Piotr Antonik, PhD

LMOPS EA-4423
CentraleSupélec, Metz campus
2 rue Edouard Belin
F-57070 Metz, France

Phone: +33 (0)3 87 76 47 03
Email: piotr.antonik@centralesupelec.fr

Profile

- **FPGA** programming (Xilinx platforms)
- Design and development of advanced **optical** and opto-electronic **experimental** systems
- Expertise in **artificial neural networks**, **computer vision** and **machine learning**
- Rich **teaching** experience
- **Trilingual** (Russian, French, English)

Academic degrees

- Ph.D. in Physics, Université libre de Bruxelles, Brussels (Oct. 2013 – Sep. 2017)
- M.S. in Physics (with great honours), Université libre de Bruxelles, Brussels (Sep. 2011 – Sep. 2013)
- B.S. in Physics (with great honours), Université libre de Bruxelles, Brussels (Sep. 2008 – Aug. 2011)

Research positions

October 2018 – present: Associate Professor at CentraleSupélec

- Position : LMOPS EA-4423 Lab & Chair in Photonics, CentraleSupélec & Université de Lorraine, Metz campus, Metz, France
- Research interests : computer vision, FPGA development, optical neuromorphic computing

October 2017 – October 2018 Postdoctoral position at CentraleSupélec

- Position : LMOPS EA-4423 Lab, CentraleSupélec, Metz campus, Metz, France
- Research interests : optical neuromorphic computing, analogue time-delay reservoir computing, large-scale free-space optical reservoir computing, wide-band opto-electronic oscillators for advanced signal processing

January – May 2017: Internship at University of Texas at Austin

- Position : Department of Biomedical Engineering, University of Texas at Austin, Austin, USA
- Topic : Application of artificial neural networks to real-time medical image processing and diagnosis

October 2013 – September 2017: PhD Student at Université libre de Bruxelles

- Position : Laboratoire d'Information Quantique & Service OPERA-Photonique, Université libre de Bruxelles, Brussels, Belgium

- Topic : Application of FPGA to real-time machine learning: hardware reservoir computers and software image processing

September 2012 – May 2013: Master's Project at Université libre de Bruxelles

- Position : Laboratoire d'Information Quantique & Service OPERA-Photonique, Université libre de Bruxelles, Brussels, Belgium
- Topic : Reservoir computing with delayed-feedback laser

Publications

I authored and co-authored 2 books, 12 journal papers and 18 conference proceedings (full-length papers and abstracts). See the full list below.

Teaching

2020 – 2021: estim. 250 h at CentraleSupélec (teaching modelling, electromagnetism, optimisation, neuromorphic computing; projects supervision)

2019 – 2020: 76 h at CentraleSupélec (teaching modelling & electromagnetism)

2018 – 2019: 102 h at CentraleSupélec (lab assistant & projects supervision)

2017 – 2018: 30 h at CentraleSupélec (projects supervision)

2016 – 2017: 68 h at ULB (lab assistant in physics and optics)

2015 – 2016: 114 h at ULB (lab assistant in physics, optics and electronics)

2014 – 2015: 73 h at ULB (lab assistant in physics and electronics)

Grants, Fellowships & Awards

- Springer Theses Award (recognising outstanding Ph.D. research, 2018)
- F.R.S.-FNRS Research Grant J.0040.16. Photonic Reservoir Computing (2016 – 2017)
- F.R.S.-FNRS Research Fellow (Oct. 2013 – Sep. 2017)
- Honourable Mention at the 38th International Physics Olympiad, Vietnam, 2008
- Winner of the Belgian Physics Olympiad, 2007

Activities

- Reviewer for IEEE TNNLS, Neurocomputing, Optics Express and Cognitive Computation journals.

