Aplikace umělé inteligence v medicíně

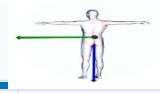
Daniel Novák

8.3.2012 Asistivni technologie





Outline



- OLDES: Older People's e-services at home
- Single DBS Neuron Processing
- Eye Movement Analysis: Slow Phase Velocity (expert systems)

Robotická chirurgie

- Bipolar & Schizophrenia Analysis
- Sleep Quality Analysis and Apnea Detection
- MRI Spectroscopy Data Analysis
- Postural Analysis & Rehabilitation
- Lower Body Negative Pressure
- Spiro-ergometric Data Analysis Activity Monitoring: Fall Detection
- Motivated Rehabilitation
- Eye Movement Analysis: Dyslexia analysis





OLDES

Older People's e-services at home

People:

Prof. Olga Stepankova, Daniel Novak, Petr Novak, Vratislav Fabian, Karel Maly, Jan Hrdlicka, Martin Janouch, Lenka Novakova III. Interni klinika, Vseobecna nemocnice: Doc. MUDr. Martin Haluzik, MUDr. Milos Mraz, MUDr. Miroslav Kremen, MUDr. Tomas Roubicek, Jan Padera (DP)

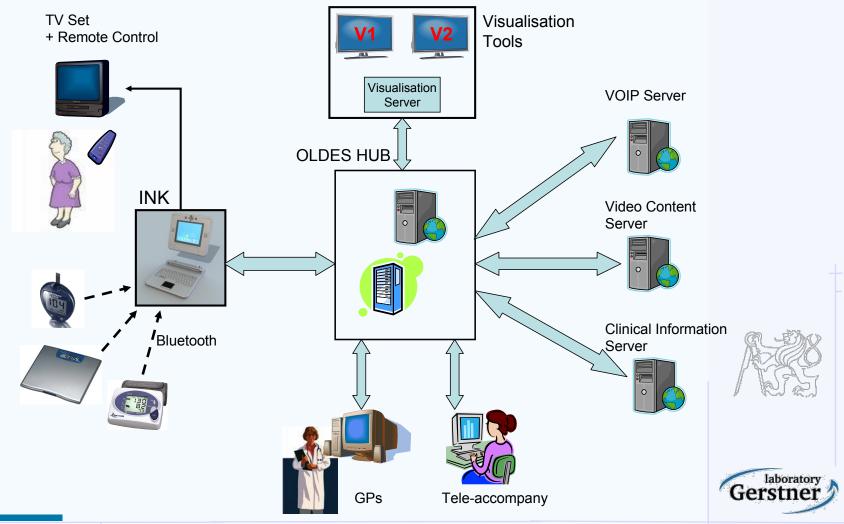


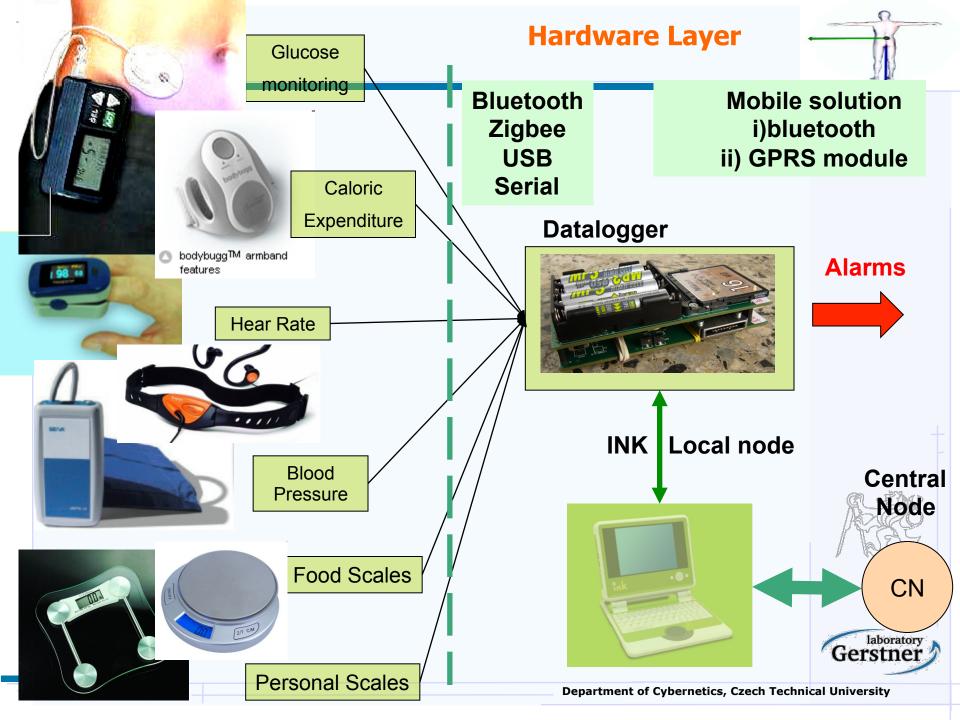
Area: Asistive Ambient Living, Applied Gerontology

