Antonio R. Porras

CURRENT POSITION

Department of Biostatistics and Informatics   2020-Present
Colorado School of Public Health, University of Colorado Anschutz Medical Campus
Assistant Professor on the Tenure Track

<u>Affiliations</u>

- Department of Pediatric Plastic and Reconstructive Surgery (Director of Research)
  Children's Hospital Colorado
- Computational Bioscience Program (core Faculty)
  School of Medicine, University of Colorado Anschutz Medical Campus
- Biomedical Sciences Program (training Faculty)
  School of Medicine, University of Colorado Anschutz Medical Campus
- Department of Pediatric Neurosurgery (secondary Faculty)
  Children's Hospital Colorado
- Department of Pediatrics (secondary Faculty)
  School of Medicine, University of Colorado Anschutz Medical Campus
- Department of Surgery (secondary Faculty)
  School of Medicine, University of Colorado Anschutz Medical Campus
- Department of Biomedical Informatics (secondary Faculty)
  School of Medicine, University of Colorado Anschutz Medical Campus

<u>Contact Information</u>

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Colorado School of Public Health
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EDUCATION

B.Sc. Technical Engineering in Computer Systems   2003-2006
University of Cordoba, Spain

<u>Thesis title</u>: Data mining tool to discover sequential rules in the "AHA!"
system.
<u>Supervisor</u>: Dr. Cristobal Romero

B.Sc. Computer Engineering   2006-2008
University of Cordoba, Spain

<u>Thesis title</u>: Collaborative filtering system for digital art
recommendations
<u>Supervisor</u>: Dr. Enrique Garcia

M.Sc. Biomedical Engineering   2008-2010
University of Barcelona / Polytechnic University of Catalonia, Spain
Thesis project at Chalmers University of Technology, Gothenburg,
Sweden

<u>Thesis title</u>: Accurate segmentation of brain MR images
<u>Supervisor</u>: Dr. Hoi-Shun Lui

Ph.D. – Department of Information and Communication Technologies   2011-2015
Pompeu Fabra University, Barcelona, Spain
Research Internship at Catholic University of Leuven, Belgium

<u>Thesis title</u>: Multi-cue image integration for cardiac tissue
characterization
<u>Supervisors</u>: Dr. Alejandro Frangi and Dr. Gemma Piella

<u>Awards</u>: *Summa cum laude* and International Quality Award – Spanish
Government

Postdoctoral training   2019-2020

Foundation for Advanced Education in the Sciences, National Institutes
of Health, Bethesda, MD.

- GENE 500 – Introduction to Medical Genetics (Dr. Susan Hart)
- GENE 505 – Embryology, Developmental Biology and Human
  Malformations (Dr. Leslie Biesecker)

Children's National Hospital, Washington, DC

- Clinical management of pediatric neurosurgery patients (Dr. Robert
  Keating).

PRIOR ACADEMIC AND RESEARCH POSITIONS

Biomedical Engineer   2009-2010
Department of Physics, University of Barcelona, Spain

<u>Responsibilities</u>: Development of controllers and graphic software
interface to manage a new robotic atomic forces microscope station
built for research

Research Assistant   2010
Department of Electrical Engineering, Chalmers University of Technology,
and Sahlgrenska Hospital, Gothenburg, Sweden.

<u>Responsibilities</u>: Development and evaluation of a software tool to
segment brain structures from magnetic resonance images

Researcher in training   2010-2011
Center for Imaging and Simulation Technologies in Biomedicine (CISTIB)
Department of Information and Communication Technologies, Pompeu
Fabra University, Barcelona, Spain

<u>Responsibilities</u>: Development of methods and graphic interface to
reconstruct patient-specific cardiac motion using interventional electro-
anatomical mapping data

Instructor and research assistant   2011-2015
Department of Information and Communication Technologies, Pompeu
Fabra University, Barcelona, Spain

<u>Teaching</u>: Computational Techniques in Biomedicine (1 year),
Fundamental of Programming (1 year), and Biomedical Image
Analysis courses (2 years)

<u>Research</u>: Multi-cue image integration for cardiac tissue characterization

Postdoctoral research fellow (2015-2016) and **Staff Scientist** (2016-2020)   2015-2020
Sheikh Zayed Institute for Pediatric Surgical Innovation, Children's National Hospital, Washington DC

<u>Responsibilities</u>: Development of quantitative image analysis and machine learning methods for:
- Quantitative evaluation of diuresis renography to assess the need for surgical treatment
- Facial screening for genetic syndromes in diverse pediatric populations
- Interventional planning and surgical treatment evaluation of craniosynostosis using imaging data, statistical models and machine learning
- Predictive modeling of cranial bone development using large cross-sectional data

HONORS AND AWARDS

Global Honors Award   2003-2004
Spanish Ministry of Education. All fees waived during the first year of college in a Spanish university.

General State Scholarship   2004-2008
Spanish Ministry of Education. All costs waived for university studies and funds for materials and transportation.

General State Scholarship for Master Studies   2008-2010
Spanish Ministry of Education. All costs waived for master studies and funds for material, transportation and living expenses.

Erasmus Scholarship for Master Studies   2010
European Commission, Spanish and Catalan Governments. Funds to finish master studies at Chalmers University of Technology, Gothenburg, Sweden.

Student Travel and Registration Award   2013
Based on paper review scores – International Conference of Medical Image Computing and Computer Assisted Interventions, Nagoya, Japan.
<u>Article</u>: Myocardial motion estimation combining tissue Doppler and B-mode echocardiographic images

Best Paper Award   2016
Workshop on Clinical Image-based Procedures – International Conference of Medical Image Computing and Computer Assisted Interventions, Athens, Greece,
<u>Article</u>: Personalized optimal planning for the surgical correction of metopic craniosynostosis

Best Research Abstract Award   2016
Annual Joseph E. Roberts Jr. Academic Day – Children's National Hospital, Washington, DC.

