

# AID: Analysis and Interpretation of Biomedical Data

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# Výzkumné cíle skupiny

- Vývoj pokročilých metod a nástrojů pro analýzu (biomedicinských) dat
- Aplikace metod strojového učení a datové analýzy na lékařská data
- Vývoj aplikací a systémů pro management nemocí (Parkinsonova nemoc, diabetes)
- **K čemu to?:** využití AI v podpoře diagnostiky a léčbě

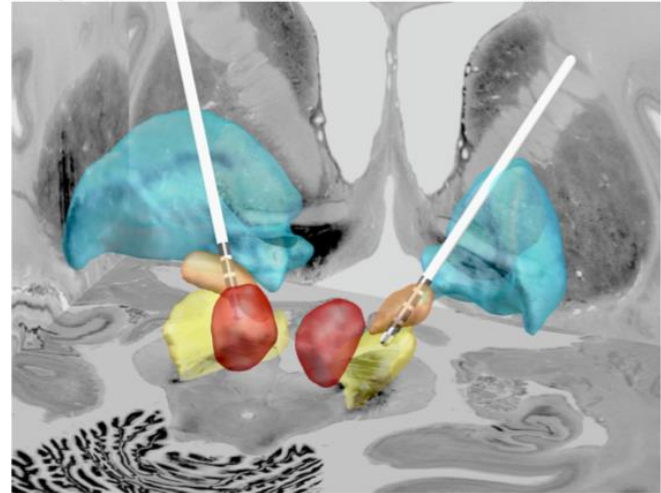
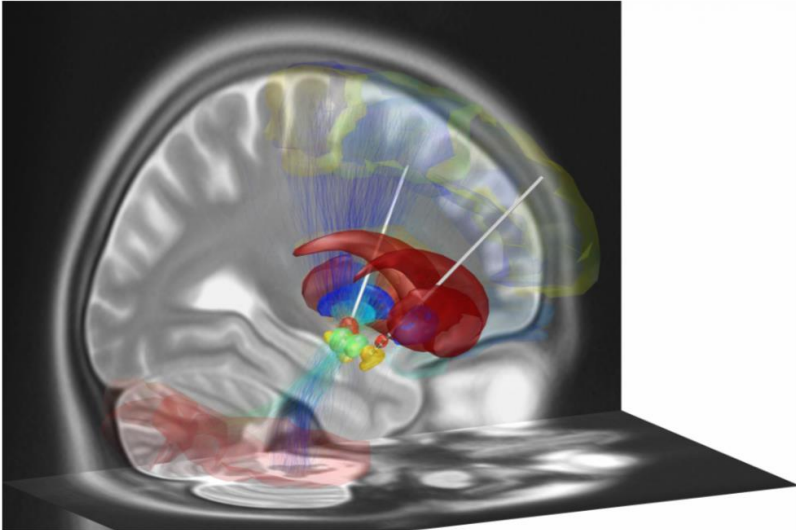


