMPORTANT DATES

21 February 2015
Application deadline

13 March 2015
Acceptance notification

15-18 June 2015
Summer School

4th Baltic-Nordic Summer School on Neuroinformatics (BNNI 2016)

Understanding neurons, cognition and behavior through neuroinformatics

15-18 June 2016
Nencki Institute of Experimental Biology
Faculty of Physics, Warsaw University
Warsaw, Poland

Confirmed speakers

Piotr Duka, University of Warsaw
Geir Eiriksson, Norwegian University of Life Sciences
Bence Kádár, University of Hertfordshire
Marja-Lieske Linn, Tampere University of Technology
Szymon Lepik, Nencki Institute of Experimental Biology
Arnd Roth, University College London
Agnieszka Stachniss, Vilnius Magnus University
Eliana Vasilaki, University of Sheffield
Daniel Wegmann, Nencki Institute of Experimental Biology
Jarosław Zygmunt, University of Warsaw

Program

Interdisciplinary course on various aspects of neuroinformatics, including:
- modeling of different levels of organization of the brain,
- analysis of neural data,
- brain atlases.
The course combines lectures, tutorials and computer exercises. The course is aimed at advanced master students, doctoral students, and postdocs.

Important dates

Application deadline: February 21, 2016
Acceptance notification: March 13, 2016
Summer school: June 15-18, 2016

We are looking forward to welcome you at
BNNI 2016 in Warsaw, Poland!

More information and registration at
<http://bnni2016.org>

