Nelson 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. degree in 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, funded by ANID FONDECYT Postdoctorado 3230489, under the supervision of Prof. Esteban Vera. Nelson's research interests include digital image processing, data science, computer vision, machine learning, computational imaging, compressive spectral imaging and video, high-dimensional signal processing, sparse image and implicit representation, adaptive sensing, ultrahigh-speed imaging and spectral image classification. Please click on the bold text to access to my academic web page **Academic WebPage**.

SKILLS

- Languages: Spanish (Native), English (B2), French (B2)

- Programming: Python (PyTorch, NumPy, SciPy, Matplotlib), MATLAB, C++, JAVA

- Document Creation: Office tools, LATEX

PROFESSIONAL EDUCATION

Doctor of Philosophy in Engineering   *2016-2020*
Department of Electrical and Computer Engineering
Universidad Industrial de Santander, Bucaramanga, 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: Advanced coding for computational imaging
Pontificia Universidad Católica de Valparaiso, Chile

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

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

Lecturer in Computer Engineering   *2016-2017*
Course: Digital Image Processing
Department of Electrical and Computer Engineering
Universidad Industrial de Santander, Bucaramanga, Colombia

Research Intern in Computational Imaging   *Summer 2015*
Project: Adaptive Grayscale Coded Aperture Design for High Dynamic Range Depart-
ment of Electrical and Computer Engineering
Texas $A\&M$ University, 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

Felipe Guzman, Alejandro Alvarado, Bastian Romero   *2023 - 2026*
Master, and PhD in Electrical Engineering
Pontificia Universidad Católica de Valparaiso, Chile

Exequiel Oliva   *2023 - 2026*
Bachelor in Electrical Engineering
Pontificia Universidad Católica de Valparaiso, Chile

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

MEMBERSHIPS

- IEEE Signal Processing Society, Member

- Optica (Formerly Optical Society of America), Member

JOURNAL REVIEWER

Applied Optics, Optics Express, Photonics Research (Since 2025) *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

IEEE Open Journal of Signal Processing (OJSP) *2024 - Present*
Institute of Electrical and Electronics Engineers, IEEE

JOURNAL ARTICLES

1. Exequiel Oliva, Nelson Díaz, Samuel Pinilla, and Esteban Vera. Multispectral extended depth-of-field imaging via stochastic wavefront optimization. *IEEE Open Journal of Signal Processing*, 6:965–974, 2025 DOI:https://doi.org/10.1109/OJSP.2025.3595046

2. Felipe Guzmán, Nelson Díaz, Bastián Romero, and Esteban Vera. Scalable coding for high-resolution, high-compression ratio snapshot compressive video. *IEEE Transactions on Image Processing*, 34:3960–3970, 2025 DOI:https://doi.org/10.1109/TIP.2025.3579208

3. Nelson Diaz, Madhu Beniwal, Miguel Marquez, Felipe Guzman, Cheng Jiang, Jinyang Liang, and Esteban Vera. Single-mask sphere-packing with implicit neural representation reconstruction for ultrahigh-speed imaging. *Opt. Express*, 33(11):24027–24038, Jun 2025 DOI:10.1364/OE.561323

4. Bastián Romero, Pablo Scherz, Nelson Díaz, Jorge Tapia, Aarón Cofré, Eduardo Peters, Esteban Vera, and Darío G. Pérez. Phase retrieval by designed hadamard complementary coded apertures. *Optics Laser Technology*, 191:113311, 2025DOI:https://doi.org/10.1016/j.optlastec.2025.113311

5. 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

6. 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

7. 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

8. 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

9. 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

10. 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

11. 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

12. 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 PROCEEDINGS

1. Exequiel Oliva, Nelson Díaz, Samuel Pinilla, and Esteban Vera. Data-driven stochastic wavefront optimization for multispectral extended depth-of-field imaging. In *Optica Imaging Congress 2025 (3D, DH, COSI, IS, pcAOP,RadIT)*, page JW2A.7. Optica Publishing Group, 2025

2. 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

3. 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

4. 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

5. 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

6. 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

7. 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

8. 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

9. 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

10. 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

11. 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

12. 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

13. 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

14. 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

15. 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

16. 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

ACADEMIC REFERENCES

- Dr. Estevan Vera, professor Pontificia Universidad Católica de Valparaíso, Chile,
  Postdoctoral Supervisor, **e-mail: esteban.vera@pucv.cl**

- Dr. Henry Arguello Fuentes, professor Universidad Industrial de Santander, Colombia,
  Doctoral Advisor, **e-mail: henarfu@uis.edu.co**

- Dr. Karen Egiazarian, professor Computational Imaging Group, Tampere University, Finland, **e-mail: karen.eguiazarian@tuni.fi**

- Dr. Jinyang Liang, professor Institut National de la Recherche Scientifique - Université du Québec, Canada,
  Research Collaborator, **e-mail: jinyang.liang@inrs.ca**

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  Doctoral Thesis reviewer, Internship Survisor, **e-mail: adrian.basarab@irit.fr**

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