Goal: Diabete project: Glycemia prediction, User Interface Development Debartment of Cybernetics, Czech Technical University



Demonstrator Architecture





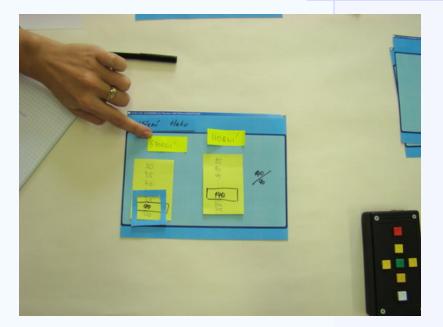




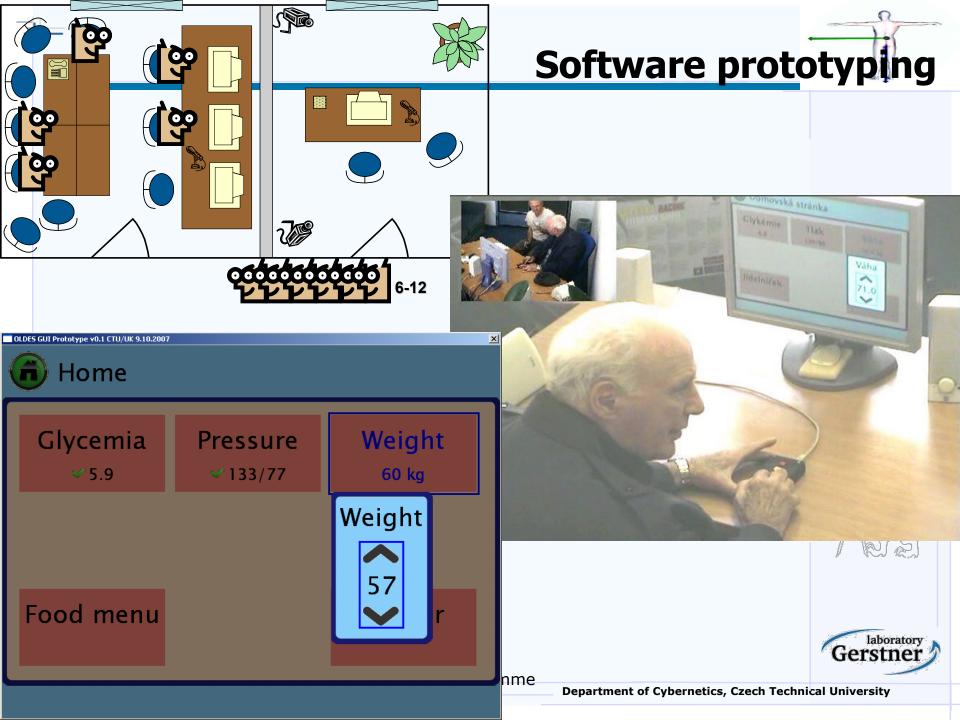
