Carlos **Hinojosa**

Ph.D. Computer Science

Computer Vision · Computational Imaging · Machine Learning

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Education

Universidad Industrial de Santander — *Colombia*

Ph.D in Computer Science — *Aug 2017 - May 2022*

- GPA: 4.58/5.0

Universidad Industrial de Santander — *Colombia*

Master of Science in Computer and System Engineering — *Feb. 2016 - Apr. 2018*

- GPA: 4.57/5.0

Universidad Industrial de Santander — *Colombia*

Bachelor of System Engineering and Informatics — *Apr. 2011 - Dec. 2015*

- GPA: 4.33/5.0

Research Work Experience

Image and Video Understanding Lab (IVUL) - KAUST AI Initiative — *KAUST, Saudi Arabia*

Posdoctoral Researcher — *January 2023 - Present*

- Conducted research under the supervision of Prof. Bernard Ghanem in efficient video understanding and privacy-preserving computer vision.
- Contributed to multiple computer vision research projects to address different problems, including temporal action localization, surgical video analysis and understanding, and self-supervised learning from images and videos.
- Research, design, and implement state-of-the-art algorithms for computer vision tasks like object detection, keypoint localization, and semantic and instance segmentation in remote sensing imagery.

Stanford Vision and Learning LAB (SVL) — *Stanford University, USA*

Research Internship — *March 2020 - May 2022*

- Conducted research in privacy-preserving optical system design to perform computer vision tasks.
- Developed an end-to-end privacy-preserving computer vision pipeline to perform human pose estimation.
- Developed an adversarial optimizing framework to perform robust privacy-preserving human action recognition.

High Dimensional Signal Processing (HDSP) Research Group — *Colombia*

Researcher — *March 2014 - May 2022*

- Conducted and participated in different research projects. The research topics include Computer vision, Computational Imaging, Compressive Sensing, Compressive Spectral Imaging, and Image/Video Processing.

Universidad Industrial de Santander (UIS) - Ecopetrol — *Colombia*

Research Engineer — *January 2019 - February 2020*

- Designed an algorithm for the conversion of 3D RMS time velocities to 3D interval velocities in depth using Image rays.
- Implemented the designed algorithm using the NVIDIA Cuda parallel computing platform.
- Validated the algorithm using 3D real seismic image datasets.

MinCiencias — *Colombia*

Researcher — *May 2017 - May 2018*

- Determined the distribution of pixels in a coded aperture responsible for saturation of a multispectral sensor and to analyze how these saturated compressed measures affect the reconstruction of the multispectral image.
- Identified the pixels of the coded aperture responsible for saturation in each of the pixels of the sensor used by analyzing the mathematical model of a compressive acquisition system of multispectral images.
- Designed and implemented an adaptive computational algorithm to generate grayscale coded apertures and reduce the saturation in the sensor of a compression acquisition system of multispectral images.
- Validated, the grayscale coded apertures generated by the developed algorithm, to analyze its impact on the dynamic range of multispectral image reconstructions.

HDSP Research Group | UIS - Ecopetrol — *Colombia*

Researcher — *March 2016 - March 2017*

- Implemented the image ray method as a module for the DecisionSpace (DSG) software using the JAVA language.
- Designed and implemented an algorithm based on the fast marching method for time to depth conversion of seismic images.
- Implemented a full seismic images' time to depth conversion module for the SeisSpace ProMAX software.

CPS Research Group | UIS - Ecopetrol *Colombia*

Researcher *April 2016 - August 2016*

- Researched in acquisition, design, modeling, and processing issues that support the 2D and 3D Seismic programs in the Ecopetrol research programs.

CPS Research Group *Colombia*

Research Assistant *November 2014 - December 2015*

- Designed and implemented an algorithm for detecting and eliminating Ground Roll noise in Seismic Images using the Curvelet transform.
- Developed a module, in C/C++ programming language, for the SeisSpace ProMAX software that implements the developed algorithm.

Publications

Journal Articles [11]

Learning to Describe Scenes via Privacy-Aware Designed Optical Lens
Paula Arguello, Jhon Lopez, Karen Sanchez, Carlos Hinojosa, Fernando Rojas-Morales, Henry Arguello
IEEE Transactions on Computational Imaging 10 (2024) pp. 1069–1079. IEEE
DOI: 10.1109/TCI.2024.3426975 2024

SoccerNet 2023 challenges results
Anthony Cioppa, Silvio Giancola, Vladimir Somers, Floriane Magera, Xin Zhou, Hassan Mkhallati, Adrien Deliège, Jan Held, Carlos Hinojosa, Amir M Mansourian
Sports Engineering 27.2 (2024) p. 24. Springer
2024

