Carlos Loza

PhD – Machine Learning Scientist – Fulbright Scholar

Experience

2020–present **Machine Learning Researcher**, *The University of Texas at Austin*, Austin, TX.

Postdoctoral fellow in charge of algorithm design for modeling and real–time detection of gamma oscillations in rodent hippocampus at the Colgin Lab.

Projects and main activities:

- Probabilistic modeling of single–channel EEG applied to sleep spindles detection.
- Design of Bayesian networks that combine probabilistic models and deep learning.
- Probabilistic modeling of neural spikes during spatial exploration tasks.

Achievements:

- Increase in 30% of the AUC of precision–recall curve of EEG sleep spindles detection.
- Consolidation and versioning of code from past projects at the Colgin Lab.

2017–2020 **Machine Learning Researcher**, *Universidad San Francisco de Quito*, Quito.

Development of supervised and unsupervised learning algorithms applied to biosignals, images, and chemometrics.

Projects and main activities:

- Unsupervised learning of prototypical patterns in EEG, ECoG and LFP.
- Predictive modeling applied to Chemometrics.
- Sparse modeling applied to Computer Vision.
- Robust estimation applied to sparse coding and dictionary learning.

Courses taught (Affiliated to Mathematics department):

- Differential, Integral, and Multivariate Calculus.
- Applied Statistics.

Achievements:

- 10 peer–reviewed papers as first (most of the times sole) author during a 2.5–year tenure.
- Redesign of Statistics course to match demands from Math and Psychology departments.

2013–2017 **Graduate Research Assistant**, *University of Florida*, Gainesville, FL.

Part of collaborative and solo projects at Computational NeuroEngineering Lab (CNEL) involving the intersection between machine learning and neuroscience.

Projects and main activities:

- Clustering of time series applied to audio signals.
- Prediction of hand movement directions via EEG–based Brain–Computer Interfaces.
- Robust sparse coding exploiting Correntropy.
- Robust dictionary learning applied to image processing.
- Unsupervised learning of reoccurring patterns in EEG, ECoG and LFP.

Achievements:

- Design of novel generative model for neuronal signals.

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Legally authorized to work in the USA. No need for sponsorship in the future.

2010–2012 **Associate Professor**, *Universidad San Francisco de Quito*, Quito.

Courses taught (Affiliated to Electrical Engineering department):

- Digital Signal Processing.
- Digital Processing of Images and Audio Signals.
- Satellite Navigation Systems.
- Differential, Integral, and Multivariate Calculus.
- Linear Algebra.

Achievements:

- Design of advanced signal processing courses.
- Dissertation chair for four undergraduate students.

2009–2009 **Research Intern**, *Magneti Marelli*, Turin, Italy.

Summer internship at the Telematics department.

Projects and main activities:

- Development of efficient and portable automotive security systems that integrate GPS and GSM technologies.

2008–2008 **Research Intern**, *University of Dundee*, Dundee, United Kingdom.

Summer internship (IAESTE) at Nick Hine's lab. Affiliation: School of Computing.

Projects and main activities:

- Prototype of Arduino-LabVIEW interface for a project that encourages children to learn about technology via playful, tangible products.

2007–2007 **Research Intern**, *Ghent University*, Ghent, Belgium.

Summer internship (IAESTE) at IBBT.

Projects and main activities:

- Software developer of a web browser for mobile devices.

Education

2014–2017 **PhD**, *University of Florida*, Electrical and Computer Engineering.

Dissertation: *A Transient Model for Neuronal Oscillations*
Advisor: Jose C. Principe
GPA: 3.87/4

2015–2016 **Master of Science**, *University of Florida*, Biomedical Engineering.

GPA: 3.97/4

2012–2014 **Master of Science**, *University of Florida*, Electrical and Computer Engineering.

GPA: 3.84/4

2008–2009 **Master of Science**, *Politecnico di Torino*, Navigation and Related Applications.

GPA: 27.02/30

2003–2007 **Bachelor of Science**, *Universidad San Francisco de Quito*, Electrical Engineering.

