

ALEJANDRO PARADA-MAYORGA

3401 Walnut, Philadelphia, PA, office 454C, USA
University of Pennsylvania
Department of Electrical and Systems Engineering

<https://alejandroparadamayorga.com/>
Tel: (+1)3023339404
alejopm@seas.upenn.edu

RESEARCH INTERESTS

Geometric deep learning, algebraic neural networks, algebraic signal processing, applications of representation theory of algebras and category theory in machine learning, graph signal processing, graph neural networks, topological data analysis, topological signal processing and compressed sensing.

EDUCATION

Ph.D. in Electrical Engineering July 2019
University of Delaware Newark, DE, USA

- Thesis: Blue Noise and Optimal Sampling on Graphs (advisor: Gonzalo Arce)

Master in Electrical Engineering May 2012
Industrial University of Santander Bucaramanga, Colombia

- Dissertation: Dynamic Tracking of Facial Expressions using DIP (advisor: Arturo Plata)

B.Sc. in Electrical Engineering (Electronic Systems) (5 year diploma) June 2009
Industrial University of Santander Bucaramanga, Colombia

- Dissertation: Analysis of thermal distribution in iron by Eddy currents using FEM (advisor: Ernesto Aguilera)

• *Additional courses: Abstract Algebra, Real Analysis, Special functions and Complex Analysis, Set Theory, Mathematical Physics I (tensor analysis), Mathematical Physics II (PDE and special functions), Differential equations and dynamical systems.*

HONORS AND AWARDS


- Professional Development Award. University of Delaware April 2019
- National Science Foundation NSF #1815992. \$ 300,000. “Blue-Noise Graph Sampling”, University of Delaware. I contributed substantially in the preparation of this proposal, under the supervision of Gonzalo R. Arce. June 1 2018 - May 31 2021
- Signal Processing and Communications Graduate Faculty Award. ECE department, University of Delaware May 2018
- UDRF Strategic Initiative Award. “Efficient Design of Uniqueness Sets for Bandlimited Signals on Networks University of Delaware. I assisted Gonzalo R. Arce in the preparation of this proposal. Feb 2018
- Dissertation Fellowship Award. University of Delaware June 2018
- Colciencias Scholarship 617
Scholarship for Ph.D studies sponsored by the government of Colombia 2014
- Scholarship for Master Studies
Department of Electrical Engineering, Industrial University of Santander, Colombia. 2009
- Outstanding Student. Industrial University of Santander, Colombia 2003

APPOINTMENTS

- **Postdoctoral Researcher.** Department of Electrical and Computer Engineering August 2019- Present. **University of Pennsylvania.**
- **Visitor Scholar.** Department of Electrical and Computer Engineering February 2013- June 2013. **University of Delaware.**

TEACHING EXPERIENCE

- **Teaching Material Development.** Department of Electrical and Computer Engineering, University of Pennsylvania.
 - Graph Neural Networks (ESE680) Fall 2020.

I worked preparing online educational resources for the course ESE680 in general ([[CourseWeb-site](#)]), taking the main lead in the section devoted to *algebraic signal processing* and *algebraic neural networks* .
- **Teaching Assistant.** Department of Electrical and Computer Engineering, University of Delaware.
 - Computational Imaging Seminar (ELEG 667) Fall 2016
 - Foundations of Statistical Learning (ELEG 815) Fall 2016
 - Electronic Circuit Analysis II (ELEG312080) Fall 2017
 - Digital Imaging and Photography (ELEG404010) Spring 2018
- **Lecturer.** Department of Electrical Engineering, Industrial University of Santander.
 - Digital Image Processing 2012
 - Signal Processing 2011-2012
- **Teaching Assistant.** Department of Electrical Engineering, Industrial University of Santander.
 - Signals and Systems 2007-2008
 - Digital Signal Processing. 2008-2009

RESEARCH EXPERIENCE BEFORE THE PH.D.