Paper prototyping



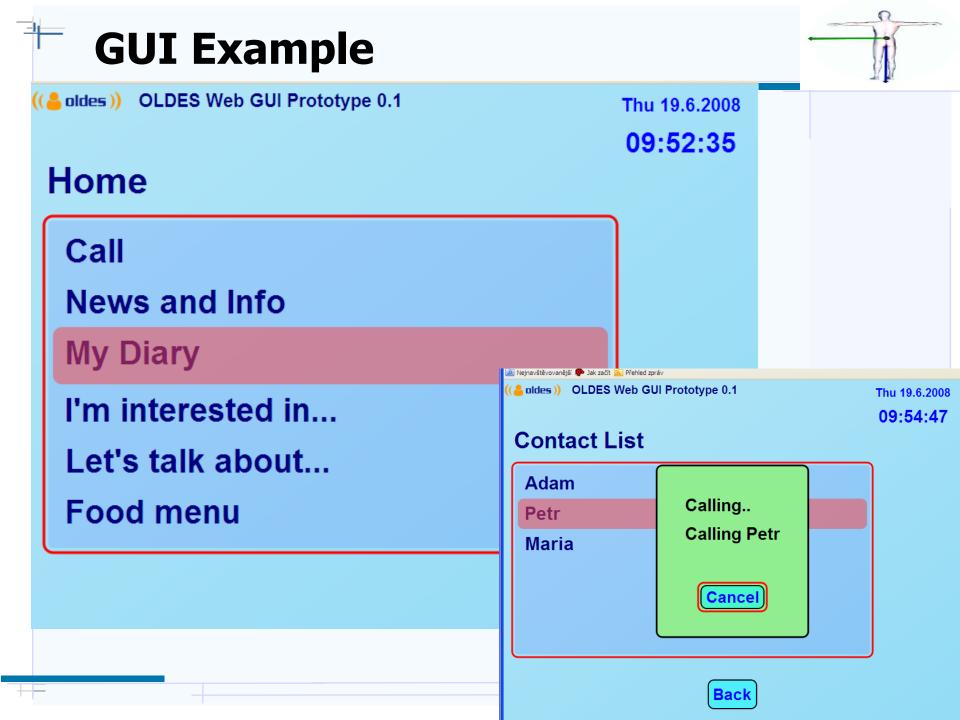




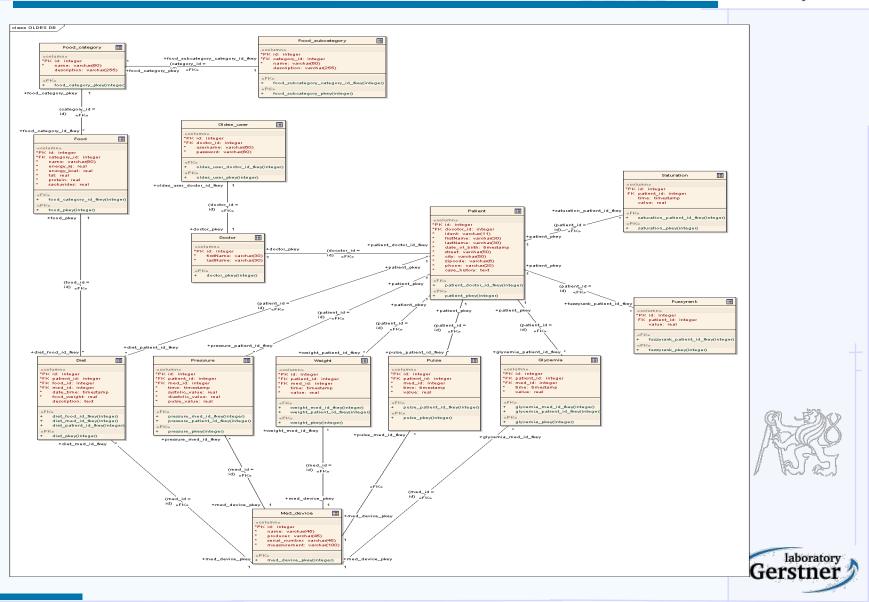




Tangible User Interface Design Evolution TOP TOP TOP TOP OK → OK ← <u>OK</u> → ← OK BACK BACK BACK OX Weemote atory 1**er** D



