

ALVARO E. ULLOA CERNA

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EDUCATION

Doctor of Philosophy, Computer Engineering University of New Mexico, Albuquerque, NM, USA. Graduated with distinction.	2019
Master of Science, Statistics University of New Mexico, Albuquerque, NM, USA. Graduated with distinction.	2016
Master of Science, Electrical Engineering University of New Mexico, Albuquerque, NM, USA.	2013
Bachelor of Science, Electrical Engineering Pontificia Universidad Catolica del Peru, Lima, Peru. Graduated with distinction.	2010
Professional memberships	
IEEE Member	2009 to date
American Heart Association Member	2017 to date

WORK EXPERIENCE

Senior Data Scientist <i>Geisinger</i>	2020 to date
<ul style="list-style-type: none">· Lead on clinical product development (machine learning using EHR data)· Mentoring other Data Scientists	
Math and Computational Scientist <i>Geisinger</i>	2017 to 2020
<ul style="list-style-type: none">· Machine learning, statistics, and data science support.· Developed risk assessment models using tabular and imaging data from EHR.<ul style="list-style-type: none">• Unsupervised learning on EHR data for patients with Heart Failure.• Echocardiography measurements with linear and non-linear models.• Echocardiography video with 3D/2D CNNs, LSTM, and GAP layers and tabular data.• Proposed a multi-modal and interpretable neural network design.	
Software Engineer Consultant	2015—2016
<ul style="list-style-type: none">· <i>Medici Technologies</i>: Image and Video processing applications. (2 weeks)· <i>Dalytic Solutions</i>: Compliance tracking web app for Lovelace Respiratory Research Institute. (2 months)	
Graduate Research Assistant <i>The Mind Research Network</i>	2011—2016
<ul style="list-style-type: none">· Conducted statistical analysis of brain MRI, copy number variations and single nucleotide polymorphisms.· Developed methods for multi-modal blind source separation.· Designed and run massive simulations using 8 servers in-site.	

- Teacher Assistant** 2014
The University of New Mexico
- Optimization Theory ECE-506, Fall 2014
- Director of the Digital Signal and Image Processing** 2010
Pontificia Universidad Católica del Perú
- Developed image processing methods for image texture classification.
 - Laboratory computer support and administration.
- Teacher Assistant** 2008-2010
Pontificia Universidad Católica del Perú
- Electronic Design 1
 - Digital Signal Processing
 - Analog Circuits
 - Programming languages 1.
- Reinforcement Teacher - Undergrad Level** 2007—2010
El Circulo S.A.
- Gave reinforcement classes to undergrad level for electronic engineering related courses.
- Intern** 2008
Petroleos del Peru S.A
- Granted technical support for the installation of category 6 LAN cable for the main building.

PATENTS

- Brandon K Fornwalt, Christopher Haggerty, Alvaro Ulloa Cerna, and Christopher Good. Systems and methods for a deep neural network to enhance prediction of patient endpoints using videos of the heart, May 20 2021. US Patent App. 17/099,743
- Brandon K Fornwalt, Alvaro Ulloa, Christopher Haggerty, Shushravya Raghunath, Christopher Good, John Pfeifer, et al. Ecg based future atrial fibrillation predictor systems and methods, March 18 2021. US Patent App. 17/026,092

PUBLICATIONS

Journal — Published

- Alvaro E Ulloa Cerna, Linyuan Jing, Christopher W Good, Sushravya Raghunath, Jonathan D Suever, Christopher D Nevius, Gregory J Wehner, Dustin N Hartzel, Joseph B Leader, Amro Alsaïd, et al. Deep-learning-assisted analysis of echocardiographic videos improves predictions of all-cause mortality. *Nature Biomedical Engineering*, pages 1–9, 2021
- Yasser El-Manzalawy, Mostafa Abbas, Ian Hoaglund, Alvaro Ulloa Cerna, Thomas B Morland, Christopher M Haggerty, Eric S Hall, and Brandon K Fornwalt. Oasis+: leveraging machine learning to improve the prognostic accuracy of oasis severity score for predicting in-hospital mortality. *BMC Medical Informatics and Decision Making*, 21(1):1–13, 2021
- Sushravya Raghunath, John M Pfeifer, Alvaro E Ulloa-Cerna, Arun Nemani, Tanner Carbonati, Linyuan Jing, David P vanMaanen, Dustin N Hartzel, Jeffery A Ruhl, Braxton F Lagerman, et al. Deep neural networks can predict new-onset atrial fibrillation from the 12-lead ecg and help identify those at risk of atrial fibrillation-related stroke. *Circulation*, 143(13):1287–1298, 2021