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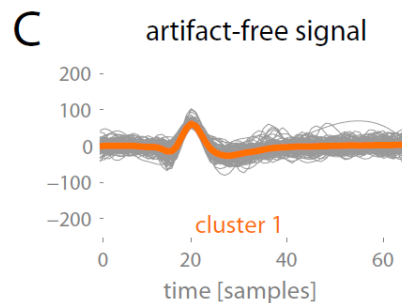
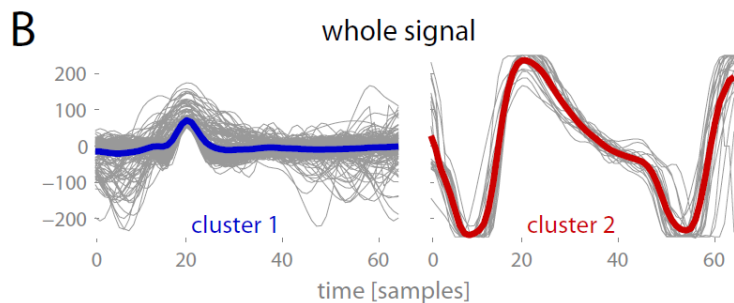
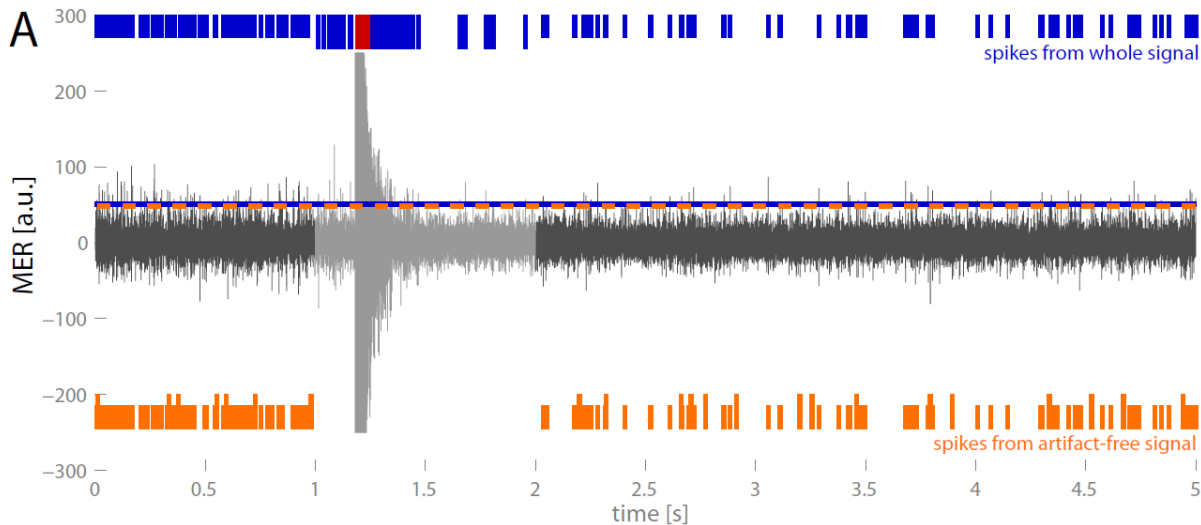
# Signal processing

# Deep brain stimulation in Parkinson's Disease

- Analýza dat (mirko-elektrodové EEG,  $\mu$ EEG)
- 3D fittování atlasu a rekonstrukce trajektorií
- Nástroje pro předzpracování (spike detection, artifact detection...)

