



PHYSICAL ENGINEER

MASTER IN BIO-ENGINEERING

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PROFESSIONAL PROFILE

Research-oriented professional with a background in **Physical Engineering** and a Master's degree in **Bioengineering**, with a strong focus on digital **image processing**, spectral data analysis, and the application of **artificial intelligence** to solve socially relevant challenges. I have participated in interdisciplinary **research projects** in **medical imaging**, bioengineering, and electronics, assuming roles such as **algorithm developer**, junior researcher, and **AI model designer**.

My expertise includes the formulation and solution of **inverse problems**, the development and implementation of scientific research methodologies, and the optimization of computational models using **Python** and **MATLAB**. I have experience designing **deep learning** architectures, performing spectral **data preprocessing**, and integrating domain knowledge into **learning-based** solutions.

In the academic and research fields, I have led **scientific writing** projects as corresponding author, conducted exhaustive **literature reviews**, and participated in the preparation of technical documentation and research proposals. I have collaborated with national and international researchers on multidisciplinary projects, demonstrating an analytical mindset, attention to detail, and commitment to scientific rigor. I am a motivated and responsible professional, capable of **working independently or in teams**, with a strong drive for continuous learning and problem-solving.

TECHNICAL SKILLS

- Python, C++, and Matlab.
- Deep learning.
- Machine Learning.
- Digital Image Processing.
- SolidWorks and AutoCAD.
- Proteus simulator.
- TensorFlow and PyTorch.
- Writing Scientific Articles.
- Latex.
- Cuda.
- GitHub.
- Linux.
- Project advisor.
- Statistical processing.
- Experimental design and validation.
- Systematic reviews (PRISMA2020).
- Data analysis.

EDUCATION

MASTER in BIOENGINEERING • 2024

Master's Final Project: *Support for glioblastoma diagnosis based on magnetic resonance imaging and responsible artificial intelligence techniques.*

University of Cauca.

PHYSICAL ENGINEER • 2022

Universidad del Cauca.

LANGUAGES

Spanish	Native
English	Intermediate

WORK EXPERIENCE AND RESEARCH PROJECTS

Research and Software Developer • 2023 - At present

Industrial University of Santander, Department of Computational Sciences (Colombia).

Design computational algorithms for estimating the physicochemical properties of cocoa using selected near-infrared spectral bands and deep learning algorithms.

- Analyze and mathematically model the estimation of physicochemical properties and classification of materials using spectral images and deep learning, within the framework of cocoa beans.
- Obtaining and organising the multispectral cocoa image database.
- Analyze and mathematically model a neural network to obtain the most significant bands in the near infrared for the estimation of the physicochemical properties of cocoa.

Achievement: Construction of a low-cost multispectral images camera to analyze the quality of Cocoa.

Co-director of the degree final project entitled "Classification of the fermentation level of dried cocoa beans through spectral image processing and deep learning". Currently under research.

Junior Research Fellow • 2019-2020

University of Cauca, Department of Morphology (Colombia).

R&D internship grant to implement an otitis classification algorithm.

- Obtaining and organising the database using a digital otoscope and Matlab.
- Development of a mathematical model to obtain intrinsic characteristic of Otitis images.
- Creation of neural networks in Matlab to differentiate the different types of Otitis.

Achievement: Implementation of an algorithm to differentiate between viral and bacterial otitis.

Junior Software Researcher • 2020-2021

University of Cauca, Department of Physics, Optics and Laser Research Group (Colombia).

Professional R&D internship to develop an algorithm for wood-sand differentiation in drone imagery.

- Data cleaning using the **Fast Fourier Transform** in the Matlab platform.

- Construction of the algorithm for obtaining the physical characteristics of wood and sand.

Achievement: Design and implementation of an algorithm with the objective of differentiating wood from sand on the beach of Puerto Velero, Colombia.

Junior Research Fellow • 2020-2021

University of Cauca, Department of Physics, Optics and Laser Research Group (Colombia).

Volunteering to develop a protection system against COVID-19.

- Mechanical design of the automatic cabin.

- Design and simulation of the electrical system using PROTEUS.

- Construction of the **electronic system**.

Achievement: Design and implementation of an automatic booth for the protection of people from Covid-19.

Junior hardware and software developer • 2019

University of Cauca, Department of Physics, Optics and Laser Research Group (Colombia).

Research project to develop an algorithm for encoding car number plates in Special Topics in Optics.

- Data cleaning using the **Fast Fourier Transform** in the **Matlab** platform.

- Development of an interactive application in Matlab to obtain car number plate digits.

Achievement: Development of an algorithm to improve vehicle number plate resolutions.

Junior hardware and software developer • 2018

University of Cauca, Department of Physics, Optics, and Laser Research Group (Colombia).

Research project to develop an orchid classification algorithm using Digital Image Processing.

- Obtaining and organising the Orchid database using a Sonic Camera, Microsoft Excel and Matlab.

- Creation of neural networks in Matlab to classify orchids.

Achievement: Development of an algorithm to classify 30 types of Colombian orchids.

SCIENTIFIC PUBLICATIONS, BOOKS, AND CONFERENCES

- Deep Learning for Glioblastoma Multiforme Detection from MRI: A Statistical Analysis for Demographic Bias.
Appl. Sci. 2025, 15(11), 6274 · 3 jun. 2025.
- A Review of Artificial Intelligence-Based Systems for Non-Invasive Glioblastoma Diagnosis.
Life 2025, 15(4), 643 · 14 abr. 2025.
- High Dynamic Range Modulo Imaging for Robust Object Detection in Autonomous Driving.
European Conference on Computer Vision. Springer, Cham. p. 171-180. 12 may. 2025.
- Autoregressive High-Order Finite Difference Modulo Imaging: High-Dynamic Range for Computer Vision Applications.
European Conference on Computer Vision. Springer, Cham. p. 211-228 · 12 may. 2025
- Spectral Assessment for Cocoa Quality.
Conference: Wacci 2024 Best Poster Award.
- CoCoSpec: A Multimodal hyperspectral dataset of cocoa beans with physicochemical annotation
Journal: Scientific Data Nature. Under Peer-Review.
- Deep Learning-Based Spectral Band Selection for Spectral Imaging Tasks
Journal: Applied Optics. Under Peer-Review.
- Learning-based Spectral Regression Techniques for Colombian Cocoa Bean Quality Assessment
Journal: Nature Food. Under Peer-Review.
- Computational Correction of Eye Aberrations: A Physical Modeling Approach with Zernike Polynomials and Deep Learning.
Conference: STSIVA-IEEE. Under Peer-Review.
- Automated Classification of Cocoa Bean Fermentation Levels Using Computer Vision.
Conference: STSIVA-IEEE. Under Peer-Review.
- Self-Supervised Low-Light Quantum RGB Image Demosaicing.
Conference: STSIVA-IEEE. Under Review.
- Deep Robust Object Detection under High Illumination Conditions Using Modulo Images.
Conference: STSIVA-IEEE. Under Review.