Title: Early detection of ureteropelvic junction obstruction from diuretic renograms

Invited demonstration   2016
Arab Health, Dubai, United Arab Emirates
Project: mGene – Early and Mobile Detection of Genetic Syndromes

Invited participation and finalist   2016
World Government Summit – Edge of Government competition. Dubai, United Arab Emirates
Project: mGene – Early and Mobile Detection of Genetic Syndromes

Junior Researcher Travel and Registration Award   2017
Based on paper review scores – International Conference of Medical Image Computing and Computer Assisted Interventions, Quebec City, Canada
Article: Locally affine diffeomorphic surface registration for planning of metopic craniosynostosis surgery

Finalist to Young Investigator Award   2017
International Conference of Medical Image Computing and Computer Assisted Interventions, Quebec City, Canada.
Article: Locally affine diffeomorphic surface registration for planning of metopic craniosynostosis surgery

Cover of Scientific Journal   2017
American Journal of Medical Genetics – Part A
Article: 22q11.2 deletion syndrome in diverse populations

Cover of Scientific Journal   2017
American Journal of Medical Genetics – Part A
Article: Noonan syndrome in diverse populations

Second Best Research Work   2017
Student Innovators Program, Children's National Hospital. Washington, DC.
Mentee: James Jared

Runner-up   2018
STAT Madness – STAT News, Boston Globe.
Project: Facial analysis technology for the early identification of genetic syndromes

Cover of Scientific Journal   2018
American Journal of Medical Genetics – Part A
Article: Williams-Beuren syndrome in diverse populations

Third Best Research Work   2018
Student Innovators Program, Children's National Hospital. Washington, DC.
Mentee: Phillip Taylor

Second Best Paper Award   2018
Annual Joseph E. Roberts Jr. Academic Day – Children's National Hospital. Washington, DC.
Title: Deep learning for screening of genetic syndromes

Top Cited Article in 2018-2019   2019
American Journal of Medical Genetics Part A

Article: 22q11.2 deletion syndrome in diverse populations

Best Scientific Poster	2019

Annual Research and Education Week at Children's National Hospital. Washington, DC.
Title: Quantification of head shape from three-dimensional photography for pre- and post-surgical evaluation of craniosynostosis

Featured paper in scientific journal	2021

IEEE Transactions on Biomedical Engineering
Article: Predictive statistical model of early cranial development

Inducted	2022

Delta Omega National Honors Society for Public Health, Alpha Upsilon Chapter.

Student Travel and Registration Award	2022

Recipient: Jiawei Liu (PhD Student I mentor)
Based on paper review scores – International Conference of Medical Image Computing and Computer Assisted Interventions, Singapore.
Article: Learning with context encoding for single-stage cranial bone labeling and landmark localization

Top Cited Article during 2021-2022	2023

Molecular Genetics and Genomic Medicine
Article: Objective differential diagnosis of Noonan and Williams-Beuren syndromes in diverse populations using quantitative facial phenotyping

PROFESSIONAL AFFILIATIONS

• Medical Image Computing and Computer Assisted Interventions Society	2017-Present
• Institute of Electrical and Electronics Engineers (IEEE), Denver section	2022-Present
• IEEE Engineering in Medicine and Biology Society (EMBS)	2022-Present
• Society for Advancing Chicanos/Hispanics and Native American in Science (SACNAS)	2022-Present
• International Association for Dental Research (IADR)	2023-Present

PROFESSIONAL LEADERSHIP AND SERVICE

Department / School

• Biostatistics and Informatics Seminar Series (chair)	2020-2022
• Computing Resources Committee (committee member)	2020-2022
• Student recruitment for graduate programs in Biostatistics (participated in research presentations and break-up sessions)	2020-2021
• Computational and Data Science Curriculum Committee (lead)	2021-2022
• Department representative for the School's Research Committee	2023-Present

University

• Chair for Diversity, Equity and Inclusion. Computational Biosciences Program	2021-Present

• Graduate Diversity, Equity and Inclusion Task Force working group	2021-Present
• Graduate student interviews. Biomedical Sciences Program and Computational Biosciences Program	2021-2023
• Led and coordinated the creation of the first local pediatric craniofacial research biobank between Children's Hospital Colorado and CU Anschutz	2021-2023
• Recruitment of graduate students at the National Diversity STEM Conference (NDiSTEM), the conference of the Society for Advancing Chicanos/Hispanics and Native American in Science (SACNAS)	2022
• Reviewer and judge for Center for Children's Surgery Symposium	2022-2023
• Chair and organizer of the first CU Anschutz Symposium on Biomedical Imaging	2023

International

• Program Committee for the Workshop on Clinical Image-based Procedures. International Conference on Medical Image Computing and Computer Assisted Interventions (MICCAI), Athens, Greece, and Quebec City, Canada	2016-2017
• Associate to General Chair, International Conference on Medical Image Computing and Computer Assisted Interventions (MICCAI), Granada, Spain	2018
• Co-chair of MICCAI Mentorship Program	2018-2022
• Co-chair for Young Investigators and Early Career Development Program, International Conference on Medical Image Computing and Computer Assisted Interventions (MICCAI): Peru, Lima (2020); Strasbourg, France (2021); Singapore (2022); and Vancouver, Canada (2023)	2020-2023
• Chair for Career Development and Student Affairs, International Conference on Medical Image Computing and Computer Assisted Interventions (MICCAI) 2024. Marrakesh, Morocco.	2022-2024
• Member of the Computer Aided Diagnosis (CAD) Committee of the International Society of Optics and Photonics (SPIE).	2022-Present
• Mentor and judge at the National Diversity in STEM (NDiSTEM) Conference of the Society for Advancing Chicanos/Hispanics and Native American in Science (SACNAS). San Juan, Puerto Rico.	2022
• Co-founder and member of the MICCAI Society Continuous Mentorship Program working group.	2022-Present
• Co-organizer of the first MICCAI / AFRICAI (African Network for Artificial Intelligence in Biomedical Imaging) Summer school, Marrakesh, Morocco.	2023

