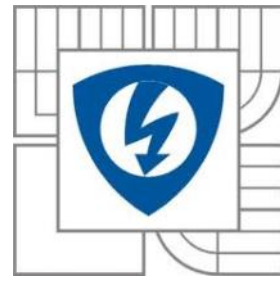




3rd SPLab Workshop

30th October – 1st November 2013



Brno University of Technology

Faculty of Electrical Engineering and Communication
Department of Telecommunications



Introduction

- Brno University of Technology (BUT) is the second largest technical university in the Czech Republic with 23,000 students currently studying at 8 faculties.
- Founded in 1849 and offers a wide array of technical disciplines.
- BUT was awarded the European Commission's ECTS and DS Label certificates

Faculties

- Faculty of Architecture
- **Faculty of Electrical Engineering and Communication**
- Faculty of Chemistry
- Faculty of Information Technology
- Faculty of Business and Management
- Faculty of Civil Engineering
- Faculty of Mechanical Engineering
- Faculty of Fine Arts





Faculty of Electrical Engineering and Communication





Faculty of Electrical Engineering and Communication

- Consists of 12 departments with about 190 teachers, 360 PhD students, and approximately 4000 BSc and MSc students.
- **Departments**
 - Department of Control and Instrumentation
 - Department of Biomedical Engineering
 - Department of Electrical Power Engineering
 - Department of Electrical and Electronic Technology
 - Department of Physics
 - Department of Foreign Languages
 - Department of Mathematics
 - Department of Microelectronics
 - Department of Radio Electronics
 - **Department of Telecommunications**
 - Department of Theoretical and Experimental Electrical Engineering
 - Department of Power Electrical and Electronic Engineering





Department of Telecommunications

- Professional education in telecommunication technology ranging from communication theory, communication networks and systems, data transmission and encryption, up to multimedia data processing and audio engineering.
- Bachelor, Master and PhD study programmes in Teleinformatics, Audio Engineering and Telecommunication and Information Technologies.
- Number of students: BSc: 628, MSc: 276, PhD: 83.
- Research mainly focuses on telecommunication and network systems, **signal processing** and analog technology.



Research Groups

- **WISLAB** (Wireless System Laboratory of Brno)

Modern wireless ad-hoc and sensor systems.



- **DINES** (The Distributed Network Systems)

Communication in IP and wireless sensor networks, (geo)localization.



- **Crypto** (Cryptology Research Group)

Cryptography, computer security and applied mathematics



- **Optolab** (Laboratory of Optical Networks)