- Linyuan Jing, Alvaro E Ulloa Cerna, Christopher W Good, Nathan M Sauers, Gargi Schneider, Dustin N Hartzel, Joseph B Leader, H Lester Kirchner, Yirui Hu, David M Riviello, et al. A machine learning approach to management of heart failure populations. *Heart Failure*, 8(7):578–587, 2020
- Sushravya Raghunath, Alvaro E Ulloa Cerna, Linyuan Jing, Joshua Stough, Dustin N Hartzel, Joseph B Leader, H Lester Kirchner, Martin C Stumpe, Ashraf Hafez, Arun Nemani, et al. Prediction of mortality from 12-lead electrocardiogram voltage data using a deep neural network. *Nature medicine*, 26(6):886–891, 2020
- Jeffrey D Lewine, Sergey Plis, Alvaro Ulloa, Christopher Williams, Mark Spitz, John Foley, Kim Paulson, John Davis, Nitin Bangera, Travis Snyder, et al. Quantitative eeg biomarkers for mild traumatic brain injury. *Journal of Clinical Neurophysiology*, 36(4):298–305, 2019
- Manar D Samad, Alvaro Ulloa, Gregory J Wehner, Linyuan Jing, Dustin Hartzel, Christopher W Good, Brent A Williams, Christopher M Haggerty, and Brandon K Fornwalt. Predicting survival from large echocardiography and electronic health record datasets: optimization with machine learning. *JACC: Cardiovascular Imaging*, 12(4):681–689, 2019
- Alexander Aliper, Sergey Plis, Artem Artemov, Alvaro Ulloa, Polina Mamoshina, and Alex Zavoronkov. Deep learning applications for predicting pharmacological properties of drugs and drug repurposing using transcriptomic data. *Molecular pharmaceuticals*, 13(7):2524–2530, 2016
- Alvaro E Ulloa, Jiayu Chen, Victor M Vergara, Vince Calhoun, and Jingyu Liu. Association between copy number variation losses and alcohol dependence across african american and european american ethnic groups. *Alcoholism: Clinical and Experimental Research*, 38(5):1266–1274, 2014
- Victor M Vergara, Alvaro Ulloa, Vince D Calhoun, David Boutte, Jiayu Chen, and Jingyu Liu. A three-way parallel ica approach to analyze links among genetics, brain structure and brain function. *Neuroimage*, 98:386–394, 2014
- Jingyu Liu, Alvaro Ulloa, Nora Perrone-Bizzozero, Ronald Yeo, Jiayu Chen, and Vince D Calhoun. A pilot study on collective effects of 22q13.31 deletions on gray matter concentration in schizophrenia. *PloS one*, 7(12):e52865, 2012

ArXiv

- http://arxiv.org/a/ulloacerna_a_1
- Raghunath, et al. Deep Neural Networks can Predict Incident Atrial Fibrillation from the 12-lead Electrocardiogram and may help Prevent Associated Strokes 2020
- Ulloa, et al. Interpretable Neural Networks for Predicting Mortality Risk using Multi-modal Electronic Health Records. 2019
- Ulloa, et al. A deep neural network to enhance prediction of 1-year mortality using echocardiographic videos of the heart. 2018
- Ulloa, et al. Improving Classification Rate of Schizophrenia Using a Multimodal Multi-Layer Perceptron Model with Structural and Functional MR. 2018
- Ulloa, et al. An Unsupervised Homogenization Pipeline for Clustering Similar Patients using Electronic Health Record Data. 2017

Conference Papers

- Jnawali et al. Automatic classification of radiological report for intracranial hemorrhage Hybrid IEEE ICSC, New Port, CA, USA. 2019
- Ulloa et al. Synthetic structural magnetic resonance image generator improves deep learning prediction of schizophrenia. Machine Learning and Signal Processing, Boston, USA 2015
- Castro et al. Generation of synthetic structural magnetic resonance images for deep learning pre-training. IEEE ISBI, New York, USA. 2015

- Arbabshirani et al. Detecting volumetric changes in fmri connectivity networks in schizophrenia patients.
IEEE EMBC, Chicago, IL, USA. 2014
- Chen et al. Parallel ica with multiple references: A semi-blind multivariate approach.
IEEE EMBC, Chicago, IL, USA. 2014.
- Ulloa et al. Three-way parallel independent component analysis for imaging genetics using multi-objective optimization.
IEEE EMBC, Chicago, USA. 2014
- Ulloa et al. A quasi-local method for instantaneous frequency estimation with application to structural magnetic resonance images.
IEEE EMBC, Chicago, USA. 2014
- Ulloa et al. Deteccion automatica de defectos en telas basado en la demodulacion am-fm.
IACTEEC, Albuquerque, USA. 2009