Additional continuous education activities

• Researcher Management and Leadership Training by Anne Libby, University of Colorado Anschutz Medical Campus, Coursera	2020
• Multicultural Mentoring Series, Center for Faculty Development & Advancement, University of Colorado Anschutz Medical Campus	2022
• Bioethics Conference, Colorado Center for Bioethics, University of Colorado Anschutz Medical Campus	2022

- Work in Progress (WIP) working group on Grant Writing led by Dr. Elizabeth Juarez-Colunga, Department of Biostatistics and Informatics, Colorado School of Public Health, University of Colorado Anschutz Medical Campus.   2022-Present

Intellectual Property

- Patent: PCT/US2018/026726 – System apparatus and method for the detection of ureteropelvic junction obstruction. Status: pending.   2016
- Software copyright: SR 1-8317833951 – Quantitative evaluation of facial dysmorphology of genetic origin. Licensed to mGeneRX (NC) in 2020.   2020

Review, Referee and Editorial Activities

Journal reviews

- Computers in Biology and Medicine
- Frontiers in Radiology
- Frontiers in Surgery
- IEEE Transactions on Medical Imaging
- IEEE Journal of Biomedical and Health Informatics
- Journal of Medical Imaging
- Journal of Magnetic Resonance Imaging
- Journal of Urology
- Nature Scientific Reports
- Personalized Medicine

Conference reviews

- International Conference on Medical Image Computing and Computer Assisted Interventions (MICCAI)
- MICCAI Workshop on Clinical Image-based Procedures (CLIP)
- MICCAI Workshop on Statistical Atlases and Computational Models of the Heart (STACOM),
- Computer Aided Diagnosis (CAD) Conference of the International Society of Optics and Photonics (SPIE)
- Center for Children's Surgery (CCS), Children's Hospital Colorado
- CU Anschutz Symposium on Biomedical Imaging, University of Colorado Anschutz Medical Campus

Funding proposal review

- Clinical Translational Imaging Science (CTIS) Study Section, National Institutes of Health.
- Colorado Center for Translational Sciences Institute (CCTSI) Pilot Grant Program.
- Colorado Center for Translational Sciences Institute (CCTSI) Translational Methods Grant Program

Invited Lectures, Presentations and Workshops

Invited seminars

Local

- Title: Quantitative imaging for the diagnosis, treatment, and surgical outcome assessment of patients with craniosynostosis.   2018

- Title: Personalized and quantitative evaluation of cranial malformations in patients with craniosynostosis.
  Venue: Innovation Rounds, Sheikh Zayed Institute for Pediatric Surgical Innovation. Children's National Hospital. Washington, DC. — 2019

- Title: Predictive statistical model of cranial development
  Venue: Department of Bioengineering, Sheikh Zayed Institute for Pediatric Surgical Innovation. Children's National Hospital. Washington, DC. — 2020

- Title: Quantitative medical image analysis for a personalized optimal clinical management of craniosynostosis.
  Venue: Department of Biostatistics and Informatics, University of Colorado Anschutz Medical Campus. Aurora, CO. — 2020

- Title: Quantitative medical image analysis for a personalized optimal clinical management of craniosynostosis.
  Venue: Bioengineering Initiative – Children's National Hospital. Washington, DC. — 2020

- Title: Predictive statistical model of cranial development
  Venue: Precision Medical Imaging lab – Children's National Hospital. Washington, DC. — 2020

- Title: Quantitative characterization of the cranium.
  Venue: Department of Pediatric Plastic and Reconstructive Surgery. Children's Hospital Colorado. Aurora, CO. — 2020

- Title: Image-based computational craniofacial phenotyping.
  Venue: Computational Bioscience Program. University of Colorado Anschutz Medical Campus. Aurora, CO. — 2020

- Title: Medical Image Computing and Computer Assisted Interventions.
  Venue: Medical Imaging Working Group. Department of Biostatistics and Informatics. University of Colorado Anschutz Medical Campus. Aurora, CO. — 2020

- Title: Medical image computing and computational phenotyping.
  Venue: Biostatistics and Informatics Seminar Series. Department of Biostatistics and Informatics. University of Colorado Anschutz Medical Campus. Aurora, CO. — 2020

- Title: Image-based computational craniofacial phenotyping.
  Venue: Human Medical Genetics and Genomics Program (HMGGP). University of Colorado Anschutz Medical Campus. Aurora, CO. — 2021

- Title: Image-based computational craniofacial phenotyping.
  Venue: Center for Personalized Medicine. University of Colorado Anschutz Medical Campus. Aurora, CO. — 2021

- Title: Medical imaging and big data
  Venue: Big Data Seminar Series. Center for Innovation Design and Analysis (CIDA). University of Colorado Anschutz Medical Campus. Aurora, CO. — 2021

- Title: Quantitative medical image analysis for a personalized optimal clinical management of craniosynostosis.
  Venue: Department of Bioengineering. University of Colorado Anschutz Medical Campus. Aurora, CO. — 2021

- Title: Image-based computational craniofacial phenotyping.
  Venue: Genetics and Metabolism Grand Rounds. University of Colorado Anschutz Medical Campus. Aurora, CO. — 2021

- Title: Using pediatric craniofacial imaging to screen for genetic and developmental anomalies. — 2022

Venue: Real World Ethics for Artificial Intelligence Research: Managing the Issues. 12th Annual Research Ethics Conference. Colorado Clinical and Translational Sciences Institute (CCTSI). Aurora, CO.