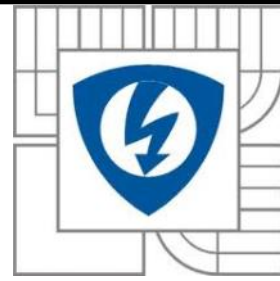
Passive optical networks deployment



- **SPLab (Signal Processing Laboratory)**

<http://splab.cz/en/>





Introduction of the Signal Processing Laboratory

There is nothing quite as practical as a good theory



Who we are

There is nothing quite as practical as a good theory

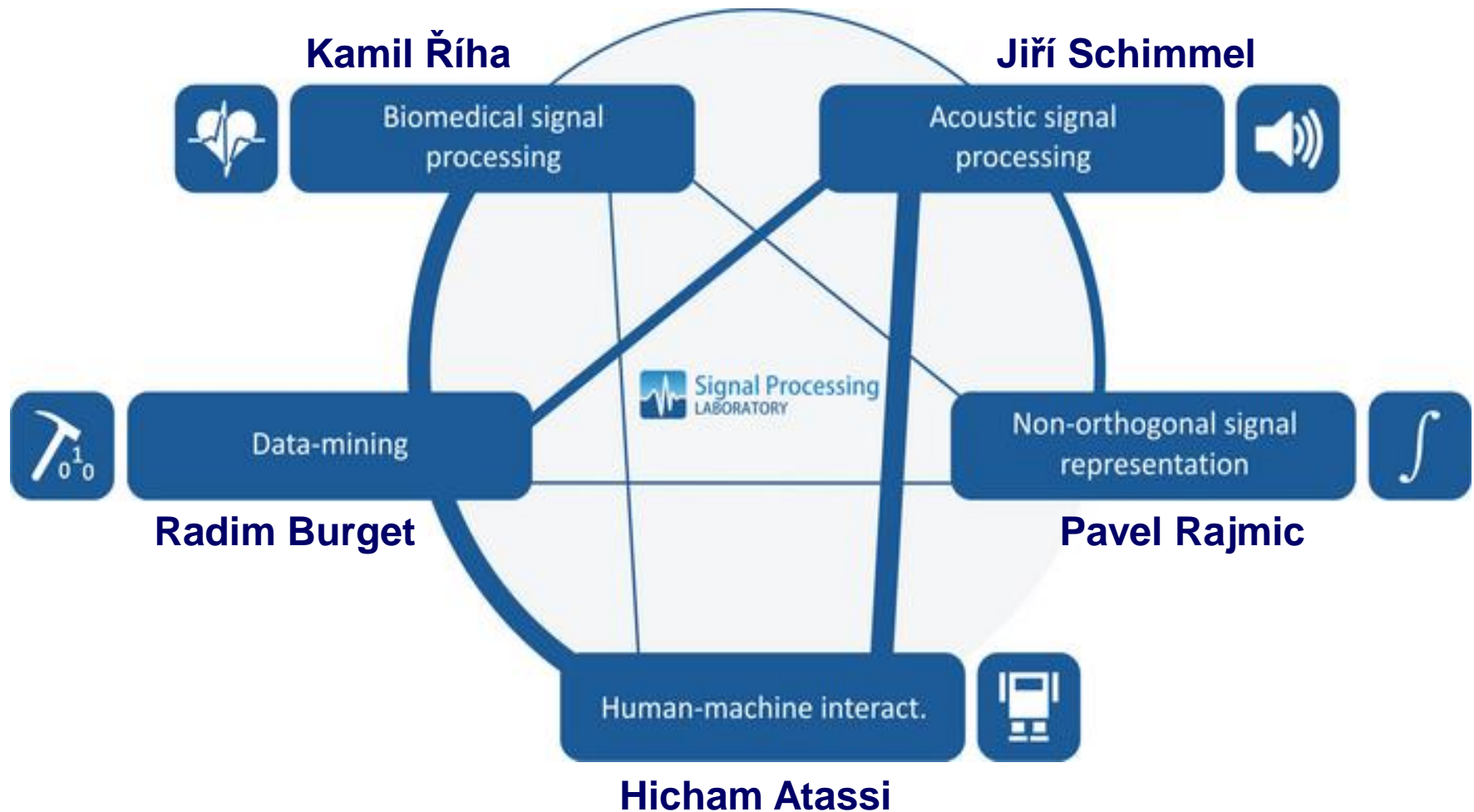
Kurt Lewin



- Team leader: Zdeněk Smékal
e-mail: smekal@feec.vutbr.cz
- 9 members
- 15 Ph.D. students



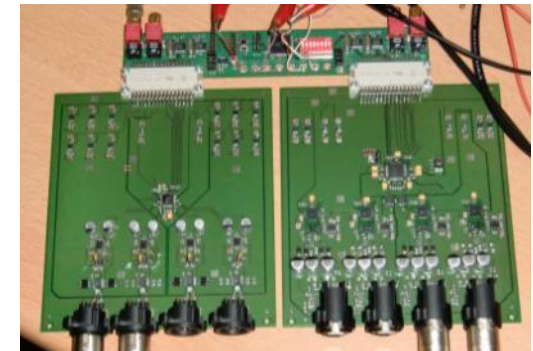
Who we are





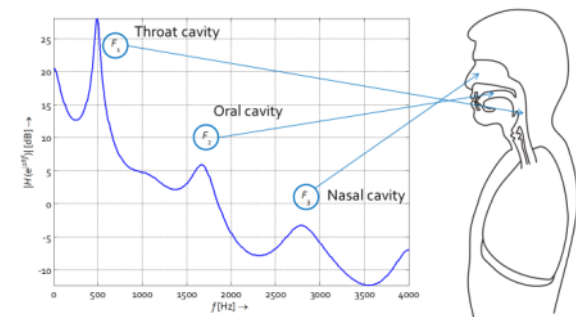
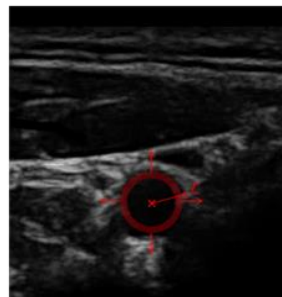
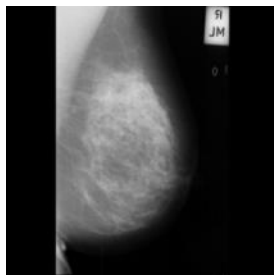
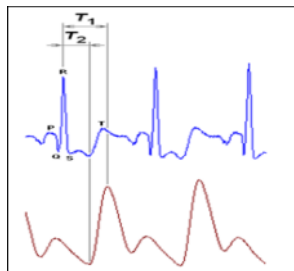
Acoustic Signal Processing

- Digital audio effects, nonlinear audio system modeling
- Sound source localization, blind source separation
- Noise cancellation in speech or other signals
- Real-time audio processing on PC and DSP
- Audio hardware
- Spatial audio