Full publications list

Books and book chapters

1. Brunner, Daniel, Miguel C. Soriano, and Guy Van der Sande, eds. "Photonic Reservoir Computing: Optical Recurrent Neural Networks." *Walter de Gruyter GmbH & Co KG*, 2019.
2. **Antonik, Piotr**. "Application of FPGA to Real-Time Machine Learning: Hardware Reservoir Computers and Software Image Processing." *Springer*, 2018.

Journal papers

2020

1. **Antonik, Piotr**, Serge Massar, and Guy Van Der Sande. "Photonic reservoir computing using delay dynamical systems." *Photoniques* 104 (2020): 45-48.
2. Baruah, V., Zahedivash, A., Hoyt, T., McElroy, A., Vela, D., Buja, L.M., Cabe, A., Oglesby, M., Estrada, A., **Antonik, P.** and Milner, T.E., 2020. "Automated Coronary Plaque Characterization With Intravascular Optical Coherence Tomography and Smart-Algorithm Approach: Virtual Histology OCT." *JACC: Cardiovascular Imaging*, 13(8), pp.1848-1850.
3. Nguimdo, R. M., **Antonik, P.**, Marsal, N., and Rontani, D. (2020). "Impact of optical coherence on the performance of large-scale spatiotemporal photonic reservoir computing systems." *Optics Express*, 28(19), 27989-28005.
4. **Antonik, Piotr**, et al. "Bayesian optimisation of large-scale photonic reservoir computers." *Cognitive Computation* (in press).

2019

- **Antonik, Piotr**, et al. "Human action recognition with a large-scale brain-inspired photonic computer." *Nature Machine Intelligence* 1.11 (2019): 530-537.
- **Antonik, Piotr**, Nicolas Marsal, and Damien Rontani. "Large-scale spatiotemporal photonic reservoir computer for image classification." *IEEE Journal of Selected Topics in Quantum Electronics* 26.1 (2019): 1-12.

2018

- **Antonik, Piotr**, et al. "Using a reservoir computer to learn chaotic attractors, with applications to chaos synchronization and cryptography." *Physical Review E* 98.1 (2018): 012215.
- **Antonik, Piotr**, et al. "Random pattern and frequency generation using a photonic reservoir computer with output feedback." *Neural Processing Letters* 47.3 (2018): 1041-1054.

2017

- **Antonik, Piotr**, Marc Haelterman, and Serge Massar. "Brain-inspired photonic signal processor for generating periodic patterns and emulating chaotic systems." *Physical Review Applied* 7.5 (2017): 054014.
- **Antonik, Piotr**, Marc Haelterman, and Serge Massar. "Online training for high-performance analogue readout layers in photonic reservoir computers." *Cognitive Computation* 9.3 (2017): 297-306.

2016

- **Antonik, Piotr**, et al. "Online training of an opto-electronic reservoir computer applied to real-time channel equalization." *IEEE transactions on neural networks and learning systems* 28.11 (2016): 2686-2698.
- Hermans, M., **Antonik, P.**, Haelterman, M., and Massar, S. (2016). "Embodiment of learning in electro-optical signal processors." *Physical review letters*, 117(12), 128301.

Conference papers

2020

1. Rontani, D., **Antonik, P.**, Marsal, N., and Brunner, D. (2020, March). Automatic classification of video using a scalable photonic neuro-inspired architecture. In *Physics and Simulation of Optoelectronic Devices XXVIII* (Vol. 11274, p. 112740F). International Society for Optics and Photonics.

2019

1. Héroux, J. B., Kanazawa, N., and **Antonik, P.** (2019, September). "Time Series Processing with VCSEL-Based Reservoir Computer." In *International Conference on Artificial Neural Networks* (pp. 165-169). Springer, Cham.
2. **Antonik, P.**, Marsal, N., Brunner, D., and Rontani, D. (2019, September). "Comparison of Feature Extraction Techniques for Handwritten Digit Recognition with a Photonic Reservoir Computer." In *International Conference on Artificial Neural Networks* (pp. 175-179). Springer, Cham.
3. **Antonik, P.**, Marsal, N., Brunner, D., and Rontani, D. (2019, September). "Classification of Human Actions in Videos with a Large-Scale Photonic Reservoir Computer." In *International Conference on Artificial Neural Networks* (pp. 156-160). Springer, Cham.

