SIGNAL PROCESSING GROUP

Contact details

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Acronym	**SPG**
Logo	Signal Processing Group
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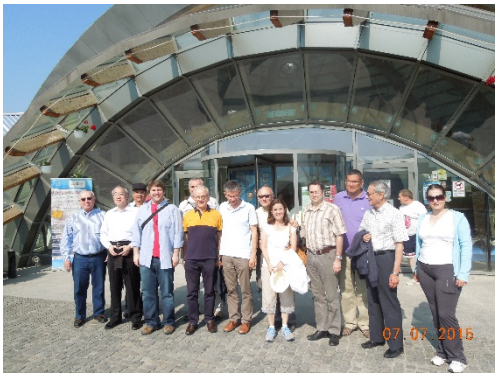

RTSP 2015
https://sp.utcluj.ro/RTSP2015/HomeRTSP2015.html

RTSP 2017
https://sp.utcluj.ro/RTSP2017/HomeRTSP2017.html

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 similar to 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 in order 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. In order 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 analyzed and solutions are proposed.

Team

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

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. 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
2. 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
3. T. Serban-Moga, L. Grama, and 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
4. C. Rusu, L. Grama, "Analog Phase Samples Approximation from Gain Samples by Discrete Hilbert Transform", Circuits, Systems, and Signal Processing, 2022.
5. L. Grama, L. Muscar, C. Rusu, "Sound Classification Algorithms for Indoor Human Activities", 2021 16th International Conference on Engineering of Modern Electric Systems (EMES)
6. 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)
7. 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)
8. C. Popescu, L. Grama, C. Rusu, "A Highly Scalable Method for Extractive Text Summarization Using Convex Optimization", Symmetry, Vol. 13 (10), 2021
9. 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),
10. 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)
11. 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)
12. L. Grama, C. Rusu, "Extending Assisted Audio Capabilities of TIAGo Service Robot," International Conference on Speech Technology and Human Computer Dialog (SpeD 2019), 10-12 Oct. 2019, Timisoara, Romania, pp. 1-8, DOI: 10.1109/SPED.2019.8906635
13. A. Lodin, L. Grama, C. Rusu," Python Implementation of the State-Space Method to Convert Analog Filters Described by a Netlist to Digital Filters," 6th International Symposium on Electrical and Electronics Engineering (ISEEE 2019), 18-20 Oct. 2019, Galati, Romania

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 modeling, mathematical methods for signal processing, applied statistics, optical processing and storage of information, Fourier optics.

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