CI: OLDES DB



Q

Single DBS Neuron Processing

People: Daniel Novak, Prof. O.Stepankova, 1.UK, Nemocnice Homolka: MUDr. Robert Jech PhD, MUDr., Karel Schmidt (DP), Bc. Jiri Wild (DP), Bc. Pavel Neuschl (DP)



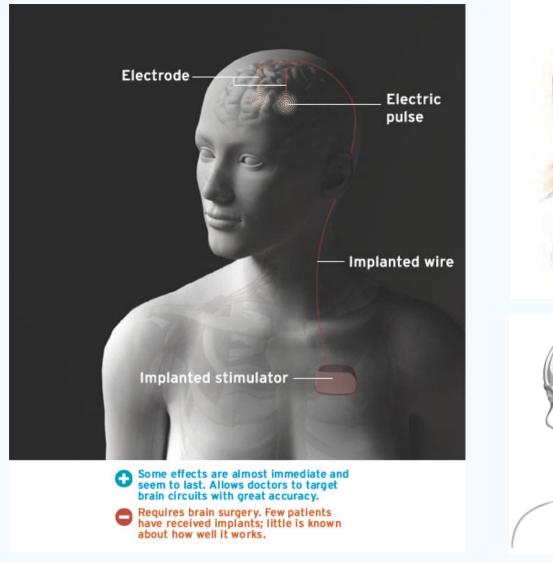
Goal: Do Neurons in Basal Ganglia Respond to Emotional Content? *i*erstn

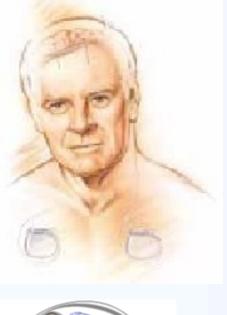
Department of Cybernetics, Czech Technical University

laboratory

DBS







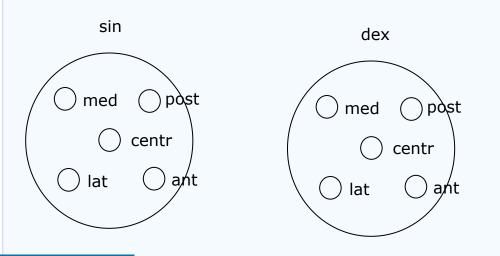


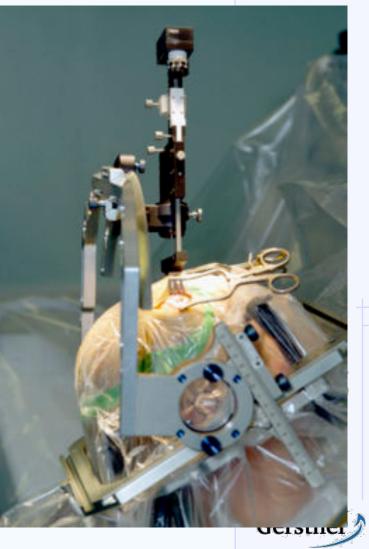




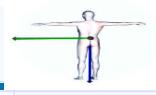
How: Functional stereotactic neurosurgery

- Surgery at sites deep within the brain utilizing a stereotactic frame and stereotactic coordinates.
- Used for making a lesion or implanting a DBS electrode in thalamus or basal ganglia for treatment of movement disorders (PD, dystonia, ET), pain, etc.