- <u>Title</u>: Medical Image Phenotyping.
  <u>Venue</u>: Computational Bioscience Program – Recruitment flash talks. University of Colorado Anschutz Medical Campus. Aurora, CO.   2022

- <u>Title</u>: Medical Image Phenotyping.
  <u>Venue</u>: CU Anschutz Symposium on Biomedical Imaging. University of Colorado Anschutz Medical Campus. Aurora, CO.   2023

- <u>Title</u>: My path to directing a machine learning and biomedical engineering research program.
  <u>Venue</u>: Aurora Science and Tech Middle School. Aurora, CO.   2023

<u>National</u>

- <u>Title</u>: Quantification of craniofacial malformations using quantitative imaging technologies.
  <u>Venue</u>: Medical Genetics Branch, National Human Genome Research Institute (NHGRI). National Institutes of Health, Bethesda, MD. Washington, DC.   2018

- <u>Title</u>: Personalized quantitative evaluation, treatment and follow-up of patients with craniosynostosis.
  <u>Venue</u>: Clinical Case Conference. National Institute of Dental and Craniofacial Research (NIDCR). National Institutes of Health, Bethesda, MD.   2018

- <u>Title</u>: Personalized quantitative evaluation, treatment and follow-up of patients with craniosynostosis.
  <u>Venue</u>: Craniofacial Anomalies and Regeneration Section. National Institute of Dental and Craniofacial Research (NIDCR). National Institutes of Health, Bethesda, MD.   2019

- <u>Title</u>: Quantitative medical image analysis for a personalized optimal clinical management of craniosynostosis.
  <u>Venue</u>: Department of Biomedical Engineering – Columbia University. New York City, NY.   2020

- <u>Title</u>: Quantitative medical image analysis for a personalized optimal clinical management of craniosynostosis.
  <u>Venue</u>: Department of Bioengineering – University of Maryland College Park, MD.   2020

- <u>Title</u>: Quantitative medical image analysis for a personalized optimal clinical management of craniosynostosis.
  <u>Venue</u>: Department of Radiology – Washington University. St. Louis, MO.   2020

- <u>Title</u>: Medical Image Phenotyping
  <u>Venue</u>: Sheikh Zayed Institute for Pediatric Surgical Innovation, Children's National Hospital. Washington, DC.   2023

- <u>Title</u>: A data-driven approach for the clinical management of craniosynostosis
  <u>Venue</u>: Plastic Surgery Grand Rounds – Banner Health, University of Arizona, Tucson, AZ.   2023

<u>Keynote/invited presentations in international venues</u>

- <u>Title</u>: Computational facial phenotyping of genetic syndromes.
  <u>Venue</u>: Digital Health and Artificial Intelligence Seminar – World Orphan Drug Conference. Washington, DC.   2019

- Title: Quantitative phenotyping and predictive modeling of cranial bone development.
  Venue: New Trends in Perinatal and Pediatric Imaging. Annual Conference of the IEEE Engineering in Medicine and Biology Society (EMBC). Virtual. 2021
- Title: Clinical Workflow 4: Abdominal and Pelvic Imaging (with Dr. Emmanuel Salinas Miranda and Dr. Vinay Duddalwar).
  Venue: IEEE International Symposium on Biomedical Imaging. Cartagena, Colombia. 2023
- Title: Best Practices for Incorporating Core Principles of Diversity, Equity, and Inclusion in Radiology Research (*accepted invitation to speak on November 2023)
  Venue: Annual Meeting of the Radiological Society of North America (RSNA) – Health Equity Series. 2023

Conference presentations

- Title: Cardiac Deformation from Electro-Anatomical Mapping Data: Application to Scar Characterization
  Conference: Functional Imaging and Modeling of the Heart (FIMH)
  Format: Poster presentation 2011
- Title: Endocardial motion estimation from electro-anatomical data
  Conference: IEEE International Symposium on Biomedical Imaging (ISBI)
  Format: 2012
- Title: Temporal Diffeomorphic Free Form Deformation to Quantify Changes Induced by Left and Right Bundle Branch Block and Pacing
  Conference: Workshop on Statistical Atlases and Computational Models of the Heart, International Conference of Medical Image Computing and Computer Assisted Interventions
  Format: Oral presentation 2013
- Title: Myocardial Motion Estimation Combining Tissue Doppler and B-mode Echocardiographic Images
  Conference: International Conference of Medical Image Computing and Computer Assisted Interventions
  Format: Poster presentation 2013
- Title: Personalized Optimal Planning for the Surgical Correction of Metopic Craniosynostosis
  Conference: Workshop on Clinical Image-Based Procedures. International Conference of Medical Image Computing and Computer Assisted Interventions
  Format: Oral presentation 2016
- Title: Locally Affine Diffeomorphic Surface Registration for Planning of Metopic Craniosynostosis Surgery
  Conference: International Conference of Medical Image Computing and Computer Assisted Interventions
  Format: Oral presentation 2017
- Title: Quantification of oxygen changes in the placenta from BOLD MR image sequences
  Conference: SPIE Computer Aided Diagnosis Conference
  Format: Oral presentation 2017
- Title: Early Detection of Ureteropelvic Obstruction from Diuretic Renograms
  Conference: American Urological Association (AUA) Annual Meeting
  Format: Oral presentation 2017

- <u>Title</u>: Personalized Optimal Planning of Fronto-Orbital Advancement Surgery for the Correction of Metopic Craniosynostosis from CT
  <u>Conference</u>: American Cleft Palate-Craniofacial Association (ACPA) Annual Meeting
  <u>Format</u>: Oral presentation   2017

