Nelson E. Díaz-Díaz

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Bio: Received the B. Sc. and M. Sc. degrees in Computer Science from the Universidad Industrial de Santander, Colombia, in 2012 and 2015, respectively, and Ph. D. degrees in Electronic Engineering from the Universidad Industrial de Santander, Bucaramanga, Colombia in 2020, sponsored by a 727 Colciencias scholarship. Currently, he holds a Postdoctoral position with the Pontificia Universidad Católica de Valparaíso (PUCV), Valparaíso, Chile, under the supervision of Prof. Esteban Vera. Nelson's research interests include high-dimensional signal processing, sparse image representation, adaptive sensing, compressive video, and spectral image classification. Please click on the bold text to access to my academic web page and my CvLAC. **Academic WebPage:**, **CvLAC: Investigador Junior**

SKILLS

- Languages: Spanish (Native), English (B2), French (B2)
- Programming: Python (NumPy, SciPy, Matplotlib), MATLAB
- Document Creation: Office tools, LATEX

PROFESSIONAL EDUCATION

Doctor of Philosophy in Engineering: emphasis in electronic *2016-2020*
Department of Electrical and Computer Engineering
Universidad Industrial de Santander, Bucaramanga, Santander, Colombia
GPA: 4.55/5.00
Advisor: PhD. Henry Arguello
Doctoral thesis: "Coded Aperture Design for Adaptive Compressive Spectral Imaging"

Master of Science in Computer Science *2013-2015*
Department of Computer Science
Universidad Industrial de Santander, Bucaramanga, Colombia.
GPA: 4.72/5.00
Advisor: Ph.D. Henry Arguello.
Master thesis: "High-dynamic range compressive spectral imaging by adaptive filtering"

Bachelor of Science in Computer Science *2006-2012*
Department of Computer Science
Universidad Industrial de Santander, Bucaramanga, Colombia.
GPA: 3.88/5.00
Advisor: Ph.D. Lola Xiomara.
Graduate project:: "Immune algorithm to solve job shop scheduling".

GRANTS

Postdoctoral grant *2023-2026*
A novel end-to-end approach to design adaptive coding patterns in compressive spectral video sensing
ANID FONDECYT Postdoctorado 3230489
Pontificia Universidad Católica de Valparaíso
Valparaiso, Chile

PROFESSIONAL EXPERIENCE

Postdoctoral Research Associate - School of Electrical Engineering *August 2020 - Present*
Project: Shuffled Rolling Shutter for Snapshot Temporal Imaging -Improved compressive temporal imaging using a shuffled rolling shutter
Role: Main researcher
Pontificia Universidad Católica de Valparaiso, Chile Valparaiso, Chile

Assistant Professor Data Structures, Fundamentals of programming, Technology of the Information and Communication TIC *February 2020 - July 2020*
Department of Computer Science
Universidad de Investigación y Desarrollo, Bucaramanga, Colombia

Research Intern on Ultrasound Imaging *Fall-winter 2018-2019*
TéSA, Telecommunications for Space an Aeronautics
Project: Convolutional Sparse Coding for Motion Estimation of Ultrasound Imaging
Role: Main researcher Toulouse, France

Assistant Professor Digital image processing *2016-2017*
Department of Electrical Engineering
Universidad Industrial de Santander, Bucaramanga, Colombia

Research Intern on Adaptive Grayscale Coded Aperture Design *Summer 2015*
Department of Electrical and Computer Engineering
University of Texas A&M, College Station, TX, USA

Adjunct Researcher on Computational Optical Image Processing *2013-Present*
High-dimensional signal processing research group (HDSP)
Department of Computer Science
Universidad Industrial de Santander, Bucaramanga, Colombia

Research Assistant on Operation Research *2011-2012*
Research Group in Biomedical Engineering
Department of Computer Science
Universidad Industrial de Santander, Bucaramanga, Colombia

HONORS AND AWARDS

Meritorious doctoral thesis *March 10th, 2020*
Meritorious degree work
Universidad Industrial de Santander
Bucaramanga, Colombia

Colciencias Scholarship *2016 - 2019*
Scholarship to pursue Ph.D. studies in Colombia.
Francisco Jose de Caldas Institute for the Development of Science and Technology
Colciencias, Bogota D.C., Colombia

STUDENT CO-SUPERVISION

Diego Armando Pinzon *2012 - 2013*
Bachelor of Science in Computer Science
Universidad Industrial de Santander, Bucaramanga, Colombia

JOURNAL REVIEWER

Optics Express *2019 - Present*
Optica (Formerly Optical Society of America), USA

Applied Optics *2019 - Present*
Optica (Formerly Optical Society of America), USA

Journal of Electronic Imaging (JEI) *2021 - Present*
The International Society for Optics and Photonics, SPIE

Journal of Selected Topics in Signal Processing (J-STSP) *2021 - Present*
Institute of Electrical and Electronics Engineers, IEEE

Transactions on Computational Imaging (TCI) *2022 - Present*
Institute of Electrical and Electronics Engineers, IEEE

ACADEMIC COLLABORATIONS

Pontificia Universidad Católica de Valparaíso, (Valparaíso, Chile) *2020 - Present*
Collaboration with Dr. Esteban Vera
Project: Snapshot video sensing with application in space surveillance and satellite instrumentation
Role: Main researcher
Other activities: Joint development of grants and application to The National Fund for Scientific and Technological Development, FONDECYT (Chile), and Pontificia Universidad Católica de Valparaíso (PUCV) Valparaíso, Chile.