Biomedical Signal Processing

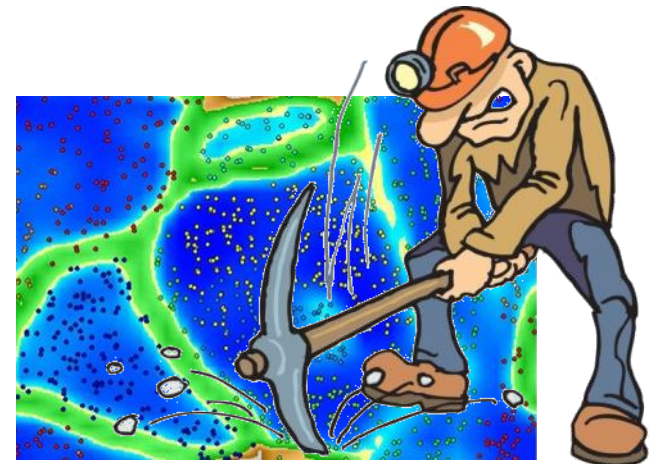
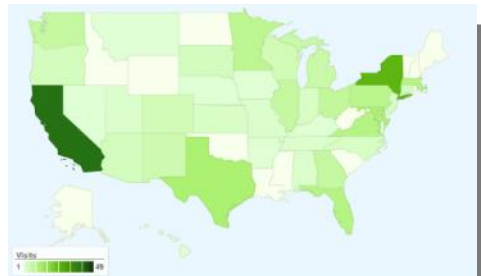
- Biomedical sensors design and signal processing
- Signal processing for computer tomography and magnetic resonance 3D data
- Ultrasound images and video sequences processing
- Medical hardware designing (specialized microprocessor controlled equipment)
- Diagnosis of nervous system disorders from speech





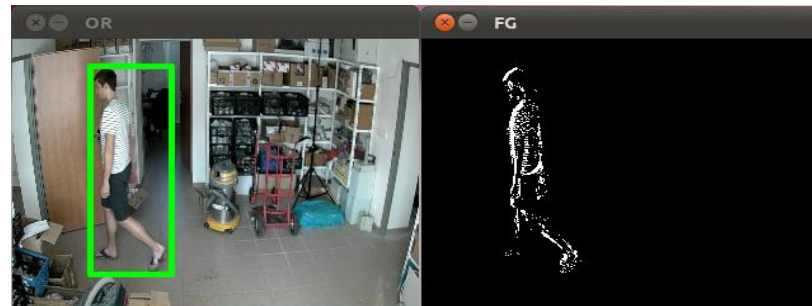
Data-Mining

- Open-source tool for Image mining and Image Processing
- Image Mining Extension with OpenCV and ImageMining
- Genetic algorithms and genetic programming
- Evolutionary optimization techniques



Human – Machine Interaction

- Speech and speaker segmentation
- Speech disorders detection and recognition
- Multimodal emotion recognition
- Text processing (helpdesk analysis)
- Body detection, gait recognition, face detection and recognition
- Image processing in both infrared and thermal spectrum
- 3D scene acquisition and spatial displaying





Non-Orthogonal Signal Representation

- Orthogonal and non-orthogonal representing systems
- Wavelets
 - Segmentwise wavelet transform (1D, 2D)
 - Image compression (modifications to SPIHT via SSIM)
- Curvelets, Contourlets, Shearlets etc.
 - Audio and image inpainting
 - Extrapolation of signals
 - Image interpolation for resizing
- Sparse signal processing
- Compressed sensing
- Advanced mathematical background for other groups





Laboratories

- Laboratory of Signal Processors
- Laboratory of Audio Systems
- Acoustic Laboratory
- Anechoic Chamber
- Multimedia Laboratory
- etc.





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Funding

- Spatial Acoustics Effects for Systems of Multi-Channel Digital Audio Processing (Ministry of Industry and Trade, 2006-2009, 440K EUR)
- Manifold System for Multimedia Digital Signal Processing (Ministry of Industry and Trade, 2009-2012, 520K EUR)
- Media-informatics system for support of advanced multimedia services (Ministry of Industry and Trade, 2010-2013, 667K EUR)
- Research and development system for product processes optimization (Ministry of Industry and Trade, 2009-2013, 649K EUR)
- The Research of Algorithms for Processing of Digital Images and Image Sequences (Ministry of Education, Youth and Sports, 2010-2012, 100K EUR)
- Improvement of risk area security using combined methods for biometrical identification of subjects (Ministry of Interior, 2010-2014, 900K EUR)
- Advanced speech analyses technology for call centers and security services, (Ministry of Industry and Trade, 2009-2011, 500K EUR)



Cooperation with Industry





European Social Fund Project

- **Project title:** Support for incorporating R&D teams in international cooperation in the area of image and audio signal processing
- **Duration planned:** 3 years, beginning on 1st May 2011
- **Number:** CZ.1.07/2.3.00/20.0094
- **Project purpose:** The project will serve as a basis for preparing international collaboration of academic staff and students in the field of signal processing.
- **Project activities:** Reciprocal short time stays for representatives of the academic community and students, lectures of foreign experts at Brno University of Technology, education training of academic and students in the use of modern-trend tools in the area of digital signal processing, **workshops**, and more.





Signal Processing Workshop

- The objectives of the workshop are:
 - to introduce research activities of the participating groups,
 - to share knowledge,
 - to discuss possible areas of further cooperation,
 - to strengthen links between the participants.





Thank you for your attention



<http://splab.cz>



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