- <u>Title</u>: Progress in Automated Intracranial Volume Quantification from 3D Photography
  <u>Conference</u>: Biennial Congress of the International Society of Craniofacial Surgery (ISCFS)
  <u>Format</u>: Poster presentation   2017

- <u>Title</u>: Automatic Planning of Cranial Vault Reconstruction for Metopic Craniosynostosis Treatment
  <u>Conference</u>: Biennial Congress of the International Society of Craniofacial Surgery (ISCFS)
  <u>Format</u>: Oral presentation   2017

- <u>Title</u>: Machine Learning Facilitates Early Detection of Ureteropelvic Junction Obstruction
  <u>Conference</u>: American Society for Artificial Internal Organs (ASAIO) Annual Meeting
  <u>Format</u>: Oral presentation   2018

- <u>Title</u>: Automatic Measurement of Intracranial Volume from Three-Dimensional Photography
  <u>Conference</u>: Biennial Congress of the International Society of Craniofacial Surgery (ISCFS)
  <u>Format</u>: Poster presentation   2019

- <u>Title</u>: Quantification of Head Shape from 3D Photography for Automatic Detection of Craniosynostosis
  <u>Conference</u>: Biennial Congress of the International Society of Craniofacial Surgery (ISCFS)
  <u>Format</u>: Oral presentation   2019

- <u>Title</u>: Quantitative Evaluation of Treatment for Craniosynostosis from 3D Photography
  <u>Conference</u>: Biennial Congress of the International Society of Craniofacial Surgery (ISCFS)
  <u>Format</u>: Poster presentation   2019

- <u>Title</u>: Normative temporal model of cranial bone development, mineral density changes and suture fusion
  <u>Conference</u>: Biennial Congress of the International Society of Craniofacial Surgery (ISCFS)
  <u>Format</u>: Oral presentation (presented by PhD student: Jiawei Liu)   2021

- <u>Title</u>: Age-dependent machine learning model improves head shape characterization and enables longitudinal evaluation of patients with craniosynostosis
  <u>Conference</u>: Rocky Bioinformatics Conference
  <u>Format</u>: Poster presentation (presented by PhD student: Connor Elkhill)   2021

- <u>Title</u>: Age-dependent machine learning model improves head shape characterization and enables longitudinal evaluation of patients with craniosynostosis
  <u>Conference</u>: Annual Conference of the American Cleft Palate & craniofacial Association (ACPA)
  <u>Format</u>: Oral presentation   2022

- <u>Title</u>: Age-dependent machine learning model improves head shape characterization and enables longitudinal evaluation of patients with craniosynostosis
  <u>Conference</u>: Children's Center for Surgery Research Symposium, Children's Hospital Colorado.
  <u>Format</u>: Oral presentation (presented by PhD student: Connor Elkhill)   2022

- <u>Title</u>: Graph convolutional network with probabilistic spatial regression: application to craniofacial landmark detection from 3D photogrammetry
  <u>Conference</u>: International Conference on Medical Image Computing and Computer Assisted Interventions
  <u>Format</u>: Poster presentation (presented by PhD student: Connor Elkhill)
  2022

- <u>Title</u>: Learning with context encoding for single-stage cranial bone labeling and landmark localization
  <u>Conference</u>: International Conference on Medical Image Computing and Computer Assisted Interventions
  <u>Format</u>: Poster presentation (presented by PhD student: Jiawei Liu)
  2022

- <u>Title</u>: Normative temporal model of cranial bone development, mineral density changes and suture fusion
  <u>Conference</u>: Children's Center for Surgery Research Symposium, Children's Hospital Colorado.
  <u>Format</u>: Oral presentation (presented by PhD student: Jiawei Liu)
  2022

- <u>Title</u>: Geometric deep learning for automated pediatric craniofacial landmarking
  <u>Conference</u>: National Library of Medicine T15 Conference
  <u>Format</u>: Oral presentation (presented by PhD student: Connor Elkhill)
  2022

Teaching Record

Courses

<u>At Pompeu Fabra University (Barcelona, Spain)</u>

22109 – Computational Techniques in Biomedicine (20 students)   2011-2012

<u>Role</u>: Single instructor in 22 seminars (2h/seminar, 33% of the course).

<u>Program</u>: BSc Biomedical Engineering, Department of Information and Communication Technologies

<u>Description</u>**:** This course provides students with fundamental concepts of: (1) algorithms, data structures and programming; and (2) mathematical modeling and finite element method (FEM) to solve biomedical linear differential equation problems.

21595 – Fundamentals of Programming (20 students)   2012-2013

<u>Role</u>: Single instructor in 20 seminars (2h/seminar, 50% of the course).

<u>Program</u>: BSc Computer Engineering, Department of Information and Communication Technologies

<u>Description</u>: This course teaches the basic concepts of algorithms, programming in C language and data structures.

22130 – Biomedical Image Analysis (20 students)   2013-2015

<u>Role</u>: Single instructor in 18 seminars/year (2 years, 2h/seminar, 50% of the course)

<u>Program</u>: BSc Biomedical Engineering, Department of Information and Communication Technologies

<u>Description</u>: The course presents a theoretical and practical introduction to the fundamentals of image processing and analysis with special emphasis on biomedical applications.

<u>At University of Colorado Anschutz Medical Campus (Aurora, CO)</u>

BIOS 7718 – Introduction to Biomedical Image Analysis (13 students).   2021-2022

Role: Single instructor (3 credits), Department of Biostatistics and Informatics. *Most of the contents and materials of this course were redesigned by the single instructor.*

Program: PhD Biostatistics. Colorado School of Public Health.