- **Industrial University of Santander** (Colombia), Department of Electrical Engineering
 - **Computational Electromagnetism** (June 2009). Mathematical modeling and simulation of heating in ferromagnetic materials induced by eddy currents: I provided the numerical and mathematical analysis of this problem in rectangular and cubic geometries using the Finite Elements Method (FEM) and developed code for simulation purposes. [[pdf](#)]
 - **Image Processing and Nonlinear Dimensionality Reduction** (December 2012). Dynamic tracking of facial expressions: I analyzed the problem of automatic tracking of facial expressions using image processing techniques, manifold analysis of data and nonlinear dimensionality reduction. [[pdf](#)]
- **University of Delaware** (USA), Department of Electrical Engineering
 - **Computational Imaging and Compressed Sensing** (Spring 2013): I provided the mathematical analysis necessary to state spectral resolution limits in CASSI systems and provided numerical and experimental results proving the hypothesis stated. [[pdf](#)]

PUBLICATIONS

Preprints

1. **A. Parada-Mayorga** and A. Ribeiro, "Convolutional Filtering and Neural Networks with Non Commutative Algebras", (submitted). [\[pdf\]](#)
2. **A. Parada-Mayorga**, H. Riess, A. Ribeiro and R. Ghrist, "Quiver Signal Processing (QSP)", (submitted). [\[pdf\]](#)

Journal papers

1. **A. Parada-Mayorga** and A. Ribeiro, "Algebraic Neural Networks: Stability to Deformations", IEEE Transactions on Signal Processing. [\[pdf\]](#)
2. D.L. Lau, G. R. Arce, **A. Parada-Mayorga**, D. Dapena, K. Pena-Pena, "Blue-Noise Sampling of Graph and Multigraph Signals", Special Issue of the IEEE Signal Processing Magazine On Graph Signal Processing: Foundations and Emerging Directions, 2020. [\[pdf\]](#)
3. **A. Parada-Mayorga**, D. Lau, Jhony H. Giraldo and G.R. Arce, "Blue-Noise Sampling on Graphs". IEEE Transactions on Signal and Information Processing over Networks. [\[pdf\]](#)
4. E. Salazar, **A. Parada-Mayorga** and G.R. Arce, "Spectral Zooming and Resolution Limits of Spatial Spectral Compressive Spectral Imagers". IEEE Transactions on Computational Imaging. [\[pdf\]](#)
5. **A. Parada-Mayorga** and G. R. Arce, "Colored Coded Aperture Design in Compressive Spectral Imaging via Minimum Coherence," in IEEE Transactions on Computational Imaging, vol. 3, no. 2, pp. 202-216, June 2017. doi: 10.1109/TCI.2017.2692649. [\[pdf\]](#)
6. **A. Parada-Mayorga** and G.R. Arce, "Spectral Super-Resolution in Colored Coded Aperture Spectral Imaging," in IEEE Transactions on Computational Imaging, vol. 2, no. 4, pp. 440-455, Dec. 2016. doi: 10.1109/TCI.2016.2612943. [\[pdf\]](#)
7. Rueda, H. F, **Parada, A.**, & Arguello, H. (2014). Spectral resolution enhancement of hyperspectral imagery by a multiple-aperture compressive optical imaging system. Ingeniera e Investigacin, 34(3), 50-55. <https://dx.doi.org/10.15446/ing.investig.v34n3.41675>. [\[pdf\]](#)

Conference Papers

1. **A. Parada-Mayorga** and A. Ribeiro, "Stability of Algebraic Neural Networks to Small Perturbations", (accepted to ICASSP 2021). [\[pdf\]](#)
2. **A. Parada-Mayorga**, L. Ruiz and A. Ribeiro, " Graphon Pooling in Graph Neural Networks". (accepted to EUSIPCO 2020). [\[pdf\]](#)
3. **A. Parada-Mayorga**, D. Lau, J. Giraldo, G. Arce, "Blue-Noise Sampling of Signals on Graphs", International Conference on Sampling Theory and Applications (SampTA), Bordeaux, 2019. [\[pdf\]](#)
4. **A. Parada-Mayorga**, D. Lau, J. Giraldo, G. Arce, "Sampling of Graph Signals with Blue Noise dithering", IEEE data Science Workshop, Minneapolis, Minnesota, 2019. [\[pdf\]](#)
5. D. Guillot, **A. Parada-Mayorga**, S. Cioaba, G. Arce, "Optimal Sampling Sets in Cographs", IEEE data Science Workshop, Minneapolis, Minnesota, 2019. [\[pdf\]](#)
6. E. Salazar, **A. Parada-Mayorga** and G.R. Arce, "Spectral zooming in SSCSI Compressive Spectral Imagers". OSA Imaging and Applied Optics Congress 2018. [\[pdf\]](#)
7. E. Salazar, **A. Parada-Mayorga** and G.R. Arce, "Spatial Super-resolution reconstruction via SSCSI Compressive Spectral Imagers". OSA Imaging and Applied Optics Congress 2018. [\[pdf\]](#)