GPA: 3.66/4

Research interests

Machine Learning — Deep learning, probabilistic modeling, computer vision, (un)supervised learning, state space models, hidden Markov models, Bayesian networks, variational inference.

Neural Engineering — Brain–Computer Interfaces (BCI), neural decoding, biomedical signal processing.

Signal Processing	Image processing, audio processing, transformations, decompositions.
Robust Estimation	Robust (outlier–aware) predictive modeling, robust sparse modeling.
Data Mining	Time series clustering, segmentation, and prediction.

Computer skills

Python	tensorflow, tensorflow probability, numpy, pandas, scikit-learn, scipy, matplotlib, seaborn libraries. Jupyter Notebooks, PyCharm, Google Colab.
MATLAB	algorithm design and main signal processing and statistical analysis toolboxes.
SQL	SQLite.
Docker	Docker Desktop, command line.
Git	version control.
LabVIEW	signal processing and algorithm design.
LaTeX	manuscript preparation and editing.

Soft skills

Exceptional communication skills.

Able to work effectively in multidisciplinary teams.

Resiliency.

Honors and awards

2019	Manuscript selected for special issue, IWANN conference.
2017	Student Paper Competition finalist, IEEE EMBS NER conference.
2014–2017	Research assistantship, Michael J Fox Foundation, University of Florida.
2012–2014	Provost scholarship, University of Florida.
2012–2014	Fulbright grant for faculty development, Fulbright Program.
2008–2009	ALPIP scholarship, Politecnico di Torino.
2007, 2008	IAESTE exchange program trainee, IAESTE.
2003–2008	Newton scholarship, Universidad San Francisco de Quito.

Grants and funding

2018–2019	Collaboration Grant: $10000. Universidad San Francisco de Quito.
2018–2019	PoliGrant: $3689. Universidad San Francisco de Quito.
2017	Registration waiver (Paper Competition finalist): $515. IEEE NER conference.
2017	Travel grant: $350. University of Florida Graduate Student Council.
2016	Travel grant: $500. 4th Minnesota Neuromodulation Symposium.

Scientific memberships

2012–present	Fulbright scholar

2014–present	IEEE (Institute for Electrical and Electronics Engineers)
2014–present	IEEE EMBS (Engineering in Medicine and Biology Society)
2018–present	IEEE Signal Processing Society

Academic services (publons.com)

2021	Progress in Neurobiology	*Reviewer*
2019	MDPI Entropy	*Reviewer*
2019	MDPI Applied Sciences	*Reviewer*
2019	Informatics in Medicine Unlocked	*Reviewer*
2019	Journal of Integrative Neuroscience	*Reviewer*
2017	IEEE Transactions on Signal Processing	*Reviewer*
2019	ICMV	*Program Committee*
2018–2021	IEEE ICASSP	*Program Committee*
2018–2021	IEEE MLSP	*Program Committee*

Languages

Spanish	Native
English	Fluent
Italian	Intermediate

Publications

Book Chapters

2019 Carlos A Loza and Jose C Principe. The generalized sleep spindles detector: a generative model approach on single-channel EEGs. In *International Work-Conference on Artificial Neural Networks*, pages 127–138. Springer, 2019.

2019 Carlos A Loza. A robust fully correntropy–based sparse modeling alternative to dictionary learning. In *International Conference on P2P, Parallel, Grid, Cloud and Internet Computing*, pages 838–847. Springer, 2019.

2018 Carlos A Loza. Robust K-SVD: a novel approach for dictionary learning. In *International workshop on artificial intelligence and pattern recognition*, pages 185–192. Springer, 2018.

Book Chapters (Submitted)

2020 Carlos A Loza and Jose C Principe. EEG models and analysis. In Nitish V. Thakor, editor, *Handbook of Neuroengineering*. Springer, 2020.

Articles

2019 Carlos A Loza. Robomp: Robust variants of orthogonal matching pursuit for sparse representations. *PeerJ Computer Science*, 5:e192, 2019.