C-3SPCD: coded aperture similarity constrained design forspatio-spectral classification of single-pixel measurements
Carlos Hinojosa, Karen Sanchez, Hans Garcia, Henry Arguello
Appl. Opt. 61.8 (2022) E21–E32. Optica Publishing Group
DOI: 10.1364/AO.445326 2022

CX-DaGAN: Domain Adaptation for Pneumonia Diagnosis on a Small Chest X-ray Dataset
Karen Sanchez, Carlos Hinojosa, Henry Arguello, Denis Kouamé, Olivier Meyrignac, Adrian Basarab
IEEE Transactions on Medical Imaging (2022). IEEE
DOI: 10.1109/TMI.2022.3182168 2022

A Fast and Accurate Similarity-Constrained Subspace Clustering Algorithm for Hyperspectral Image
Carlos Hinojosa, Esteban Vera, Henry Arguello
IEEE Journal of Selected Topics in Applied Earth Observations and Remote Sensing 14 (2021) pp. 10773–10783
. DOI: 10.1109/JSTARS.2021.3120071 2021

Hyperspectral image segmentation using 3D regularized subspace clustering model
Carlos A. Hinojosa, Fernando Rojas, Sergio Castillo, Henry Arguello
Journal of Applied Remote Sensing 15.1 (2021) pp. 1–17. SPIE
DOI: 10.1117/1.JRS.15.016508 2021

Efficient subspace clustering of hyperspectral images using similarity-constrained sampling
Jhon Lopez, Carlos Hinojosa, Henry Arguello
Journal of Applied Remote Sensing 15.3 (2021) pp. 1–16. SPIE
DOI: 10.1117/1.JRS.15.036507 2021

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

Supervised spatio-spectral classification of fused images using superpixels
Karen Sanchez, Carlos Hinojosa, Henry Arguello
Appl. Opt. 58.7 (2019) B9–B18. OSA
DOI: 10.1364/AO.58.0000B9 2019

Coded Aperture Design for Compressive Spectral Subspace Clustering
Carlos Hinojosa, Jorge Bacca, Henry Arguello
IEEE Journal of Selected Topics in Signal Processing 12.6 (2018) pp. 1589–1600
. DOI: 10.1109/JSTSP.2018.2878293 2018

Multiple snapshot colored compressive spectral imager
Claudia V. Correa, Carlos A. A. Hinojosa, Gonzalo R. Arce, Henry Arguello Sr.
Optical Engineering 56.4 (2016) pp. 1–10. SPIE
DOI: 10.1117/1.OE.56.4.041309 2016

Conference Proceedings [19]

ColorMAE: Exploring data-independent masking strategies in Masked AutoEncoders
Carlos Hinojosa, Shuming Liu, Bernard Ghanem
European Conference on Computer Vision
DOI: 10.1007/978-3-031-72661-3_25 2024

Privacy-preserving Optics for Enhancing Protection in Face De-identification
Jhon Lopez, Carlos Hinojosa, Henry Arguello, Bernard Ghanem

Proceedings of the IEEE/CVF Conference on Computer Vision and Pattern Recognition
DOI: 10.1109/cvpr52733.2024.01152 2024

Efficient Semantic Segmentation For Aerial Imagery Using Query Points and Superpixel Supervision
Santiago Rivier, Carlos Hinojosa, Silvio Giancola, Bernard Ghanem
2024 IEEE International Conference on Image Processing (ICIP)
DOI: 10.1109/ICIP51287.2024.10647646 2024

CO2Wounds-V2: Extended Chronic Wounds Dataset From Leprosy Patients
Karen Sanchez, Carlos Hinojosa, Olinto Mieles, Chen Zhao, Bernard Ghanem, Henry Arguello
2024 IEEE International Conference on Image Processing (ICIP)
2024

BiPer: Binary Neural Networks using a Periodic Function
Edwin Vargas, Claudia V Correa, Carlos Hinojosa, Henry Arguello
Proceedings of the IEEE/CVF Conference on Computer Vision and Pattern Recognition
DOI: 10.1109/cvpr52733.2024.00543 2024

Mask-guided Data Augmentation for Multiparametric MRI Generation with a Rare Hepatocellular Carcinoma
Karen Sanchez, Carlos Hinojosa, Kevin Arias, Henry Arguello, Denis Kouame, Olivier Meyrignac, Adrian Basarab
arXiv preprint arXiv:2307.16314 (2023)
. 2023

Privhar: Recognizing human actions from privacy-preserving lens
Carlos Hinojosa, Miguel Marquez, Henry Arguello, Ehsan Adeli, Li Fei-Fei, Juan Carlos Niebles
European Conference on Computer Vision
2022