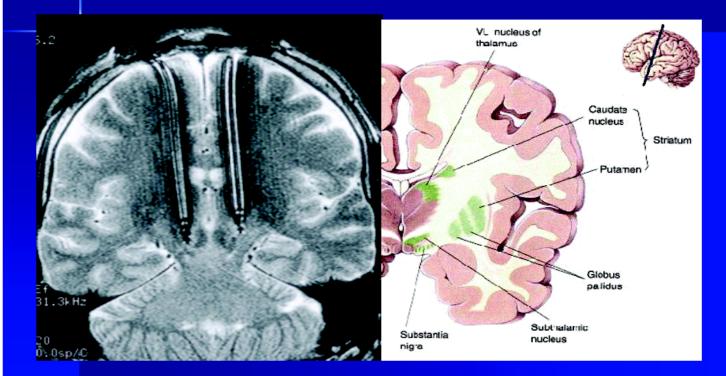




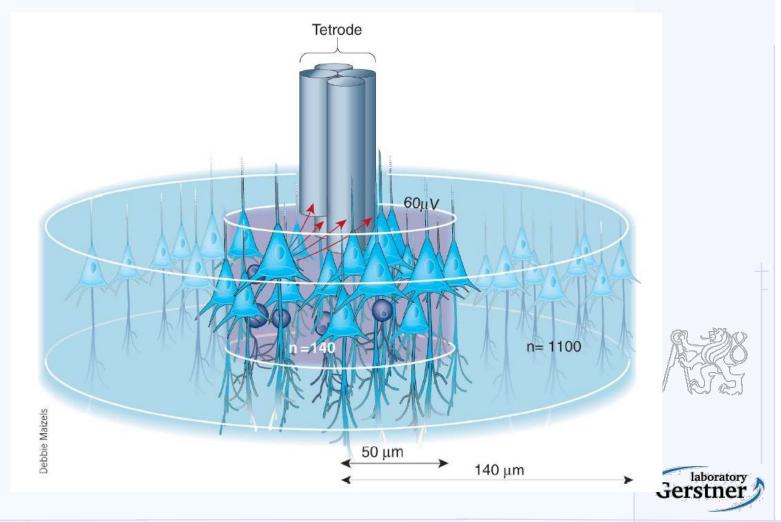




DBS: Topography



Neuron single action potential



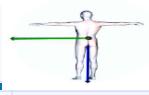


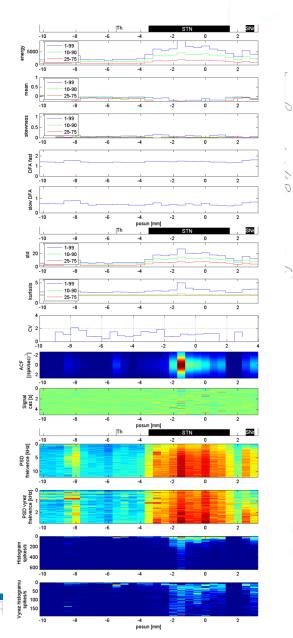
3)Visualization of navigation – raw parameters

i'l plan

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	Center EL	Anterior EL	Posterior EL	Medial EL	Lateral EL	DBS Lead Position
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Micro electrode recording: DATE: 14/3/06

