Information about a group interested in cooperation with industry
Poland Chapter of IEEE Signal Processing Society (max. two pages)

Name of research group	Department of Biocybernetics and Biomedical Engineering
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Web address	http://www.kbib.agh.edu.pl
Areas of research, projects, implementation works	A. Modelling of biological systems for decision making, B. Design and prototyping of medical equipment and software, C. Development of biosignal and images interpretation methodology, D. Research of human monitoring and assisted living, E. Research of visual perception and technical applications of eyetracking, F. Development of sensor systems for affective computing, G. Research on Human-Computer Interfaces H. Automatic processing, analysis, recognition and understanding of medical images, I. Application of neural networks as problem-solving and system modelling tool, J. Analysis of pathological speech for diagnosis and therapy optimization K. Development of computational intelligence methods and tools for medical data analysis L. Research and development of new biologically plausible models of neurons and their networks to reproduce biological functionalities of real neural networks.
Short information about research group – max. 250 words	Several research groups develop the applications of electronics, signal processing and information technology in medicine and biology. We have a longstanding experience in acquiring, processing and interpreting biosignals and images of various origins and modalities. Main directions of research include electrocardiology, electroencephalography with BCI applications, posture and motion tracking, vocal tract diseases, human visual system, telemedicine, ambient assisted living, virtual reality, human-computer interaction, computer vision, machine learning, affective computing, knowledge representation and modelling, neural networks and image understanding. The particular projects are usually inspired by the needs of the partners from medical sciences and from the industry. Recently, the most important projects are founded by the Polish Government and concern the cross-country solutions for the public health service. The area of expertise includes applications of modern

	mathematical and statistical tools for data analysis and interpretation like wavelets, higher order spectra and principal/independent component analysis. The techniques recently added to the knowledge portfolio are: non-uniform sampling (frames theory), perceptual models of signals and images and MRI noise estimation. The pursuit of the expert's scanpaths justifies the hope for extracting the non-verbalized knowledge about the signal and creates new possibilities of intelligent signal optimization for storage and transmission. The affective computing research paves the way for a more effective and natural man-machine interaction. The strategy for the next years includes the further development of information technology methods for medical applications.
Key staff (name, degree, position) – max. 5	Piotr Augustyniak / professor (head)/DSc. EE. (2004)/empl. 1989 Ryszard Tadeusiewicz / professor/DSc. AC. (1980)/empl. 1971 Adrian Horzyk / associate professor/DSc. CS. (2014)/empl. 2002 Piotr Szymczyk / associate professor/DSc. CS. (2017)/empl. 1988 Andrzej Izworski/associate professor/PhD. EE. (1988)/empl. 1984 (**total: 16 researchers, 6 PhD Students**)
R&D infrastructure	software engineering, signal/image processing, prototyping of electronic devices, acquisition of biosignals/speech/images/ motion capture
Experience (research, projects, implementations)	1. Investigation of multimodal measurements of selected human biological parameters and their evaluation as prospective sensors in the domicile of a disable / National Science Centre 2. Non-stationary signal-dependent noise modelling in parallel magnetic resonance imaging / National Science Centre 3. Investigation of using wearable technologies for human monitoring / National Science Centre 4. Investigation of application of wearable sensors to provide telemedicine services / National Science Centre
Cooperation	***Clinical:*** Institute of Microbiology, Collegium Medicum, Jagiellonian University, Krakow Institute of Physiology and Pathology of Hearing, Warszawa John Paul II Hospital, Krakow 5th Military Hospital with Polyclinic, Krakow Krakow Cardiac Research Center Fraunhoffer Institute Erasmus Research Center, Thorax Center ***Industrial:*** Silvermedia (manufacturer of telemedicine software) - common R&D projects, software validation, Aspel SA. Zabierzow (manufacturer of ECG equipment) - common R&D projects, software validation and students trainings,

	Siemens Healthcare (manufacturer of medical equipment) - students trainings, Institute of Medical Technology and Equipment (ITAM) - common R&D projects, software validation,
The greatest achievements in recent five years (projects, implementations, patents, key publications - max. 10, no. of PhD degrees awarded)	1. P. Augustyniak, G. Ślusarczyk Graph-based representation of behavior in detection and prediction of daily living activities Computers in Biology and Medicine, Volume 95, 1 April 2018, Pages 261-270 DOI: 10.1016/j.compbiomed.2 017.11.007 IF= 1,953 2. T. Moszkowski, D. W. Kauff, C. Wegner, R. Ruff, K.H. Somerlik-Fuchs, T.B. Krüger, P. Augustyniak, K-P. Hoffmann, W. Kneist Extracorporeal Stimulation of Sacral Nerve Roots for Observation of Pelvic Autonomic Nerve Integrity: Description of a Novel Methodological Setup IEEE Trans. Biomed. Eng. 2018 Mar;65(3):550-555 DOI: 10.1109/TBME.2017.27 IF= 2,720 3. Horzyk, J. A. Starzyk, J. Graham, Integration of Semantic and Episodic Memories, IEEE Transactions on Neural Networks and Learning Systems, Vol. 28, Issue 12, Dec. 2017, DOI: 10.1109/TNNLS.2017.2728203, IF = 6.108 4. T. Pieciak, S. Aja-Fernández, and G. Vegas Sánchez-Ferrero. "Non-Stationary Rician Noise Estimation in Parallel MRI using a Single Image: A Variance-Stabilizing Approach." IEEE Transactions on Pattern Analysis and Machine Intelligence, vol. 39, no. 10, 2017, pp. 2015-2029, IF = 8.329 5. Staszuk, B. Wiatrak, R. Tadeusiewicz, E. Karuga-Kuźniewska, Z. Rybak *Telerehabilitation approach for patients with hand impairment*, Acta of Bioengineering and Biomechanics, No. 4, 2016, pp. 55-62 ; DOI:10.5277/ABB-00428-2015-03 IF=1,042 6. J. Przybyło, E. Kańtoch, M. Jabłoński, P. Augustyniak Distant measurement of plethysmographic signal in various lighting conditions using configurable frame-rate camera Metrology and Measurement Systems, 23(4), pp. 579-592 IF=1,203 7. P. Szymczyk Z-transform artificial neural networks, Neurocomputing 2015 vol. 168, s. 1207-1210. IF=2.083 8. Broniec, Analysis of EEG signal by flicker-noise spectroscopy: identification of right-/left-hand movement imagination, Medical & Biological Engineering & Computing, 2016 vol. 54 iss. 12, s. 1935–1947. IF=1.916 9. S. Aja-Fernández, T. Pieciak, and G. Vegas-Sánchez-Ferrero. "Spatially variant noise estimation in MRI: A homomorphic approach." Medical image analysis, vol. 20, no. 1, 2015, pp. 184-197, IF: 4.188 10. P. Augustyniak, M. Smoleń, Z. Mikrut, E. Kańtoch Seamless tracing of human behavior using complementary wearable and house-embedded sensors Sensors 2014 vol. 14 iss. 5, pp. 7831–7856 IF= 2,964 Total publications: 196

	PhD graduates: 12