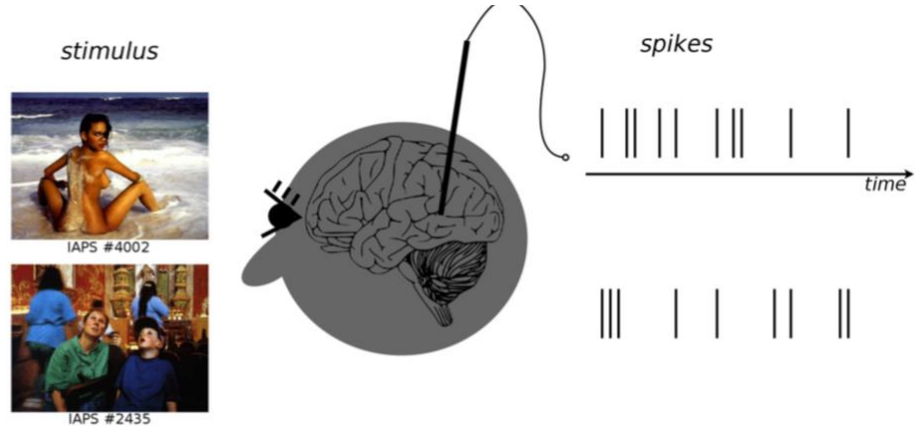
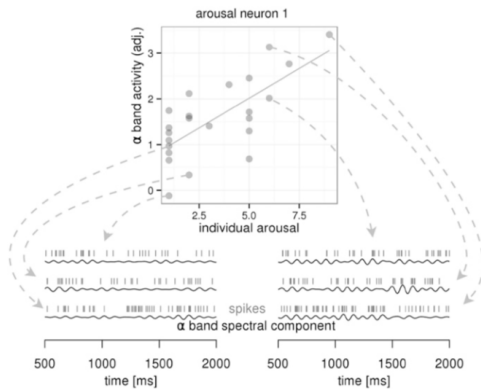
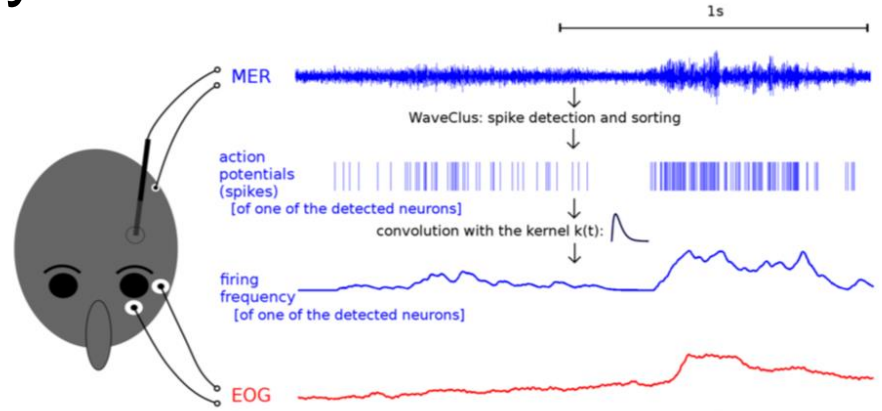