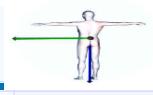
Annotation Surgery protocol



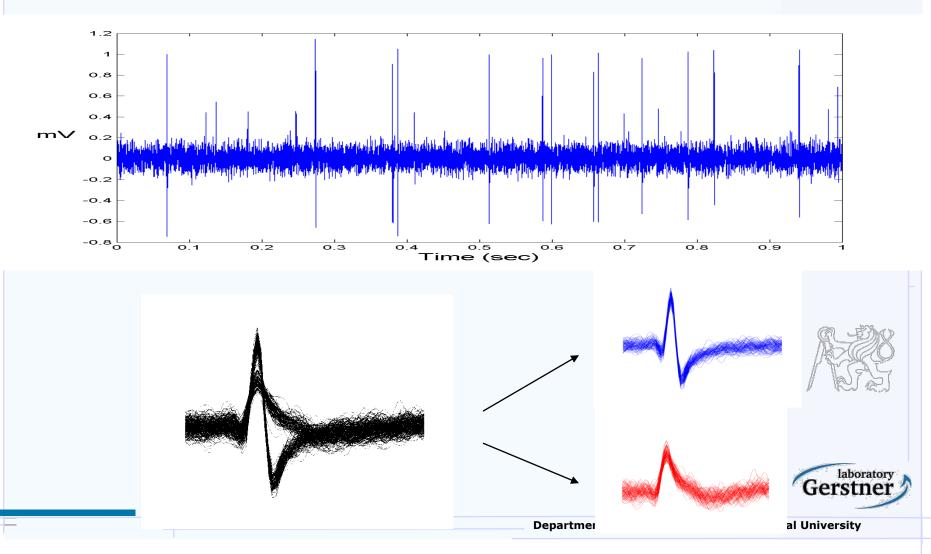
Gerstner

s, Czech Technical University

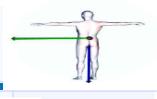
Main Idea

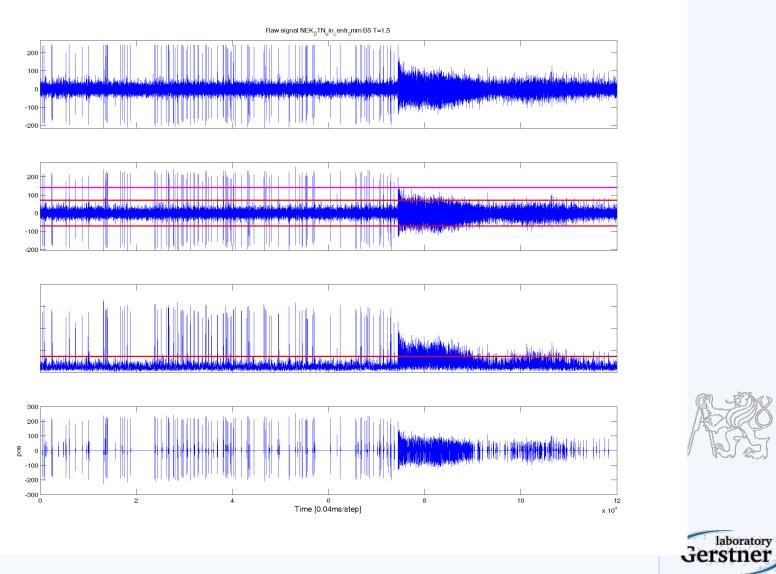


- Motivation
 - Assign stimuli (picture, sound, movement) to different neurons !!!