Universidad Industrial de Santander, (Bucaramanga, Colombia) *2013 - Present*
Collaboration with Dr. Henry Arguello
Project: Adaptive grayscale coded aperture design
Role: Master and PhD student
Other activities: Joint development of grants and application to the Colombian Institute of Development of Science and Technology - Colciencias

PROJECTS WITH COLOMBIAN RESEARCH GROUPS

Universidad de Investigación Y Desarrollo, (Bucaramanga, Colombia) *2020 - present*
Project: Procesamiento de nube de puntos adquiridas con un escáner laser terrestre mediante técnicas de aprendizaje de máquina (machine learning) (2021)
Project: Arquitectura óptica de imágenes espectrales comprimidas para clasificación en agricultura usando deep learning (2020)
Role: Main researcher
Other activities: master's and undergraduate's project evaluator.

JOURNAL PAPERS

1. Nelson Díaz, Madhu Beniwal, Miguel Marquez, Felipe Guzmán, Cheng Jiang, Jinyang Liang, Felipe Guzmán, and Esteban Vera. Single-mask sphere-packing with implicit neural representation reconstruction for ultrahigh-speed imaging. *Opt. Express*, -(-):–, - 2025 DOI:10.1364/OE.561323

2. Bastian Romero, Aarón Cofré, Nelson Diaz, Pablo Scherz, Jorge Tapia, Eduardo Peters, Dario Perez, and Esteban Vera. Phase Retrieval by Designed Hadamard Complementary Coded Apertures. 4 2024 DOI:10.1364/opticaopen.25706580.v1

3. Nelson Diaz, Alejandro Alvarado, Pablo Meza, Felipe Guzmán, and Esteban Vera. Multispectral filter array design by optimal sphere packing. *IEEE Transactions on Image Processing*, 32:3634–3649, 2023 DOI:https://doi.org/10.1109/TIP.2023.3288414

4. Esteban Vera, Felipe Guzmán, and Nelson Díaz. Shuffled rolling shutter for snapshot temporal imaging. *Opt. Express*, 30(2):887–901, Jan 2022 DOI: 10.1364/OE.444864

5. Nelson Diaz, Omar Gallo, Jhon Caceres, and Hernan Porras. Real-time ground filtering algorithm of cloud points acquired using terrestrial laser scanner (tls). *International Journal of Applied Earth Observation and Geoinformation*, 105:102629, 2021 DOI:https://doi.org/10.1016/j.jag.2021.102629

6. N. Diaz, J. M. Ramirez, E. Vera, and H. Arguello. Adaptive classification via spatial contextual information in multisensor compressive spectral imaging. *IEEE Journal of Selected Topics in Applied Earth Observations and Remote Sensing*, 14:9254–9266, 2021 DOI:10.1109/JSTARS.2021.3111508

7. Nelson Diaz, Carlos Hinojosa, and Henry Arguello. Adaptive grayscale compressive spectral imaging using optimal blue noise coding patterns. *Optics & Laser Technology*, 117:147–157, September 2019 DOI:https://doi.org/10.1016/j.optlastec.2019.03.038

8. Nelson Diaz, Hoover Rueda, and Henry Arguello. Adaptive filter design via a gradient thresholding algorithm for compressive spectral imaging. *Applied Optics*, 57(17):4890–4900, June 2018 DOI:https://doi.org/10.1364/AO.57.004890

9. Edson Flórez, Nelson Díaz, Wilfredo Gómez, Lola Bautista, and Darío Delgado. Evaluación de algoritmos bioinspirados para la solución del problema de planificación de trabajos. *I+ D Revista de Investigaciones*, 11(1):133–143, 2018 Open access

10. Nelson Diaz, Hoover Rueda Chacon, and Henry Arguello Fuentes. High-dynamic range compressive spectral imaging by grayscale coded aperture adaptive filtering. *Ingeniería e Investigación*, 35(3):53–60, 2015 DOI:http://dx.doi.org/10.15446/ing.investig.v35n3.49868

BOOK CHAPTERS

1. Esteban Vera, Felipe Guzman, and Nelson Diaz. *Shuffled Rolling Shutter Camera*, pages 499–513. Springer International Publishing, Cham, 2024 DOI:10.1007/978-3-031-39062-3_27

CONFERENCE PAPERS

1. Alejandro Alvarado, Nelson Díaz, Pablo Meza, and Esteban Vera. Multiplexed multispectral filter array by 3d sphere packing design. In *Optica Imaging Congress 2024 (3D, AOMS, COSI, ISA, pcAOP)*, page JF2A.8. Optica Publishing Group, 2024

