

Expression of interest for research cooperation in Horizon 2020

Description of institution

| | |
|---|--|
| Interested institution: | AGH University of Science and Technology |
| Department carrying out the proposed research | Department of Measurement and Electronics Image, Signal Processing and Biomedical Informatics Group |
| Address and webpage | http://www.kmet.agh.edu.pl/?lang=en |
| Contact person (name, e-mail address, phone) | Andrzej Skalski, skalski@agh.edu.pl , +48126172828 |

Research offer

Brief description of the department (key research facilities, infrastructure, equipment)

Our group is a part of the Department of Measurement and Electronics, Faculty of Electrical Engineering, Automatics, Computer Science and Biomedical Engineering AGH. This determines the area of our scientific activity, which encompasses all directions of research developed in the field of signal, image processing and computer vision.

Equipment:

- optical localizers (NDI Optotrak, NDI Polaris Spectra) with active transmitters and passive reflective rigid bodies
- lighting equipment: softboxes, background screens
- camera stands, sliders, turntables, motorized positioning stages, gimbals
- laser rangefinders,
- industrial-grade cameras, thermographic cameras, ToF cameras
- image processing workstations
- surgical navigation systems (OrthoPilot) and surgical instruments
- ultrasonographs
- camera calibration tools

Scientific area

| | |
|---|--|
| <ul style="list-style-type: none">• Chemistry | <ul style="list-style-type: none">• Social Sciences and Humanities |
| <ul style="list-style-type: none">• Economic Sciences | <ul style="list-style-type: none">■ Information Science and Engineering |
| <ul style="list-style-type: none">• Environment and Geosciences | <ul style="list-style-type: none">• Life Sciences |
| <ul style="list-style-type: none">• Mathematics | <ul style="list-style-type: none">• Physics |

Research field

Our research focuses on processing of images, video sequences and acoustic signals, particularly in the field of biomedical engineering.

We specialize in image segmentation and registration, medical visualization and vision-based tracking. Besides the algorithms, we develop tracking systems for the preoperative planning and intraoperative surgical guidance.

In the field of acoustic signal analysis, we focus on voice and speech signals in the context of pathology detection and monitoring of the treatment process of patients with neurodegenerative diseases (e.g. Parkinson's disease).

We are experts in longitudinal studies, feature extraction, segmentation, quantification, pattern recognition, classification, prediction models, machine learning, risk models in the field of biomedical engineering.

Current research topics:

- Preoperative planning and intraoperative support for partial nephrectomy. Segmentation of kidney, renal ureter and arteries.
- Computed Tomography/MRI - based radiotherapy planning of prostate cancer.
- Oncoplastic breast tumor bed localization for radiotherapy planning using image registration.
- Voice data mining for laryngeal pathology assessment and automatic detection/monitoring of Parkinson's disease.
- Smartphone-based localizers for computer-assisted orthopedic surgery.

The proposed research/project description

- Segmentation, tracking, registration of medical images
- Computer aided diagnosis and therapy
- Application of mobile devices in surgical navigation
- Analysis of medical images
- Medical signal processing and analysis, especially speech and voice signals
- Computer Vision

Additional information (key Persons and Expertise; additional trainings, research programme, other)

Key Team Members: prof. Janusz Gajda; Andrzej Skalski, PhD; Mirosław Socha, PhD; Adrian Goral, MSc; Daria Hemmerling, MSc; Katarzyna Heryan, MSc; Marek Wodziński, MSc

Finished

projects:

- "CT data segmentation in application to prostate cancer radiotherapy", NN518 497739.
- "Examination of required hardware and signal processing algorithms features for heart attack prediction system based on Echocardiographic images". Polish-Italian grant, decision no 363/N-Wlochy/2008/0.
- "The Computer System for Bronchoscopy Laboratory Integrating the CT-Based Bronchoscopy and Transbronchial Needle-Aspiration Biopsy Planning, Virtual Bronchoscopy, Management of the Bronchoscopic Procedures Recordings, Automatic Image-Based Data Retrieval, Artefact and Pathology Detection and Interactive 2D & 3D Visualization", R13 011 03.
- "Versatile Endoscopic Capsule for gastrointestinal TumOr Recognition and therapy", VECTOR, (<http://www.vector-project.com>), EU 6 framework.
- ECSON: "Engineering and Computational Science for Oncology Network" (<http://www.ecson.org/>), supported by Engineering and Physical Sciences Research Council EPSRC,
- "The flexible architecture system designed for the traffic parameters measurements", no. R01 035 01.
- "Development of a bronchoscopic model of a navigation system based on the analysis of endoscopic and virtual images", KBN no 3 T11E 039 27.
- "The use of the speech signal as a source of diagnostic, control and forecasting information in selected medical problems related to otorhinolaryngology", no.0136/DIA/2013/42.

Collaboration with B.Braun Aesculap AG within the field of surgical navigation and computer-assisted interventions: joint replacement, lumbar spinal fusion, navigated biopsies.

Collaboration with Universidad de Antiquia, Medellin in Colombia, Friedrich- Alexander-Universitat Erlangen-Nurnberg Erlangen, Germany and University of Naples L'Orientale, Italy in the field of signal (including voice and speech) processing.

Medical partners: Rydygier Memorial Hospital (Cracow, Poland), The University Hospital (Cracow, Poland), Specialized Municipal Hospital G. Narutowicz (Cracow, Poland), Holycross Cancer Center (Kielce, Poland), John Paul II Hospital in Krakow, Ortopedicum Hospital and Rehabilitation Center (Cracow, Poland)