2018

1. **Antonik, P.**, Gulina, M., Pauwels, J., Rontani, D., Haelterman, M., and Massar, S. (2018, July). "Spying on chaos-based cryptosystems with reservoir computing." In *2018 International Joint Conference on Neural Networks (IJCNN)* (pp. 1-7). IEEE.
2. **Antonik, P.**, Marsal, N., Brunner, D., and Rontani, D. (2018). "Performance analysis of a large-scale photonic reservoir computer on image classification." In *NOLTA*.

2017

1. Akram Akrout, **Piotr Antonik**, Marc Haelterman, and Serge Massar. "Towards autonomous photonic reservoir computer based on frequency parallelism of neurons". In: *Proc. SPIE.* Vol. 10089. 2017, 100890S-100890S-7.
2. **Piotr Antonik**, Michiel Hermans, Marc Haelterman, and Serge Massar. "Photonic Reservoir Computer With Output Feedback for Chaotic Time Series Prediction". In: *2017 International Joint Conference on Neural Networks*. 2017.
3. **Piotr Antonik**, Marc Haelterman, and Serge Massar. "Improving Performance of Analogue Readout Layers for Photonic Reservoir Computers with Online Learning". In: *AAAI Conference on Artificial Intelligence*. 2017.

4. **Piotr Antonik**, Michiel Hermans, Marc Haelterman, and Serge Massar. "Chaotic Time Series Prediction Using a Photonic Reservoir Computer with Output Feedback". In: *AAAI Conference on Artificial Intelligence*. 2017.

5. **Piotr Antonik**, Marc Haelterman, and Serge Massar. "Predicting chaotic time series using a photonic reservoir computer with output feedback". In: *26th Belgian-Dutch Conference on Machine Learning*. 2017.

6. **Piotr Antonik**, Marc Haelterman, and Serge Massar. "Towards high-performance analogue readout layers for photonic reservoir computers". In: *26th Belgian-Dutch Conference on Machine Learning*. 2017.

2016

1. **Piotr Antonik**, Michiel Hermans, François Duport, Marc Haelterman, and Serge Massar. "Towards pattern generation and chaotic series prediction with photonic reservoir computers". In: *SPIE's 2016 Laser Technology and Industrial Laser Conference*. Vol. 9732. 2016, 97320B.

2. **Piotr Antonik**, Michiel Hermans, Marc Haelterman, and Serge Massar. "Towards adjustable signal generation with photonic reservoir computers". In: *25th International Conference on Artificial Neural Networks*. Vol. 9886. 2016.

3. **Piotr Antonik**, Michiel Hermans, Marc Haelterman, and Serge Massar. "Pattern and frequency generation using an opto-electronic reservoir computer with output feedback". In: *APNNS's 23th International Conference on Neural Information Processing*. Vol. 9948. LNCS. 2016, pp. 318-325.

2015

1. **Piotr Antonik**, Anteo Smerieri, François Duport, Marc Haelterman, and Serge Massar. "FPGA implementation of reservoir computing with online learning". In: *24th Belgian-Dutch Conference on Machine Learning*.

2. **Piotr Antonik**, François Duport, Anteo Smerieri, Michiel Hermans, Marc Haelterman, and Serge Massar. "Online training of an opto-electronic reservoir computer". In: *APNNA's 22th International Conference on Neural Information Processing*. Vol. 9490. LNCS. 2015, pp. 233-240.

3. **Piotr Antonik**, François Duport, Anteo Smerieri, Michiel Hermans, Marc Haelterman, and Serge Massar. "Improving performance of opto-electronic reservoir computers with online learning". In: *20th Annual Symposium of the IEEE Photonics Society Benelux Chapter*. 2015.