Conference Abstracts

- Ulloa et al. A Multi-view Echocardiography Video Deep Learning Model Outperforms The Seattle Heart Failure Model In Predicting Mortality.
AHA Scientific Sessions, Dallas, TX, USA. 2020
- Raghunath et al. A Deep Neural Network for Predicting Incident Atrial Fibrillation Directly From 12-Lead Electrocardiogram Traces.
AHA Scientific Sessions, Philadelphia, PA, USA. 2019
- Jing et al. A Novel Approach to Managing Heart Failure Populations Using Actionable Machine Learning Models.
AHA Scientific Sessions, Philadelphia, PA, USA. 2019
- Ulloa et al. Cardiologist vs Machine: A Neural Network Predicts One-Year Survival from Clinically-Acquired Raw Echocardiograms Better than an Experienced Cardiologist.
AHA Scientific Sessions, Chicago, IL, USA. 2018
- Ulloa et al. Electronic Health Record simulation framework for unsupervised clustering.
MLSE, Pittsburg, PA, USA. 2018
- Predicting Mortality and Hospitalization in 11,327 Patients with Heart Failure using Machine Learning.
AHA Scientific Sessions, Chicago, IL, USA. 2018
- Jing et al. Machine Learning Significantly Improves Accuracy to Predict Survival Over the Seattle Heart Failure Model.
AHA Scientific Sessions, Chicago, IL, USA. 2018.
- Agasthya et al. Machine learning models show that global longitudinal strain is a strong predictor of survival after echocardiography that is superior to ejection fraction.
AHA Scientific Sessions, Chicago, IL, USA. 2018.
- Samad et al. A Machine Learning Framework to Optimize Patient Outcome Predictions Using Large Electronic Health Records and Clinically Acquired Imaging Measurements.
MLSE, Pittsburg, PA, USA. 2018
- Agasthya et al. A machine Learning approach to understanding the importance of echo strain measurements in cardiac outcomes research.
MLSE, Pittsburg, PA, USA. 2018
- Ulloa et al. Data-Driven Phenotyping of Patients with Heart Failure using a Deep-learning Cluster Representation of Echocardiographic and Electronic Health Record Data.
AHA Scientific Sessions, Anaheim, CA, USA 2017
- Samad et al. Machine Learning-Based Classification of Echocardiographic Measurements Significantly Improves Accuracy in Predicting Mortality over Standard Clinical Variables.
AHA Scientific Sessions, Anaheim, CA, USA. 2017.

- Basile et al. Using a simulation approach to evaluate data-driven algorithms for studying clinical heterogeneity in complex traits.
TBC, Los Angeles, CA, USA. 2017

Thesis and Dissertation Publications

- Large Scale Electronic Health Record Data and Echocardiography Video Analysis for Mortality Risk Prediction.
PhD Engineering with outstanding mention 2019
- Data driven sample generator model with application to classification.
MSc. Statistics with outstanding mention 2016
- Am-fm analysis of structural and functional magnetic resonance images.
MSc. Electrical Engineering with concentration in Image Processing 2013
- Diseño y comparación metodos para la deteccion automatica de defectos en telas.
BSc. Electronic Engineering with outstanding mention 2010

AWARDS

Breadwinner Award 2018, 2019
Awarded by the Cardiac Imaging Technology Lab at Geisinger based on anonymous peer vote.
It recognizes the significant need for the presence of the awardee in the lab.

Lee Award for Best Student Presentation 2016
Awarded by the Albuquerque chapter of the American Statistical Association.

Programa de Apoyo a la Iniciacion en la Investigacion 2009
Prize recipient of the "Support for research initiation program" (Programa de Apoyo a la Iniciacion en la Investigacion, PAIN 2009) for the project named "Filterbank analysis and selection for AM-FM demodulation" (Analisis y Seleccion del Banco de Filtros para la Demodulacion AM-FM).

INVITED TALKS

Introduction to Machine learning.
Event: Supercomputing Challenge. September, 2016
Place: Socorro, New Mexico, USA.
Organizer: New Mexico Tech

Specialized Deep Learning for Magnetic Resonance Images: Constrained Optimization, Data Augmentation, and Multi-modality.
Event: Graduate Seminar, November, 2016
Place: Pontificia Universidad Catolica del Peru, Lima, Peru.
AND
Event: Momento Stat, November, 2016
Place: Universidad Nacional de Ingenieria, Lima, Peru.

Simulating fMRI brain data for deep learning.
Event: QuantBrains UNM/MRN Research Seminar Series,
Place: Albuquerque, New Mexico.
Organizer: Mathematics and Statistics Department, University of New Mexico

SOFTWARE DEVELOPMENT

Main developer

- DISI-ML: Deep learning utilities to train multimodal data (video, time-series, tabular data) or combinations of them.
<https://gitlab.com/alvarouc/disiml/>
- Polyssifier: Run a multitude of classifiers on data to get a comprehensive classification report.
<https://github.com/alvarouc/polyssifier>
- Keras-MLP: Multilayer perceptron based on keras and compatible with scikit-learn that contains the fit, predict, and predict_proba methods.
<https://github.com/alvarouc/mlp>
- Data-generator: Implementation on MS thesis for data-driven sample generator.
https://github.com/alvarouc/data_generator
- ICA-gsl: Independent component analysis implementation on C and OpenMP.
https://github.com/alvarouc/ica_gsl

Contributed

- Scikit-learn: Python module for machine learning built on top of SciPy.
<https://github.com/scikit-learn/scikit-learn>
- Keras: Deep-learning library.
<https://github.com/fchollet/keras>
- BROCCOLI: software for analysis of fMRI.
<https://github.com/alvarouc/BROCCOLI>

TECHNICAL SKILLS

Programming (Advanced)	Python, C, R, Matlab
Programming (Basic)	C++, Java, Bash script, HTML, JavaScript, MS-SQL
Software & Tools	TensorFlow, OpenCV, Theano, Octave, Django, GNU Linux, Git, D3.js, DC.js, L ^A T _E X