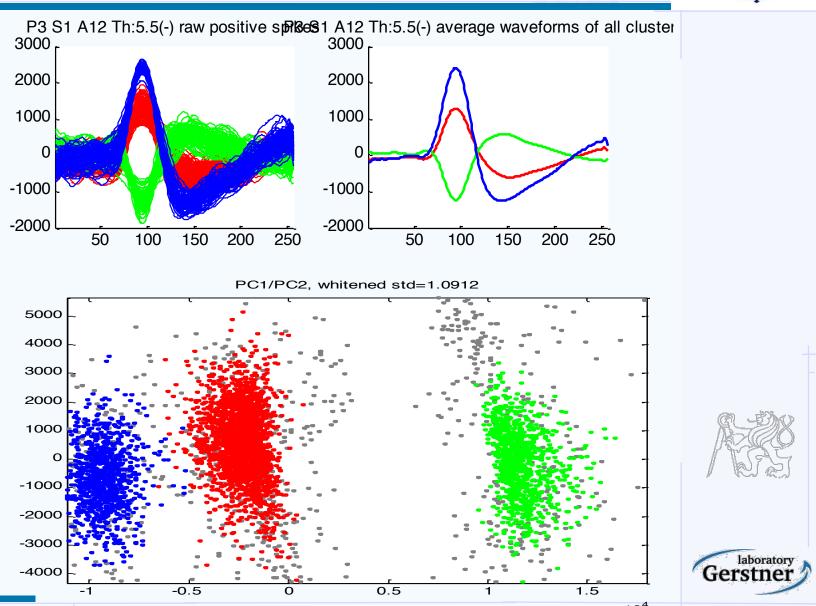


Spike Detection

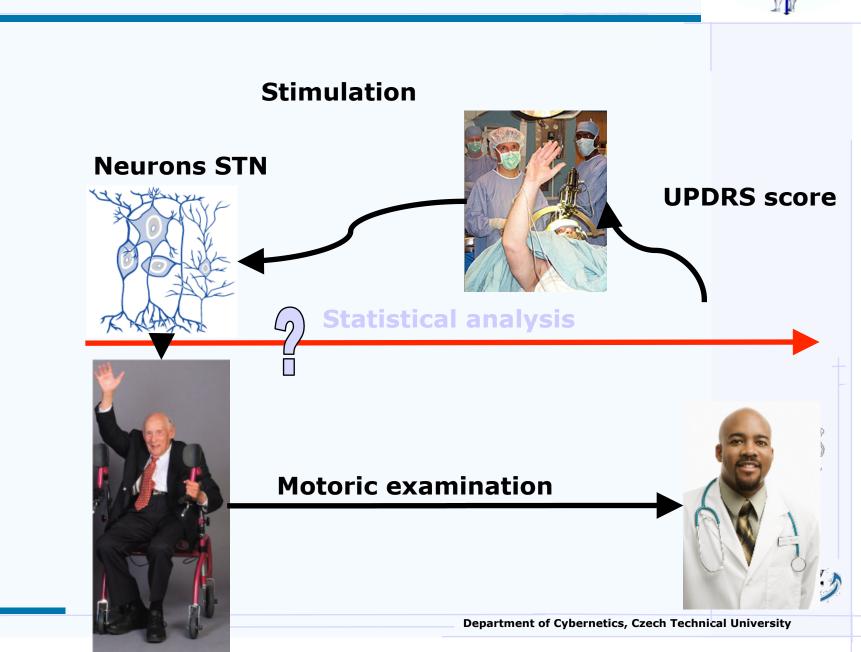




Spike Sorting: one channel, 3 cluster, PCA projection



Dependence UPDRS or depression?



IAPS experiment

- affective visual stimulation
- a series of 24 IAPS pictures



MicroEEG Data Recording

- peroperative STN exploration
 - integral part of DBS implantation
- 5 parallel microelectrodes
- sampling at 24kHz



- 10 patients
- 43 recording positions
- 141 recordings (74 from STN)
- 173 minutes (89 from STN)
- 176 neurons (101 in STN)





baseline 2







presentation for 2s + 2s

recording during presentation

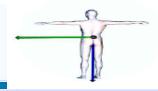
stimulation 1

- pseudorandom ISIs
- pseudorandom picture emotional content
- uniqueness

baseline 1



rsity



Bipolar & Schizophrenia Analysis

People:

Daniel Novak, Ing. Jan Hrdlicka (PhD), Katerina Sedlackova (DP), Jan Poupe (DP), Radek Jedlicka (BP), **PPC:** MUDr. Filip Spanel PhD, **EPSA:** (Dr. David Cuesta Frau)

Area: Biological Signal Processing, Temporal Pattern Recognition, Multivariate Time Series Classification

> **Goal: Schizophrenia Relapse Prediction, Prediction of Mania and Depressive states**



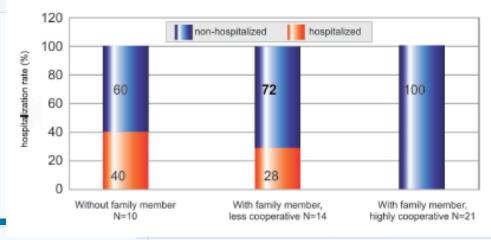
laboratory



TAREPS

PROGRAM PREVENCE RELAPSU PSYCHOTICKÉHO ONEMOCNĚNÍ

Fig. 1: HOSPITALIZATION RATE AND ADHERENCE TO THE ITAREPS PROTOCOL. CUT OFF POINT OF COOPERATIVENESS DEFINED AS MORE OR LESS THEN 70 % OF REQUIRED EWSQ QUESTIONNAIRES RETURNED