Learning Privacy-Preserving Optics for Human Pose Estimation
Carlos Hinojosa, Juan Carlos Niebles, Henry Arguello
Proceedings of the IEEE/CVF International Conference on Computer Vision (ICCV)
2021

Fast Subspace Clustering Algorithm with Efficient Similarity-Constrained Sampling for Hyperspectral Images
Jhon Lopez, Carlos Hinojosa, Henry Arguello
2021 IEEE 31st International Workshop on Machine Learning for Signal Processing (MLSP)
DOI: 10.1109/MLSP52302.2021.9596507 2021

Subspace-based Domain Adaptation Using Similarity Constraints for Pneumonia Diagnosis within a Small Chest X-ray Image Dataset
Karen Sanchez, Carlos Hinojosa, Henry Arguello, Simon Freiss, Nicolas Sans, Denis Kouamé, Olivier Meyrignac, Adrian Basarab
2021 IEEE 18th International Symposium on Biomedical Imaging (ISBI)
DOI: 10.1109/ISBI48211.2021.9434173 2021

Compressed-domain Classification Algorithm for Spectral Imaging Based on Designed Single-Pixel Camera Codification
Karen Sanchez, Carlos Hinojosa, Hans Garcia, Henry Arguello, Sergio Castillo
OSA Imaging and Applied Optics Congress 2021 (3D, COSI, DH, ISA, pcAOP)
DOI: 10.1364/COSI.2021.CTu2F.5 2021

Accurate Deep Learning-based Gastrointestinal Disease Classification via Transfer Learning Strategy
Jessica Escobar, Karen Sanchez, Carlos Hinojosa, Henry Arguello, Sergio Castillo
2021 XXIII Symposium on Image, Signal Processing and Artificial Vision (STSIVA)
DOI: 10.1109/STSIVA53688.2021.9591995 2020

Single-Pixel Camera Sensing Matrix Design for Hierarchical Compressed Spectral Clustering
Carlos Hinojosa, Jorge Bacca, Edwin Vargas, Sergio Castillo, Henry Arguello
2019 IEEE 29th International Workshop on Machine Learning for Signal Processing (MLSP)
DOI: 10.1109/MLSP.2019.8918856 2019

Spectral-Spatial Classification from Multi-Sensor Compressive Measurements Using Superpixels
Carlos Hinojosa, Juan Marcos Ramirez, Henry Arguello
2019 IEEE International Conference on Image Processing (ICIP)
DOI: 10.1109/ICIP.2019.8803266 2019

Spectral Imaging Subspace Clustering with 3-D Spatial Regularizer
Carlos A. Hinojosa, Jorge Bacca, Henry Arguello
Imaging and Applied Optics 2018 (3D, AO, AIO, COSI, DH, IS, LACSEA, LS&C, MATH, pcAOP)
DOI: 10.1364/3D.2018.JW5E.7 2018

Supervised Classification of Hyperspectral Images using Side Information
Karen Sanchez, Carlos Hinojosa, Henry Arguello
Imaging and Applied Optics 2018 (3D, AO, AIO, COSI, DH, IS, LACSEA, LS&C, MATH, pcAOP)
URL: http://www.osapublishing.org/abstract.cfm?URI=COSI-2018-JW5E.5 2018

Kernel Sparse Subspace Clustering with Total Variation Denoising for Hyperspectral Remote Sensing Images
Jorge Bacca, Carlos A. Hinojosa, Henry Arguello
Imaging and Applied Optics 2017 (3D, AIO, COSI, IS, MATH, pcAOP)
DOI: 10.1364/MATH.2017.MTu4C.5 2017

Compressive spectral imaging using multiple snapshot colored-mosaic detector measurements
Carlos A. Hinojosa, Claudia V. Correa, Henry Arguello, Gonzalo R. Arce
Computational Imaging
URL: https://doi.org/10.1117/12.2224369 2016

Analysis of Matrix Completion algorithms for spectral image estimation from compressive coded projections
Henry Arguello Fuentes, Hoover Rueda Chacón, Carlos Alberto Hinojosa Montero
2015 20th Symposium on Signal Processing, Images and Computer Vision (STSIVA)
DOI: 10.1109/STSIVA.2015.7330441 2015

Patents

International Patents [2]

Systems and Methods for Recognizing Human Actions from Privacy-Preserving Optics
Carlos Hinojosa, Miguel Marquez, Henry Arguello, Ehsan Adeli, Li Fei-Fei, Juan Carlos Niebles
US Patent App. 63/368,314, 2022

Systems and Methods for Privacy Preserving Optical Systems
Carlos Hinojosa, Juan Carlos Niebles, Henry Arguello
US Patent No. WO2022266670A1, Application No. PCT/US2022/073014, 2021

Teaching Experience

KAUST Academy — *Saudi Arabia*

Teacher - Main Instructor — *June 2024 - July 2024*

- Taught Python programming as part of the **Saudi Arabia Ministry of Interior (MOI) AI Bridging Course** organized by KAUST Academy.
- Taught foundational and practical **Python programming** lessons to prepare potential Saudi postgraduate students for advanced academic studies.