2019 Carlos Loza, Chandan Reddy, Shailaja Akella, and José Príncipe. Discrimination of movement-related cortical potentials exploiting unsupervised learned representations from ECoGs. *Frontiers in Neuroscience*, 13:1248, 2019.

2017 Carlos A Loza, Michael S Okun, and José C Príncipe. A marked point process framework for extracellular electrical potentials. *Frontiers in systems neuroscience*, 11:95, 2017.

Preprints

2021 Carlos A Loza and Laura L Colgin. Deep neural dynamic bayesian networks applied to EEG sleep spindles modeling. In *arxiv*, cs.LG, v2, 2021-03-03.

Conference Proceedings

2019 Carlos A Loza and Jose C Principe. Sparse wave packets discriminate motor tasks in EEG–based BCIs. In *2019 9th International IEEE/EMBS Conference on Neural Engineering (NER)*, pages 639–642, 2019.

2019 Carlos A Loza. Robust variants of dictionary learning exploiting m-estimators. In *2019 IEEE CHILEAN Conference on Electrical, Electronics Engineering, Information and Communication Technologies (CHILECON)*, pages 1–6, 2019.

2018 Carlos A Loza and Jose C Principe. Robust estimation of shift–invariant patterns exploiting correntropy. In *2018 IEEE Third Ecuador Technical Chapters Meeting (ETCM)*, pages 1–6. IEEE, 2018.

2018 Carlos A Loza and Jose C Principe. The embedding transform. a novel analysis of non-stationarity in the EEG. In *2018 40th Annual International Conference of the IEEE Engineering in Medicine and Biology Society (EMBC)*, pages 3112–3115. IEEE, 2018.

2017 Carlos A Loza, Jonathan B Shute, Jose C Principe, Michael S Okun, and Aysegul Gunduz. A marked point process approach for identifying neural correlates of tics in tourette syndrome. In *2017 39th Annual International Conference of the IEEE Engineering in Medicine and Biology Society (EMBC)*, pages 4375–4378. IEEE, 2017.

2017 Carlos A Loza and Jose C Principe. Unsupervised robust detection of behavioral correlates in ECoG. In *2017 8th International IEEE/EMBS Conference on Neural Engineering (NER)*, pages 509–512. IEEE, 2017.

2016 Carlos A Loza and José C Principe. Transient model of EEG using gini index-based matching pursuit. In *2016 IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP)*, pages 724–728. IEEE, 2016.

2016 Carlos A Loza and Jose C Principe. A robust maximum correntropy criterion for dictionary learning. In *2016 IEEE 26th International Workshop on Machine Learning for Signal Processing (MLSP)*, pages 1–6. IEEE, 2016.

2016 Carlos A Loza and Jose C Principe. Generalized correntropy matching pursuit: a novel, robust algorithm for sparse decomposition. In *2016 International Joint Conference on Neural Networks (IJCNN)*, pages 1723–1727. IEEE, 2016.

2016 Carlos A Loza and Jose C Principe. Estimation and modeling of EEG amplitude-temporal characteristics using a marked point process approach. In *2016 38th Annual International Conference of the IEEE Engineering in Medicine and Biology Society (EMBC)*, pages 3720–3723. IEEE, 2016.

2014 Carlos A Loza, Gavin R Philips, Mehrnaz Kh Hazrati, Janis J Daly, and Jose C Principe. Classification of hand movement direction based on EEG high-gamma activity. In *2014 36th Annual International Conference of the IEEE Engineering in Medicine and Biology Society*, pages 6509–6512. IEEE, 2014.

2014 Goktug T Cinar, Carlos A Loza, and Jose C Principe. Hierarchical linear dynamical systems: A new model for clustering of time series. In *2014 International Joint Conference on Neural Networks (IJCNN)*, pages 2464–2470. IEEE, 2014.

Abstracts

2017 Carlos A Loza and Jose C Principe. ECoG behavioral correlates based on neuromodulation rates. In *2017 Minnesota Neuromodulation Symposium*, page 163, 2017.

2016 Carlos A Loza and Jose C Principe. A transient model for neuronal oscillations. In *2016 Minnesota Neuromodulation Symposium*, page 181, 2016.