Description: This course provides students with the theoretical and computational skills to tackle a biomedical image analysis problem, covering important topics such as image segmentation, feature quantification, object recognition, etc.

BIOS 7747 – Machine Learning for Biomedical Applications (13 students).   2022-2024

Role: Single instructor (2 credits), Department of Biostatistics and Informatics. *The entirety of this new course was designed and developed by the instructor.*

Program: PhD Biostatistics. Colorado School of Public Health.

Description: Students learn the theoretical background of unsupervised and supervised machine learning methods, and how to develop programs to solve biomedical problems using machine learning techniques.

Guest lectures

CPBS 7711 – Methods and Tools in Biomedical Informatics (3 - 6 students).   2021-2023

Role: Guest 3h lecture on supervised machine learning methods

Program: Computational Bioscience Program. School of Medicine. University of Colorado Anschutz Medical Campus, Aurora, CO.

Description: In this class, students receive an overview of the most popular supervised machine learning methods, and they learn about the different steps to build and evaluate a supervised machine learning model using Python.

BIOS 6670 – Special Topics: Biostatistics (20 students).   2023

Role: Four lectures on machine learning methods in biomedicine

Program: Colorado Summer Institute in Biostatistics (CoSIBS). University of Colorado Anschutz Medical Campus, Aurora, CO.

Description: Students received an overview of machine learning methods that are typically used to solve biomedical problems, with focus on supervised learning methods.

Mentoring and supervision

Supervision and mentoring at Children's National Hospital, Washington, DC

- Elijah Biggs, Research assistant, University of Maryland College Park, MD.   2015-2017
  Role: Supervisor. Mentee duties: clinical data curation and anonymization, MATLAB software development, support on research experiments for pediatric craniofacial analysis studies.

- Catherine Arnold, Summer intern, Colgate University, NY.   2016
  Role: Supervisor. Mentee duties: clinical data curation and anonymization, MATLAB software development, support on research experiments for pediatric craniofacial analysis studies.

- Mohammed Al-Tenaiji, Summer intern, Khalifa University, Abu Dhabi, UAE.   2016
  Role: Mentor. Project: improvement of automated facial analysis technology for the detection of genetic syndromes.

- Scott Ensel, Research assistant, University of Maryland College Park, MD.
  Role: Supervisor. Mentee duties: data curation and evaluation of quantitative methods for an automated diagnosis and optimal treatment of craniosynostosis.
2016-2017

- James Jared, Summer intern, Princeton University, NJ.
  Role: Mentor. Project: development of mobile phone application using Xamarin for the early detection of genetic syndromes: patient consenting and server-side HIPAA-compliant storage.
2017

- Alec Boyle, Research assistant, University of Maryland College Park, MD.
  Role: Supervisor. Mentee duties: clinical data curation and anonymization, MATLAB software development, support on experiments for evaluation of facial analysis technology for the early detection of genetic syndromes in diverse populations.
2017-2018

- Manuel Mastromanolis, Research assistant, University of Maryland College Park, MD.
  Role: Supervisor. Mentee duties: data curation and evaluation of quantitative methods for an automated diagnosis and optimal treatment of craniosynostosis. Translation of MATLAB software to Python.
2017-2018

- Phillip Taylor, Summer intern, Princeton University, NJ.
  Role: Mentor. Project: implementation of a neural network for the early detection of genetic syndromes using photography data.
2018

- Liyun Tu, Postdoctoral fellow.
  Role: supervisor. Project: quantitative evaluation of craniofacial dysmorphology using two- and three-dimensional photographic data.
2016-2019

- Daniel Perez, Research assistant, University of Maryland College Park, MD.
  Role: Supervisor. Mentee duties: clinical data curation and anonymization, MATLAB software development, support on research experiments for evaluation of deep learning technology to identify genetic syndromes from photographic data.
2017-2018

- Graham Buck, Research assistant, University of Maryland College Park, MD.
  Role: Supervisor. Mentee duties: data curation and evaluation of quantitative methods for automated diagnosis and optimal treatment of craniosynostosis.
2018-2019

- Sacheth Sathyanarayanan, Summer intern, Princeton University, NJ.
  Role: Mentor. Project: automated pose estimation and three-dimensional representation of facial geometry and texture using iPhone infrared sensors.
2019

- Sofia Gonzalez, Research assistant, University of Maryland College Park, MD.
  Role: Supervisor. Mentee duties: clinical data curation and anonymization, MATLAB software development, support on research experiments for facial analysis studies.
2019-2020

- Tenzin Sonam, Research assistant, University of Maryland College Park, MD.
  Role: Supervisor. Mentee duties: clinical data curation and
2019-2020

anonymization, support on research experiments for facial analysis studies.

Student Supervision at University of Colorado Anschutz Medical Campus, Aurora, CO

- Jiawei Liu, Research assistant (PhD student). Department of Biostatistics and Informatics.
  Role: Mentor and thesis supervisor. Project: Development of image computing and machine learning methods to build models of pediatric cranial bone development.
  2020-Present

- Connor Elkhill, Research assistant (PhD student). Computational Bioscience Program.
  Role: Mentor and thesis supervisor. Project: Development of geometric deep learning algorithms for craniofacial evaluation from non-invasive 3D photogrammetry data.
  2021-Present

- Abbas Shaikh, Research intern (high school senior).
  Role: Mentor. Project: development and testing of convolutional neural network for the automated segmentation of cranial bones in computed tomography images.
  2021-2022

- Joseph Froelicher, Research assistant (MS student). Department of Biostatistics and Informatics.
  Role: Mentor and thesis supervisor. Project: Data-driven diffeomorphic cranial suture growth model. Graduated in 2022.
  2021-2022