2. Bastián Romero, Nelson Díaz, Jorge Tapia, and Esteban Vera. Phase retrieval of elongated laser guide star by sphere packing coded apertures. In Kathryn J. Jackson, Dirk Schmidt, and Elise Vernet, editors, *Adaptive Optics Systems IX*, volume 13097, page 130973L. International Society for Optics and Photonics, SPIE, 2024

3. Nelson Díaz, Madhu Beniwal, Felipe Guzmán, Miguel Marquez, Jinyang Liang, and Esteban Vera. Binary coded aperture design by sphere packing in compressive ultrafast photography. In *Optica Sensing Congress 2024 (AIS, LACSEA, Sensors, QSM)*, page JF3A.4. Optica Publishing Group, 2024

4. Nelson Díaz, Alejandro Alvarado, Pablo Meza, and Esteban Vera. Compressive spectral video by optimal 4d-sphere packing. In *Optica Imaging Congress (3D, COSI, DH, FLatOptics, IS, pcAOP)*, page CM1E.4. Optica Publishing Group, 2023

5. Alejandro Alvarado, Nelson Díaz, Pablo Meza, and Esteban Vera. A sphere packing approach to design multiplexed multispectral filter arrays. In *Optica Imaging Congress (3D, COSI, DH, FLatOptics, IS, pcAOP)*, page CTh2A.6. Optica Publishing Group, 2023

6. Nelson Diaz and Esteban Vera. Compressive spectral-video by optimal 3d-sphere packing. In *2023 IEEE Research and Applications of Photonics in Defense Conference (RAPID)*, pages 1–2, 2023

7. Alejandro Alvarado, Nelson Díaz, Pablo Meza, Felipe Guzmán, and Esteban Vera. Multispectral mosaic design using a sphere packing filter array. In *Imaging and Applied Optics Congress 2022 (3D, AOA, COSI, ISA, pcAOP)*, page CTh4C.1. Optica Publishing Group, 2022

8. Felipe Guzmán, Nelson Díaz, and Esteban Vera. Improved compressive temporal imaging using a shuffled rolling shutter. In *OSA Optical Sensors and Sensing Congress 2021 (AIS, FTS, HISE, SENSORS, ES)*, page JTh6A.9. Optical Society of America, 2021

9. J. Bacca, N. Diaz, and H. Arguello. Compressive classification via deep learning using single-pixel measurements. In *2020 Data Compression Conference (DCC)*, pages 359–359, 2020

10. N. Diaz, C. Noriega-Wandurraga, A. Basarab, J.Y Tourneret, and H Arguello. Adaptive coded aperture design by motion estimation using convolutional sparse coding in compressive spectral video sensing. In *2019 IEEE 8th International Workshop on Computational Advances in Multi-Sensor Adaptive Processing (CAMSAP), Guadeloupe, France*, pages 1–5, Dec 2019

11. N. Diaz, A. Basarab, J.Y. Tourneret, and H. Arguello. Cardiac motion estimation using convolutional sparse coding. In *2019 27th European Signal Processing Conference (EUSIPCO), Coruña, España*, Sep 2019

12. M. Marquez, N. Diaz, J. Bacca, S. Pertuz, and H. Arguello. Compressive light field spectral imaging in a single-sensor device by using coded apertures. In *Imaging and Applied Optics 2017 (3D, AIO, COSI, IS, MATH, pcAOP)*, page CTh1B.5. Optical Society of America, 2017

13. N. Diaz, J. Bacca, and H. Arguello. Gradient thresholding algorithm for adaptive colored coded aperture design in compressive spectral imaging. In *Imaging and Applied Optics 2017 (3D, AIO, COSI, IS, MATH, pcAOP), San Francisco, California*, page JTu5A.4. Optical Society of America, 2017

14. Nelson Diaz, Hoover Rueda, and Henry Arguello. Adaptive uniform grayscale coded aperture design for high dynamic range compressive spectral imaging. In *Hyperspectral Imaging Sensors: Innovative Applications and Sensor Standards, Baltimore, USA*, volume 9860, page 98600A. International Society for Optics and Photonics, 2016

15. N. Diaz, H. Rueda, and H. Arguello. High-dynamic range compressive spectral imaging by adaptive filtering. In *2015 3rd International Workshop on Compressed Sensing Theory and its Applications to Radar, Sonar and Remote Sensing (CoSeRa)*, pages 89–93, June 2015

MEMBERSHIPS

- IEEE Signal Processing Society, Member
- Optica (Formerly Optical Society of America), Member

ACADEMIC REFERENCES

- Dr. Estevan Vera, professor Pontificia Universidad Católica de Valparaíso, Chile, **esteban.vera@pucv.cl**
- Dr. Henry Arguello Fuentes, professor Universidad Industrial de Santander, Colombia, **henarfu@uis.edu.co**
- Dr. Hoover Fabian Rueda, professor Universidad Industrial de Santander, Colombia, **hoover.rueda@correo.uis.edu.co**
- Dr. Pablo Meza, professor Universidad de la Frontera, Chile, **pablo.meza@ufrontera.cl**