# $\mu$ EEG: detekce akčních potenciálů a artefaktů

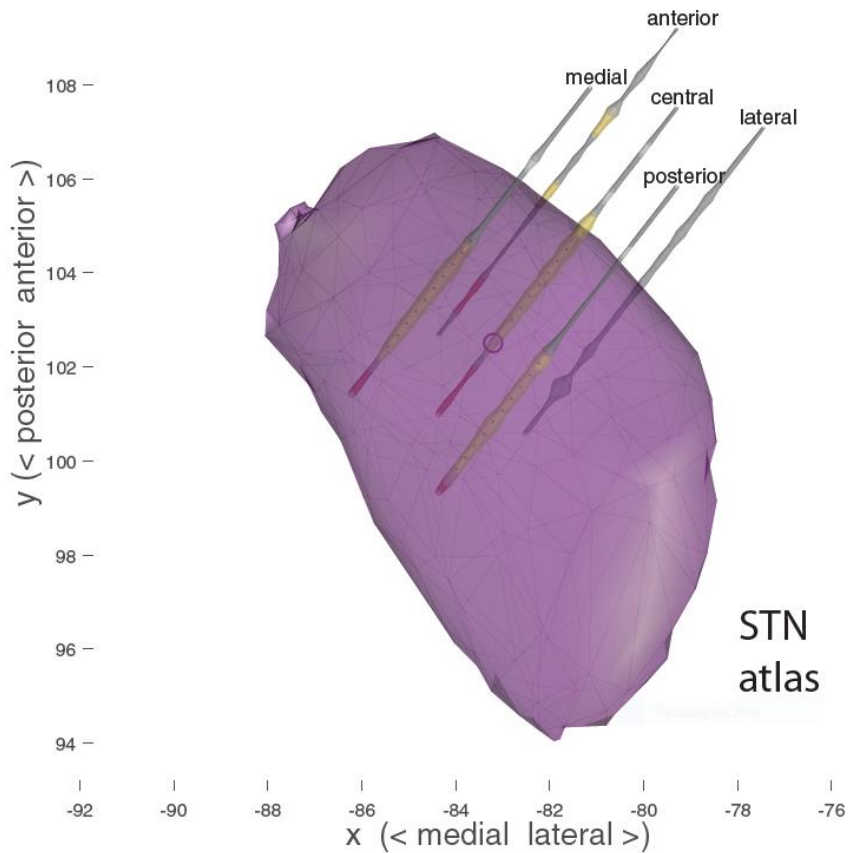


# $\mu$ EEG: Task-related activity

- eye-movement-related neurons
- “emotional” neurons
- **Partners:** LF1 UK

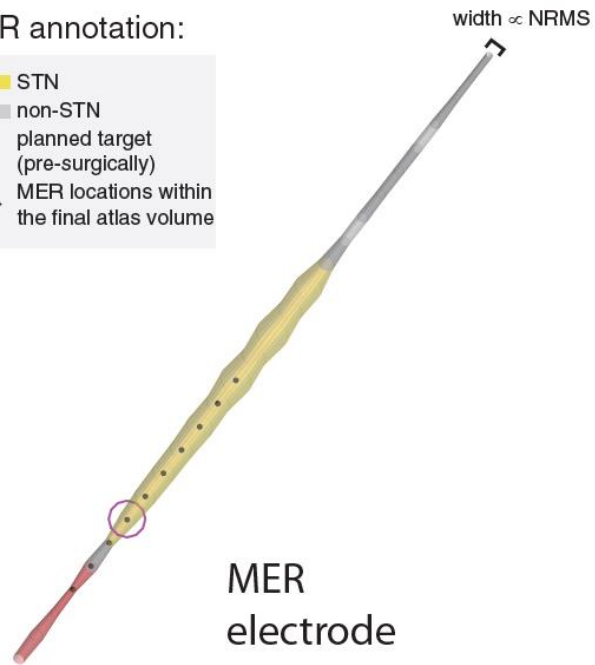


# Microelectrode recording and atlas fitting



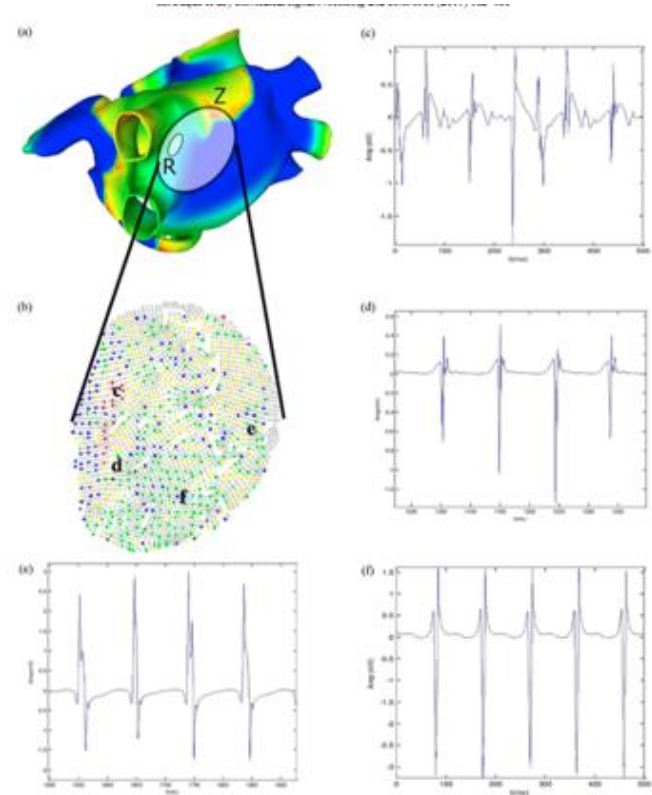
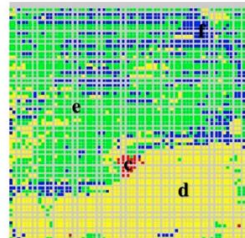
MER annotation:

- STN
- non-STN
- planned target (pre-surgically)
- MER locations within the final atlas volume



# SIGNALS: Atrial fibrillation targeting

- Classification of complex fractionated atrial electrograms
- Target for treatment of atrial fibrillation
- Sample entropy mapping
- **Partners:** UPV, UPB





# E-health applications

# Diabetes management



# Application screenshots

- Main app – each tab represents one module
  - caloric intake, caloric expenditure, blood glucose, blood pressure, education module, communication with physician

**Caloric intake**

Search for a food  
bread

Search from favorites Search

**Your today income**

Energy: 2582.0 / 9053 kJ

Sugars: 74.4 / 319 g

Lipids: 29.1 / 61 g

Proteins: 10.8 / 79 g

Show more details

**Wheat bread**

|           |        |        |          |
|-----------|--------|--------|----------|
| Energy    | Sugars | Lipids | Proteins |
| 1001.0 kJ | 54.0 g | 0.9 g  | 5.6 g    |

\* values per 100g food

Note (normal portions, etc.)

**Adding food**

Date and time 19.11. 17:02

Quantity (g~ml) 100

Food category Snack (PM)

Add to consumed food

Remove from favorites

**Caloric expenditure**

Activity categories:

Favorites activities

Select activity:  
walking - 5,0 km/h

Date and time:  
19.11.2014 Od 17:03 Do 17:18

Remove from favorites Save activity.

**List of activities for day 19.11.2014**

| Activity name:     | Time (min): | Expenditure (kJ): |
|--------------------|-------------|-------------------|
| walking - 5,0 km/h | 15          | 337.5             |

**Glucose blood**

Hide...

Measured value of blood glucose:  
4.9 mmol/l

Note to measured value: (optionally)  
Before meal Select


Select date and time, save value:  
19.11.2014 11:59 Save measured value

**Measured values for day 19.11.2014**

| Time  | mmol / l | Note        |
|-------|----------|-------------|
| 07:59 | 4.8      | Before meal |
| 08:59 | 5.7      | After meal  |

# Relapse prevention in schizophrenia and bipolar disorder

- **Aim:** predict relapse (clinical worsening) in psychiatric diseases
- **Projects:**
  - ITAREPS: sms system, weekly self-reports
  - BIPO: activity tracking in bipolar disorders
- **Tasks:**
  - Activity analysis: sleep detection, anomaly detection, classification
  - Mood analysis: multivariate statistics, system dynamics

- **Collaboration:**   
NÁRODNÍ ÚSTAV DUŠEVNÍHO ZDRAVÍ

# Zdroje Financování

- Zdroje financování: GACR, AZV, FP7, H2020
  - Support to Patients through E-service Solutions
  - Older People's e-services at home  
Mechanisms of deep brain stimulation: Role of the subthalamus in motor, visual and affective processing
  - Nanoelectronics for Mobile Ambient Assisted Living Systems
  - Mikro a makro konektomika subthalamického jádra u Parkinsonovy nemoci, spoluřešitel

# Témata prací + Kontakty

- Strojové učení nad reálnými problémy (signály, data)
  - Ing. Eduard Bakštein, Ph. D. ([@fel.cvut.cz](mailto:@fel.cvut.cz))
  - Mgr. Tomáš Sieger, Ph. D. ([@fel.cvut.cz](mailto:@fel.cvut.cz))
- Vývoj systémů pro podporu pacientů (diabetes, závislosti)
  - Doc. Daniel Novák ([@fel.cvut.cz](mailto:@fel.cvut.cz))
- Vývoj HW a SW, asistivní systémy
  - Ing. Petr Novák, Ph.D. ([@fel.cvut.cz](mailto:@fel.cvut.cz))



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