- David Baraghoshi, Research assistant (PhD student). Department of Biostatistics and Informatics.
  Role: Mentor and thesis supervisor. Project: Bayesian deep learning method for uncertainty quantification in the evaluation of patients with chronic obstructive pulmonary disease from computed tomography images.
  2022-Present

- Jasmine Chaij, Fellow (Medical student). Department of Pediatric Plastic and Reconstructive Surgery.
  Role: Research mentor. Project: Clinical translation of artificial intelligence methods to improve the clinical management of pediatric craniofacial disorders.
  2023-Present

- Marcel Roux, Research assistant (MS student). Department of Applied Mathematics.
  Role: Mentor and thesis supervisor. Project: Deep geometric surface-matching framework for anatomical standardization in 3D photogrammetry data.
  2023-Present

Thesis Committee Member at University of Colorado Anschutz Medical Campus, Aurora, CO

- Benjamin Steinhart (MS student). Department of Biostatistics and Informatics.
  Project: A Video Analysis Pipeline for Detecting Differences in Pupil Dilation across Marijuana User Groups. Primary advisor: Dr. Julia Wrobel. Status: graduated.
  2021-2022

- Jared Rieck (MS student). Department of Biostatistics and Informatics.
  Project: fMRI data analysis for emotional response prediction. Primary
  2022-2023

advisor: Dr. Julia Wrobel. Status: expected to graduate in Spring 2023.

- Xinyi Yang (PhD student). Department of Biostatistics and Informatics. Project: Domain adaptation and domain generalization methods for hepatic lesion detection on PET images. Primary advisor: Dr. Fuyong Xing. Status: ongoing.   2023-Present

Mentoring within the MICCAI Mentorship Program

- Luke Shepherd, MS student at University College London (UCL), United Kingdom.   2020-2021
- Charles Lu, PhD student at Massachusetts Institute of Technology (MIT), USA.   2022

Other teaching activities

- Weekly Python working group to help students improve their computational and programming skill (instructor)   2021
- Working group on Neural Networks (Biostatistics Department and Computational Bioscience Program)   2023

Training grants

ACTIVE

International Conference on Medical Image Computing and Computer Assisted Interventions (MICCAI) 2021   2020-2023

Funding agency: National Institute of Biomedical Imaging and Bioengineering, National Institutes of Health

Award identifier: R13EB032243

Total award: $29,850 (FY 2021); $10,000 (FY 2022); $10,000 (FY 2023)

Summary: This award aims to enhance the diversity of the attendees to the International Conference on Medical Image Computing and Computer Assisted Interventions (MICCAI) in 2021, 2022 and 2023 by funding travel awards to students and early career investigators from underrepresented groups in science including women, racial/ethnic minorities, students with disabilities, and people from disadvantaged backgrounds.

Role: Co-principal investigator

Colorado Biomedical Informatics Training Program   2020-2023

Funding agency: National Library of Medicine, National Institutes of Health

Award identifier: T15LM009451

Total award: $445,363 (FY 2020); $613,049 (FY 2021); $465,973 (FY 2022)

Summary: Our program is designed to provide graduate students and post-doctoral fellows training in both computational methods and molecular biology, an intimate familiarity with the science and technology that synthesizes the two, and the skills necessary to pioneer novel computational approaches to significant biomedical questions.

Role: Core faculty, mentor   Principal investigator: Dr. Larry Hunter

PENDING

International Conference on Medical Image Computing and Computer Assisted Interventions (MICCAI) 2024-2027

Funding agency: National Institute of Biomedical Imaging and Bioengineering, National Institutes of Health

Total award: $30,000.   Status: submitted.

Summary: This award aims to enhance the diversity of the attendees to the International Conference on Medical Image Computing and Computer Assisted Interventions (MICCAI) in 2024, 2025 and 2026 by funding travel awards to students and early career investigators from underrepresented groups in science including women, racial/ethnic minorities, students with disabilities, and people from disadvantaged backgrounds.

Role: Co-principal investigator

COMPLETED

International Conference on Medical Image Computing and Computer Assisted Interventions (MICCAI) 2020 2019-2020

Funding agency: National Institute of Biomedical Imaging and Bioengineering, National Institutes of Health

Award identifier: R13EB030422

Total award: $9,850

Summary: This award aims to enhance the diversity of the attendees to the International Conference on Medical Image Computing and Computer Assisted Interventions (MICCAI) in 2021, 2022 and 2023 by funding travel awards to students and early career investigators from underrepresented groups in science including women, racial/ethnic minorities, students with disabilities, and people from disadvantaged backgrounds.

Role: Co-principal investigator

Development and clinical translation of machine learning methods to optimize treatment outcomes in craniosynostosis on a patient specific level 2022-2023

Funding agency: National Center for Advancing Translational Sciences, National Institutes of Health

Award identifier: TL1TR2533   Total award: $26,352

Summary: This predoctoral award has the goal to partially fund one of the PhD students that I supervise in my lab, Connor Elkhill, who is developing novel geometric learning methods to quantify and optimize treatment outcomes of patients with craniosynostosis in collaboration with the Children's Colorado Craniofacial Clinic.