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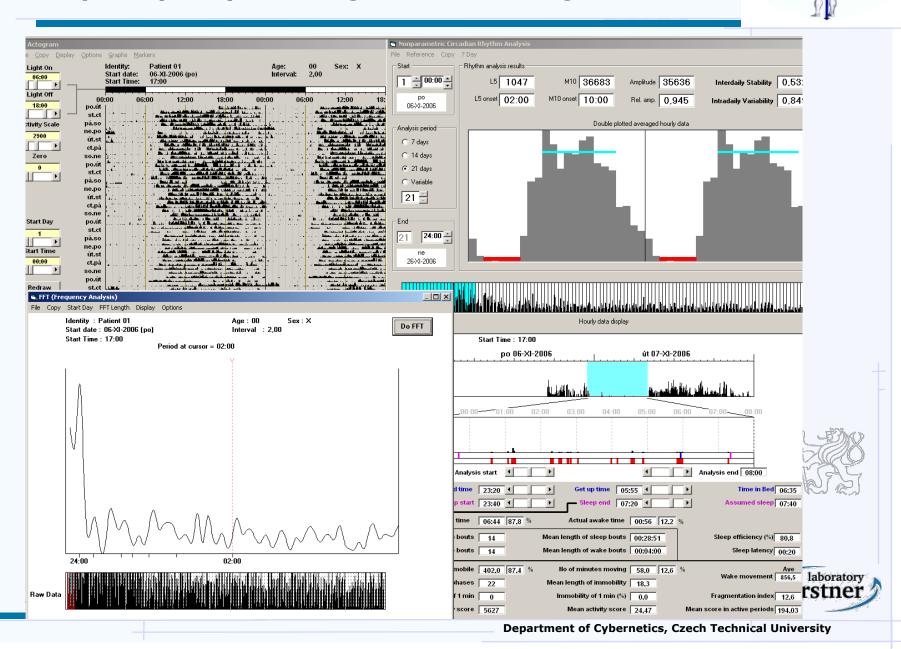


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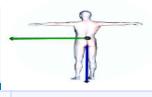
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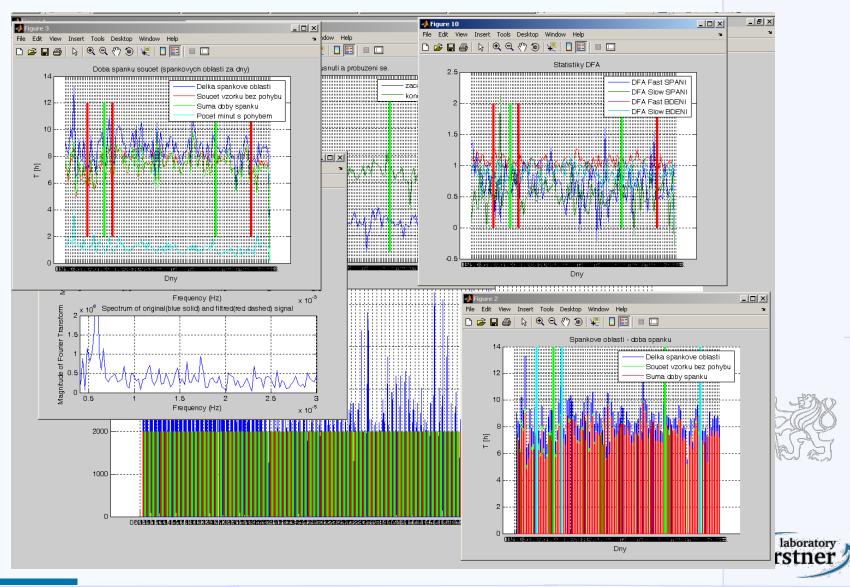
INFORMACI O Z MĚNĚ BTAVU PACIENTA

Sleep Analysis by Cambridge Neurotechnologies



Sleep analysis









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