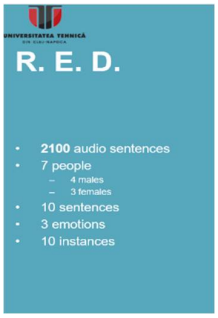
SIGNAL PROCESSING GROUP

Contact details

Name	**Signal Processing Group**
Acronym	**SPG**
Logo	
Site	www.sp.utcluj.ro
Address	26-28 G. Barițiu Str., 400027, Cluj-Napoca, Romania
Faculty Department	**Faculty of Electronics, Telecommunications and Information Technology** **Bases of Electronics Department**
Telephone	+40 264 202382
Fax	+40 264 591689
Director	Prof. Dr. Eng. Corneliu Rusu
e-mail	Corneliu.Rusu@bel.utcluj.ro

Acoustic monitoring of wild areas [8]

Romanian Emotional Database [2]



Areas of expertise

Adaptive filters for data echo cancellation – A family of stochastic gradient algorithms and their behaviour in the data echo cancellation work platform have been studied. The cost function adaptation algorithms use an error exponent update strategy based on an absolute error mapping, which is updating at every step. Performances like standard variable step-size methods have been obtained.
Signal reconstruction and phase retrieval – The phase retrieval problem is to reconstruct a signal given the modulus of its Fourier transform. This problem is associated with various applications including antenna design, filter design, image reconstruction. Recent research results relate phase retrieval to properties of zero-phase sequences or trigonometric polynomials.
Extracting a digital elevation model from a colour-coded relief scanned map – The focus of the project is in extracting a digital elevation model (DEM) from a colour-coded relief scanned map. The map is pre-processed to remove the dithering effect that appears during the printing process. For the pre-processing we propose a WHMM based algorithm, which preserves better the thin edges than the vector median filtering.
Exploration of singing voice individuality – The human voice is the result of a complex biological mechanism. It carries out information about our thoughts, feelings, and state of health. This great amount of information of different types can be extracted and interpreted. A new research domain is the acoustic configuration of the vocal sounds in singing. The singing voice analysis is useful for training singers in a professional manner.
Audio based solutions for detecting intruders in wild areas – The motivation of such an application is related to protection of large wildlife regions, such as forests, lakes, and other natural reservations. The sounds of interest are represented by humans, engines, birds and animals. To simulate various environmental situations, different types of noisy environments have been considered. Both low complexity and standard audio classification methods are delivered. Standard audio classification methods prove to be more robust, but at an expense of significantly increased complexity. Since low complexity systems are more feasible for monitoring remote areas, the complexity issue is analysed, and solutions are proposed.
Improving contextual awareness of a robot through the analysis of acoustic information - The main objective of the project is to develop a robust sound environment analysis system, for the TIAGo service robot, capable to identify in everyday life various normal, abnormal and distress conditions. Specific objectives: study of hardware, operating system and available procedures for TIAGo service robot, identification of its acoustic performance, data acquisition with TIAGo service robot, development of experimental model of sound analysis, implementation and testing of the experimental model, results validation through testing under real conditions.
Two-Dimensional Polynomial Predictors - Many signals in nature and engineering systems can be locally modeled as relatively low degree polynomials. The goal of this work is to introduce the two-dimensional polynomial predictive FIR filters, present their properties and advances in practical applications.

Team

Prof. Dr. Eng. Corneliu RUSU, Assoc. Prof. Dr. Eng. Lăcrimioara GRAMA, Lecturer. Dr. Eng. Alexandru LODIN, Dr. Marius Claudiu POPESCU, Olimpiu POP, Toma TELEMBICI, Phd. Student Lorena MUSCAR

Representative projects

OMNI-Z – "Versatile and economically viable robotic platform for indoor navigation in cluttered environments with obstacles", PN-III-P2-2.1-PTE-2019-0867, (2020-2022), http://www.citst.ro/projects/omni-z/
SASID – "Smart Acoustic Sensor for Intruder Detection", PN-III-P2-2.1-PED-2016-1608, (2017-2018), https://sp.utcluj.ro/SASID2017/HomePage.html
ROXAC – "Improving contextual awareness of a robot through the analysis of acoustic information", PN-III-P2-2.1-BG-2016-0378, https://sp.utcluj.ro/ROXAC2016/HomePage.html
PAV3M – "Intelligent management system, monitoring and maintenance of pavements and roads using modern imagistic techniques", PCCA (2014-2016), http://193.231.19.17/PAV3M/
RTSP 2015, "International Workshop on Recent Trends on Signal Processing" http://sp.utcluj.ro/RTSP2015/HomeRTSP2015.html **(2015)**
SpeD, **"The 7th International Conference on Speech Technology and Human-Computer Dialogue"**, http://www.sped2013.ro/ (2013)
SPAMEC, **"Signal Pocessing and Applied Mathematics for Electronics and Communication"**, ANCS, http://sp.utcluj.ro/SPAMEC/HomeSPAMEC2011.html (2012)
SPSWC, **"Signal Processing Systems for Wireless Communications"**, CNCSIS, http://sp.utcluj.ro/SPSWC/HomeSPSWC2008.html (2008)

