SIGNAL PROCESSING GROUP

Contact details

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Acronym	**SPG**
Logo	Signal Processing Group
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SpeD 2013
http://www.sped2013.ro/index.php?page=home

SPAMEC 2011 Workshop
http://sp.utcluj.ro/SPAMEC/HomeSPAMEC2011.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. Corneliu Rusu, Assist. Prof. Dr. Lăcrimioara Grama
Phd. students: Eng. Adriana Dăbâcan, Eng. Dalia Dănilescu, Eng. Alexandru Lodin. Eng. Gheorghiu Medorian

Representative projects

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)
"Adaptive Reconstruction of Signals for Compressive Sampling of Acoustic Sensors Arrays", PN-ID,
http://sp.utcluj.ro/PN_ID_162_2008/HomePage.html (2008)

Significant results

The most representative publications of the past 5 years:

1. C. Rusu, J. Astola, The extended 1-D (One-Dimensional) Discrete Phase Retrieval Problem, Vol. 9520, *Lecture Notes in Computer Scienc*e, Springer, Berlin / Heidelberg, 2015, pp. 640–647. doi:10.1007/978-3-319-27340-2 79.
2. L. Grama, C. Rusu, The quantization effect on audio signals for wildlife intruder detection systems, Vol. 9520, *Lecture Notes in Computer Science*, Springer, Berlin / Heidelberg, 2015, pp. 655–662. doi:10.1007/978-3-319-27340-2 81.
3. L. Grama, C. Rusu, About quantization of audio signals for wildlife intruder detection systems, in*: Proceedings 22nd European Conference on Circuit Theory and Design (ECCTD)*, IEEE, Trondheim, Norway, 2015, pp. 1–4. doi:10.1109/ECCTD.2015.7300036.
4. M. V. Ghiurcau, C. Rusu, R. C. Bilcu, J. Astola, "Audio based solutions for detecting intruders in wild areas", in *Signal Processing*, vol. 92, no. 3, 2012, pp. 829-840
5. L. Iozan, M. Kirkko-Jaakkola, J. Collin, J. Takala, C. Rusu, " Using a MEMS gyroscope to measure the Earth's rotation for gyrocompassing applications", in *Measurement Science and Technology*, vol. 23, no. 2, 2012, pp. 2-9
6. C. Rusu, C. F. N. Cowan, "The exponentiated convex variable step-size (ECVSS) algorithm", in *Signal Processing*, vol. 90, no. 9, 2010, p. 2784-2791
7. C. Rusu, J. Astola, "Minimum-phase parts of zero-phase sequences", in *Signal Processing*, vol. 84, no. 6, 2009, pp. 1032-1037
8. C. Rusu, L. Grama, J. Takala, *Lecture Notes in Computer Science - Computer Aided Systems Theory - EUROCAST 2009*, vol. 5717, 2009, *ch. SPICE Simulation of Analog Filters: A Method for Designing Digital Filters*, pp. 534-539.
9. C. Rusu, J. Astola, "About positive trigonometric polynomials and 1-D discrete phase retrieval problem", in *Proc. EUSIPCO*, Aug. 2012, Bucharest
10. L. Grama, C. Rusu, "Hilbert transform by divide and-conquer piecewise linear approximation", in *Proc. ECCTD* 2011, Linkoping, Sweden, Aug. 2011, pp. 373-376
11. M. V. Ghiurcau, C. Rusu, J. Astola, "A study of the effect of emotional state upon text independent speaker identification", in *Proc. ICASSP*, Prague, Czech Republic, May 2011, pp. 4944-4947

See http://www.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.