Role: Primary mentor   Trainee: Connor Elkhill

Research Record

ACTIVE

Quantitative characterization and predictive modeling of cranial bone development in patients with craniosynostosis 2020-2024

Funding agency: National Institute of Dental and Craniofacial Research (NIDCR), National Institutes of Health (NIH)

Award identifier: R00DE027993

Total award: $737,906 (+$115,969.66 transferred from previous K99 award)

Summary: To develop a normative evidence-based predictive development model of the cranial bones to characterize and predict normal and abnormal growth in children with craniosynostosis

Role: Principal investigator

Early joint cranial and brain development from fetal and pediatric imaging   2021-2025

Funding agency: National Institute of Dental and Craniofacial Research (NIDCR), National Institutes of Health (NIH)

Award identifier: R01DE030286

Total award: $ 2,162,069 (total budget awarded only until May 2024)

Summary: The main goal of this project is to study the coupled mechanisms of cranial and brain development using perinatal and pediatric imaging data

Role: Co-investigator

Principal investigators: Dr. Natasha Lepore, Dr. Marius Linguraru

Data-driven quantification and prediction of pre-surgical local head volume distributions and post-surgical development in patients with craniosynostosis   2023-2028

Funding agency: National Institute of Dental and Craniofacial Research (NIDCR), National Institutes of Health (NIH)

Award identifier: R01DE032681

Total award: $1,965,270

Summary: To study, model and predict the compensatory volume mechanisms in the cranium in presence of growth constraints, and how they are modified after surgical treatment.

Role: Principal investigator

Development of CT image-based cranial bone markers of intra-cranial hypertension   2023-2025

Funding agency: National Institute of Dental and Craniofacial Research (NIDCR), National Institutes of Health (NIH)

Award identifier: R21DE031824

Total award: $447,497

Summary: We aim to create image analysis and machine learning methods to identify and quantify for the first time cranial bone development anomalies that are indicative of intra-cranial hypertension. Then, we will investigate the development of elevated pressure in patients with non-syndromic craniosynostosis and we will study if there are differential patterns across patient groups.

Role: Principal-investigator

PENDING

Identification of intracranial hypertension in pediatric patients using CT images and machine learning   2023-2024

Funding agency: Colorado Clinical and Translational Sciences Institute, and NIH National Center for Advancing Translational Sciences

Award identifier: CO-J-23-99

Total award: $40,000.   Status: selected for funding.

Summary: We aim to quantify local bone thickness, density and volume anomalies in patients with ICH, and study elevated pressure in patients with syndromic and non-syndromic craniosynostosis.

Role: Principal-investigator

COMPLETED

Convergence of medical technologies for the integral management of cardiovascular remodeling   2010-2012

Funding agency: Center for Industrial Technology Development (CDTI), Spanish Ministry of Science and Innovation

Award identifier: CEN20091044

Total award: €13.6M

Summary: This multi-institutional national project supported the development of methods, computational models and tools to help evaluate cardiac remodeling in presence of cardiovascular disease, with the overall goal to achieve personalized prevention, diagnosis and treatment strategies through the use of patient-specific quantitative information.

Role: Research assistant   Local principal investigator: Dr. Alejandro Frangi

Multi-modal data fusion for cardiac tissue characterization in patients with ischemic cardiomyopathy   2011-2015

Funding agency: FPU - Training program for university professors, Spanish Ministry of Education

Award identifier: AP2010-3684

Total award: €60,000

Summary: This competitive grant funded a PhD research project towards creating new computational and image analysis methods to quantitatively characterize ischemic cardiomyopathy

Role: Principal investigator

Physiological integration of morphological and functional information for quantification of cardiac motion (PhysIQ)   2012-2015

Funding agency: National plan for research, development and innovation, Spanish Ministry of Economy and Competitiveness

Award identifier: TIN2012-35874

Total award: €33,520

Summary: The goal of this project was to develop computational techniques to integrate patient-specific information from different sources to quantify accurately cardiac motion.

Role: Co-investigator   Principal investigator: Dr. Gemma Piella

mGene – Early and Mobile Detection of Genetic Syndromes   2015-2018

Funding agency: Pediatric Innovation Fund, Children's Hospital Foundation, Children's National Hospital

Total award: $100,000

Summary: These funds were awarded to develop and validate a mobile technology for facial analysis for the early and non-invasive screening of genetic syndromes with dysmorphology.

Role: Co-investigator.

Principal investigators: Dr. Marius Linguraru, Dr. Marshall Summar

Early detection of ureteropelvic junction obstruction using signal analysis and machine learning 2016-2018

Funding agency: Joseph E. Roberts, Jr. Award, Children's National Hospital

Total award: $25,000

Summary: The goal of this projects was to improve the interpretation of dynamic information embedded in the renal drainage curves trough developing signal processing and machine learning methods to assess disease severity.

Role: co-investigator

Principal investigators: Dr. Marius Linguraru, Dr. Hans Pohl

Image-guided planning system for skull correction in children with craniosynostosis 2016-2019

Funding agency: Eunice Kennedy Shriver National Institute of Child Health and Human Development (NICHD), National Institutes of Health (NIH)

Award identifier: R42HD081712

Total award: $1,445,476

Summary: The goal of this project was to develop a personalized pre-operative planning framework for cranial remodeling of infants with craniosynostosis using image computing and statistical shape analysis methods to decrease operative time and morbidity.

Role: Co-investigator

Principal investigators: Dr. Marius Linguraru, Dr. Andinet Enquobahrie

Quantitative characterization and predictive modeling of cranial bone development in patients with craniosynostosis 2019-2020

Funding agency: National Institute of Dental and Craniofacial Research (NIDCR), National Institutes of Health (NIH)

Award identifier: K99DE027993

Total award: $251,529

Summary:

- Training: To receive formal training in medical genetics, embryology, developmental biology and craniofacial surgery.
- Research: To develop a normative evidence-based predictive development model of the cranial bones to characterize and predict normal and abnormal cranial bone growth in children with craniosynostosis.

Role: Principal investigator

Mentors: Dr. Marius Linguraru (Children's National Hospital), Dr. Robert Keating (Children's National Hospital), Dr. Maximilian Muenke (National Human Genome Research Institute), Dr. Janice Lee (National Institute of Dental and Craniofacial Research).

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Note: (*) indicates publication by training, and (+) indicates equal contribution of two first authors.

Peer-reviewed journal articles

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