Significant results

The most representative publications of the past 5 years:

1. L. Muscar, T. Telembici, C. Rusu, "Deep Learning-Based Sound Classification Algorithms for Enhanced Service Robots Audio Capabilities," 2024 15th International Conference on Communications (COMM), Bucharest, Romania, 2024, pp. 1-6, doi: 10.1109/COMM62355.2024.10741397.
2. T. Telembici, L. Muscar, C. Rusu, "What Influence Does the Type of Extracted Audio Features Have on Emotional States?" 2024 IEEE International Conference on Automation, Quality and Testing, Robotics (AQTR), Cluj-Napoca, Romania, 2024, pp. 1-6, doi: 10.1109/AQTR61889.2024.10554243.
3. M. Popescu., L. Grama, C. Rusu, "An algorithm for training a class of polynomial models,"Digital Signal Processing", vol. 141, p. 104168, 2023. [Online]. Available: https://www.sciencedirect.com/science/article/pii/S1051200423002634
4. H. Pop, A. Grama, A. Fodor, C. Rusu, "Infrastructure development for electric vehicle charging stations in Cluj-Napoca municipality - a case study," Energies, vol. 16, no. 8, 2023. [Online]. Available: https://www.mdpi.com/1996-1073/16/8/3552
5. T. Serban-Moga, L. Grama, C. Rusu, "Classification and identification of certain types of car accidents based on sound information," in International Conference on Speech Technology and Human-Computer Dialogue, SpeD 2023, Bucharest, Romania, October 25-27, 2023. IEEE, 2023, pp. 30–35. [Online]. Available: https://doi.org/10.1109/SpeD59241.2023.10314919
6. C. Rusu, L. Grama, "Analog Phase Samples Approximation from Gain Samples by Discrete Hilbert Transform", Circuits, Systems, and Signal Processing, 2022.
7. L. Grama, L. Muscar, C. Rusu, "Sound Classification Algorithms for Indoor Human Activities", 2021 16th International Conference on Engineering of Modern Electric Systems (EMES)
8. O. Pop, C. Rusu, L. Grama, "Acoustic monitoring of outdoor areas by a sensor consisting of four microphones", 2021 International Symposium on Signals, Circuits and Systems (ISSCS)
9. L. Muscar, L. Grama, C. Rusu, "Sound Classification by the TIAGo Service Robot for Healthcare Applications ", 2021 International Symposium on Signals, Circuits and Systems (ISSCS)
10. C. Popescu, L. Grama, C. Rusu, "A Highly Scalable Method for Extractive Text Summarization Using Convex Optimization", Symmetry, Vol. 13 (10), 2021
11. T. Telembici, L. Grama, L. Muscar, C. Rusu, "Results on the MFCC extraction for improving audio capabilities of TIAGo service robot", 2021 International Conference on Speech Technology and Human-Computer Dialogue (SpeD),
12. C. Popescu, C. Rusu, L. Grama, "Word Embeddings for Romanian Language and Their Use for Synonyms Detection", 2021 International Conference on Speech Technology and Human-Computer Dialogue (SpeD)
13. P. Rarago, L. Grama, M. Farago, S. Hintea, "A Novel Wearable Foot and Ankle Monitoring System for the Assessment of Gait Biomechanics ", Applied Sciences, Vol. 11 (1), 2021

See https://sp.utcluj.ro/SPGroup/SPG_Pub_Database.html for SPG publications.

The offer addressed to the economic environment

Research & development	Signal Processing Group makes research - in the core areas: signal reconstruction, adaptive filtering, compressive sampling, acoustic sensors, processing of signals obtained from specific sensors or from medical devices. - in the applied fields: sensor arrays, image processing, security and protection, intruder detection and forensics.
Consulting	Signal Processing Group provides consulting in the areas of digital signal and image processing, digital filtering, optical signal processing, computer analysis and synthesis of circuits, algorithms for signal processing, numerical methods, medical electronics, sensors and devices, wireless networks.
Training	Digital signal processing, digital filter design, adaptive filtering, signal modelling, mathematical methods for signal processing, applied statistics, optical processing and storage of information, Fourier optics.

Last updated: January 2025