KAUST Academy — *Saudi Arabia*

Teacher - Main Instructor — *July 2024 - August 2024*

- Taught Introduction to Machine Learning and Deep Learning as part of the **KAUST Artificial Intelligence (AI) Training Program** designed for TAHAKOM company by KAUST Academy.
- Focused on the Mathematical Foundations of Machine Learning, covering topics such as PCA, SVD, Eigenvalue Decomposition, Spectral Clustering, and Convolution, among others.

KAUST Academy — *Saudi Arabia*

Teaching Assistant — *May 2024 - October 2024*

- Teacher assistant with Prof. Bernard Ghanem for the KAUST Computer Vision Training Program for Tahakom, focusing on two main topics. The first, Transformers for Vision, covered the fundamentals of vision transformer architectures such as ViT, DeiT, and Swin, along with efficient training strategies and applications in tasks like classification, object detection, and semantic segmentation.
- The second topic, Beyond the Supervised Training Paradigm, introduced advanced methods, including self-supervised learning, active learning, domain generalization, imbalanced learning, and zero/few-shot learning, emphasizing practical applications and the integration of state-of-the-art techniques into real-world scenarios.

KAUST Academy — *Saudi Arabia*

Teaching Assistant — *July 2023 - August 2023*

- Collaborated on delivering a specialized deep learning course designed for Saudi Aramco professionals.
- Contributed to lectures and practical sessions covering advanced topics, including Generative Adversarial Networks (GANs), inversion and visualization techniques, and contemporary advancements in deep learning research and applications.

Universidad Industrial de Santander (UIS) — *Colombia*

Assistant Professor — *June 2016 - December 2016*

- Taught computer programming using C and C++ languages.
- Single instructor. I taught 50 students distributed in two groups.

Engineering Work Experience

Turing — *Remote*

Senior Python Developer with OpenAI — *July 2022 - April 2023*

- As a Senior Python Developer contracted with Turing, I worked to enhance the OpenAI ChatGPT model's capabilities through my technical feedback and expertise.
- OpenAI used Reinforcement Learning from Human Feedback (RLHF) to incorporate my knowledge and intuition into the learning process, allowing the ChatGPT model to be trained faster and more effectively.
- Collaborated closely with the development team of OpenAI to provide technical insights, expediting the ChatGPT Large Language Model (LLM) training.

Universidad Industrial de Santander — *Colombia*

Research/Software Engineer - Consultant — *November 2021 - December 2021*

- Consulted for developing a web-based platform for chronic wounds detection and segmentation in skin lesion medical images.

Universidad Industrial de Santander — *Colombia*

Software Engineer — *June 2021 - December 2021*

- Designed compressive seismic reconstruction algorithms and implemented them in Python programming language.
- Incorporated the implemented algorithms in a graphical user interface.

TIP - CISLAB *Colombia*

Software Engineer *January 2021 - April 2021*

- Implemented the image-ray-based 3D conversion algorithm in the DSG software using the development kit (SDK).
- Implemented the image-ray-based algorithm for converting RMS 3D velocities in the time domain to 3D interval velocities in depth using the SDK of DSG.

TIP - CISLAB *Colombia*

Software Engineer *October 2020 - December 2020*

- Developed user tests for the time-to-depth conversion (ImageRayTZ 2D) and interactive picking (IPickingTZ 2D) modules for DecisionSpace Geoscience (DSG).
- Developed a training workshop for Ecopetrol S.A users on geophysics concepts and software development for the DSG software using the software development kit (SDK).
- Tested the 3D time-to-depth conversion algorithm in a production environment.

Universidad Industrial de Santander *Colombia*

Consultant *March 2020 - May 2020*

- Designed and developed an algorithm for converting RMS 3D velocities in the time domain to 3D interval velocities in depth using the image-ray method.

TIP - CISLAB *Colombia*

Software Engineer *June 2018 - December 2018*

- Developed a plugin in the Halliburton software DecisionSpace Geosciences (DSG) for 2D interactive picking in time and depth domains.
- Developed unit test cases for the 2D interactive picking plug-in in DecisionSpace Geoscience and elaborated a report.
- Developed a training workshop on the plug-in tool for Ecopetrol S.A users.
- Developed a technical document of the productive version of the 2D interactive picking plug-in.