8. **A. Parada-Mayorga**, A. Cuadros and G.R. Arce, "Coded Aperture Design for Compressive X-ray Tomosynthesis via Coherence Analysis". IEEE International Symposium on Biomedical Imaging. Melbourne, Australia. April 2017. [\[pdf\]](#)
9. **A. Parada Mayorga**, G.R. Arce, "Spectral Super-Resolution in Colored Coded Aperture Spectral Imaging," in Imaging and Applied Optics 2015, OSA Technical Digest (online) (Optical Society of America, 2015), paper CTh2E.2. [\[pdf\]](#)
10. H. Rueda, **A. Parada**, H. Arguello, Y. Wu, D. Prather, and G.R. Arce, "Demonstration of a Higher-Order Discretization Model for Compressive Spectral Imaging," in Imaging and Applied Optics, OSA Technical Digest (online) (Optical Society of America, 2013), paper CM4C.4. [\[pdf\]](#)
11. H. Arguello, **A. Parada**, G.R. Arce; Optimization of pseudorandom coded apertures for compressive spectral imaging . Proc. SPIE 8717, Compressive Sensing II, 87170D (May 31, 2013). [\[pdf\]](#)
12. **A. Parada-Mayorga** and A. Plata. Fast Object Detection using Colour Segmentation. ISSN: 2145-812X. *Tercer Congreso Internacional de Ingeniería Mecatrónica. Bucaramanga 2011.* [\[pdf\]](#)
13. **A. Parada-Mayorga** and A. Plata. A New Facial Point Detector using Active Appearance Models. ISSN: 2145-812X. *Tercer Congreso Internacional de Ingeniería Mecatrónica. Bucaramanga 2011.* [\[pdf\]](#)

In preparation

1. **A. Parada-Mayorga**, L. Ruiz and A. Ribeiro, "Graphon Pooling".
2. **A. Parada-Mayorga**, D. Guillot, S. Cioaba and G.R. Arce, "Uniqueness sets in the Paley-Wiener Space of Cographs".
3. **A. Parada-Mayorga**, H. Riess, A. Ribeiro and R. Ghrist, "Signal Processing on Quiver Representations: Beyond Scalar Representations of Node-Data".
4. **A. Parada-Mayorga**, L. Ruiz and A. Ribeiro, "Removable and Uniqueness sets in Graphon Signal Processing".
5. **A. Parada-Mayorga**, F. Gama and A. Ribeiro, "Stability properties in Generalized Aggregation Neural Networks".
6. **A. Parada-Mayorga**, L. Ruiz, L. Chamon and A. Ribeiro, "Signal Filtering on Graphings".

Master Thesis

- Dynamic Tracking of Facial Expressions using Digital Image Processing. Industrial University of Santander, 2012. [\[pdf\]](#)

Bsc. Thesis

- Analysis of the Thermal Distribution in Iron by Eddy currents, using the Finite Element Method. Industrial University of Santander, 2009. [\[pdf\]](#)

PROFESSIONAL SERVICE

Reviewer for the following Journals

- | | |
|--|----------------------|
| • IEEE transactions on Image Processing | January 2018-Present |
| • IEEE transactions on Computational Imaging | January 2018-Present |
| • IEEE Signal Processing Letters | January 2019-present |
| • IEEE transactions on Signal Processing | January 2019-present |
| • IEEE transactions of Signal and Information Processing over Networks | January 2020-present |

Reviewer for the following conferences

- 13th International conference on sampling theory and applications Bordeaux, France. 2019
- 26th European Signal Processing Conference EUSIPCO 2018 Rome, Italy. 2018

LANGUAGES

- English: Full professional proficiency.
- Spanish: Native or bilingual proficiency.