Mentorship

2018-2019 **Jhon Lopez,** Undergraduate thesis, Universidad Industrial de Santander *Colombia*

Honors & Awards

2022	**Best Paper Award,** for our paper "Optics Lens Design for Privacy-preserving Scene Captioning" awarded by the IEEE International Conference on Image Processing (ICIP2022).	*ICIP2022, France*
2022	**RSIPvision Magazine Cover Story,** of our oral paper on privacy-preserving human action recognition.	*ECCV 2022, Israel*
2022	**ECCV2022 Oral Presentation,** For the paper titled "PrivHAR: Recognizing Human Actions From Privacy-preserving Lens", **awarded to top (2.7%)** 158 papers out of 5803 submissions in ECCV 2022.	*ECCV 2022, Israel*
2022	**Laureate Thesis Award,** For my doctoral thesis titled "Efficient, Robust, And Similarity-constrained Algorithm For Subspace Learning And Clustering With Applications In Compressive Imaging"	*Colombia*
2022	**Data Challenge 3rd Place Winner,** Won third place in the "Data augmentation in artificial intelligence for rare tumors" challenge competition organized by the Société Française de Radiologie (SFR). Our team joined colleges' efforts from the CREATIS lab, IRIT lab, the Hôpitaux de Paris (France), and Ph.D. students and researchers from my Lab in Colombia (HDSP).	*France*
2021	**ICCV2021 Oral Presentation,** For the paper titled "Learning Privacy-preserving Optics for Human Pose Estimation", **awarded to top (3%)** 201 papers out of 6236 submissions in ICCV 2021.	*ICCV 2021, USA*
2021	**Best Oral Poster Presentation,** For outstanding presentation of submission entitled "Learning Privacy-preserving Optics for Human Pose Estimation" (Poster version), in the **LXCV workshop** at ICCV.	*ICCV 2021, USA*
2017	**Young Researcher,** Winner of the young researchers and innovators scholarship 2016, awarded by the administrative department of science, technology, and innovation (**MinCiencias**).	*Colombia*
2016	**Academic Excellence as a Researcher,** Disctintion awarded by the high dimensional signal processing group (HDSP) of the Industrial University of Santander.	*Colombia*

Technical Skills

Machine Learning Libraries	Pytorch, Tensorflow, Keras, Tensorlayer, PyTorch Lightning, OpenCV, Scipy, Scikit-learn, Pandas, MXNet
Programming Languages	Python, C/C++, C#, Java, MATLAB, R, Javascript (JS), Typescript, Bash
Cloud Computing Platform	Google Cloud, Amazon Web Services (AWS), Microsoft Azure
Parallel Computing Libraries	CUDA, OpenMP, OpenCL
Web & Hybrid Mobile Development	Angular JS, Ionic Framework, PhoneGAP, Cordova, Node JS, HTML, PHP
OS Platform	Windows, Linux
Speciallized Softwares	Halliburton DecisionSpace Geoscience (DSG)
Other Tools/Libraries	LaTeX

Invited Talks

Privacy-preserving in Computer Vision through Optics Learning (2024)

- Keynote speaker at the Privacy for Vision & Imaging Workshop, 2nd International Workshop in conjunction with ECCV 2024, Milan, Italy.

Privacy-preserving in Computer Vision through Optics Learning (2023)

- Rising Stars in AI Symposium 2023 at King Abdullah University of Science and Technology (KAUST)
- Computational Imaging Group at the KAUST Visual Computing Center

PrivHAR: Recognizing Human Actions From Privacy-preserving Lens (2022)

- Stanford Vision and Learning LAB (SVL) Research Group - Stanford University

Systems and Methods for Privacy-preserving Computer Vision (2021)

- Stanford Vision and Learning LAB (SVL) Research Group - Stanford University
- High Dimensional Signal Processing (HDSP) Research Group - Universidad Industrial de Santander

Academic Services

Reviewer: CVPR, ICCV, ECCV, Neurips, TPAMI, TIP, TMM, TCI, IJRS, OPTICA (formerly OSA) journals.
General Chair in LatinX in Computer Vision (LXCV) Research workshop at CVPR 2023, and ICCV 2023.
Program Committee Chair in LatinX in Computer Vision (LXCV) Research workshop at ICCV 2021, CVPR 2022, and ECCV 2022.
Thesis committee member (evaluator) of two undergraduate thesis at Universidad Industrial de Santander.